Road transport emission projections in the context of the EU NEC Directive ceiling commitments. Impacts of model versions

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Front page picture: *Emissions from road transport*

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1 Introduction – Objectives

The National Emission Ceilings Directive (2001/81/EC) is one of the key European policy measures in controlling the emission of the main pollutants responsible for eutrophication, acidification, and ground-level ozone. The Directive sets emission ceilings (i.e. total emission limits at a national level) in all EU27 Member States to be achieved by 2010 for four pollutants (SO_2, NO_x, VOC, NH_3) across all economic sectors. Penalties are foreseen if emission ceilings are exceeded.

The emission ceilings for each Member State were designed in the period 1998-99 prior to the Directive coming into force in 2001. Setting the actual ceiling (in kT) was a meticulous task. The ceilings were designed using the RAINS model of IIASA (Amann et al., 1998). At the time of designing the NECD ceilings, emissions were projected to 2010 using the best available information of the time. This information included category classification within each sector, activity projection per emission source, and emission factors per technology. RAINS first established a reference scenario (CLE), which represented the evolution of emissions assuming only the legislation in place in 1999. A second scenario (MFR) estimated ceilings assuming full implementation of available control measures of the time. This was a hypothetical scenario that demonstrated the maximum reduction potential for reference.

The actual emission ceiling per Member State was finally the result of a political decision supported by the RAINS calculations. The political decision took into account the cost-effectiveness of different measures and the national circumstances to reach an agreement at a European Union level. The Directive includes the results of this political discussion as an emission target per Member State. Although the ceilings inherently assume the introduction of a bunch of measures, the Directive does not specify the technical or non-technical measures that each Member State needs to introduce. Each Member State is liable against the ceiling, but the approach to reach it is within the jurisdiction of each Member State.

In order to calculate road transport emissions in this procedure, RAINS received input data from two main sources: Energy consumption data was provided by PRIMES (Capros et al., 1997) and emission reduction factors for (then) future emission technologies were derived by COPERT II and personal communications of the IIASA staff with LAT/AUTh personnel. Both datasets tried to reflect the best knowledge of the time. However, it is natural to expect that all methodologies used to forecast emissions may deviate from reality because it is not possible to predict the exact impact of every single policy measure. In particular in Europe, it has been reported that diesel NOx emission standards have for several years and for several technology reasons failed to introduce the expected reductions (Vestreng et al., 2008). As a result, total NOx emissions in several Member States may exceed the respective ceiling, despite introducing all implicit measures assumed when designing the ceiling.

In this report we try to provide some estimates of the magnitude of this deviation. In this respect, road transport emission calculations are performed in alternative ways. First emissions are calculated using the COPERT II emission factors and the original energy projections assumed at the RAINS version used to deliver the original ceilings. Then, we use the most updated COPERT 4 version (v8.0 – November 2010) and the most recent activity data from Member States to recalculate the emission ceilings. The different emission levels produced by the different runs may provide a good indication of the extent of the emission deviation due to the methodology and the activity data used in each case.

2 Methodology

2.1 Country selection

Four countries were selected to demonstrate the impact of changing methodologies in the emission ceiling calculation:

- Germany: Germany alone is allocated 12 % of the total EU-27 NO_x emission ceiling (1051/9003 kt) and subsequent differences in actual emissions compared to the emission ceiling will have a large impact on total European-wide achievements under the NEC Directive. Germany uses the TREMOD model to estimate emissions, which is different than the COPERT 4 used in this study.
- France: France is also a large country with its emission ceiling representing 9 % of the EU-27 total ceiling (810/9003 kt). The difference to Germany is that France uses the COPERT model for national submissions. Therefore, changes in the methodology should be directly proportional to national data.
- Netherlands: Netherlands is a medium sized country (260 kt NOx) and uses its own model to calculate emissions (VERSIT+). However, Netherlands have already tried to assess the impact of changing methodologies in the emission ceilings (Geilenkirchen, 2010). This provides a good opportunity to check our calculations with corresponding national work.
- Ireland: Ireland represents less than 1% of the total emission ceiling (65 kt). However, Ireland uses COPERT to calculate emissions and have independently also estimated the effect of changing COPERT versions on their ceilings (Leinert, 2010). This allows a direct comparison of our calculation to national estimates as a verification of the two approaches.

2.2 Data sources/models

A number of sources were used to calculate emissions in alternative ways:

The original RAINS activity and emission factor data were provided directly from IIASA (J. Cofala) in November 2010. These data correspond to the final data delivered to the Commission to support Directive 2001/81/EC. The data contain fuel consumption values (in PJ) for vehicles categorized in three types, diesel heavy duty, diesel light duty and petrol light duty. All vehicle types are then further distinguished into Conventional, and Euro 1 through Euro 4. An emission factor (g/PJ) is assigned to the Conventional technology. Emission factors for all other technologies are calculated on the basis of the Conventional emission factor by utilizing the so called ‘removal efficiencies’ for each technology, i.e. reduction factors over the conventional.

Revised estimates for the activity data were obtained from the results of the FLEETS project (Ntziachristos et al., 2008). These are data which have been collected in the framework of a European Commission project, aiming at developing a consistent data set of detailed activity data of road transport for all Member States. The data collected originated from national submissions and international sources (Eurostat, ACEA, …) and a methodology to streamline and refine any inconsistencies was developed. The activity data have been further refined and have been used in the framework of the LIFE+ EC4MACS project (Amann et al., 2010). This is the main project supporting the further development of IIASA’s GAINS model, i.e. the follow-up of RAINS. This dataset is described with the acronym EC4MACS in the remaining of this report.

The emission estimates calculated with use of this dataset and their implementation into COPERT 4 have been compared to national submissions for the years 2005 and 2010 in an ETC/ACC report to EEA (Mellios et al., 2009). In general (*Table 1*), the deviations are small except of the case of the Netherlands, where centralised calculations are some +20% above the national data. This is mostly due to the effect of tank tourism, i.e. the fuelling of vehicles in one country and the consumption in neighbouring countries. In Netherlands this can be the case because of the large ports. Diesel vehicles may therefore refuel in the Netherlands and then consume their fuel in neighbouring countries. The values in *Table 1* demonstrate however that the centralised data and methodology fairly well represents national submissions. A perfect match is not possible because the model we have used in this work (COPERT 4 v8.0) is the latest version that has not been yet used by any country using COPERT (France, Ireland) and because Netherlands and Germanys use alternative models (VERSIT+ and TREMOD respectively). Also, the emission ceilings were designed based on statistics of fuel sold in each country. However, Member States calculate total emissions on the basis of vehicle kilometres travelled. Our definition of calculating emissions on the basis of fuel sold and not vehicle kilometres driven is consistent with the method used to develop the emission ceilings. This may lead though to some differences to calculations based on total vehicle kilometers.

Table 1: *National submissions and centralised calculations of road transport NO_x emissions for countries examined in this report.*

Country	Year	National Submission (kt)	Centralised Calculation* (kt)	Deviation (%)
Germany	2000	996	940	-5,6
	2005	656	711	8,4
France	2000	886	807	-8,9
	2005	747	679	-9,2
Netherlands	2000	164	199	21,3
	2005	133	157	18,1
Ireland	2000	58	55	-5,7
	2005	50	52	4,1

* Centralised estimates are based on total fuel sold – national submissions on vehicle kilometres driven on national ground.

The COPERT 4 version (v8.0) used in this study is the latest version available. It includes all our knowledge on emission factors, including the heavy duty emission factors from HBEFA version 3.1 which demonstrate the high NOx emissions of SCR equipped heavy duty trucks. Version 8.0 does not yet include revised emission factors for Euro 5 diesel cars which are also expected higher that the estimates used in v8.0. However, as our calculations in this report extend only up to 2010, the impact of the uncertainty in the Euro 5 emission factor is expected to be very small.

2.3 Runs executed

Five runs were conducted in total to demonstrate the impact of the changing methodologies and the revised activity data on the emission ceilings calculation.

Run 1 : Original RAINS

The first run is the original RAINS run, using the activity data (PJ), the conventional emission factors, and the removal efficiencies from RAINS. As an example, the activity data included in RAINS for Germany are shown in *Table 2* and the conventional emission factors and removal efficiencies, as an example for diesel heavy duty vehicles, are shown in *Table 3*. Values in red are the calculated emission factors (g/MJ) per new technology level, based on the removal efficiencies and the conventional emission factor. RAINS considers busses to be included in heavy duty vehicles, and light commercial vehicles and power two wheelers as part of the passenger cars.

Table 2: *Activity data (PJ) per vehicle type, technology, and calculation year from RAINS*

Fuel	Category	Technology	1995	2000	2005	2010
MD	TRA_RD_HD	Conventional	349	130	8	1
MD	TRA_RD_HD	EUR1	150	157	27	1
MD	TRA_RD_HD	EUR2	0	235	161	29
MD	TRA_RD_HD	EUR3	0	0	284	249
MD	TRA_RD_HD	EUR4	0	0	0	184
LF	TRA_RD_LD4	Conventional	416	33	2	0
LF	TRA_RD_LD4	LFCC1	885	823	397	92
LF	TRA_RD_LD4	LFCC2	0	562	551	327
LF	TRA_RD_LD4	LFCC3	0	0	598	570
LF	TRA_RD_LD4	LFCC4	0	0	0	624
MD	TRA_RD_LD4	Conventional	345	178	60	9
MD	TRA_RD_LD4	MDLDCM	107	134	94	27
MD	TRA_RD_LD4	MDLDAM	0	171	212	158
MD	TRA_RD_LD4	MDLDEC	0	0	192	214
MD	TRA_RD_LD4	MDLDNX	0	0	0	215

Table 3: *Emission factors (g/MJ) diesel heavy duty vehicles in Germany (example)*

Country	Run	FUEL_ABB	Category	Technology	Conventional EF	RF	NOx EF
GERM	NEWL	MD	TRA_RD_HD	Conventional	0.85	0	0.85
GERM	NEWL	MD	TRA_RD_HD	EUR1	0.85	32.90	0.57
GERM	NEWL	MD	TRA_RD_HD	EUR2	0.85	42.70	0.49
GERM	NEWL	MD	TRA_RD_HD	EUR3	0.85	59.80	0.34
GERM	NEWL	MD	TRA_RD_HD	EUR4	0.85	84.20	0.13

Run 2 : COPERT II + RAINS (C2+RAINS)

This run calculates emissions using COPERT II and the activity data of RAINS. The idea behind this run is basically to validate the RAINS data and check that the COPERT II calculations result to similar values. It is not possible to result to identical values because COPERT II uses emission factors in g/km compared to g/MJ of RAINS. The following methodology was applied to streamline the data: Vehicle population and mileage per technology were obtained from the FLEETS database. This includes light commercial vehicles, mopeds, motorcycles, and petrol heavy duty vehicles. Also, all other data (share, speed, fuel injection percentages, etc.) were received from FLEETS. In a first step, the fuel consumption calculated per technology with COPERT II and the FLEETS data was equalized to RAINS consumption per technology by calibrating the mileage values. Then, total NOx emissions are calculated.

Run 3 : COPERT II + EC4MACS (C2+EC4MACS)

This run reveals what the effect of methodology is if revised activity data are used. This is useful to reveal what would have been the ceiling if we exactly knew how activity data would have developed. In principle, this run may be used to check whether the lack to meet the ceiling is due to the changing methodology or because the activity in the country has significantly increased. In the prior case, the responsibility of missing the ceiling is because of the changing methodology and the inability of policies to introduce the reductions they should.

Run 4 : COPERT 4 + RAINS (C4+RAINS)

The rationale of this run is to check the impact of methodology change and keeping the same activity data as in the original RAINS calculation. Otherwise, the methodology followed is the same to Run 2, i.e first the mileage is calibrated to match the activity data of RAINS and second, NOx emissions are calculated.

Run 5 : COPERT 4 + EC4MACS (C4+EC4MACS)

This can be considered the most updated calculation, using updated methodology and activity data. Run 5 is considered to reflect the evolution of emissions as they will be reported by the Member States in their 2011 submission year (2010 calculations).

Main Assumptions

- The ‘Conventional’ emission technology of RAINS is corresponded to ECE 1504 in COPERT as the most widespread non-catalyst technology.
- COPERT II methodology does not include technologies post Euro 3 for passenger cars and post Euro II for heavy duty vehicles. In order to perform Runs 2 and 3 we had to introduce these technologies in COPERT II, as RAINS included emission technologies up to Euro IV/4. For the NOx emission factor we used the same RAINS removal efficiency over the conventional technology also on COPERT II. For fuel consumption we used the fuel consumption factor (g/km) of the latest available technology in COPERT II.
- RAINS fuel consumption is reported in energy units (PJ). COPERT fuel consumption is reported in tones (t). For comparison and reporting reasons in all cases we converted fuel consumption from RAINS into tones by using the heating values of 0.042 [PJ/t] for diesel and 0.044 [PJ/t] for gasoline.
- In Run 3 (COPERT II + EC4MACS) the Euro 5/V activity has been lumped to Euro 4/IV as no emission factors for such vehicles exist in COPERT II.

2.4 Emission factors vs emission standard

Using the methodologies and the input data mentioned before, it is possible to calculate mean NOx emission factors for RAINS and COPERT 4. These emission factors may be expressed as a fraction of the 'Conventional' technology. This is shown in *Figure 1* for the three vehicle types (heavy duty trucks – HDT, gasoline passenger cars – GPC and diesel passenger cars – DPC) included in RAINS. For comparison, the emission standard reductions (over Euro 1/I) are also shown (ES). It is clear that RAINS emission reductions clearly followed the emission standards. Some deviations (for example Euro IV HDT and Euro 5 DPC) are because these emission standards were not finalised in 1999. Therefore, the methodology which was introduced in RAINS was correct at the time of developing it. However, the reality (COPERT 4) shows that the emission factors did not follow the reductions requested by the emission standards. This is clear for both HDTs and DPCs. For example, the Euro 4 diesel passenger car emission factor is at 40% of the conventional emission level, while the emission standard is only at 20%. This is a large difference, with potentially significant implications in meeting the emission ceiling.

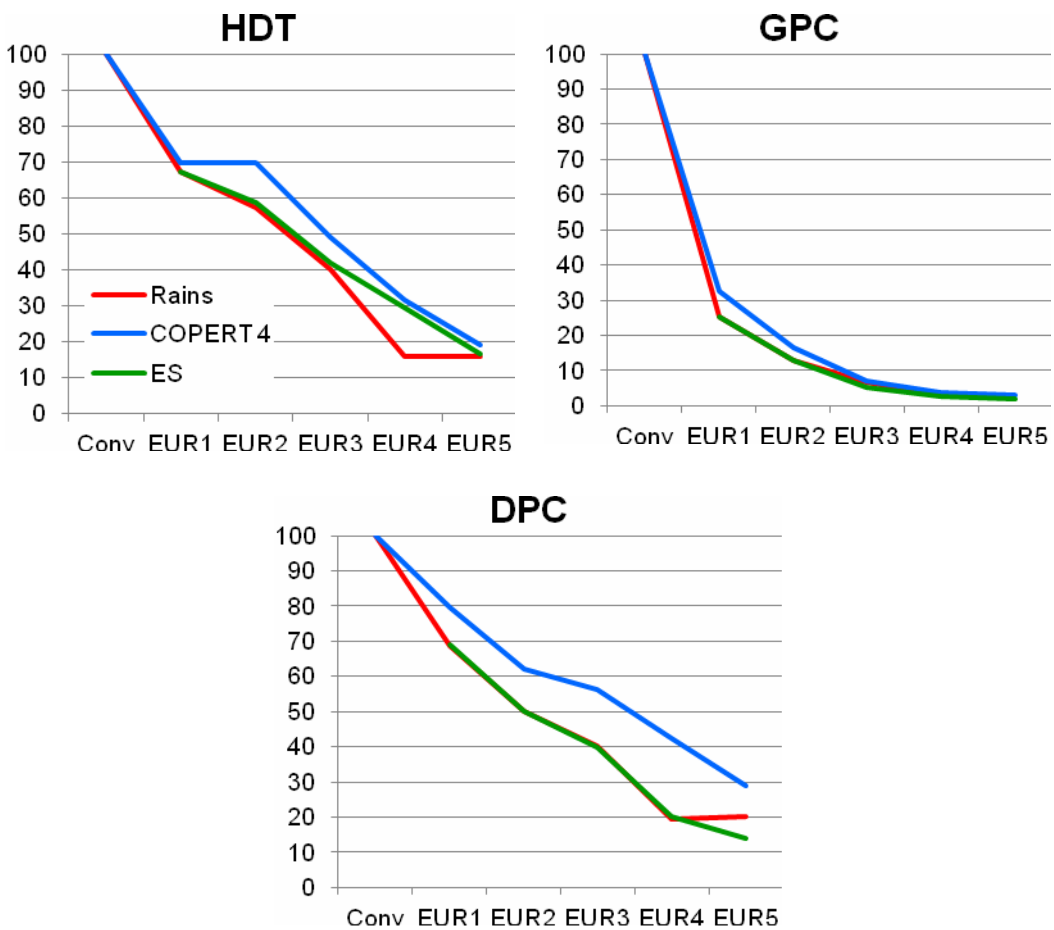

Figure 1: *Reductions in emissions (Conventional = 100) introduced by emission standards (ES), assumed in RAINS and included in COPERT 4.*

The only case that emission standards and emission factors reached similar reductions is the GPC case. It also needs to be repeated that the Euro 5 passenger car emission factors (both gasoline and diesel) are estimates only and are not based on measured data. This may not be a problem for gasoline cars (Euro 5 and Euro 4 technologies are identical) but first indications of diesel cars imply that the NOx emission level will be yet higher than assumed by COPERT 4.

The deviation between real on-road and reductions as specified in emission standards leads to significant differences between the foreseen and actual progress in reducing emissions.

3 Results

The results of the calculations are presented in the following sections. The Annex presents all results per country.

3.1 Total fuel consumption

Figure 2 presents the total fuel consumption for the different vehicle types and total road transport per scenario in the case of Germany. All runs which are based on the activity data from RAINS (Run 1, 3, 5) lead to the same fuel consumption because they are based on the same activity data. The scenarios based on new estimate of activity data show that activity developed differently than foreseen. The total energy consumption for road transport was actually lower than what was projected in RAINS. Moreover, the gasoline consumption dropped significantly, instead of increasing as assumed in RAINS. However, the diesel consumption, in particular of heavy duty vehicles, developed much higher than what it was considered. As NOx emissions are mainly associated with diesel heavy duty vehicles, this fact alone is assumed to have a significant impact on the attainment of emission ceilings.

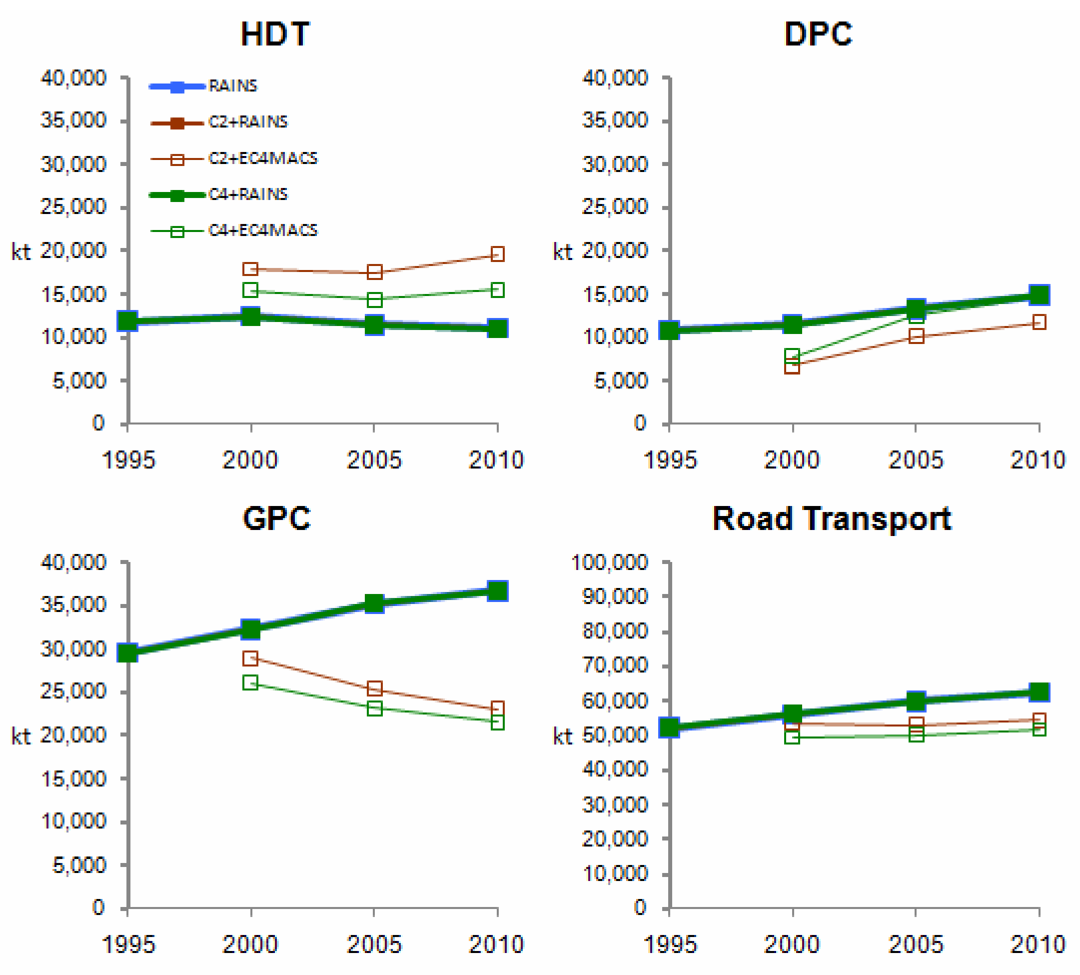

Figure 2: *Total fuel consumption in the different runs for Germany*

The corresponding picture for France is shown in *Figure 3*. Again, actual fuel consumption is lower that what was assumed with RAINS. However, the difference in the split between gasoline and diesel is dramatic, in particular in the passenger car sector. The fuel consumption of diesels in 2010 is some 60% higher than was assumed in RAINS. A corresponding drop in gasoline consumption is encountered. In 2008, diesel cars corresponded to 77.3% of new car registrations in France (the second highest next to Belgium with 79%) compared to 46.5% in 1999. This explains the change in trends between gasoline and diesel.

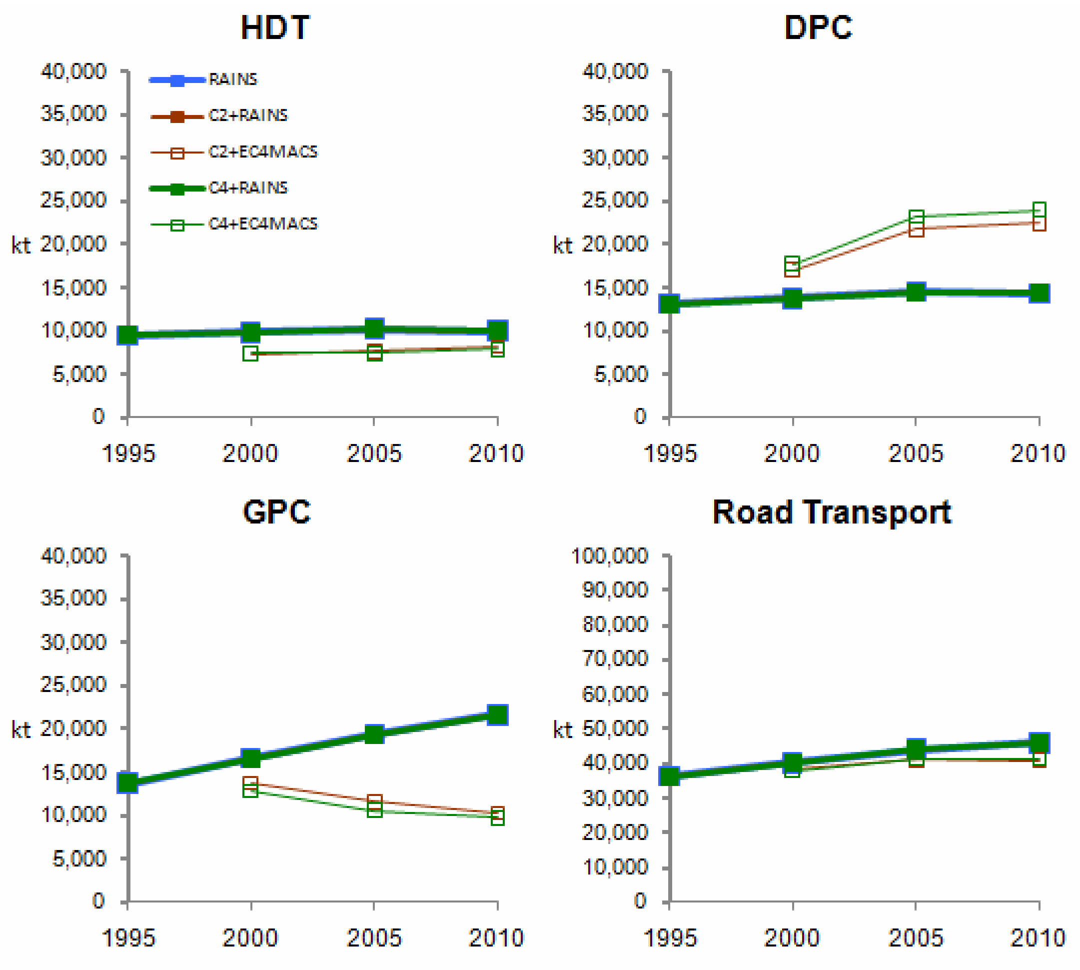

Figure 3: *Total fuel consumption in the different runs for France*

In the case of Netherlands, fuel consumption developed very similar to what was projected with RAINS (*Figure 4*). Any differences are basically below 5%. However, the difference in the split between gasoline and diesel is also visible here. Similar to France, the diesel consumption between cars and trucks is different. Because of the higher fuel consumption specific emission factor of NOx (g NOx/ kg fuel) for heavy duty vehicles, the shift of diesel consumption towards heavy duty vehicles will further increase the total emissions.

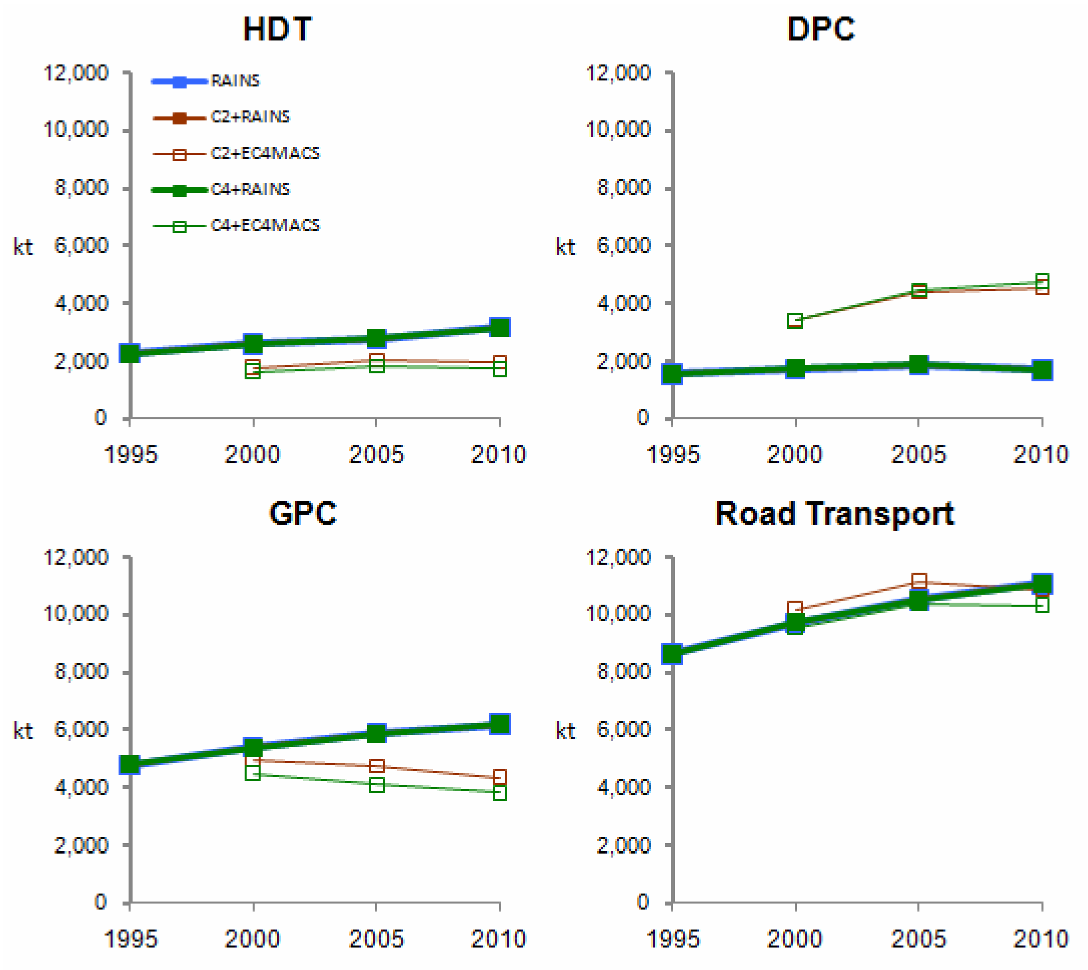

Figure 4: *Total fuel consumption in the different run for the Netherlands*

Ireland (*Figure 5*) is unique compared to the previous cases, in the sense that total fuel consumption reported significantly exceeds what was foreseen in RAINS. A main reason for this has been the booming economy of Ireland over the previous years. Despite this, and the changes expected again to 2010, due to the financial problems that Ireland is faced with, it still means that emission ceilings designed in 1999 will be difficult to be met by 2010. The fuel consumption is higher than expectations for all vehicle classes but in particular for passenger cars (both gasoline and diesel). The diesel consumption in 2010 is actually three time higher than what was thought in 1999. In Ireland, diesel car registrations were below 25% of total registrations until 2006 but they reached 62% in 2010. This explains the steep increase in diesel passenger car consumption.

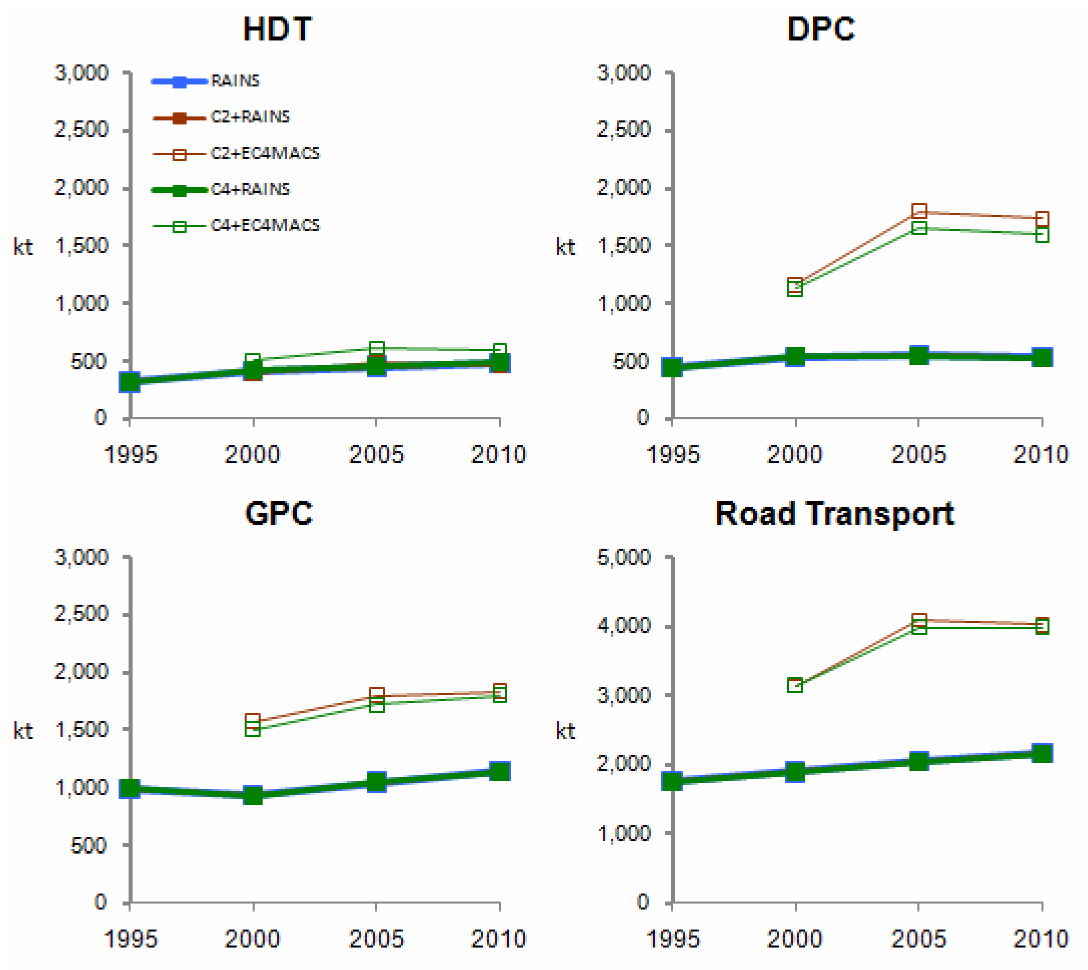

Figure 5: *Total fuel consumption in the different runs for Ireland*

3.2 Penetration of new technologies

The second parameter that may have a strong effect in the emission calculation is the rate of penetration of new technologies. RAINS made some predictions on the basis of historical data and assumptions on the vehicle replacement rate. A faster vehicle replacement leads to lower emissions at a given moment and vice versa.

The share of energy consumed by the various technologies per vehicle type is given in *Figure 6*. In order not to make the graph extremely busy, only the years 2000 and 2010 are shown. The 'RAINS' bars correspond to activity data in runs 1, 2, and 4. The 'EC4MACS' bars correspond to activity data in runs 3 and 5.

The technology mix in each particular year depends on the vehicle category, the country and the activity dataset considered. The trends in the year 2000 are not clear, and the technology mix is case specific. The only significant difference that can be observed is that the German and the French passenger cars stocks also consisted of Euro 3 (also some Euro 4 gasoline in Germany) vehicles in reality. RAINS estimates only included up to Euro 2 technologies. The faster replacement in this case, and the introduction of Euro 4 (which officially was introduced in 2005) were the results of national incentives and the fast technology improvements.

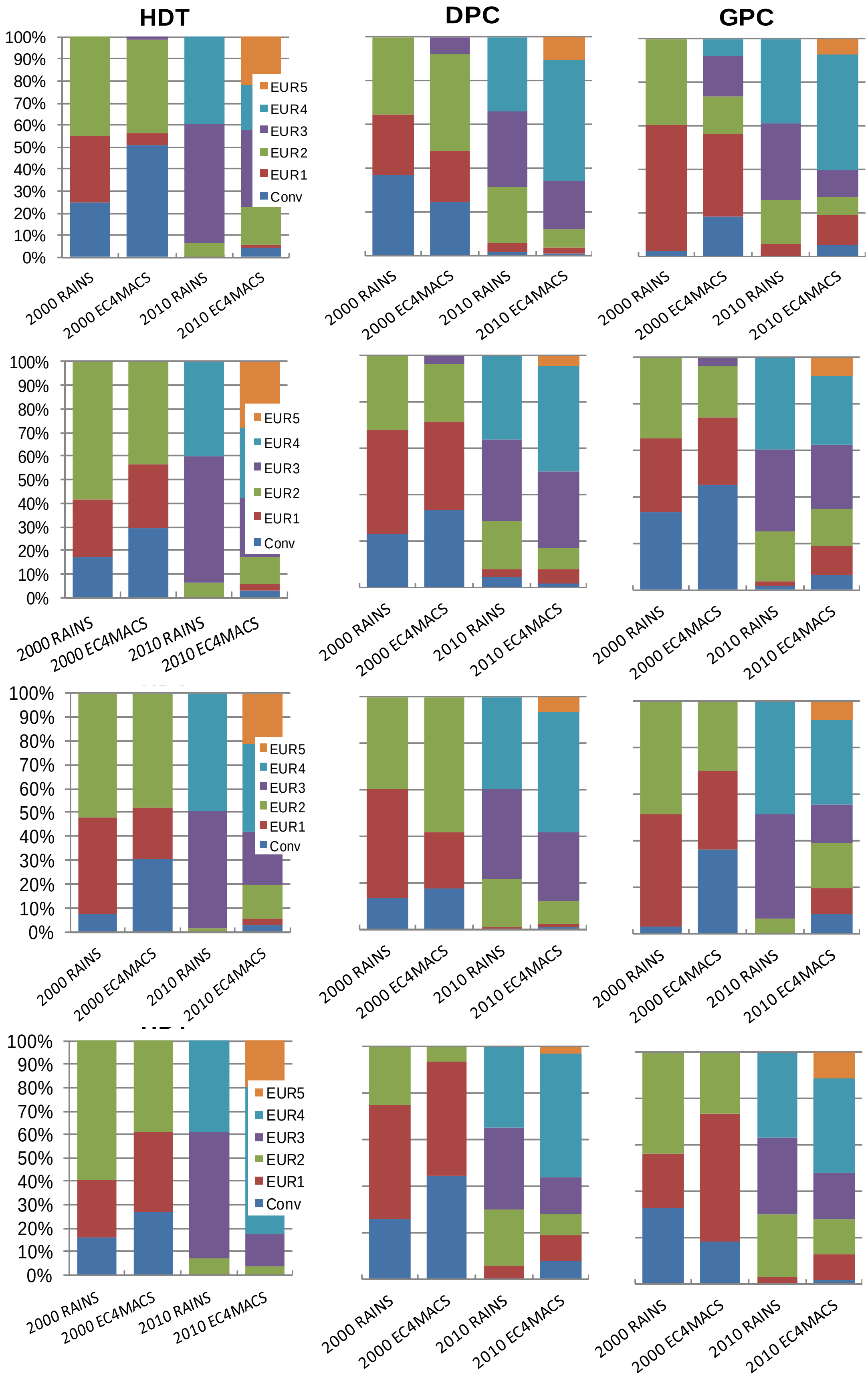

Figure 6: *Penetration of technologies assumed in the different runs for the years 2000 and 2010. From top to bottom rows: Germany, France, the Netherlands, and Ireland.*

However, some clear trends can be seen regarding the technology mix in the year 2005. First, in all cases, Euro 5 technology has appeared while RAINS stopped at Euro IV for heavy duty vehicles and Euro 4 for passenger cars. At the same time, RAINS has assumed a practically complete replacement of pre-Euro II HDVs and pre-Euro 2 passenger cars. However, the data of EC4MACS show that this is not true and that, despite the 18 years that have passed since the introduction of Euro 1 cars, these still correspond to a measurable activity. The same applies (to a lesser extent) for conventional cars as well. These two observations lead to a more diverse technology mix in reality, than the one considered in RAINS. The impact of old vehicle technologies on total emissions is not to be neglected due to their relatively high emission factors.

3.3 Total emission calculations

The total NOx emissions calculated per run in the case of Germany are shown in *Figure 7*. Run 1 (RAINS) and Run 2 (C2+RAINS) practically result to identical emissions, which confirms that the COPERT 2 implementation within RAINS has been successful. Starting from gasoline passenger cars, it is clear that basically all runs lead to the same emission calculation. COPERT 4 calculations are basically also marginally below the COPERT 2 ones, especially when the EC4MACS data are used.

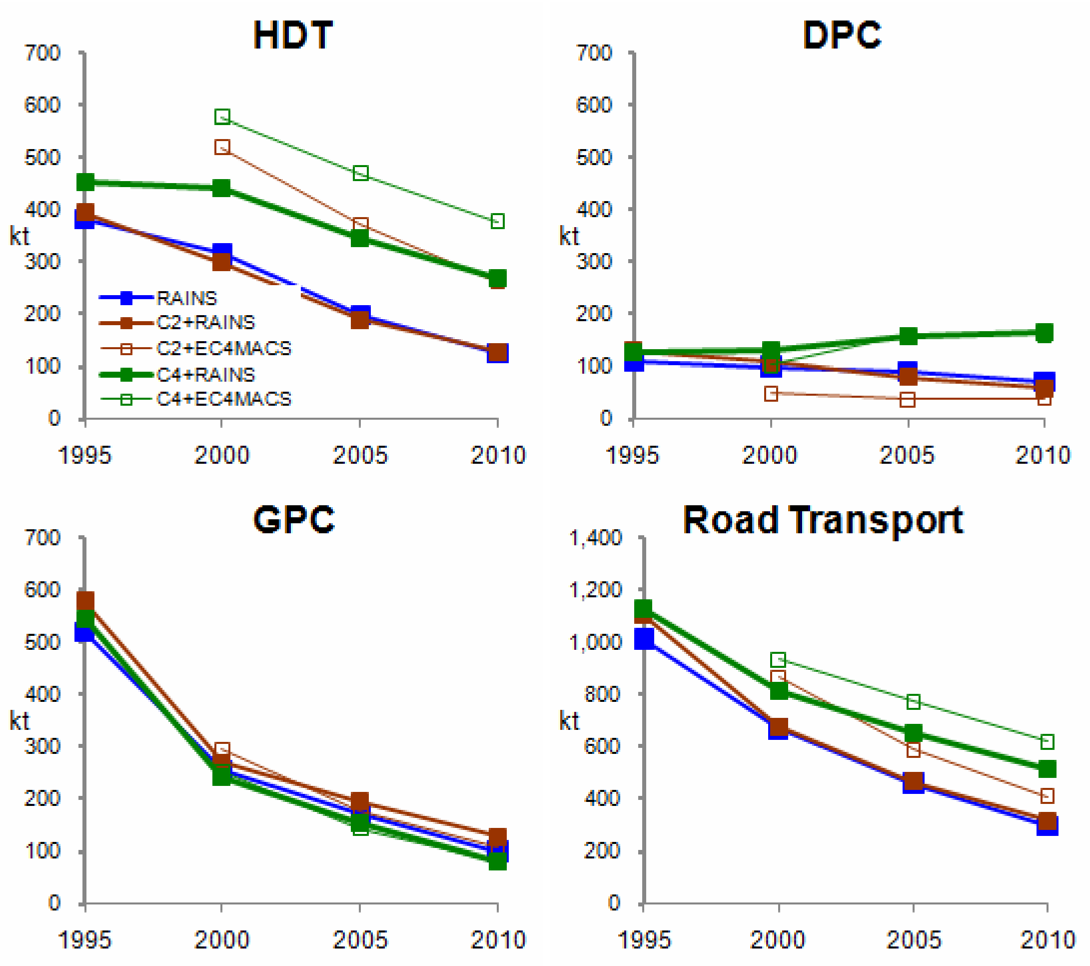

Figure 7: *NOx emissions for all runs in the case of Germany*

The main differences therefore originate from diesel cars. For HDVs, both the change of methodology and the activity data are responsible for much higher NOx emissions than has been predicted by RAINS. For passenger cars, the difference is mostly due to the change of methodology rather than on the activity data.

The total road transport NOx emissions in 2010 calculated with RAINS were 297 kt, i.e. 28% of the total NOx emission ceiling. With the change of methodology from COPERT II to COPERT 4, total emissions reached 518 kt, i.e. +74% of the original value. If in addition one assumes the change in the activity data, total NOx emissions reach 620 kt, or +109% of the original estimate. If the methodology did not change, then emissions would have been 410 kt, or +38% of the emission margin for transport. This analysis shows that both activity data and methodological changes are significant for the exceedance of the emission target in Germany.

The case of France (*Figure 8*) is quite similar to Germany. Gasoline passenger car emissions evolve as originally predicted and, due to their lower activity, emit in total marginally less than what RAINS assumed. There is some substantial difference in HDT emissions calculated by RAINS and by COPERT 2 with RAINS data. In principle, the two methodologies should have led to equivalent emissions. The different comes from the conventional emission factor assumed in RAINS (+38% of the emission factor considered in Germany). The reason for this higher emission factor is unknown. In any case, when all road transport is considered, the differences between RAINS and COPERT 2 are minimal by using the same activity data.

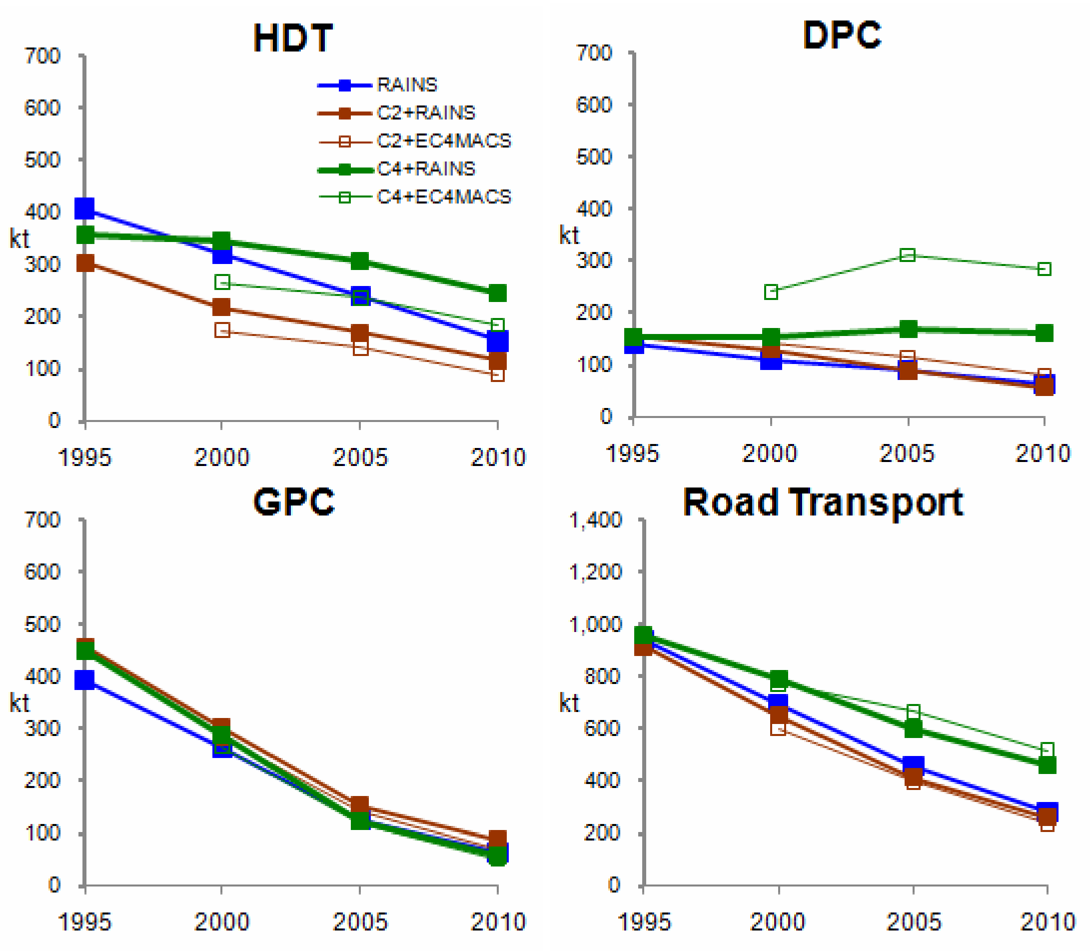

Figure 8: *NOx emissions for all runs in the case of France*

Large increases in total NOx emissions originate mostly from changes in the methodology rather than changes in the activity data. The two runs conducted with COPERT 4 are distinctly different than all other runs for total road transport, regardless of the activity dataset that has been used for the calculations. The total road transport NOx emissions in 2010 calculated with RAINS were 280 kt, i.e. 35% of the total NOx emission ceiling. With the change of methodology from COPERT II to COPERT 4, total emissions reached 463 kt, i.e. +65% of the original value. If one assumes the change in the activity data, total NOx emissions reach 518 kt, or +85% of the original estimate. If the methodology did not change, then emissions would have been 236 kt, or -16% of the emission margin for road transport. This shows that the changes in the methodology have had a significant impact on the contribution to which road transport makes as a fraction of the emission ceiling.

Dutch NOx emissions for road transport are shown in *Figure 9*. Dutch diesel passenger car emissions are relatively less important than German and French diesel car emissions due to their relatively smaller numbers in the total stock. The main difference in this case originates from diesel trucks and secondarily by gasoline passenger cars, which are still a significant portion of the stock and have not been removed as effectively as RAINS had assumed.

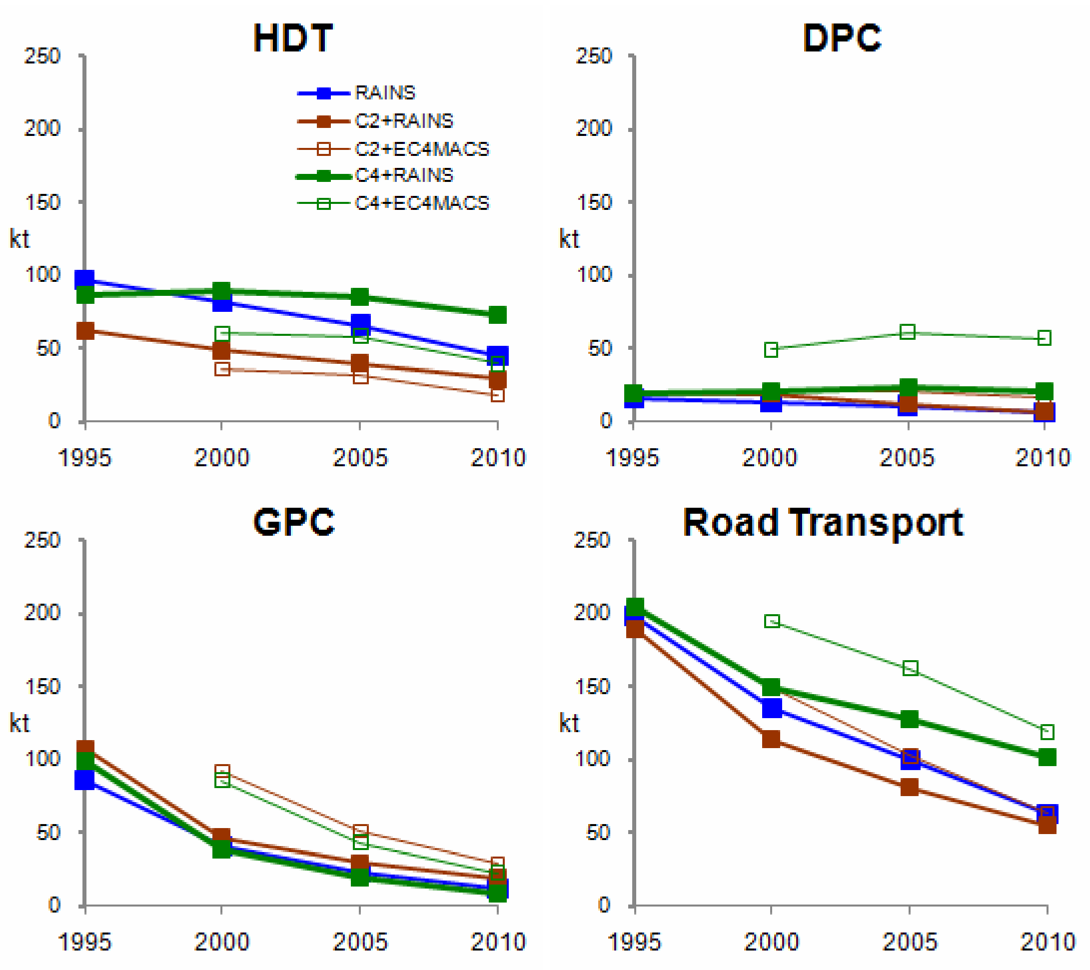

Figure 9: *NOx emissions for all runs in the case of the Netherlands*

Total road transport NOx emissions by RAINS in 2010 was 63 kt, i.e. 24% of the total NOx emission ceiling. With the change of methodology from COPERT II to COPERT 4, total emissions reach 102 kt, i.e. +62% of the original value. If in addition one assumes the change in the activity data, total NOx emissions reach 119 kt, or +89% of the original estimate. If the methodology had not changed, then emissions would have been 63 kt, i.e. exactly the same as the original RAINS predicted. This shows that road transport emissions in 2010 for the Netherlands would have exactly consistent with the original projections had the methodology not changed.

It is interesting to compare these results with the national estimates of the Netherlands for the attainment of the emission ceiling (Geilenkirchen, 2010). The Netherlands calculate that due to changes in methodology, the 2010 HDV emissions would have been +13 kt of what originally foreseen. Comparison of Run 5 with Run 3 in our case (change in methodology) shows +21 kt. This is of the same order of magnitude as Dutch calculations reveal.

Finally, the Irish case is shown in *Figure 10*. It is repeated that Ireland is one of the few cases that activity data greatly exceeded the projections for all vehicle categories and in particular for diesel cars. At the same time, this large increase in activity and economy growth meant a much faster introduction of new technologies than earlier foreseen. These are competing effects in terms of how total emissions evolve compared to the original calculations. Total road transport NOx by RAINS in 2010 was 12 kt, i.e. 18% of the total NOx emission ceiling. If the same activity data are introduced in COPERT 4 then total emissions reach 20 kt, i.e. +66% of the original value. If the new activity data are taken into account, total NOx reaches 37 kt, or +208% of the original estimate. If the methodology had not changed, then emissions would have been 17 kt, i.e. 42% higher than the target. This shows that in Ireland both activity data and methodology change contribute in missing the target.

Again it is interesting to compare these estimates with national calculations (Leinert, 2010). Calculations have not been made for 2010 but for 2008. In any case, this can still provide some insights. The total difference calculated by the Irish authorities with the actual 2008 data between COPERT II and COPERT 4 are 12.2 kt higher emissions in the latter case. Our difference is 20 kt referring to the year 2010 and mostly comes from diesel passenger cars. The difference to a certain extent comes from changes in the definitions between the two calculations. The Irish authorities apparently have transferred some of the COPERT 4 emission factors into COPERT 2 for these technology classes that COPERT 2 did not include data (Euro 3 and later). However, in our calculations we have used the RAINS emission reductions for these technologies, which according to *Figure 1* are comparatively high. This may explain most of the difference between the Irish and our calculations.

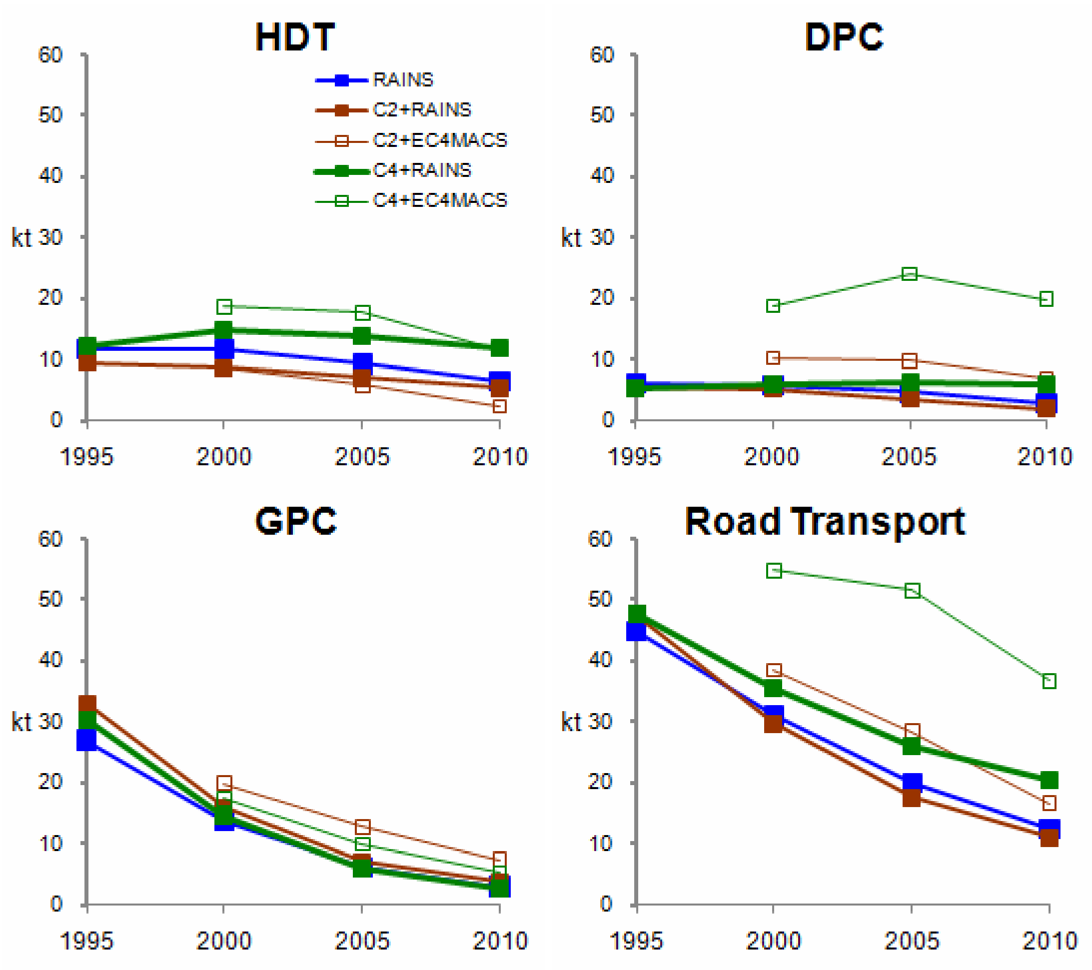

Figure 10: *NOx emissions for all runs in the case of Ireland*

3.4 Impact of individual vehicle classes

More insight on the particular vehicle classes which are responsible for the deviations in emissions is given in *Table 4* through *Table 7*. The tables provide the differences in fuel consumption and NOx emissions per vehicle type in RAINS in the case of Run 5 (COPERT 4 + EC4MACS) minus Run 1 (RAINS) and in the case of Run 4 (COPERT 4 + RAINS) minus RAINS. The first comparison expresses the difference between the most up-to-date activity data and methodology with the original RAINS calculations. The second comparison expresses the effect of changing the methodology using the original activity data. In this case no difference in the fuel consumption exists between the two runs.

The various vehicle categories in these tables have been classified in decreasing order based on their NOx emission difference in Run 5 minus RAINS. Two columns are also given which express emission differences per vehicle category over the RAINS total. For example in *Table 4* the Euro 4 and 5 diesel passenger cars only are responsible for 28% higher emissions than the total road transport that RAINS predicted for the year 2010. If the activity of these vehicles is considered equal to what RAINS originally predicted, the difference becomes 13% higher. This can be attributed solely to changes in the emission factor.

Table 4: *Consumption and emission differences per vehicle type in 2010 (Germany)*

Category	Technology	(C4 + EC4MACS) - RAINS			(C4 + RAINS) - RAINS	
		FC	NOx	NOx	NOx	NOx
		(kt)	(kt)	(% over RAINS total)	(kt)	(% over RAINS total)
DPC	EUR4+5	4,534	83	28	37	13
DHDV	EUR2	2,014	81	27	10	3
DHDV	EUR4+5	2,168	77	26	60	20
DHDV	EUR3	-541	61	21	74	25
GPC	Conv	1,151	33	11	0	0
DHDV	Conv	674	27	9	0	0
DPC	EUR3	-1,881	18	6	41	14
GPC	EUR1	831	7	2	-1	0
DHDV	EUR1	158	5	2	0	0
DPC	EUR1	-259	2	1	3	1
DPC	Conv	-87	0	0	0	0
GPC	EUR4+5	-1,219	-5	-2	-4	-1
DPC	EUR2	-2,500	-13	-5	12	4
GPC	EUR2	-5,668	-26	-9	-3	-1
GPC	EUR3	-10,217	-26	-9	-9	-3
Total G		-15,122	-17	-6	-17	-6
Total D		4,281	341	115	239	81

Table 5: *Consumption and emission differences per vehicle type in 2010 (France)*

Category	Technology	(C4 + EC4MACS) - RAINS			(C4 + RAINS) - RAINS	
		FC	NOx	NOx	NOx	NOx
		(kt)	(kt)	(% over RAINS total)	(kt)	(% over RAINS total)
DPC	EUR4+5	6,763	111	40	38	13
DPC	EUR3	2,955	86	31	41	15
DHDV	EUR4+5	541	51	18	46	16
DHDV	EUR2	297	15	5	4	2
DPC	EUR1	872	14	5	2	1
DPC	EUR2	-719	12	4	16	6
GPC	Conv	275	12	4	2	1
DHDV	Conv	218	9	3	0	0
DHDV	EUR1	207	7	2	0	0
GPC	EUR1	695	5	2	-1	0
DPC	Conv	-226	-2	-1	0	0
GPC	EUR4+5	-4,992	-6	-2	-1	0
GPC	EUR2	-2,971	-12	-4	-1	0
GPC	EUR3	-4,929	-12	-4	-4	-2
DHDV	EUR3	-3,435	-51	-18	40	14
Total G		-11,922	-13	-5	-5	-2
Total D		7,475	251	89	187	67

Table 6: *Consumption and emission differences per vehicle type in 2010 (Netherlands)*

Category	Technology	(C4 + EC4MACS) - RAINS			(C4 + RAINS) - RAINS	
		FC	NOx	NOx	NOx	NOx
		(kt)	(kt)	(% over RAINS total)	(kt)	(% over RAINS total)
DPC	EUR4+5	2,094	28	45	6	10
DPC	EUR3	771	16	26	6	9
GPC	Conv	320	13	21	0	0
DHDV	EUR2	200	7	12	0	1
DHDV	EUR4+5	-564	5	7	18	28
DPC	EUR2	108	4	7	2	4
GPC	EUR1	410	4	6	0	0
DHDV	Conv	39	2	3	0	0
DHDV	EUR1	49	2	3	0	0
GPC	EUR2	357	1	2	0	0
DPC	EUR1	60	1	1	0	0
DPC	Conv	38	0	1	0	0
GPC	EUR4+5	-1,293	-2	-3	-1	-2
GPC	EUR3	-2,175	-5	-9	-2	-4
DHDV	EUR3	-1,161	-20	-32	11	17
Total G		-2,381	11	17	-4	-6
Total D		1,634	45	73	43	69

Table 7: *Consumption and emission differences per vehicle type in 2010 (Ireland)*

Category	Technology	(C4 + EC4MACS) - RAINS			(C4 + RAINS) - RAINS	
		FC	NOx	NOx	NOx	NOx
		(kt)	(kt)	(% over RAINS total)	(kt)	(% over RAINS total)
DPC	EUR4+5	705	9	69	1	9
DHDV	EUR4+5	300	7	59	2	19
DPC	EUR1	154	2	20	0	0
DPC	Conv	122	2	20	0	0
DPC	EUR3	72	2	19	1	10
GPC	EUR1	166	1	10	0	0
DPC	EUR2	8	1	8	0	4
GPC	Conv	28	1	5	0	0
GPC	EUR4+5	514	1	4	0	0
DHDV	EUR1	0	0	0	0	0
DHDV	Conv	-1	0	0	0	0
GPC	EUR2	-34	0	0	0	0
DHDV	EUR2	-12	0	0	0	3
GPC	EUR3	-16	0	-1	0	-2
DHDV	EUR3	-182	-2	-18	3	21
Total G		658	2	18	0	-2
Total D		1,166	22	177	8	66

4 Discussion and conclusions

The results in the previous chapter allow some important messages to be delivered concerning the attainment of the emission ceilings by the different Member States and the impact of methodologies on the target.

The first conclusion comes from observation of the total consumption values. With the exception of Ireland, the total fuel consumption reported is similar between the RAINS projections and what has been observed in reality. In Ireland, the economic boom over the 2000s led to total fuel consumption greatly (+80%) exceeding predictions. Moreover, in all four countries examined, the diesel fuel consumption greatly exceeds what was foreseen by RAINS. The reason in three countries (FR, NL, IE) has been the increasing dieselisation of the passenger car stock. In 1999, when preparing the emission ceilings, the new registrations of diesel cars corresponded to 44%, 23%, and 11% respectively of total car registrations. In 2010, the corresponding figures where 71%, 17%, and 62%, i.e. with the exception of the Netherlands, much higher figures. In the Netherlands, the 17% is a low number, which only appeared in 2010. Diesel car registrations have been generally up to 28% in the 2000s. In Germany the higher diesel consumption has not been so much due to cars, although the rate by which diesel consumption in cars increases is much higher than foreseen. The reason has rather been the heavy duty diesel consumption. The higher share of diesel consumption than predicted is by itself a good reason to exceed the emission ceiling, due to the much higher NOx emission factors of diesel vehicles.

The vehicle replacement rate is also a significant parameter that has an impact on emissions. The comparison of the actual stock evolution with the RAINS projections for 2010 shows that the actual stock is more diverse than what RAINS assumed. That means that both the penetration of new technologies is faster than predicted but also that the older technologies (Conventional and Euro 1) are not removed from the stock as assumed in RAINS. The introduction of new technologies is advantageous for emission reductions, to the extent that emission factors of new technologies drop. However, the remaining of old technologies means that, despite their low contribution in total activity, they may still lead to significant emissions due to their relatively high emission factors.

Based on analysis of this work, *Table 8* presents a summary of the most important calculations. The table shows that when using COPERT 4 and the most up-to-date activity data significantly higher emissions will occur from the road transport sector than originally foreseen. The deviations from original RAINS calculations are actually very high, ranging from +89% in the case of the Netherlands up to 208% in the case of Ireland. Had the methodology not changed, then France may have met by some margin their emission reduction targets while the Netherlands would have exactly achieved the target assuming in both instances that emissions from the other sectors in the economy remained consistent in terms of their contributions to total emissions. In both Germany and in particular Ireland, the unforeseen increases in their total activity compared to what RAINS predicted has led to significantly higher emissions than originally predicted.

Table 8: *Summary of differences between alternative calculations*

Country	Units	RAINS	COPERT II +New Activity	COPERT 4 + New Activity	Ceiling
Germany	kt	297	410	620	1051
	(%)		38	109	
France	kt	280	236	518	810
	(%)		-16	85	
Netherlands	kt	63	63	119	260
	(%)		0	89	
Ireland	kt	12	17	37	65
	(%)		42	208	

The vehicle types which are responsible for the large deviation between original estimates and actual emissions are mainly new technologies of - primarily - passenger cars and secondarily HDVs. In both cases, the emission standards failed to bring equivalent reductions to the emission factors.

As road transport is in most Member States one of, or the single most significant contributor to total NOx emissions, methodological effects on road transport NOx emission calculations do have a direct impact on the reported total NOx emissions. The analysis in this work therefore shows that changes in the methodology, coupled with the consequence of emission standards which have failed to bring about the reductions foreseen, together result in significant increases in road transport NOx emissions.

5 References

Amann et al. (2010). Greenhouse gases and air pollutants in the European Union: Baseline projections up to 2030. EC4MACS Interim Assessment. IIASA, Austria.

Amann, M., Bertok, I., Cofala, J., Gyarfas, F., Heyes, Ch., Klimont, Z., Makowski, M., Schöpp, W., Syri, S. (1998). Cost-effective Control of Acidification and Ground-Level Ozone. Part A: Methodology and Databases. Sixth Interim Report, IIASA, Austria, p.111.

Capros et al., 1997, Business as Usual Energy Scenario for EU-15. National Technical University of Athens (NTUA), Athens, Greece.

Geilenkirchen, G. (2010). Implications of new insights on Euro-V NOx-emissions for Dutch emission inventory. Presentation in the EEA Workshop on road transport emission uncertainties. 18 November 2010, Copenhagen, Denmark. Available online at http://www.eionet.europa.eu/events/transport%20uncertainties/.

Leinert, S. (2010). Effect of Copert emission factors on calculated NOx emissions. Presentation in the EEA Workshop on road transport emission uncertainties. 18 November 2010, Copenhagen, Denmark. Available online at http://www.eionet.europa.eu/events/transport%20uncertainties/.

Mellios, G., Papageorgiou, Th., Ntziachristos, L. (2009). Centralised and national submissions of transport emissions. Report 09.RE.0026.V1, Lab of Applied Thermodynamics, Thessaloniki, Greece.

Ntziachristos, L. et al. (2008). Final Report: European Database of Vehicle Stock for the Calculation and Forecast of Pollutant and Greenhouse Gases Emissions with TREMOVE and COPERT. Lab of Applied Thermodynamics, Thessaloniki, Greece.

Vestreng, V., Ntziachristos, L., Semb, A., Reis, S., Isaksen, I., Tarrasón, L. 2008. Evolution of NOx emissions in Europe with focus on road transport control measures. Atmospheric Chemistry and Physics, 9, 1503–1520.

6 Annex: Detailed calculations per country, year, run and vehicle type

Germany

RAINS [SCEN_1]			FC (kt)				NOx (kt)			
			1995	2000	2005	2010	1995	2000	2005	2010
D	Heavy Duty Trucks	Conv	8,312	3,106	179	23	297	111	6	1
D	Heavy Duty Trucks	EUR1	3,562	3,727	654	17	85	89	16	0
D	Heavy Duty Trucks	EUR2	0	5,590	3,829	689	0	114	78	14
D	Heavy Duty Trucks	EUR3	0	0	6,751	5,923	0	0	97	85
D	Heavy Duty Trucks	EUR4	0	0	0	4,388	0	0	0	25
D	Heavy Duty Trucks	EUR5								
G	Passenger Cars	Conv	9,461	758	35	4	338	27	1	0
G	Passenger Cars	EUR1	20,105	18,704	9,023	2,086	182	169	82	19
G	Passenger Cars	EUR2	0	12,781	12,519	7,441	0	58	57	34
G	Passenger Cars	EUR3	0	0	13,599	12,954	0	0	33	31
G	Passenger Cars	EUR4	0	0	0	14,171	0	0	0	16
G	Passenger Cars	EUR5								
D	Passenger Cars	Conv	8,225	4,243	1,418	214	95	49	16	2
D	Passenger Cars	EUR1	2,541	3,179	2,236	653	15	18	13	4
D	Passenger Cars	EUR2	0	4,067	5,049	3,765	0	32	40	30
D	Passenger Cars	EUR3	0	0	4,574	5,100	0	0	21	24
D	Passenger Cars	EUR4	0	0	0	5,115	0	0	0	12
D	Passenger Cars	EUR5								
D	Heavy Duty Trucks	ALL	11,874	12,422	11,413	11,040	382	315	198	125
G	Passenger Cars	ALL	29,566	32,243	35,176	36,656	520	254	172	100
D	Passenger Cars	ALL	10,766	11,488	13,276	14,847	110	100	91	71
Road Transport			52,206	56,153	59,865	62,543	1,012	669	460	297

COPERT II [SCEN_2]			FC (kt)				NOx (kt)			
			1995	2000	2005	2010	1995	2000	2005	2010
D	Heavy Duty Trucks	Conv	8,312	3,106	179	23	312	117	7	1
D	Heavy Duty Trucks	EUR1	3,562	3,727	654	17	82	86	15	0
D	Heavy Duty Trucks	EUR2	0	5,590	3,829	689	0	97	66	12
D	Heavy Duty Trucks	EUR3	0	0	6,751	5,923	0	0	102	89
D	Heavy Duty Trucks	EUR4	0	0	0	4,388	0	0	0	26
D	Heavy Duty Trucks	EUR5								
G	Passenger Cars	Conv	9,461	758	35	4	379	30	1	0
G	Passenger Cars	EUR1	20,105	18,704	9,023	2,086	200	186	90	21
G	Passenger Cars	EUR2	0	12,781	12,519	7,441	0	54	52	31
G	Passenger Cars	EUR3	0	0	13,599	12,954	0	0	52	49
G	Passenger Cars	EUR4	0	0	0	14,171	0	0	0	26
G	Passenger Cars	EUR5								
D	Passenger Cars	Conv	8,225	4,243	1,418	214	100	52	17	3
D	Passenger Cars	EUR1	2,541	3,179	2,236	653	29	37	26	8
D	Passenger Cars	EUR2	0	4,067	5,049	3,765	0	21	26	20
D	Passenger Cars	EUR3	0	0	4,574	5,100	0	0	11	12
D	Passenger Cars	EUR4	0	0	0	5,115	0	0	0	17
D	Passenger Cars	EUR5								
D	Heavy Duty Trucks	ALL	11,874	12,422	11,413	11,040	394	299	190	129
G	Passenger Cars	ALL	29,566	32,243	35,176	36,656	579	270	195	128
D	Passenger Cars	ALL	10,766	11,488	13,276	14,847	129	109	80	59
Road Transport			52,206	56,153	59,865	62,543	1,103	678	465	315

COPERT II [SCEN_3]			FC (kt)				NOx (kt)			
			1995	2000	2005	2010	1995	2000	2005	2010
D	Heavy Duty Trucks	Conv		8,689	3,048	794	0	357	129	34
D	Heavy Duty Trucks	EUR1		854	415	182	0	20	10	4
D	Heavy Duty Trucks	EUR2		8,124	6,955	3,589	0	142	123	65
D	Heavy Duty Trucks	EUR3		212	7,009	6,733	0	0	110	109
D	Heavy Duty Trucks	EUR4		0	99	8,302	0	0	0	51
D	Heavy Duty Trucks	EUR5								
G	Passenger Cars	Conv		4,688	2,375	1,138	0	139	68	32
G	Passenger Cars	EUR1		11,586	6,506	3,347	0	113	64	33
G	Passenger Cars	EUR2		4,971	3,308	1,964	0	19	13	7
G	Passenger Cars	EUR3		5,402	4,797	2,992	0	21	18	11
G	Passenger Cars	EUR4		2,246	8,414	13,646	0	4	16	25
G	Passenger Cars	EUR5								
D	Passenger Cars	Conv		1,951	581	130	0	23	7	2
D	Passenger Cars	EUR1		1,720	1,077	434	0	13	7	3
D	Passenger Cars	EUR2		2,566	2,455	1,114	0	12	11	4
D	Passenger Cars	EUR3		451	4,353	2,505	0	1	13	8
D	Passenger Cars	EUR4		0	1,614	7,538	0	0	0	22
D	Passenger Cars	EUR5								
D	Heavy Duty Trucks	ALL		17,880	17,527	19,600	0	519	372	263
G	Passenger Cars	ALL		28,893	25,400	23,087	0	296	178	109
D	Passenger Cars	ALL		6,688	10,080	11,721	0	49	37	38
Road Transport				53,460	53,008	54,408	0	864	588	410

COPERT 4 [SCEN_4]			FC (kt)				NOx (kt)			
			1995	2000	2005	2010	1995	2000	2005	2010
D	Heavy Duty Trucks	Conv	8,312	3,106	179	23	340	127	7	1
D	Heavy Duty Trucks	EUR1	3,562	3,727	654	17	113	118	21	1
D	Heavy Duty Trucks	EUR2	0	5,590	3,829	689	0	195	134	24
D	Heavy Duty Trucks	EUR3	0	0	6,751	5,923	0	0	182	160
D	Heavy Duty Trucks	EUR4	0	0	0	4,388	0	0	0	84
D	Heavy Duty Trucks	EUR5								
G	Passenger Cars	Conv	9,461	758	35	4	372	30	1	0
G	Passenger Cars	EUR1	20,105	18,704	9,023	2,086	173	160	77	18
G	Passenger Cars	EUR2	0	12,781	12,519	7,441	0	53	51	31
G	Passenger Cars	EUR3	0	0	13,599	12,954	0	0	23	22
G	Passenger Cars	EUR4	0	0	0	14,171	0	0	0	12
G	Passenger Cars	EUR5								
D	Passenger Cars	Conv	8,225	4,243	1,418	214	100	52	17	3
D	Passenger Cars	EUR1	2,541	3,179	2,236	653	28	35	24	7
D	Passenger Cars	EUR2	0	4,067	5,049	3,765	0	46	57	42
D	Passenger Cars	EUR3	0	0	4,574	5,100	0	0	58	65
D	Passenger Cars	EUR4	0	0	0	5,115	0	0	0	49
D	Passenger Cars	EUR5								
D	Heavy Duty Trucks	ALL	11,874	12,422	11,413	11,040	453	441	344	269
G	Passenger Cars	ALL	29,566	32,243	35,176	36,656	545	242	153	83
D	Passenger Cars	ALL	10,766	11,488	13,276	14,847	128	132	157	166
Road Transport			52,206	56,153	59,865	62,543	1,126	815	653	518

COPERT 4 [SCEN_5]			FC (kt)				NOx (kt)			
			1995	2000	2005	2010	1995	2000	2005	2010
D	Heavy Duty Trucks	Conv	[redacted]	7,903	2,708	697	0	317	109	28
D	Heavy Duty Trucks	EUR1	[redacted]	808	402	175	0	26	13	6
D	Heavy Duty Trucks	EUR2	[redacted]	6,564	5,419	2,703	0	230	190	95
D	Heavy Duty Trucks	EUR3	[redacted]	175	5,758	5,382	0	5	156	146
D	Heavy Duty Trucks	EUR4	[redacted]	0	88	3,211	0	0	2	62
D	Heavy Duty Trucks	EUR5	[redacted]	0	0	3,345	0	0	0	40
G	Passenger Cars	Conv	[redacted]	4,739	2,405	1,154	0	141	70	33
G	Passenger Cars	EUR1	[redacted]	9,997	5,637	2,917	0	84	48	25
G	Passenger Cars	EUR2	[redacted]	4,440	2,962	1,773	0	17	12	8
G	Passenger Cars	EUR3	[redacted]	4,787	4,256	2,737	0	8	7	5
G	Passenger Cars	EUR4	[redacted]	2,114	7,889	11,359	0	2	7	10
G	Passenger Cars	EUR5	[redacted]	0	0	1,593	0	0	0	1
D	Passenger Cars	Conv	[redacted]	1,926	571	127	0	28	9	2
D	Passenger Cars	EUR1	[redacted]	1,801	1,049	394	0	24	15	6
D	Passenger Cars	EUR2	[redacted]	3,470	3,034	1,266	0	42	38	16
D	Passenger Cars	EUR3	[redacted]	608	5,697	3,219	0	8	76	42
D	Passenger Cars	EUR4	[redacted]	0	2,177	8,072	0	0	23	83
D	Passenger Cars	EUR5	[redacted]	0	0	1,577	0	0	0	11
D	Heavy Duty Trucks	ALL	[redacted]	15,450	14,376	15,514	0	577	469	377
G	Passenger Cars	ALL	[redacted]	26,076	23,150	21,534	0	253	143	83
D	Passenger Cars	ALL	[redacted]	7,805	12,528	14,654	0	102	160	161
Road Transport			[redacted]	49,331	50,054	51,701	0	932	772	620

France

RAINS [SCEN_1]			FC (kt)				NOx (kt)			
			1995	2000	2005	2010	1995	2000	2005	2010
D	Heavy Duty Trucks	Conv	5,988	1,672	152	19	292	81	7	1
D	Heavy Duty Trucks	EUR1	3,517	2,397	577	14	115	78	19	0
D	Heavy Duty Trucks	EUR2	0	5,742	3,409	614	0	160	95	17
D	Heavy Duty Trucks	EUR3	0	0	6,090	5,352	0	0	119	105
D	Heavy Duty Trucks	EUR4	0	0	0	4,001	0	0	0	31
D	Heavy Duty Trucks	EUR5								
G	Passenger Cars	Conv	10,626	5,576	1,348	367	367	193	47	13
G	Passenger Cars	EUR1	3,096	5,212	3,500	497	27	46	31	4
G	Passenger Cars	EUR2	0	5,801	6,787	4,536	0	25	30	20
G	Passenger Cars	EUR3	0	0	7,757	7,560	0	0	18	17
G	Passenger Cars	EUR4	0	0	0	8,640	0	0	0	10
G	Passenger Cars	EUR5								
D	Passenger Cars	Conv	10,616	3,208	1,189	596	120	36	13	7
D	Passenger Cars	EUR1	2,469	6,090	3,588	572	19	47	28	4
D	Passenger Cars	EUR2	0	4,434	4,450	2,890	0	25	25	16
D	Passenger Cars	EUR3	0	0	5,287	5,112	0	0	24	23
D	Passenger Cars	EUR4	0	0	0	5,157	0	0	0	11
D	Passenger Cars	EUR5								
D	Heavy Duty Trucks	ALL	9,504	9,811	10,228	10,000	407	320	241	154
G	Passenger Cars	ALL	13,721	16,589	19,392	21,600	394	264	125	64
D	Passenger Cars	ALL	13,086	13,732	14,514	14,326	140	109	91	62
Road Transport			36,311	40,132	44,133	45,926	940	693	456	280

COPERT II [SCEN_2]			FC (kt)				NOx (kt)			
			1995	2000	2005	2010	1995	2000	2005	2010
D	Heavy Duty Trucks	Conv	5,988	1,672	152	19	223	62	6	1
D	Heavy Duty Trucks	EUR1	3,517	2,397	577	14	81	55	13	0
D	Heavy Duty Trucks	EUR2	0	5,742	3,409	614	0	99	59	11
D	Heavy Duty Trucks	EUR3	0	0	6,090	5,352	0	0	91	80
D	Heavy Duty Trucks	EUR4	0	0	0	4,001	0	0	0	24
D	Heavy Duty Trucks	EUR5								
G	Passenger Cars	Conv	10,626	5,576	1,348	367	426	224	54	15
G	Passenger Cars	EUR1	3,096	5,212	3,500	497	32	53	36	5
G	Passenger Cars	EUR2	0	5,801	6,787	4,536	0	26	31	20
G	Passenger Cars	EUR3	0	0	7,757	7,560	0	0	32	31
G	Passenger Cars	EUR4	0	0	0	8,640	0	0	0	17
G	Passenger Cars	EUR5								
D	Passenger Cars	Conv	10,616	3,208	1,189	596	126	38	14	7
D	Passenger Cars	EUR1	2,469	6,090	3,588	572	28	70	41	7
D	Passenger Cars	EUR2	0	4,434	4,450	2,890	0	22	23	15
D	Passenger Cars	EUR3	0	0	5,287	5,112	0	0	12	12
D	Passenger Cars	EUR4	0	0	0	5,157	0	0	0	17
D	Passenger Cars	EUR5								
D	Heavy Duty Trucks	ALL	9,504	9,811	10,228	10,000	304	217	169	116
G	Passenger Cars	ALL	13,721	16,589	19,392	21,600	458	303	152	88
D	Passenger Cars	ALL	13,086	13,732	14,514	14,326	154	131	90	57
Road Transport			36,311	40,132	44,133	45,926	917	651	411	261

COPERT II [SCEN_3]			FC (kt)				NOx (kt)			
			1995	2000	2005	2010	1995	2000	2005	2010
D	Heavy Duty Trucks	Conv		1,726	476	195	0	67	19	8
D	Heavy Duty Trucks	EUR1		2,048	852	217	0	47	19	5
D	Heavy Duty Trucks	EUR2		3,529	2,771	925	0	61	48	16
D	Heavy Duty Trucks	EUR3		0	3,506	1,874	0	0	55	29
D	Heavy Duty Trucks	EUR4		0	0	4,996	0	0	0	31
D	Heavy Duty Trucks	EUR5								
G	Passenger Cars	Conv		5,815	2,162	650	0	217	80	23
G	Passenger Cars	EUR1		4,077	2,654	1,312	0	46	30	15
G	Passenger Cars	EUR2		3,333	2,795	1,786	0	17	15	9
G	Passenger Cars	EUR3		494	3,695	2,804	0	2	17	13
G	Passenger Cars	EUR4		0	286	3,689	0	0	1	7
G	Passenger Cars	EUR5								
D	Passenger Cars	Conv		6,231	2,222	384	0	74	26	5
D	Passenger Cars	EUR1		6,407	4,019	1,282	0	51	33	11
D	Passenger Cars	EUR2		3,934	3,859	1,910	0	17	16	8
D	Passenger Cars	EUR3		503	11,051	7,626	0	1	39	27
D	Passenger Cars	EUR4		0	623	11,266	0	0	0	29
D	Passenger Cars	EUR5								
D	Heavy Duty Trucks	ALL		7,304	7,605	8,208	0	175	140	88
G	Passenger Cars	ALL		13,720	11,592	10,242	0	283	142	67
D	Passenger Cars	ALL		17,075	21,774	22,468	0	143	114	81
Road Transport				38,098	40,971	40,918	0	600	396	236

COPERT 4 [SCEN_4]			FC (kt)				NOx (kt)			
			1995	2000	2005	2010	1995	2000	2005	2010
D	Heavy Duty Trucks	Conv	5,988	1,672	152	19	245	68	6	1
D	Heavy Duty Trucks	EUR1	3,517	2,397	577	14	112	76	18	0
D	Heavy Duty Trucks	EUR2	0	5,742	3,409	614	0	202	120	22
D	Heavy Duty Trucks	EUR3	0	0	6,090	5,352	0	0	164	145
D	Heavy Duty Trucks	EUR4	0	0	0	4,001	0	0	0	77
D	Heavy Duty Trucks	EUR5								
G	Passenger Cars	Conv	10,626	5,576	1,348	367	426	223	54	15
G	Passenger Cars	EUR1	3,096	5,212	3,500	497	23	39	26	4
G	Passenger Cars	EUR2	0	5,801	6,787	4,536	0	25	29	19
G	Passenger Cars	EUR3	0	0	7,757	7,560	0	0	14	13
G	Passenger Cars	EUR4	0	0	0	8,640	0	0	0	8
G	Passenger Cars	EUR5								
D	Passenger Cars	Conv	10,616	3,208	1,189	596	128	39	14	7
D	Passenger Cars	EUR1	2,469	6,090	3,588	572	27	67	39	6
D	Passenger Cars	EUR2	0	4,434	4,450	2,890	0	50	50	33
D	Passenger Cars	EUR3	0	0	5,287	5,112	0	0	67	64
D	Passenger Cars	EUR4	0	0	0	5,157	0	0	0	49
D	Passenger Cars	EUR5								
D	Heavy Duty Trucks	ALL	9,504	9,811	10,228	10,000	357	346	309	244
G	Passenger Cars	ALL	13,721	16,589	19,392	21,600	449	287	123	59
D	Passenger Cars	ALL	13,086	13,732	14,514	14,326	155	155	170	160
Road Transport			36,311	40,132	44,133	45,926	960	789	602	463

COPERT 4 [SCEN_5]			FC (kt)				NOx (kt)			
			1995	2000	2005	2010	1995	2000	2005	2010
D	Heavy Duty Trucks	Conv	[redacted]	2,197	615	237	0	88	25	10
D	Heavy Duty Trucks	EUR1	[redacted]	1,972	822	221	0	63	26	7
D	Heavy Duty Trucks	EUR2	[redacted]	3,247	2,612	911	0	115	93	32
D	Heavy Duty Trucks	EUR3	[redacted]	0	3,363	1,917	0	0	93	53
D	Heavy Duty Trucks	EUR4	[redacted]	0	0	2,334	0	0	0	46
D	Heavy Duty Trucks	EUR5	[redacted]	0	0	2,208	0	0	0	36
G	Passenger Cars	Conv	[redacted]	5,804	2,140	642	0	221	81	24
G	Passenger Cars	EUR1	[redacted]	3,661	2,416	1,192	0	29	20	10
G	Passenger Cars	EUR2	[redacted]	2,891	2,442	1,565	0	14	12	8
G	Passenger Cars	EUR3	[redacted]	441	3,308	2,631	0	1	6	5
G	Passenger Cars	EUR4	[redacted]	0	267	2,875	0	0	0	3
G	Passenger Cars	EUR5	[redacted]	0	0	773	0	0	0	1
D	Passenger Cars	Conv	[redacted]	5,975	2,135	370	0	84	29	5
D	Passenger Cars	EUR1	[redacted]	6,668	4,256	1,444	0	89	56	18
D	Passenger Cars	EUR2	[redacted]	4,461	4,249	2,171	0	58	56	28
D	Passenger Cars	EUR3	[redacted]	632	11,763	8,066	0	9	161	109
D	Passenger Cars	EUR4	[redacted]	0	782	10,768	0	0	8	114
D	Passenger Cars	EUR5	[redacted]	0	0	1,152	0	0	0	9
D	Heavy Duty Trucks	ALL	[redacted]	7,416	7,413	7,829	0	267	237	184
G	Passenger Cars	ALL	[redacted]	12,796	10,574	9,678	0	265	119	51
D	Passenger Cars	ALL	[redacted]	17,735	23,186	23,972	0	241	310	283
Road Transport			[redacted]	37,947	41,172	41,479	0	773	666	518

Ireland

RAINS [SCEN_1]			FC (kt)				NOx (kt)			
			1995	2000	2005	2010	1995	2000	2005	2010
D	Heavy Duty Trucks	Conv	195	67	6	1	8	3	0	0
D	Heavy Duty Trucks	EUR1	123	102	27	1	3	3	1	0
D	Heavy Duty Trucks	EUR2	0	248	160	32	0	6	4	1
D	Heavy Duty Trucks	EUR3	0	0	261	264	0	0	4	4
D	Heavy Duty Trucks	EUR4	0	0	0	188	0	0	0	1
D	Heavy Duty Trucks	EUR5								
G	Passenger Cars	Conv	759	303	64	5	25	10	2	0
G	Passenger Cars	EUR1	228	219	152	26	2	2	1	0
G	Passenger Cars	EUR2	0	411	446	314	0	2	2	1
G	Passenger Cars	EUR3	0	0	383	377	0	0	1	1
G	Passenger Cars	EUR4	0	0	0	418	0	0	0	0
G	Passenger Cars	EUR5								
D	Passenger Cars	Conv	370	141	64	3	5	2	1	0
D	Passenger Cars	EUR1	77	264	155	28	1	3	2	0
D	Passenger Cars	EUR2	0	135	137	129	0	1	1	1
D	Passenger Cars	EUR3	0	0	191	187	0	0	1	1
D	Passenger Cars	EUR4	0	0	0	187	0	0	0	1
D	Passenger Cars	EUR5								
D	Heavy Duty Trucks	ALL	319	418	454	486	12	12	9	7
G	Passenger Cars	ALL	987	933	1,045	1,140	27	14	6	3
D	Passenger Cars	ALL	447	540	547	534	6	6	5	3
Road Transport			1,753	1,890	2,046	2,160	45	31	20	12

COPERT II [SCEN_2]			FC (kt)				NOx (kt)			
			1995	2000	2005	2010	1995	2000	2005	2010
D	Heavy Duty Trucks	Conv	195	67	6	1	7	2	0	0
D	Heavy Duty Trucks	EUR1	123	102	27	1	3	2	1	0
D	Heavy Duty Trucks	EUR2	0	248	160	32	0	4	3	1
D	Heavy Duty Trucks	EUR3	0	0	261	264	0	0	4	4
D	Heavy Duty Trucks	EUR4	0	0	0	188	0	0	0	1
D	Heavy Duty Trucks	EUR5								
G	Passenger Cars	Conv	759	303	64	5	31	12	3	0
G	Passenger Cars	EUR1	228	219	152	26	2	2	1	0
G	Passenger Cars	EUR2	0	411	446	314	0	2	2	1
G	Passenger Cars	EUR3	0	0	383	377	0	0	1	1
G	Passenger Cars	EUR4	0	0	0	418				
G	Passenger Cars	EUR5					0	0	0	1
D	Passenger Cars	Conv	370	141	64	3	4	2	1	0
D	Passenger Cars	EUR1	77	264	155	28	1	3	2	0
D	Passenger Cars	EUR2	0	135	137	129	0	1	1	1
D	Passenger Cars	EUR3	0	0	191	187	0	0	0	0
D	Passenger Cars	EUR4	0	0	0	187	0	0	0	1
D	Passenger Cars	EUR5								
D	Heavy Duty Trucks	ALL	319	418	454	486	9	9	7	5
G	Passenger Cars	ALL	987	933	1,045	1,140	33	16	7	4
D	Passenger Cars	ALL	447	540	547	534	5	5	4	2
Road Transport			1,753	1,890	2,046	2,160	48	30	18	11

COPERT II [SCEN_3]			FC (kt)				NOx (kt)			
			1995	2000	2005	2010	1995	2000	2005	2010
D	Heavy Duty Trucks	Conv		96	14	0	0	3	0	0
D	Heavy Duty Trucks	EUR1		132	28	0	0	3	1	0
D	Heavy Duty Trucks	EUR2		168	112	6	0	3	2	0
D	Heavy Duty Trucks	EUR3		0	256	52	0	0	3	1
D	Heavy Duty Trucks	EUR4		0	80	396	0	0	0	2
D	Heavy Duty Trucks	EUR5								
G	Passenger Cars	Conv		259	93	31	0	9	3	1
G	Passenger Cars	EUR1		880	493	202	0	9	5	2
G	Passenger Cars	EUR2		436	518	300	0	2	2	1
G	Passenger Cars	EUR3		0	543	370	0	0	2	2
G	Passenger Cars	EUR4		0	153	933	0	0	0	2
G	Passenger Cars	EUR5								
D	Passenger Cars	Conv		483	259	120	0	6	3	2
D	Passenger Cars	EUR1		629	423	210	0	4	2	1
D	Passenger Cars	EUR2		52	299	149	0	0	1	0
D	Passenger Cars	EUR3		0	576	292	0	0	3	1
D	Passenger Cars	EUR4		0	241	962	0	0	0	2
D	Passenger Cars	EUR5								
D	Heavy Duty Trucks	ALL		396	490	455	0	8	6	2
G	Passenger Cars	ALL		1,574	1,799	1,836	0	20	13	7
D	Passenger Cars	ALL		1,164	1,798	1,733	0	10	10	7
Road Transport				3,134	4,087	4,023	0	38	28	17

COPERT 4 [SCEN_4]			FC (kt)				NOx (kt)			
			1995	2000	2005	2010	1995	2000	2005	2010
D	Heavy Duty Trucks	Conv	195	67	6	1	8	3	0	0
D	Heavy Duty Trucks	EUR1	123	102	27	1	4	3	1	0
D	Heavy Duty Trucks	EUR2	0	248	160	32	0	9	6	1
D	Heavy Duty Trucks	EUR3	0	0	261	264	0	0	7	7
D	Heavy Duty Trucks	EUR4	0	0	0	188	0	0	0	4
D	Heavy Duty Trucks	EUR5								
G	Passenger Cars	Conv	759	303	64	5	29	11	2	0
G	Passenger Cars	EUR1	228	219	152	26	2	2	1	0
G	Passenger Cars	EUR2	0	411	446	314	0	2	2	1
G	Passenger Cars	EUR3	0	0	383	377	0	0	1	1
G	Passenger Cars	EUR4	0	0	0	418	0	0	0	0
G	Passenger Cars	EUR5								
D	Passenger Cars	Conv	370	141	64	3	4	2	1	0
D	Passenger Cars	EUR1	77	264	155	28	1	3	2	0
D	Passenger Cars	EUR2	0	135	137	129	0	1	2	1
D	Passenger Cars	EUR3	0	0	191	187	0	0	2	2
D	Passenger Cars	EUR4	0	0	0	187	0	0	0	2
D	Passenger Cars	EUR5								
D	Heavy Duty Trucks	ALL	319	418	454	486	12	15	14	12
G	Passenger Cars	ALL	987	933	1,045	1,140	30	15	6	3
D	Passenger Cars	ALL	447	540	547	534	5	6	6	6
Road Transport			1,753	1,890	2,046	2,160	48	35	26	20

COPERT 4 [SCEN_5]			FC (kt)				NOx (kt)			
			1995	2000	2005	2010	1995	2000	2005	2010
D	Heavy Duty Trucks	Conv	[redacted]	138	16	0	0	6	1	0
D	Heavy Duty Trucks	EUR1	[redacted]	175	58	1	0	6	2	0
D	Heavy Duty Trucks	EUR2	[redacted]	199	178	21	0	7	6	1
D	Heavy Duty Trucks	EUR3	[redacted]	0	268	82	0	0	7	2
D	Heavy Duty Trucks	EUR4	[redacted]	0	91	371	0	0	2	7
D	Heavy Duty Trucks	EUR5	[redacted]	0	0	117	0	0	0	2
G	Passenger Cars	Conv	[redacted]	272	100	33	0	9	3	1
G	Passenger Cars	EUR1	[redacted]	829	466	191	0	6	4	1
G	Passenger Cars	EUR2	[redacted]	403	482	280	0	2	2	1
G	Passenger Cars	EUR3	[redacted]	0	515	361	0	0	1	1
G	Passenger Cars	EUR4	[redacted]	0	152	728	0	0	0	1
G	Passenger Cars	EUR5	[redacted]	0	0	204	0	0	0	0
D	Passenger Cars	Conv	[redacted]	501	269	125	0	10	5	3
D	Passenger Cars	EUR1	[redacted]	558	371	182	0	8	6	3
D	Passenger Cars	EUR2	[redacted]	70	279	137	0	1	4	2
D	Passenger Cars	EUR3	[redacted]	0	513	259	0	0	7	3
D	Passenger Cars	EUR4	[redacted]	0	223	838	0	0	2	9
D	Passenger Cars	EUR5	[redacted]	0	0	54	0	0	0	0
D	Heavy Duty Trucks	ALL	[redacted]	511	612	592	0	19	18	12
G	Passenger Cars	ALL	[redacted]	1,504	1,716	1,798	0	17	10	5
D	Passenger Cars	ALL	[redacted]	1,130	1,655	1,595	0	19	24	20
Road Transport			[redacted]	3,145	3,984	3,985	0	55	52	37

Netherlands

RAINS [SCEN_1]			FC (kt)				NOx (kt)			
			1995	2000	2005	2010	1995	2000	2005	2010
D	Heavy Duty Trucks	Conv	1,365	206	21	9	67	10	1	0
D	Heavy Duty Trucks	EUR1	910	1,034	44	0	30	34	1	0
D	Heavy Duty Trucks	EUR2	0	1,354	1,221	52	0	38	34	1
D	Heavy Duty Trucks	EUR3	0	0	1,492	1,544	0	0	29	30
D	Heavy Duty Trucks	EUR4	0	0	0	1,574	0	0	0	12
D	Heavy Duty Trucks	EUR5								
G	Passenger Cars	Conv	1,679	175	13	3	58	6	0	0
G	Passenger Cars	EUR1	3,119	2,608	593	20	27	23	5	0
G	Passenger Cars	EUR2	0	2,614	2,420	384	0	11	11	2
G	Passenger Cars	EUR3	0	0	2,842	2,789	0	0	7	6
G	Passenger Cars	EUR4	0	0	0	3,002	0	0	0	3
G	Passenger Cars	EUR5								
D	Passenger Cars	Conv	1,140	227	101	2	13	3	1	0
D	Passenger Cars	EUR1	420	815	273	15	3	6	2	0
D	Passenger Cars	EUR2	0	695	747	355	0	4	4	2
D	Passenger Cars	EUR3	0	0	747	641	0	0	3	3
D	Passenger Cars	EUR4	0	0	0	675	0	0	0	2
D	Passenger Cars	EUR5								
D	Heavy Duty Trucks	ALL	2,275	2,594	2,779	3,179	96	82	66	44
G	Passenger Cars	ALL	4,798	5,398	5,868	6,199	85	40	23	12
D	Passenger Cars	ALL	1,560	1,737	1,868	1,688	16	13	11	7
Road Transport			8,633	9,729	10,516	11,066	198	135	100	63

COPERT II [SCEN_2]			FC (kt)				NOx (kt)			
			1995	2000	2005	2010	1995	2000	2005	2010
D	Heavy Duty Trucks	Conv	1,365	206	21	9	44	7	1	0
D	Heavy Duty Trucks	EUR1	910	1,034	44	0	18	21	1	0
D	Heavy Duty Trucks	EUR2	0	1,354	1,221	52	0	21	19	1
D	Heavy Duty Trucks	EUR3	0	0	1,492	1,544	0	0	19	20
D	Heavy Duty Trucks	EUR4	0	0	0	1,574	0	0	0	8
D	Heavy Duty Trucks	EUR5								
G	Passenger Cars	Conv	1,679	175	13	3	76	8	1	0
G	Passenger Cars	EUR1	3,119	2,608	593	20	32	27	6	0
G	Passenger Cars	EUR2	0	2,614	2,420	384	0	12	11	2
G	Passenger Cars	EUR3	0	0	2,842	2,789	0	0	12	11
G	Passenger Cars	EUR4	0	0	0	3,002	0	0	0	5
G	Passenger Cars	EUR5								
D	Passenger Cars	Conv	1,140	227	101	2	14	3	1	0
D	Passenger Cars	EUR1	420	815	273	15	6	12	4	0
D	Passenger Cars	EUR2	0	695	747	355	0	4	5	2
D	Passenger Cars	EUR3	0	0	747	641	0	0	2	2
D	Passenger Cars	EUR4	0	0	0	675	0	0	0	3
D	Passenger Cars	EUR5								
D	Heavy Duty Trucks	ALL	2,275	2,594	2,779	3,179	62	48	40	29
G	Passenger Cars	ALL	4,798	5,398	5,868	6,199	108	46	29	19
D	Passenger Cars	ALL	1,560	1,737	1,868	1,688	20	19	12	7
Road Transport			8,633	9,729	10,516	11,066	190	114	81	55

COPERT II [SCEN_3]			FC (kt)				NOx (kt)			
			1995	2000	2005	2010	1995	2000	2005	2010
D	Heavy Duty Trucks	Conv		461	153	45	0	15	5	1
D	Heavy Duty Trucks	EUR1		390	180	50	0	7	3	1
D	Heavy Duty Trucks	EUR2		923	780	278	0	14	11	4
D	Heavy Duty Trucks	EUR3		0	881	416	0	0	11	5
D	Heavy Duty Trucks	EUR4		0	30	1,166	0	0	0	6
D	Heavy Duty Trucks	EUR5								
G	Passenger Cars	Conv		1,545	672	306	0	66	29	13
G	Passenger Cars	EUR1		1,802	1,009	507	0	18	10	5
G	Passenger Cars	EUR2		1,635	1,564	908	0	7	7	4
G	Passenger Cars	EUR3		0	1,037	687	0	0	4	3
G	Passenger Cars	EUR4		0	457	1,934	0	0	1	3
G	Passenger Cars	EUR5								
D	Passenger Cars	Conv		623	148	40	0	7	2	0
D	Passenger Cars	EUR1		803	356	55	0	7	3	1
D	Passenger Cars	EUR2		1,992	1,539	403	0	8	6	2
D	Passenger Cars	EUR3		0	2,109	1,397	0	0	9	6
D	Passenger Cars	EUR4		0	237	2,668	0	0	0	7
D	Passenger Cars	EUR5								
D	Heavy Duty Trucks	ALL		1,774	2,025	1,956	0	36	31	18
G	Passenger Cars	ALL		4,982	4,739	4,342	0	92	51	29
D	Passenger Cars	ALL		3,418	4,389	4,563	0	21	21	17
Road Transport				10,174	11,153	10,861	0	149	102	63

COPERT 4 [SCEN_4]			FC (kt)				NOx (kt)			
			1995	2000	2005	2010	1995	2000	2005	2010
D	Heavy Duty Trucks	Conv	1,365	206	21	9	57	9	1	0
D	Heavy Duty Trucks	EUR1	910	1,034	44	0	29	33	1	0
D	Heavy Duty Trucks	EUR2	0	1,354	1,221	52	0	47	43	2
D	Heavy Duty Trucks	EUR3	0	0	1,492	1,544	0	0	40	41
D	Heavy Duty Trucks	EUR4	0	0	0	1,574	0	0	0	30
D	Heavy Duty Trucks	EUR5								
G	Passenger Cars	Conv	1,679	175	13	3	73	8	1	0
G	Passenger Cars	EUR1	3,119	2,608	593	20	26	21	5	0
G	Passenger Cars	EUR2	0	2,614	2,420	384	0	10	9	1
G	Passenger Cars	EUR3	0	0	2,842	2,789	0	0	4	4
G	Passenger Cars	EUR4	0	0	0	3,002	0	0	0	2
G	Passenger Cars	EUR5								
D	Passenger Cars	Conv	1,140	227	101	2	14	3	1	0
D	Passenger Cars	EUR1	420	815	273	15	5	9	3	0
D	Passenger Cars	EUR2	0	695	747	355	0	9	9	4
D	Passenger Cars	EUR3	0	0	747	641	0	0	10	9
D	Passenger Cars	EUR4	0	0	0	675	0	0	0	7
D	Passenger Cars	EUR5								
D	Heavy Duty Trucks	ALL	2,275	2,594	2,779	3,179	87	89	85	73
G	Passenger Cars	ALL	4,798	5,398	5,868	6,199	98	39	19	8
D	Passenger Cars	ALL	1,560	1,737	1,868	1,688	19	21	24	21
Road Transport			8,633	9,729	10,516	11,066	204	149	128	102

COPERT 4 [SCEN_5]			FC (kt)				NOx (kt)			
			1995	2000	2005	2010	1995	2000	2005	2010
D	Heavy Duty Trucks	Conv	[redacted]	505	171	48	0	21	7	2
D	Heavy Duty Trucks	EUR1	[redacted]	354	169	49	0	11	5	2
D	Heavy Duty Trucks	EUR2	[redacted]	790	679	252	0	28	24	9
D	Heavy Duty Trucks	EUR3	[redacted]	0	786	382	0	0	21	10
D	Heavy Duty Trucks	EUR4	[redacted]	0	27	641	0	0	1	12
D	Heavy Duty Trucks	EUR5	[redacted]	0	0	369	0	0	0	4
G	Passenger Cars	Conv	[redacted]	1,625	708	323	0	67	29	13
G	Passenger Cars	EUR1	[redacted]	1,525	855	430	0	13	7	4
G	Passenger Cars	EUR2	[redacted]	1,344	1,278	741	0	5	5	3
G	Passenger Cars	EUR3	[redacted]	0	866	615	0	0	1	1
G	Passenger Cars	EUR4	[redacted]	0	398	1,398	0	0	0	1
G	Passenger Cars	EUR5	[redacted]	0	0	311	0	0	0	0
D	Passenger Cars	Conv	[redacted]	591	146	40	0	9	2	0
D	Passenger Cars	EUR1	[redacted]	816	376	75	0	11	5	1
D	Passenger Cars	EUR2	[redacted]	1,992	1,551	463	0	29	22	6
D	Passenger Cars	EUR3	[redacted]	0	2,131	1,412	0	0	29	19
D	Passenger Cars	EUR4	[redacted]	0	251	2,461	0	0	3	27
D	Passenger Cars	EUR5	[redacted]	0	0	308	0	0	0	3
D	Heavy Duty Trucks	ALL	[redacted]	1,648	1,832	1,742	0	60	58	39
G	Passenger Cars	ALL	[redacted]	4,495	4,106	3,818	0	86	43	22
D	Passenger Cars	ALL	[redacted]	3,399	4,455	4,759	0	49	61	57
Road Transport			[redacted]	9,542	10,393	10,319	0	194	162	119