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Fuel use and emissions from non-road machinery in Denmark from 1985–2004 – and projections from 2005-2030

Morten Winther & Ole-Kenneth Nielsen

National Environmental Research Institute, Denmark

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Contents

Preface

The non road sector comprises a large group of different types of mobile machinery and working equipment. The machines are used in the agricultural and forestry sectors, for building and construction purposes, by the manufacturing industry, and by private and professionals for household and gardening purposes. A certain use of recreational craft also takes place. Taken as a whole, the non road sector shares of the Danish fuel use and emission totals are significant, and the need for accurate and detailed emission data in the annual national emission inventories makes it necessary to make precise emission calculations for the non road sector also.

The National Environmental Research Institute of Denmark (NERI) is responsible for the annual Danish emission reporting to the UNFCCC (United Nations Framework Convention of Climate Changes) and the UNECE CLRTAP (United Nations Economic Commission for Europe Convention of Long Range Transboundary Air Pollutants) conventions and the EU Monitoring Mechanism. In the national inventory, the non road machinery types are classified as equipment used in agriculture, forestry, industry, household/gardening and inland waterways, and fuel use and emission figures are stored in the central CollectER database for all Danish sources.

Outside the official national system for inventorying and annual emission reporting, three specific Danish studies have been made to quantify the fuel use and emissions from non road machinery and recreational craft.

A 1990 inventory was made in two separate studies by Dansk Teknologisk Institut (1992 and 1993), covering all non road sources. The 1992 report comprised fuel use and emission results for agricultural machinery and construction machinery, while the 1993 study contained a fuel use and emission inventory for small working equipment in industry, households and gardening. The latter study also included fuel use and emission estimates for recreational craft. An updated inventory for 2000 was made by Bak et al. (2003) with a special focus on agricultural machines, fork lifts, household and gardening equipment, and recreational craft.

Until now, much of the Danish background data gathered has been used together with European fuel use and emission factors from EMEP/CORINAIR (2003), to make the official Danish non road emission estimates. However, due to the relative importance of the non road emission sources and due to the fact that much of the operational data and fuel use/emission information used in the NERI inventory has been outdated, there is a pressing need for a complete inventory revision.

The aims of this project is to make an updated 1985-2004 inventory of fuel use and the emissions of SO_2, NO_x, NMVOC, CH_4, CO, CO_2,

N_2O, NH_3 and TSP for non road machinery and recreational craft. An important task is to gather new stock and operational data for the most important types of machinery and to obtain new fuel use and emission data for the non road sector in general. The fuel use and emission results are aggregated into subtotals for agriculture, forestry, industry, household/gardening and inland waterways, as required by the CollectER database system. In addition a 2005-2030 fuel use and emission forecast is presented.

Chapter 1 explains the EU emission legislation for non road machinery and recreational craft, and the actual fuel use and emission factors used in the inventory are provided in Chapter 2. Chapter 3 gives a thorough documentation of the data sources behind stock and operational data and a transformation of these into inventory input formats. In Chapter 4 the fuel use and emission calculation methods are described, and the calculated 1985-2004 results and the 2005-2030 forecast estimates are shown in Chapter 5 and 6, respectively. The project conclusions are found in Chapter 7.

The project steering group consisted of Lise Bjergbakke, The Ministry of Transport and Energy, Ken Friis Hansen, Danish Technological Institute, Jens Johnsen Høy, Danish Agricultural Advisory Service, Thomas Pedersen, The Association of Danish Agricultural Machinery Dealers, Peter Dal and Thomas Jensen, the Danish Energy Authority, and Ulrik Torp, Erik Iversen, Lisbeth Strandmark and Dorte Kubel, Danish Environmental Protection Agency.

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Summary

This report documents the updated 1985-2004 fuel use and emission inventory for non road machinery and recreational craft in Denmark. The inventory comprises the emission components of SO_2, NO_x, NMVOC, CH_4, CO, CO_2, N_2O, NH_3 and TSP, and in addition a fuel use and emission forecast is presented from 2005-2030. The calculated results are grouped into the sub-sectors agriculture, forestry, industry, household/gardening and inland waterways, according to the structure of the CollectER database used for all Danish sources.

The report explains the existing EU emission directives for non road machinery, the actual fuel use and emission factors used, sources of background and operational data, calculation methods and the calculated fuel use and emission results.

EU emission directives
The emission directives agreed by the EU relates to both diesel and gasoline fuelled non road machinery, and list specific emission limit values for NO_x, VOC (in some cases NO_x + VOC), CO and particulates. The specific limit values (g/kWh) depend on engine size (kW for diesel, ccm for gasoline) and date of implementation (referring to engine market date).

For diesel engines, the EU directives 97/68 (emission stage I and II) and 2004/26 (emission stage IIIA, IIIB and IV) relates to non road machinery other than agricultural and forestry tractors, whereas for tractors the relevant directives are 2000/25 (emission stage I and II) and 2005/13 (emission stage IIIA, IIIB and IV). For gasoline engines, the EU directive 2002/88 (emission stage I and II) distinguishes between hand held (SH) and not hand held (NS) types of machinery.

For recreational craft, the EU directive 2003/44 comprises emission legislation limits for diesel and for 2-stroke and 4-stroke gasoline engines, respectively. The CO and VOC emission limits depend on engine size (kW), whereas for NO_x, a constant limit value is given for each of the three engine types. For TSP a constant emission limit regards diesel engines only.

Fuel use and emission factors
The emission factors used in the Danish inventory are grouped into EU emission legislation categories. However, for engines older than directive first level implementation dates three additional emission level classes are added so that a complete matrix of fuel use and emission factors underpins the inventory.

Actual measured factors of fuel use and NO_x, VOC, CO and TSP emissions, predominantly come from IFEU (2004) together with factors for deterioration, transient engine loads and gasoline evaporation. EMEP/CORINAIR (2003) is the source of N_2O and NH_3 emission factors, whereas the CH_4/NMVOC split of VOC is taken from USEPA

(2004). The determination of emission factors for future machinery is based on own judgement, taking into account today's emission factors for new machinery and future EU emission legislation limits.

Stock and operational data

For agricultural tractors and harvesters, total fleet numbers and new sales/engine size figures are provided by Statistics Denmark and The Association of Danish Agricultural Machinery Dealers, respectively. The latter organisation has also provided new sales numbers for the most important types of construction machinery. Fork lift new sales/lifting capacity data is provided by IFAG. For household and gardening equipment and recreational craft, total stock numbers and engine sizes per machinery/vessel type have been assumed based on personal communication with people employed in relevant professional bodies, large engine manufacturers, research institutes etc.

Data for load factors, annual working hours and engine lifetime are primarily from the existing non road inventory model. However, in some cases data have been updated and/or new data added through discussions with external key experts for the relevant types of non road machinery.

Calculation procedure

The fuel use and emissions are calculated as the product of the number of engines, annual working hours, average rated engine size, load factor, and fuel use/emission factors. For diesel and gasoline engines, the deterioration effects (due to engine ageing) are included in the emission calculation equation by using deterioration factors according to engine type, size, age, lifetime and emission level. For diesel engines before Stage IIIB and IV, transient operational effects are also considered by using average transient factors.

The evaporation of gasoline hydrocarbon emissions is also estimated from the fuelling procedure and because of tank evaporation. The tank loading emissions are calculated as the product of total gasoline fuel use and evaporation factors (g NMVOC/kg fuel), whereas tank evaporation emissions are found as the product of engine numbers and evaporation factors (g NMVOC/year).

Fuel use and emission results

The diesel fuelled machinery in agriculture and industry are the most important sources of fuel use and emissions of SO_2, NO_x, CO_2, N_2O, NH_3 and TSP in 2004. Agricultural tractors is the most dominant single source, with fuel use and emission totals of around one third of the grand totals for land based non road machinery.

For diesel machinery as a total, the fuel use and emissions of SO_2, CO_2, NMVOC, CH4, CO and TSP decrease by 6, 91, 6, 43, 43, 33 and 54%, respectively, from 1985-2004. In the same time period the emissions of NO_x, N_2O and NH_3 increase by 4, 2 and 2%, respectively.

The trend in total diesel fuel use (and CO_2) is dominated by a decrease in fuel use for agricultural machinery, and an increase in fuel use especially for non road construction machinery and fork lifts. The significant SO_2 emission decline is caused by a large reduction of the

sulphur content in non road diesel. For NO_x, the slight emission increase is due to the relatively large 1991-stage I emission factors, whereas the large emission reductions for NMVOC, CH_4, CO and TSP are due to the gradually improved engine emission techonology for these emission components.

The development towards cleaner diesel engines continues in the future, and for NO_x, NMVOC, CH_4, CO and TSP the total emissions are expected to decrease by 81, 78, 78, 63 and 85% from 2004-2030. This is due to the gradually strengthened future EU emission standards. A significant reduction of the sulphur content for diesel in 2005 cuts down the diesel related SO_2 emissions by as much as 98%. In the 2004-2030 time period a moderate decline in fuel use and CO_2, N_2O and NH_3 emissions is expected, mainly due to a decrease in the use of agricultural tractors.

Most of the NMVOC, CH_4 and CO emissions come from gasoline fuelled working machinery. Set in relation to the total land based non road emissions, the NMVOC emission share is 26% for chain saws used in forestry and for household, and for CH_4 and CO the emission shares for riders (private and professional) are 34 and 53%, respectively.

From 1985-2004 the emissions of NMVOC, CH_4 and CO from gasoline machinery increase by 18, 12 and 8%, respectively. From a broad perspective the engines have become more emission efficient, since the total gasoline fuel use has increased by 39% in the same time period. In the forecast period from 2004-2030 the gasoline related fuel use and emissions of NMVOC and CH_4 is expected to decrease by 5, 34 and 11%, respectively, whereas an emission increase of 9% is expected for CO. Here, small or zero emission factor reductions for stage I and II engines in combination with higher deterioration factors cause the CO emissions for gasoline machinery to increase even after the time of stage I and II engines entering the market.

For recreational craft, most of the fuel use, SO_2, NO_x, CO_2, N_2O, NH_3 and TSP emissions are attributed to the diesel engine category, while most of the NMVOC, CH_4 and CO emissions come from gasoline fuelled engines, as is the case for land based non road machinery. However, compared to the latter machinery group, the fuel use and emissions from sailing vessels are small.

From 1985 to 2004 there has been a large increase in sailing activities, most significantly for diesel fuelled boats, and a gradual shift from 2-stroke to 4-stroke technology for gasoline engines. These tendencies are reflected in the increases of fuel use (188%), N_2O (300%), NH_3 (258%), NO_x (239%), SO_2 (201%), CO_2 (189%), TSP (106%), CO (81%), CH_4 (75%) and NMVOC (13%). The overall diesel fuel increase is the main reason for the SO_2, NO_x, CO_2, N_2O, NH_3 and TSP emission growths, whereas the increase in gasoline fuel use explains the CO and CH_4 emission inclines. The small NMVOC emission increase is explained by the gasoline engine shift to the more environmentally friendly 4-stroke technology, since total gasoline fuel use has gone up with 50% from 1985 to 2004.

From 2004 to 2030 the emissions of NMVOC and CO are expected to decrease significantly due to the 2-stroke/4-stroke technology shift (NMVOC) and the relatively low future EU 2003/44 directive emission limit. The latter explanation also applies for the NO_x and TSP emission decreases, mainly driven by the emission trend for diesel fuelled boats.

Conclusion

The present project has provided valuable new Danish information for different types of non road machinery and recreational craft, in terms of stock and operational data, fuel use and emission factors, and calculated results. The new non road inventory model is facilitated to produce annual fuel use and emission estimates both for historical years and projection years in order to fulfil various national obligations.

An important outcome of the present study has also been the establishment of contacts with Danish experts dealing with statistical data and experts from research institutes, relevant professional bodies, machinery manufacturers, etc. It is the goal to obtain information of new sales and total stock on an annual basis, in order to ensure continuously updated inventories. To the extent that statistical numbers are produced, new sales figures for tractors, harvesters, construction machinery and fork lifts should be gathered together with total stock data for household/gardening machinery, and recreational craft.

On a European level, the purpose of the EMEP/CORINAIR guidebook published by the European Environment Agency is to provide inventory support for country estimates. However, the guidebook data are more than ten years old and consequently the demand for new data is becoming more and more urgent. The fuel use and emission data used in the German inventory (IFEU, 2004) and in the present report are able to solve this task, and work should therefore be made to include these data in the EMEP/CORINAIR guidebook.

Sammendrag

Denne rapport indeholder de opdaterede danske opgørelser af energiforbrug og emissioner for non road arbejdsredskaber og maskiner samt fritidsfartøjer for perioden 1985-2004. Rapporten indeholder emissionsresultater for SO_2, NO_x, NMVOC, CH_4, CO, CO_2, N_2O, NH_3 og TSP, og derudover præsenteres en emissionsfremskrivning for perioden 2005-2030. Resultaterne er grupperet indenfor sektorerne landbrug, skovbrug, industri, have- og hushold samt fritidsfartøjer, der benyttes af CollectER databasen i det nationale system for emissionsopgørelser.

I Rapporten gennemgås også den eksisterende EU emissionslovgivning for non road maskinel og fritidsfartøjer samt de benyttede faktorer for brændstof og emissioner. Derudover dokumenteres opgørelsens aktivitetsdata og -kilder, samt beregningsmetoden og de beregnede energi- og emissionsresultater.

EU emissionslovgivning

Den eksisterende EU emissionslovgivning for motorer der benyttes i non road maskiner og fritidsfartøjer omhandler både diesel og benzin. De enkelte emissionsdirektiver anviser specifikke emissionsgrænseværdier for NO_x, VOC (i visse tilfælde NO_x + VOC), CO og partikler. Grænseværdierne (g/kWh) afhænger af motorstørrelse (kW for diesel og ccm for benzin) og implementeringsdato (henført til markedsføringstidspunkt).

For dieselmotorer generelt (undtagen motorer installeret i traktorer) anvises emissionsgrænseværdier i EU direktiverne 97/68 (emissionstrin I og II) og 2004/26 (emissionstrin IIIA, IIIB og IV). For motorer installeret i traktorer reguleres emissionerne i direktiv 2000/25 (emissionstrin I og II) og 2005/13 (emissionstrin IIIA, IIIB og IV). For benzinmotorer opdeles emissionsgrænseværdierne efter håndbåret og ikke håndbåret maskinel i EU direktivet 2002/88 (emissionstrin I og II).

For fritidsfartøjer indeholder EU direktivet 2003/44 emissionsgrænseværdier for dieselmotorer samt 2- og 4-takt benzinmotorer. Grænseværdierne for CO og VOC afhænger af motorstørrelsen (kW), mens der anvises en konstant emissionsgrænseværdi for NO_x (en for hver motortype) og TSP (kun diesel).

Brændstof- og emissionsfaktorer

De benyttede emissionsfaktorer er grupperet efter EU lovgivningens kategorier. For at repræsentere de motorer der er ældre end først gældende implementeringsår, er der lavet yderligere tre aldersgrupperinger, sådan at en komplet matrix af brændstof- og emissionsfaktorer understøtter projektets beregninger.

For det nutidige materiel stammer faktorerne for brændstofforbrug, NO_x, VOC, CO og TSP fra faktiske målinger (IFEU, 2004). Den

samme kilde indeholder data for emissionsændringer som følge af forværrelse, transient drift og benzinfordampning. Kilden til N_2O og NH_3 emissionsfaktorerne er EMEP/CORINAIR (2003), og opdelingen af VOC i CH_4 og NMVOC er taget fra USEPA (2004). Bestemmelse af emissionsfaktorerne for det fremtidige maskinel er gjort ud fra egne vurderinger, hvor der er taget højde for emissionsfaktorerne i dagens situation samt de fremtidige EU emissionsgrænseværdier.

Bestands- og driftsdata

Data for totalbestanden af landbrugstraktorer og mejetærskere er oplyst af Danmarks Statistik, og nysalg pr. motorstørrelse er fremskaffet fra Dansk Maskinhandlerforening. Den sidstnævnte brancheforening har også angivet det samlede nysalg for de vigtigste typer af entreprenørmateriel. Data for nysalg af gaffeltrucks (pr. løfteevne) er oplyst af IFAG. For haveredskaber og -maskiner samt fritidsfartøjer er totalbestande og motorstørrelser anslået ud fra diskussioner med brancheorganisationer, store maskinforhandlere, forskningsinstitutioner m.v.

Data for lastfaktorer, årlige driftstimer og levetider stammer hovedsageligt fra den eksisterende non road model. I visse tilfælde er der dog sket opdateringer eller tilføjelser af nye data ud fra diskussioner med eksterne eksperter for de konkrete typer af materiel.

Beregningsmetode

Energiforbrug og emissioner beregnes som produktet af antal maskiner, gennemsnitlig motorstørrelse, lastfaktor, årlige driftstimer og brændstof/emissionsfaktor. For diesel og benzinmotorer inkluderes emissionsforværrelse i beregningerne ved at bruge forværrelsesfaktorer der afhænger af motorens type, størrelse, alder, levetid og emissionstrin. For dieselmotorer før trin IIIB og IV justeres for varierende motordrift ved brug af gennemsnitlige transientfaktorer.

Fordampningen af kulbrinter fra benzinmotorer beregnes for brændstofpåfyldning og tankfordampning. For brændstofpåfyldning beregnes emissionerne pr. maskintype som produktet af det totale benzinforbrug og fordampningsfaktoren (g NMVOC/kg brændstof), mens tankfordampningsemissionerne findes som antal maskiner gange fordampningsfaktoren (g NMVOC/år).

Resultater

De dieseldrevne maskiner i landbrug og industri har de største energiforbrug og er de vigtigste non road emissionskilder for SO_2, NO_x, CO_2, N_2O, NH_3 og TSP i 2004. Landbrugstraktorer er den største enkeltkilde med energiforbrugs- og emissionsandele på omkring en tredjedel af den samlede totaler for de landbaserede non road maskiner.

For dieselmotorerne falder det samlede energiforbrug med 6%, og SO_2, CO_2, NMVOC, CH4, CO og TSP emissionerne falder med hhv. 91, 6, 43, 43, 33 og 54%, fra 1985 til 2004. I samme periode stiger NO_x, N_2O og NH_3 emissionerne med hhv. 4, 2 og 2%.

Udviklingen i det samlede dieselforbrug (og CO_2 emission) drives hovedsageligt af et fald i energiforbruget for landbrugsmaskiner og en stigning i energiforbruget for entreprenørmateriel og gaffeltrucks. Det

markante SO_2 emissionsfald skyldes en stor reduktion af svovlindholdet i diesel. Grunden til den lille stigning i NO_x emissionen er de relativt store emissionsfaktorer for 1991-trin I motorer. De store emissionsfald for NMVOC, CH_4, CO og TSP skyldes den gradvist forbedrede motorteknologi mht. disse emissionstyper.

Udviklingen mod renere dieselmotorer fortsætter i fremtiden, og pga. de gradvist skærpede EU emissionsnormer falder totalemissionen for NO_x, NMVOC, CH_4, CO og TSP med hhv. 81, 78, 78, 63 og 85% fra 2004 til 2030. En markant reduktion af svovlindholdet i diesel (fra 2005) får de dieselrelaterede SO_2 emissioner til at falde med hele 98% i samme periode. Samtidigt ses et lille fald i dieselforbruget samt CO_2, N_2O og NH_3 emissionerne, hvilket hovedsageligt skyldes en mindre brug af landbrugstraktorer.

Størsteparten af NMVOC, CH_4 og CO emissionerne kommer fra de benzindrevne motorer. NMVOC emissionsandelen for kædesave (skovbrug og havebrug) er 26%, og CH_4 og CO emissionsandelene for riders (privat og professionel) er hhv. 34 og 53%, set i forhold til de samlede totaler for alle landbaserede non road maskiner.

Fra 1985 til 2004 stiger NMVOC, CH_4 og CO emissionerne fra benzinmotorer med hhv. 18, 12 og 8%. Overordnet set er motorerne blevet gradvist renere i perioden, da benzinforbruget stiger med 39%. I prognoseperioden fra 2004 til 2030 forventes et fald i benzinforbruget og NMVOC and CH_4 emissionerne med hhv. 5, 34 og 11%, hvorimod CO emissionerne forventes at stige med 9%. For CO gælder, at små eller slet ingen basisemissionsforbedringer for trin I og II motorer kombineret med relativt store forværrelsesfaktorer får de samlede emissioner til at stige, selv efter tidspunktet hvor trin I og II maskinerne bliver taget i brug.

For fritidsfartøjer beregnes det største energiforbrug og størsteparten af SO_2, NO_x, CO_2, N_2O, NH_3 og TSP emissionerne for dieselmotorer, mens hovedparten af NMVOC, CH_4 and CO emissionerne kommer fra benzinmotorerne, ganske som for de landbaserede non road maskiner. Sammenlignet med denne maskingruppe er energiforbruget og emissionerne fra fritidsfartøjer dog små.

Fra 1985 til 2004 har der været en stor stigning i sejlaktiviteten, mest markant for både med dieselmotorer. Derudover er sket et gradvist skifte i de solgte benzinmotorer fra 2-takt til 4-takt. Disse ændringer afspejles i stigningen for det samlede energiforbrug (188%), og emissionerne af N_2O (300%), NH_3 (258%), NO_x (239%), SO_2 (201%), CO_2 (189%), TSP (106%), CO (81%), CH_4 (75%) og NMVOC (13%). Den generelle stigning i dieselforbruget er hovedårsagen til emissionsvæksten for SO_2, NO_x, CO_2, N_2O, NH_3 og TSP, mens emissionsstigningerne for CO og CH_4 hovedsageligt skyldes væksten i benzinforbruget. Den begrænsede stigning i NMVOC emissionen skyldes skiftet til den mere miljøvenlige 4-takt motorteknologi, idet det samlede benzinforbrug er steget med 50% fra 1985 til 2004.

Fra 2004 til 2030 falder NMVOC og CO emissionerne markant, dels pga. skiftet fra 2- til 4-takt motorer (især NMVOC) og dels pga. den relativt lave fremtidige EU 2003/44 emissionsnorm. Den sidstnævnte

emissionsnorm giver også et beregnet emissionsfald for NO_x og TSP i prognoseperioden (mest markant for diesel).

Konklusion

Dette projekt har tilføjet ny vigtig viden om bestands- og driftsdata, faktorer for brændstofforbrug og emissioner, og samlede emissioner og energiforbrug for non road maskiner og fritidsfartøjer i Danmark. Den nye non road model er skabt til at beregne emissioner og energiforbrug både for historiske år og prognoseår, på en måde der sikrer opfyldelsen af de forskellige nationale forpligtigelser.

Et vigtigt udbytte af projektet har også været de kontakter der er knyttet til danske eksperter indenfor statistiske data, forskningsinstitutioner, forskellige brancheorganisationer, store maskinforhandlere, osv. For at sikre en kontinuerlig opdatering af emissionsopgørelsen, er det målet at fremskaffe årlig information om nysalg og totalbestande. I det omfang at data er tilgængelige, skal data indhentes for nysalget af traktorer, mejetærskere, entreprenørmateriel og gaffeltrucks, samt totalbestanden for haveredskaber og fritidsfartøjer.

På europæisk plan er formålet med EMEP/CORINAIR guidebogen at understøtte beregningen af nationale emissionsopgørelser, men for non road maskiner er de publicerede brændstof- og emissionsdata mere end ti år gamle. Der er med andre ord et stort behov for en opdatering af EMEP/CORINAIR guidebogen på dette område. Databehovet kan dækkes at de brændstof- og emissionsdata der bruges af IFEU (2004) og i nærværende rapport, og et arbejde bør derfor gøres for at inkludere disse i en ny version af guidebogen.

1 Emission legislation

The engines used for non road mobile purposes have to comply with the emission legislation limits agreed by the EU. The emission directives relate to both diesel and gasoline fuelled non road machinery, and list specific emission limit values (g/kWh) depending on engine size (kW for diesel, ccm for gasoline) and date of implementation (referring to engine market date).

For diesel, the directives 97/68 and 2004/26 relates to non road machinery other than agricultural and forestry tractors, and the directives have different implementation dates for machinery operating under transient and constant loads. For tractors the relevant directives are 2000/25 and 2005/13. For gasoline, the directive 2002/88 distinguishes between hand held (SH) and not hand held (NS) types of machinery.

For engine type approval, the emissions are measured using various test cycles (ISO 8178). Each test cycle consists of a number of measurement points for specific engine loads during constant operation. The specific test cycle used depends of the machinery type in question, and the test cycles are described in more details in the directives.

Table 1 Overview of EU emission directives relevant for diesel fuelled non road machinery

Stage/Engine size [kW]	CO	VOC	NO_x	VOC+NO_x	PM	Diesel machinery			Tractors	
							Implement. date		EU	Implement.
	[g/kWh]					EU directive	Transient	Constant	directive	date
Stage I										
37<=P<75	6.5	1.3	9.2	-	0.85	97/68	1/4 1999	-	2000/25	1/7 2001
Stage II										
130<=P<560	3.5	1	6	-	0.2	97/68	1/1 2002	1/1 2007	2000/25	1/7 2002
75<=P<130	5	1	6	-	0.3		1/1 2003	1/1 2007		1/7 2003
37<=P<75	5	1.3	7	-	0.4		1/1 2004	1/1 2007		1/1 2004
18<=P<37	5.5	1.5	8	-	0.8		1/1 2001	1/1 2007		1/1 2002
Stage IIIA										
130<=P<560	3.5	-	-	4	0.2	2004/26	1/1 2006	1/1 2011	2005/13	1/1 2006
75<=P<130	5	-	-	4	0.3		1/1 2007	1/1 2011		1/1 2007
37<=P<75	5	-	-	4.7	0.4		1/1 2008	1/1 2012		1/1 2008
19<=P<37	5.5	-	-	7.5	0.6		1/1 2007	1/1 2011		1/1 2007
Stage IIIB										
130<=P<560	3.5	0.19	2	-	0.025	2004/26	1/1 2011	-	2005/13	1/1 2011
75<=P<130	5	0.19	3.3	-	0.025		1/1 2012	-		1/1 2012
56<=P<75	5	0.19	3.3	-	0.025		1/1 2012	-		1/1 2012
37<=P<56	5	-	-	4.7	0.025		1/1 2013	-		1/1 2013
Stage IV										
130<=P<560	3.5	0.19	0.4	-	0.025	2004/26	1/1 2014		2005/13	1/1 2014
56<=P<130	5	0.19	0.4	-	0.025		1/10 2014			1/10 2014

Table 2 Overview of the EU emission directive 2002/88 for gasoline fuelled non road machinery

Category	Engine size [ccm]	CO [g/kWh]	HC [g/kWh]	NO_x [g/kWh]	HC+NO_x [g/kWh]	Implementation date
Stage I						
SH1	S<20	805	295	5.36	-	1/2 2005
SH2	20=<S<50	805	241	5.36	-	1/2 2005
SH3	50=<S	603	161	5.36	-	1/2 2005
SN3	100=<S<225	519	-	-	16.1	1/2 2005
SN4	225=<S	519	-	-	13.4	1/2 2005
Stage II						
SH1	S<20	805	-	-	50	1/2 2008
SH2	20=<S<50	805	-	-	50	1/2 2008
SH3	50=<S	603	-	-	72	1/2 2009
SN1	S<66	610	-	-	50	1/2 2005
SN2	66=<S<100	610	-	-	40	1/2 2005
SN3	100=<S<225	610	-	-	16.1	1/2 2008
SN4	225=<S	610	-	-	12.1	1/2 2007

For small boats and pleasure crafts, directive 2003/44 comprises the emission legislation limits for diesel and for 2-stroke and 4-stroke gasoline engines, respectively. The CO and VOC emission limits depend on engine size (P=kW), and the inserted parameters given in the calculation formulas in Table 3. For NO_x, a constant limit value is given for each of the three engine types. For TSP, the constant emission limit regards diesel engines only.

Table 3 Overview of the EU emission directive 2003/44 for small boats and pleasure crafts (P=kW)

Engine type	Impl. date	CO=A+B/P^n			HC=A+B/P^n			NO_x	TSP
		A	B	n	A	B	n		
2-stroke gasoline	1/1 2007	150.0	600.0	1.0	30.0	100.0	0.75	10.0	-
4-stroke gasoline	1/1 2006	150.0	600.0	1.0	6.0	50.0	0.75	15.0	-
Diesel	1/1 2006	5.0	0.0	0	1.5	2.0	0.5	9.8	1.0

2 Fuel use and emission factors

The emission factors used for emission calculations are classified according to the current emission legislation (see Chapter 1). For engines older than directive first implementation dates three additional emission level classes are added so that a complete matrix of fuel use and emission factors underpins the inventory.

Factors which also influence the emission estimates are engine ageing effects (deterioration factors), transient engine loads (transient factors) and the evaporation of gasoline fuels. Background data are also gathered in order to incorporate these effects in the fuel use and emission calculations.

2.1 Basis emission factors

For diesel engines actual fuel use and emission measurements of NO_x, VOC, CO and TSP are behind the fuel use and emission factors for Stage II engine levels and before (IFEU, 2004). For Stage IIIA, IIIB and IV engines, the emission factors are estimated using the following assumption: If the emission factor constructed as 90% of the emission legislation value is higher than the Stage II value, for a given component and emission stage, the Stage II value is used. Otherwise, the 90% figure of the legislation value is used.

For Stage IIIA (all engine sizes, P=kW) and Stage IIIB (37<=P<56) the emission legislation limits are given as the sum of NO_x and VOC (see Table 1). The constructed Stage IIIA emission factors for NO_x and VOC are calculated as 90% of the product of the Stage IIIA (NO_x+VOC) emission limit and the NO_x/(NO_x+VOC) or the VOC/(NO_x+VOC) ratio for the corresponding Stage II emission limit.

For N_2O and NH_3 the emission factors are taken from EMEP/CORINAIR (2003).

Table 4 Fuel use and emission factors for diesel fuelled non road machinery

Engine size [P=kW]	Emission Level	NO_x [g/kWh]	VOC	CO	N_2O	NH_3	TSP	Fuel
P<19	<1981	12.0	5.0	7	0.035	0.002	2.8	300
P<19	1981-1990	11.5	3.8	6	0.035	0.002	2.3	285
P<19	1991-Stage I	11.2	2.5	5	0.035	0.002	1.6	270
P<19	Stage I	11.2	2.5	5	0.035	0.002	1.6	270
P<19	Stage II	11.2	2.5	5	0.035	0.002	1.6	270
P<19	Stage IIIA	11.2	2.5	5	0.035	0.002	1.6	270
P<19	Stage IIIB	11.2	2.5	5	0.035	0.002	1.6	270
P<19	Stage IV	11.2	2.5	5	0.035	0.002	1.6	270
19<=P<37	<1981	18.0	2.5	6.5	0.035	0.002	2	300
19<=P<37	1981-1990	18.0	2.2	5.5	0.035	0.002	1.4	281
19<=P<37	1991-Stage I	9.8	1.8	4.5	0.035	0.002	1.4	262
19<=P<37	Stage I	9.8	1.8	4.5	0.035	0.002	1.4	262
19<=P<37	Stage II	6.5	0.6	2.2	0.035	0.002	0.4	262
19<=P<37	Stage IIIA	6.2	0.6	2.2	0.035	0.002	0.4	262
19<=P<37	Stage IIIB	6.2	0.6	2.2	0.035	0.002	0.4	262
19<=P<37	Stage IV	6.2	0.6	2.2	0.035	0.002	0.4	262
37<=P<56	<1981	7.7	2.4	6	0.035	0.002	1.8	290
37<=P<56	1981-1990	8.6	2.0	5.3	0.035	0.002	1.2	275
37<=P<56	1991-Stage I	11.5	1.5	4.5	0.035	0.002	0.8	260
37<=P<56	Stage I	7.7	0.6	2.2	0.035	0.002	0.4	260
37<=P<56	Stage II	5.5	0.4	2.2	0.035	0.002	0.2	260
37<=P<56	Stage IIIA	3.9	0.4	2.2	0.035	0.002	0.2	260
37<=P<56	Stage IIIB	3.9	0.4	2.2	0.035	0.002	0.0225	260
37<=P<56	Stage IV	3.9	0.4	2.2	0.035	0.002	0.0225	260
56<=P<75	<1981	7.7	2.0	5	0.035	0.002	1.4	290
56<=P<75	1981-1990	8.6	1.6	4.3	0.035	0.002	1	275
56<=P<75	1991-Stage I	11.5	1.2	3.5	0.035	0.002	0.4	260
56<=P<75	Stage I	7.7	0.4	1.5	0.035	0.002	0.2	260
56<=P<75	Stage II	5.5	0.3	1.5	0.035	0.002	0.2	260
56<=P<75	Stage IIIA	4.0	0.3	1.5	0.035	0.002	0.2	260
56<=P<75	Stage IIIB	3.0	0.2	1.5	0.035	0.002	0.0225	260
56<=P<75	Stage IV	0.4	0.2	1.5	0.035	0.002	0.0225	260
75<=P<130	<1981	10.5	2.0	5	0.035	0.002	1.4	280
75<=P<130	1981-1990	11.8	1.6	4.3	0.035	0.002	1	268
75<=P<130	1991-Stage I	13.3	1.2	3.5	0.035	0.002	0.4	255
75<=P<130	Stage I	8.1	0.4	1.5	0.035	0.002	0.2	255
75<=P<130	Stage II	5.2	0.3	1.5	0.035	0.002	0.2	255
75<=P<130	Stage IIIA	3.4	0.3	1.5	0.035	0.002	0.2	255
75<=P<130	Stage IIIB	3.0	0.2	1.5	0.035	0.002	0.0225	255
75<=P<130	Stage IV	0.4	0.2	1.5	0.035	0.002	0.0225	255
130<=P<560	<1981	17.8	1.5	2.5	0.035	0.002	0.9	270
130<=P<560	1981-1990	12.4	1.0	2.5	0.035	0.002	0.8	260
130<=P<560	1991-Stage I	11.2	0.5	2.5	0.035	0.002	0.4	250
130<=P<560	Stage I	7.6	0.3	1.5	0.035	0.002	0.2	250
130<=P<560	Stage II	5.2	0.3	1.5	0.035	0.002	0.1	250
130<=P<560	Stage IIIA	3.4	0.3	1.5	0.035	0.002	0.1	250
130<=P<560	Stage IIIB	3.0	0.2	1.5	0.035	0.002	0.0225	250
130<=P<560	Stage IV	0.4	0.2	1.5	0.035	0.002	0.0225	250

For gasoline engines, the fuel use and NO_x, VOC, CO and TSP (2-stroke only) emission factors are taken from IFEU (2004). For engines prior to stage I, the fuel use and emission factors are measured in

various measurement programmes. For stage I and II engines a large number of type approval test results are used. The emission factor source for 4-stroke TSP is TNO (2001). For N_2O and NH_3 the emission factors are taken from EMEP/CORINAIR (2003). The emission factors used for hand held (SH) and not hand held (SN) types of working equipment are listed in the tables 5 and 6, for 4-stroke and 2-stroke engines respectively.

Table 5 Fuel use and emission factors for 4-stroke gasoline non road machinery

Engine	Size code	Size classe [S=ccm]	Emission Level	NO_x	VOC	CO	N_2O	NH_3	TSP	Fuel
				[g/kWh]						
4-stroke	SH2	20<=S<50	<1981	2.4	33	198	0.002	0.03	0.08	496
4-stroke	SH2	20<=S<50	1981-1990	3.5	27.5	165	0.002	0.03	0.08	474
4-stroke	SH2	20<=S<50	1991-Stage I	4.7	22	132	0.002	0.03	0.08	451
4-stroke	SH2	20<=S<50	Stage I	4.7	22	132	0.002	0.03	0.08	406
4-stroke	SH2	20<=S<50	Stage II	4.7	22	132	0.002	0.03	0.08	406
4-stroke	SH3	S>=50	<1981	2.4	33	198	0.002	0.03	0.08	496
4-stroke	SH3	S>=50	1981-1990	3.5	27.5	165	0.002	0.03	0.08	474
4-stroke	SH3	S>=50	1991-Stage I	4.7	22	132	0.002	0.03	0.08	451
4-stroke	SH3	S>=50	Stage I	4.7	22	132	0.002	0.03	0.08	406
4-stroke	SH3	S>=50	Stage II	4.7	22	132	0.002	0.03	0.08	406
4-stroke	SN1	S<66	<1981	1.2	26.9	822	0.002	0.03	0.08	603
4-stroke	SN1	S<66	1981-1990	1.8	22.5	685	0.002	0.03	0.08	603
4-stroke	SN1	S<66	1991-Stage I	2.4	18	548	0.002	0.03	0.08	603
4-stroke	SN1	S<66	Stage I	4.3	16.1	411	0.002	0.03	0.08	475
4-stroke	SN1	S<66	Stage II	4.3	16.1	411	0.002	0.03	0.08	475
4-stroke	SN2	66<=S<100	<1981	2.3	10.5	822	0.002	0.03	0.08	627
4-stroke	SN2	66<=S<100	1981-1990	3.5	8.7	685	0.002	0.03	0.08	599
4-stroke	SN2	66<=S<100	1991-Stage I	4.7	7	548	0.002	0.03	0.08	570
4-stroke	SN2	66<=S<100	Stage I	4.7	7	467	0.002	0.03	0.08	450
4-stroke	SN2	66<=S<100	Stage II	4.7	7	467	0.002	0.03	0.08	450
4-stroke	SN3	100<=S<225	<1981	2.6	19.1	525	0.002	0.03	0.08	601
4-stroke	SN3	100<=S<225	1981-1990	3.8	15.9	438	0.002	0.03	0.08	573
4-stroke	SN3	100<=S<225	1991-Stage I	5.1	12.7	350	0.002	0.03	0.08	546
4-stroke	SN3	100<=S<225	Stage I	5.1	11.6	350	0.002	0.03	0.08	546
4-stroke	SN3	100<=S<225	Stage II	5.1	9.4	350	0.002	0.03	0.08	546
4-stroke	SN4	S>=225	<1981	1.3	11.1	657	0.002	0.03	0.08	539
4-stroke	SN4	S>=225	1981-1990	2	9.3	548	0.002	0.03	0.08	514
4-stroke	SN4	S>=225	1991-Stage I	2.6	7.4	438	0.002	0.03	0.08	490
4-stroke	SN4	S>=225	Stage I	2.6	7.4	438	0.002	0.03	0.08	490
4-stroke	SN4	S>=225	Stage II	2.6	7.4	438	0.002	0.03	0.08	490

Table 6 Fuel use and emission factors for 2-stroke gasoline non road machinery

Engine	Size code	Size classe [ccm]	Emission Level	NO_x	VOC	CO	N_2O	NH_3	TSP	Fuel
				[g/kWh]						
2-stroke	SH2	20<=S<50	<1981	1	305	695	0.002	0.01	7	882
2-stroke	SH2	20<=S<50	1981-1990	1	300	579	0.002	0.01	5.3	809
2-stroke	SH2	20<=S<50	1991-Stage I	1.1	203	463	0.002	0.01	3.5	735
2-stroke	SH2	20<=S<50	Stage I	1.5	188	379	0.002	0.01	3.5	720
2-stroke	SH2	20<=S<50	Stage II	1.5	44	379	0.002	0.01	3.5	500
2-stroke	SH3	S>=50	<1981	1.1	189	510	0.002	0.01	3.6	665
2-stroke	SH3	S>=50	1981-1990	1.1	158	425	0.002	0.01	2.7	609
2-stroke	SH3	S>=50	1991-Stage I	1.2	126	340	0.002	0.01	1.8	554
2-stroke	SH3	S>=50	Stage I	2	126	340	0.002	0.01	1.8	529
2-stroke	SH3	S>=50	Stage II	1.2	64	340	0.002	0.01	1.8	500
2-stroke	SN1	S<66	<1981	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN1	S<66	1981-1990	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN1	S<66	1991-Stage I	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN1	S<66	Stage I	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN1	S<66	Stage II	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN2	66<=S<100	<1981	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN2	66<=S<100	1981-1990	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN2	66<=S<100	1991-Stage I	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN2	66<=S<100	Stage I	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN2	66<=S<100	Stage II	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN3	100<=S<225	<1981	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN3	100<=S<225	1981-1990	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN3	100<=S<225	1991-Stage I	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN3	100<=S<225	Stage I	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN3	100<=S<225	Stage II	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN4	S>=225	<1981	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN4	S>=225	1981-1990	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN4	S>=225	1991-Stage I	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN4	S>=225	Stage I	0.5	155	418	0.002	0.01	2.6	652
2-stroke	SN4	S>=225	Stage II	0.5	155	418	0.002	0.01	2.6	652

For LPG the fuel use factor and the emission factors of CO, VOC, NO_x and TSP shown in Table 7 are taken from IFEU (2004). For N_2O and NH_3 the emission factors are taken from EMEP/CORINAIR (2003).

Table 7 Fuel use and emission factors for LPG fork lifts

NO_x [g/kWh]	VOC [g/kWh]	CO [g/kWh]	NH_3 [g/kWh]	N_2O [g/kWh]	TSP [g/kWh]	FC [g/kWh]
19	2.2	1.5	0.003	0.05	0.07	311

The emission factors for All terrain Vehicles (ATV) are derived from the European COPERT III road transport emission model as aggregated fuel related emission factors for small conventional motorcycles under urban driving conditions (Ntziachristos et al., 2000).

Table 8 Fuel use and emission factors for ATV's

ATV type	NO_x [g/GJ]	VOC [g/GJ]	CO [g/GJ]	NH_3 [g/GJ]	N_2O [g/GJ]	TSP [g/GJ]	Fuel [kg/hour]
Professional	108	1077	16306	2	2	32	1.125
Private	128	1527	22043	2	2	39	0.75

For recreational craft, the emission factors are shown in Table 8. For engines complying with Directive 2003/44, the CO and VOC emission legislation limits rely on engine size, and are calculated by inserting the engine size value into the CO and VOC emission factor equations in Table 3 (Chapter 1).

The final emission factors for CO, VOC, NO_x and TSP are estimated using the assumption that if the emission factor constructed as 90% of the emission legislation value is higher than the conventional emission factor, the latter value is used. Otherwise, the 90% figure of the Directive 2003/44 legislation value is used.

For N_2O and NH_3 the emission factors are taken from EMEP/CORINAIR (2003).

Table 9 Fuel use and emission factors for recreational craft

Fuel type	Vessel type	Engine	Engine type	Direktive	Engine size	CO	VOC	N_2O	NH_3	NO_x	TSP	Fuel
					[kW]	[g/kWh]						
Gasoline	Other boats (< 20 ft)	Out board	2-stroke	2003/44	8	202.5	45.9	0.01	0.002	2	10	791
Gasoline	Other boats (< 20 ft)	Out board	2-stroke	Konv.	8	427	257.0	0.01	0.002	2	10	791
Gasoline	Other boats (< 20 ft)	Out board	4-stroke	2003/44	8	202.5	24.0	0.03	0.002	7	0.08	426
Gasoline	Other boats (< 20 ft)	Out board	4-stroke	Konv.	8	520	24.0	0.03	0.002	7	0.08	426
Gasoline	Yawls and cabin boats	Out board	2-stroke	2003/44	20	162	36.5	0.01	0.002	3	10	791
Gasoline	Yawls and cabin boats	Out board	2-stroke	Konv.	20	374	172.0	0.01	0.002	3	10	791
Gasoline	Yawls and cabin boats	Out board	4-stroke	2003/44	20	162	14.0	0.03	0.002	10	0.08	426
Gasoline	Yawls and cabin boats	Out board	4-stroke	Konv.	20	390	14.0	0.03	0.002	10	0.08	426
Gasoline	Sailing boats (< 26 ft)	Out board	2-stroke	2003/44	10	189	43.0	0.01	0.002	2	10	791
Gasoline	Sailing boats (< 26 ft)	Out board	2-stroke	Konv.	10	427	257.0	0.01	0.002	2	10	791
Gasoline	Sailing boats (< 26 ft)	Out board	4-stroke	2003/44	10	189	24.0	0.03	0.002	7	0.08	426
Gasoline	Sailing boats (< 26 ft)	Out board	4-stroke	Konv.	10	520	24.0	0.03	0.002	7	0.08	426
Gasoline	Speed boats	In board	4-stroke	2003/44	90	141	10.0	0.03	0.002	12	0.08	426
Gasoline	Speed boats	In board	4-stroke	Konv.	90	346	10.0	0.03	0.002	12	0.08	426
Gasoline	Speed boats	Out board	2-stroke	2003/44	50	145.8	31.8	0.01	0.002	3	10	791
Gasoline	Speed boats	Out board	2-stroke	Konv.	50	374	172.0	0.01	0.002	3	10	791
Gasoline	Speed boats	Out board	4-stroke	2003/44	50	145.8	14.0	0.03	0.002	10	0.08	426
Gasoline	Speed boats	Out board	4-stroke	Konv.	50	390	14.0	0.03	0.002	10	0.08	426
Gasoline	Water scooters	Built in	2-stroke	2003/44	45	147	32.2	0.01	0.002	3	10	791
Gasoline	Water scooters	Built in	2-stroke	Konv.	45	374	172.0	0.01	0.002	3	10	791
Gasoline	Water scooters	Built in	4-stroke	2003/44	45	147	14.0	0.03	0.002	10	0.08	426
Gasoline	Water scooters	Built in	4-stroke	Konv.	45	390	14.0	0.03	0.002	10	0.08	426
Diesel	Motor boats (27-34 ft)	In board		2003/44	150	5	1.7	0.035	0.002	8.6	1	275
Diesel	Motor boats (27-34 ft)	In board		Konv.	150	5.3	2.0	0.035	0.002	8.6	1.2	275
Diesel	Motor boats (> 34 ft)	In board		2003/44	250	5	1.6	0.035	0.002	8.6	1	275
Diesel	Motor boats (> 34 ft)	In board		Konv.	250	5.3	2.0	0.035	0.002	8.6	1.2	275
Diesel	Motor boats (< 27 ft)	In board		2003/44	40	5	1.8	0.035	0.002	9.8	1	281
Diesel	Motor boats (< 27 ft)	In board		Konv.	40	5.5	2.2	0.035	0.002	18	1.4	281
Diesel	Motor sailors	In board		2003/44	30	5	1.9	0.035	0.002	9.8	1	281
Diesel	Motor sailors	In board		Konv.	30	5.5	2.2	0.035	0.002	18	1.4	281
Diesel	Sailing boats (> 26 ft)	In board		2003/44	30	5	1.9	0.035	0.002	9.8	1	281
Diesel	Sailing boats (> 26 ft)	In board		Konv.	30	5.5	2.2	0.035	0.002	18	1.4	281

The emission factors for NMVOC and CH_4 are derived from the VOC emission factor using CH_4 shares of VOC reported by USEPA (2004) for diesel and gasoline. The CH_4 shares for LPG are taken from EMEP/CORINAIR (2003).

Table 10 CH_4 shares of VOC for diesel, gasoline and LPG

Fuel type	CH_4 share of VOC
Diesel	0.016
Gasoline 4-stroke	0.1
Gasoline 2-stroke	0.009
LPG	0.05

2.2 Deterioration factors

The emissions from non road machinery increase as engines become older, and the deterioration factor expresses the emission factor increase during the entire engine lifetime, relative to the basis emission factor. The deterioration factors are taken from IFEU (2004) and are shown in the Tables 11-13 for diesel, 2-stroke gasoline and 4-stroke gasoline, respectively.

Table 11 Deterioration factors for diesel machinery

Emission Level	NO_x	VOC	CO	TSP
<1981	0.024	0.047	0.185	0.473
1981-1990	0.024	0.047	0.185	0.473
1991-Stage I	0.024	0.047	0.185	0.473
Stage I	0.024	0.036	0.101	0.473
Stage II	0.009	0.034	0.101	0.473
Stage IIIA	0.008	0.027	0.151	0.473
Stage IIIB	0.008	0.027	0.151	0.473
Stage IV	0.008	0.027	0.151	0.473

Table 12 Deterioration factors for gasoline 2-stroke machinery

Engine	Size code	Size classe	Emission Level	NO_x	VOC	CO	TSP
2-stroke	SH2	20<=S<50	<1981	0	0.2	0.2	0
2-stroke	SH2	20<=S<50	1981-1990	0	0.2	0.2	0
2-stroke	SH2	20<=S<50	1991-Stage I	0	0.2	0.2	0
2-stroke	SH2	20<=S<50	Stage I	0	0.29	0.24	0
2-stroke	SH2	20<=S<50	Stage II	0	0.29	0.24	0
2-stroke	SH3	S>=50	<1981	-0.031	0.2	0.2	0
2-stroke	SH3	S>=50	1981-1990	-0.031	0.2	0.2	0
2-stroke	SH3	S>=50	1991-Stage I	-0.031	0.2	0.2	0
2-stroke	SH3	S>=50	Stage I	0	0.266	0.231	0
2-stroke	SH3	S>=50	Stage II	0	0.266	0.231	0
2-stroke	SN1	S<66	<1981	-0.6	0.201	0.9	1.1
2-stroke	SN1	S<66	1981-1990	-0.6	0.201	0.9	1.1
2-stroke	SN1	S<66	1991-Stage I	-0.6	0.201	0.9	1.1
2-stroke	SN1	S<66	Stage I	-0.33	0.266	1.109	5.103
2-stroke	SN1	S<66	Stage II	-0.33	0	1.109	5.103
2-stroke	SN2	66<=S<100	<1981	-0.6	0.201	0.9	1.1
2-stroke	SN2	66<=S<100	1981-1990	-0.6	0.201	0.9	1.1
2-stroke	SN2	66<=S<100	1991-Stage I	-0.6	0.201	0.9	1.1
2-stroke	SN2	66<=S<100	Stage I	-0.33	0.266	1.109	5.103
2-stroke	SN2	66<=S<100	Stage II	-0.33	0	1.109	5.103
2-stroke	SN3	100<=S<225	<1981	-0.6	0.201	0.9	1.1
2-stroke	SN3	100<=S<225	1981-1990	-0.6	0.201	0.9	1.1
2-stroke	SN3	100<=S<225	1991-Stage I	-0.6	0.201	0.9	1.1
2-stroke	SN3	100<=S<225	Stage I	-0.33	0.266	1.109	5.103
2-stroke	SN3	100<=S<225	Stage II	-0.33	0	1.109	5.103
2-stroke	SN4	S>=225	<1981	-0.6	0.201	0.9	1.1
2-stroke	SN4	S>=225	1981-1990	-0.6	0.201	0.9	1.1
2-stroke	SN4	S>=225	1991-Stage I	-0.6	0.201	0.9	1.1
2-stroke	SN4	S>=225	Stage I	-0.274	0	0.887	1.935
2-stroke	SN4	S>=225	Stage II	-0.274	0	0.887	1.935

Table 13 Deterioration factors for gasoline 4-stroke machinery

Engine	Size code	Size classe	Emission Level	NO_x	VOC	CO	TSP
4-stroke	SN1	S<66	<1981	-0.6	1.1	0.9	1.1
4-stroke	SN1	S<66	1981-1990	-0.6	1.1	0.9	1.1
4-stroke	SN1	S<66	1991-Stage I	-0.6	1.1	0.9	1.1
4-stroke	SN1	S<66	Stage I	-0.3	1.753	1.051	1.753
4-stroke	SN1	S<66	Stage II	-0.3	1.753	1.051	1.753
4-stroke	SN2	66<=S<100	<1981	-0.6	1.1	0.9	1.1
4-stroke	SN2	66<=S<100	1981-1990	-0.6	1.1	0.9	1.1
4-stroke	SN2	66<=S<100	1991-Stage I	-0.6	1.1	0.9	1.1
4-stroke	SN2	66<=S<100	Stage I	-0.3	1.753	1.051	1.753
4-stroke	SN2	66<=S<100	Stage II	-0.3	1.753	1.051	1.753
4-stroke	SN3	100<=S<225	<1981	-0.6	1.1	0.9	1.1
4-stroke	SN3	100<=S<225	1981-1990	-0.6	1.1	0.9	1.1
4-stroke	SN3	100<=S<225	1991-Stage I	-0.6	1.1	0.9	1.1
4-stroke	SN3	100<=S<225	Stage I	-0.3	1.753	1.051	1.753
4-stroke	SN3	100<=S<225	Stage II	-0.3	1.753	1.051	1.753
4-stroke	SN4	S>=225	<1981	-0.6	1.1	0.9	1.1
4-stroke	SN4	S>=225	1981-1990	-0.6	1.1	0.9	1.1
4-stroke	SN4	S>=225	1991-Stage I	-0.6	1.1	0.9	1.1
4-stroke	SN4	S>=225	Stage I	-0.599	1.095	1.307	1.095
4-stroke	SN4	S>=225	Stage II	-0.599	1.095	1.307	1.095
4-stroke	SH2	20<=S<50	<1981	0	0	0	0
4-stroke	SH2	20<=S<50	1981-1990	0	0	0	0
4-stroke	SH2	20<=S<50	1991-Stage I	0	0	0	0
4-stroke	SH2	20<=S<50	Stage I	0	0	0	0
4-stroke	SH2	20<=S<50	Stage II	0	0	0	0
4-stroke	SH3	S>=50	<1981	0	0	0	0
4-stroke	SH3	S>=50	1981-1990	0	0	0	0
4-stroke	SH3	S>=50	1991-Stage I	0	0	0	0
4-stroke	SH3	S>=50	Stage I	0	0	0	0
4-stroke	SH3	S>=50	Stage II	0	0	0	0

2.3 Transient factors

To account for fuel use and emission changes due to varying engine loads, transient factors, see IFEU (2004), are used in the fuel use and emission calculations for diesel machinery. In the inventory, the high load region is defined for load factors $\exists$0.4.

For stage IIIB and IV the EU type approval test procedure takes into account transient engine loads, and hence the transient factors become 1 for diesel machinery of these emission levels.

Table 14 Transient factors for diesel machinery

Emission Level	Load	NO_x	VOC	CO	TSP	Fuel
<1981	High	0.95	1.05	1.53	1.23	1.01
1981-1990	High	0.95	1.05	1.53	1.23	1.01
1991-Stage I	High	0.95	1.05	1.53	1.23	1.01
Stage I	High	0.95	1.05	1.53	1.23	1.01
Stage II	High	0.95	1.05	1.53	1.23	1.01
Stage IIIA	High	0.95	1.05	1.53	1.23	1.01
Stage IIIB	High	1	1	1	1	1
Stage IV	High	1	1	1	1	1
<1981	Low	1.1	2.29	2.57	1.97	1.18
1981-1990	Low	1.1	2.29	2.57	1.97	1.18
1991-Stage I	Low	1.1	2.29	2.57	1.97	1.18
Stage I	Low	1.1	2.29	2.57	1.97	1.18
Stage II	Low	1.1	2.29	2.57	1.97	1.18
Stage IIIA	Low	1.1	2.29	2.57	1.97	1.18
Stage IIIB	Low	1	1	1	1	1
Stage IV	Low	1	1	1	1	1

2.4 Evaporation factors

The evaporation of hydrocarbons during the fuelling procedure and from the fuel tank is estimated using evaporation factors. For fuelling and fuel tank evaporation, respectively, the emission factors are expressed as g NMVOC per kg fuel and g NMVOC per year. The emission factors are from IFEU (2004), and are listed in Annex 5 for all types of gasoline machinery.

3 Stock and operational data

3.1 Agriculture

3.1.1 Tractors

Stock
For each inventory year, the distribution of agricultural tractors into numbers per new sales year has been established using information from Statistics Denmark, The Association of Danish Agricultural Machinery Dealers (Dansk Maskinhandlerforening) and Danish Agricultural Advisory Service (Dansk Landbrugsrådgivning - Landscentret).

The total number of tractors from 1985 to 2000 in agriculture and forestry is given by Statistics Denmark (2005), based on information from questionnaires and registers of crop subsidy application kept by the Ministry of Agriculture. To obtain the number of agricultural diesel tractors, the number of gasoline tractors and forestry tractors (diesel) are subtracted from the overall totals. The latter sector's fleet numbers are obtained from KVL (2005).

Figures for the total number of gasoline tractors exist for 1974 (Statistics Denmark, 1974), and 1990 (Teknologisk Institut, 1992). Since no new sales has occured since the beginning of the 1970's, a linear decrease in stock numbers between 1974 and 1990, and a gradual phasing out of gasoline tractors after 1990 (using same increment) is assumed (Høy, 2005).

For each year in the inventory period, the number of diesel tractors in agriculture is distributed into size classes, using new sale figures from The Association of Danish Agricultural Machinery Dealers (2005a), and a tractor lifetime of 30 years (Teknologisk Institut, 1992). The 1982 new sales distribution is used for the years before 1982, and for 2004, the figures for 2003 is used. For each inventory year the ratio between total stock (Statistics Denmark) and estimated stock (from new sales/lifetime) is used to adjust the stock-engine size distribution, in order to end up with the total stock numbers given by Statistics Denmark. For 2001-2004 the adjustment ratio for 2000 is used.

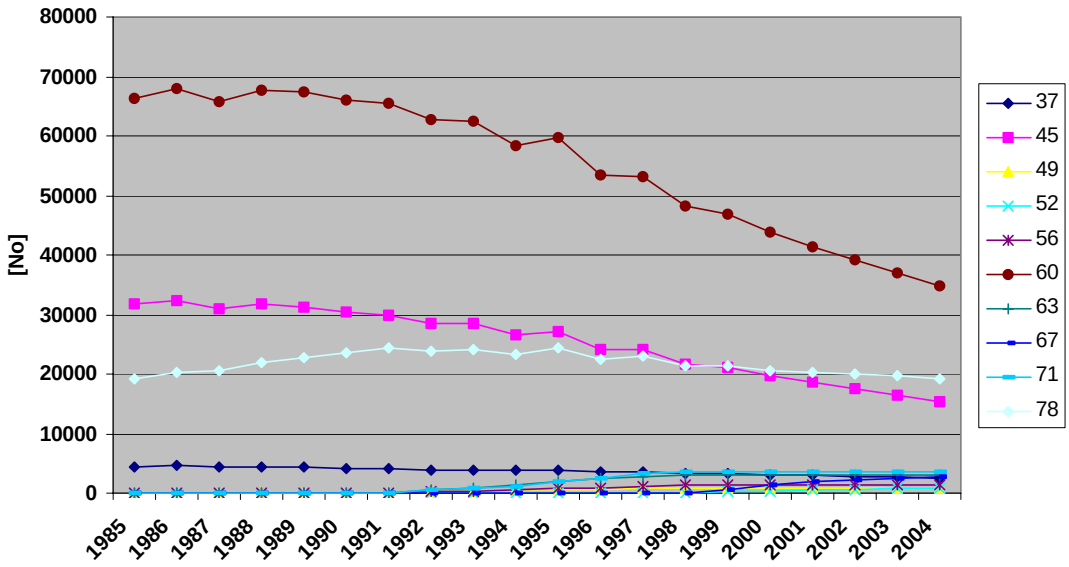


Figure 1 Total numbers in kW classes (< 80 kW) for tractors from 1985 to 2004

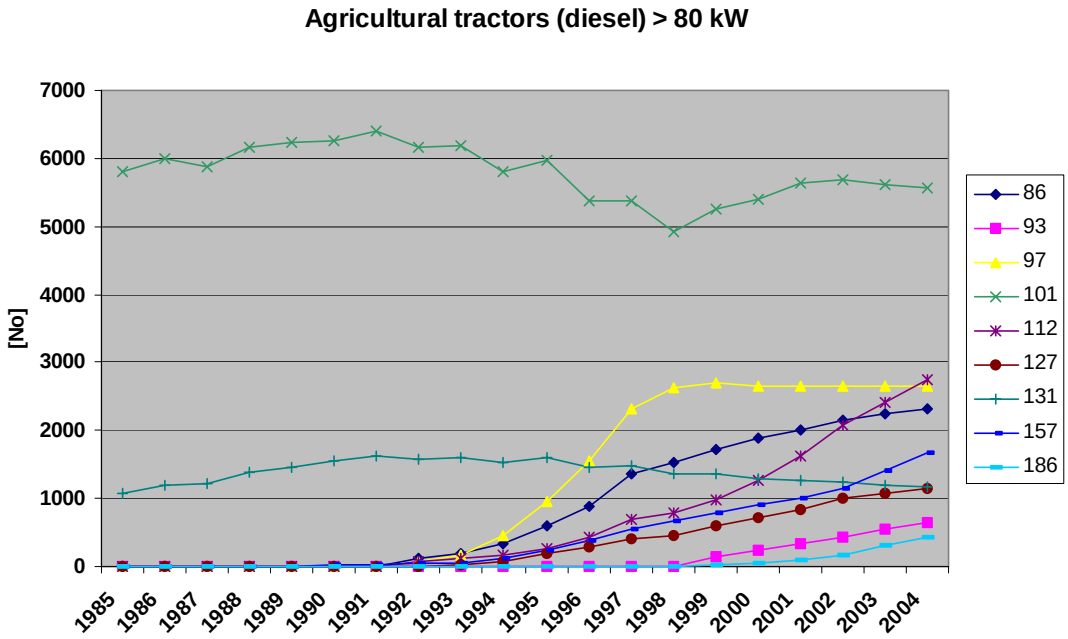


Figure 2 Total numbers in kW classes (> 80 kW) for tractors from 1985 to 2004

The total number of agricultural tractors per year are shown in the Figures 1 and 2, for engine sizes < 80 kW and > 80 kW, respectively. The Figures clearly show a decrease in the number of small tractors, being replaced by tractors in the large engine size ranges. The overall development towards smaller tractor numbers and increasing engine sizes is also visible from Figure 3. The number of vehicles decreases with 20% from 1985 to 2004, whereas the average engine size increase around 16% in the same time period.

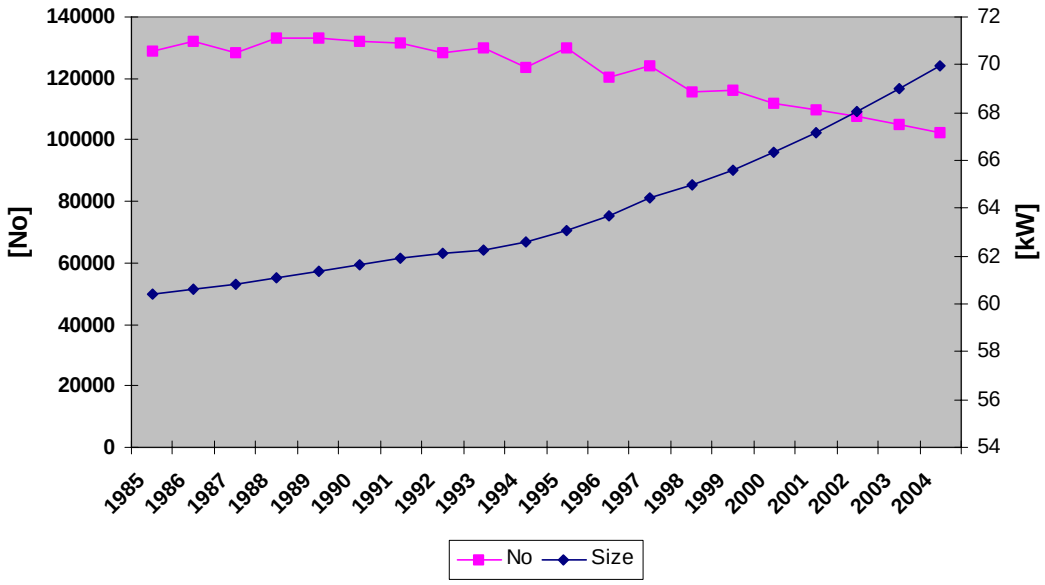


Figure 3 Total numbers and average engine size for tractors from 1985 to 2004

The emission level shares for the Danish stock of diesel tractors are shown in Figure 4. The specific stage I and II implementation years rely on engine size (see Chapter 1), and therefore individual size segment shares differ slightly from the Figure 4 overall country shares.

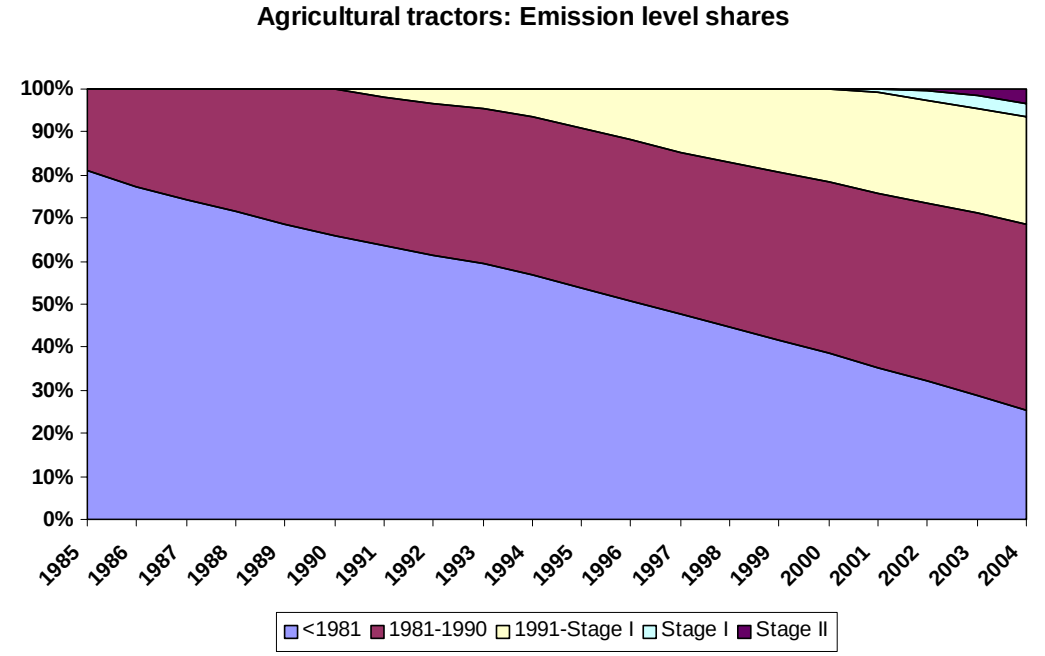


Figure 4 Emission level shares for tractors from 1985 to 2004

The number of gasoline fuelled tractors is shown in Figure 5, distributed into certified and non certified tractors. The split between certified and non certified tractors is given by Høy (2005) and Teknologisk Institut (1992).

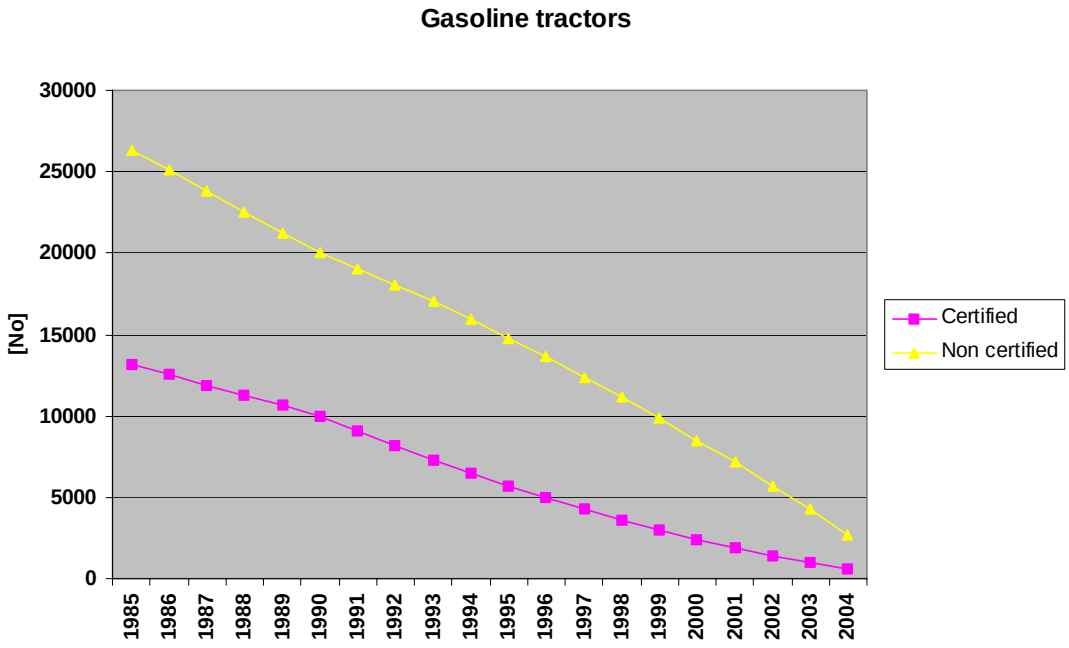


Figure 5 Total numbers of gasoline fuelled tractors from 1985 to 2004

The stock distribution of diesel tractors into engine size and emission levels, and the number of gasoline tractors used in the inventory from 1985-2004 are given in Annex 1.

Operational data

For 0-7 year old diesel tractors the number of annual working hours is assumed to be 500. For 7-16 year old tractors the annual working hours gradually decrease from 500 to a level of 100, which is also used for tractors older than 16 year (Bak et al., 2003).

The load factor for diesel tractors is assumed to be 0.5 (Bak et al., 2003). A similar load factor was calculated in the present project as a part of an assessment of the inventory operational data. The calculations were based on figures for engine loads and annual hours for different types of tractor usage provided by Sørensen (2005), for three different farm types (see also Iversen et al., 1987).

An overview of annual working hours and load factors used for agricultural tractors in all inventory years is given in Table 15.

Table 15 Annual working hours, load factors and lifetimes for agricultural tractors

Tractor type	Annual working hours	Load factor	Lifetime (yrs)
Diesel	500 (0-7 years) 500-100 (7-16 years) 100 (>16 years)	0.5	30
Gasoline (certified)	100	0.4	37
Gasoline (non certified)	50	0.4	37

3.1.2 Harvesters

Stock
As for tractors, the total number of harvesters from 1985 to 2000 is given by Statistics Denmark (2005). For each year in the inventory period, the number of harvesters is distributed into new sales year and size classes, using new sale figures from The Association of Danish Agricultural Machinery Dealers (2005b), and a harvester lifetime of 25 years (Høy, 2005). The 1982 new sales distribution is used for the years before 1982, and for 2004, the figures for 2003 are used.

New sales figures are given in numbers per harvester platform width (ft), and to transform these into actual engine sizes a kW:ft ratio is assumed based on information from Høy (2005). The latter source assume a kW:ft ratio of 5 in 1985 and 10 in 2004. A linear interpolation is used to produce the kW:ft ratio's for the years in between.

In order to end up with the total stock numbers given by Statistics Denmark, an adjustment ratio between total stock (Statistics Denmark) and estimated stock (from new sales/lifetime) is used to correct each inventory year's stock-engine size distribution. Due to lack of data, the adjustment ratio for 2000 is used also for 2001-2004.

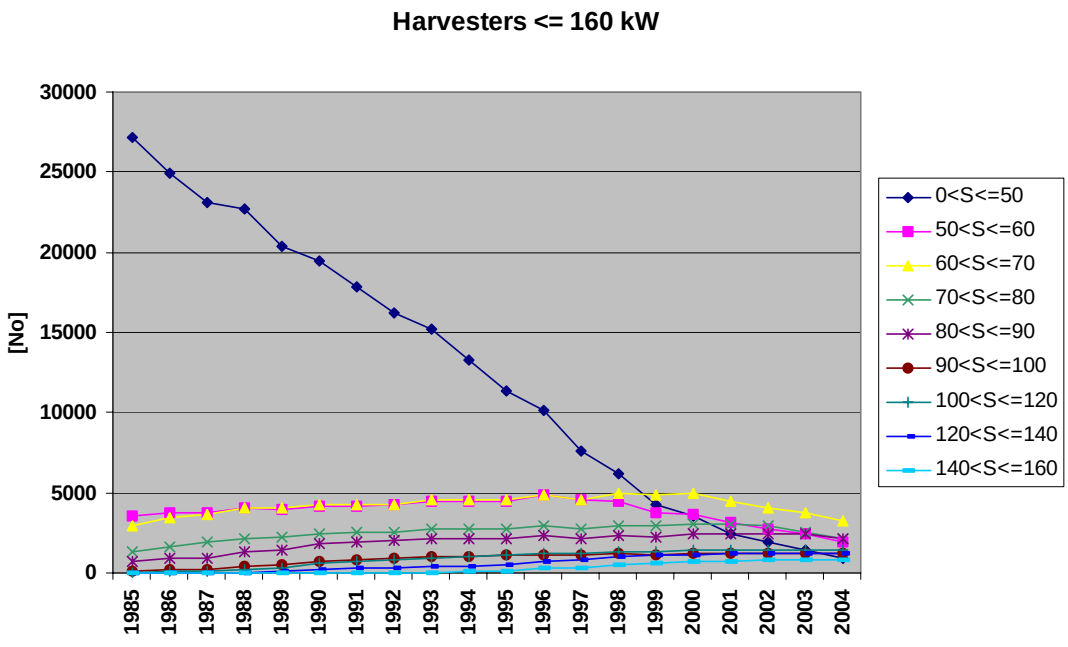


Figure 6 Total numbers in kW classes (<= 160 kW) for harvesters from 1985 to 2004

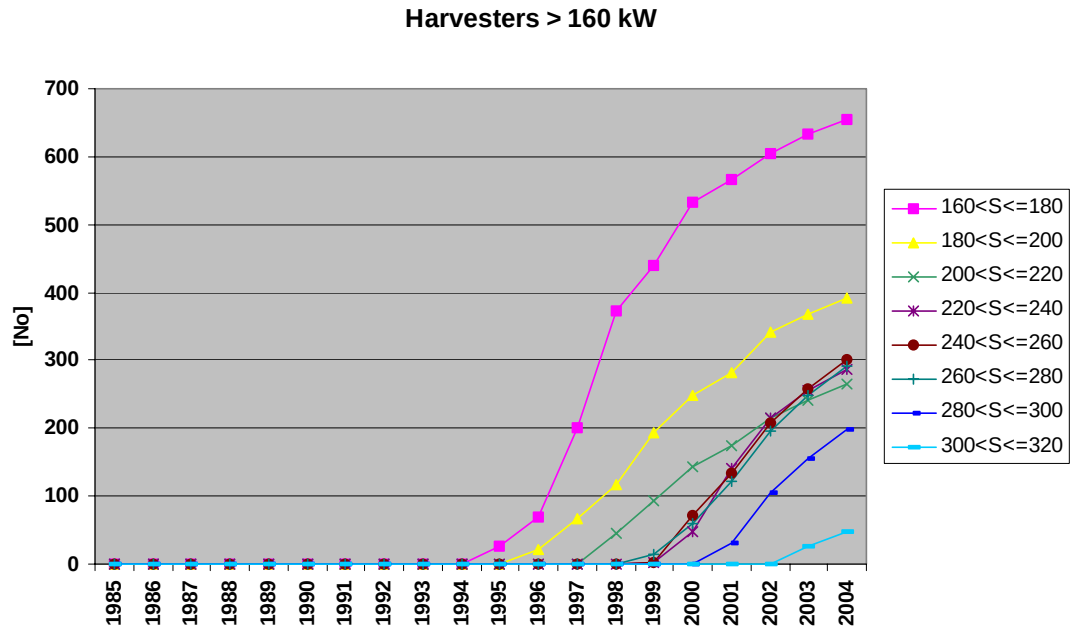


Figure 7 Total numbers in kW classes (> 160 kW) for harvesters from 1985 to 2004

The total number of harvesters per year are shown in the Figures 6 and 7, for engine sizes < 160 kW and > 160 kW, respectively. The figures clearly show a decrease in the number of small harvesters, being replaced by harvesters in the large engine size ranges.

The harvester development towards fewer vehicles and larger engines shown in Figure 8, is very clear. From 1985 to 2004 the number of vehicles decreases with around 50% whereas the average engine size increases more than 100%.

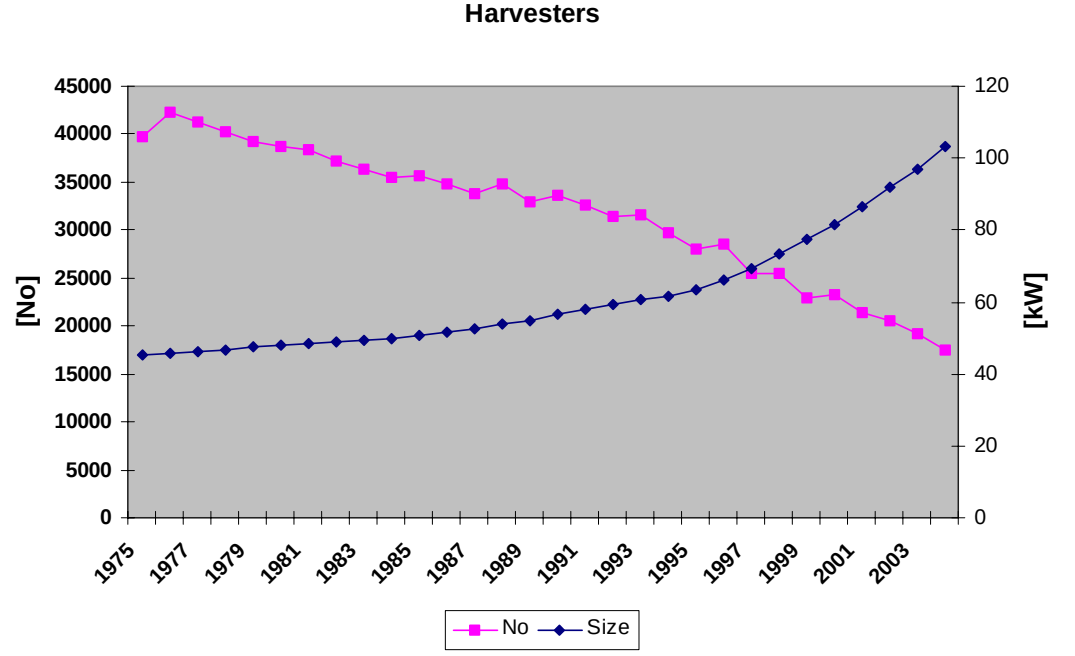


Figure 8 Total numbers and average engine size for harvesters from 1985 to 2004

The emission level shares for harvesters are shown in Figure 9. As for tractors, the Stage I and II implementation years rely on engine size, and therefore specific size segment shares will differ slightly from the picture shown in Figure 9.

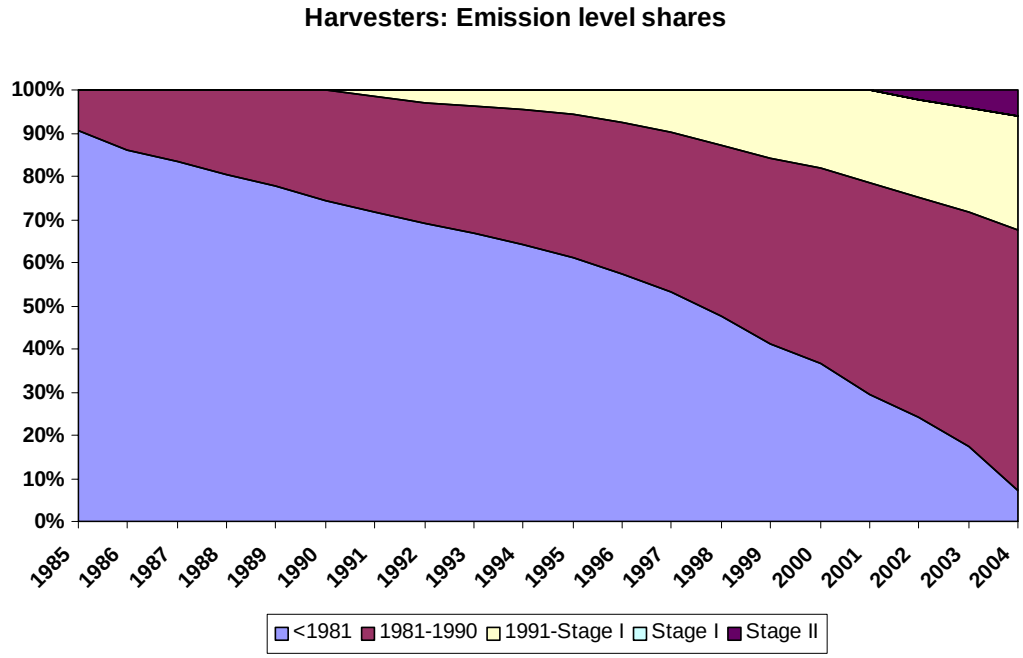


Figure 9 Emission level shares for harvesters from 1985 to 2004

The engine size-emission level distribution of the harvester stock used in the inventory from 1985-2004 is given in Annex 1.

Operational data
Based on information from Høy (2005), the annual working hours are expected to decrease linearly from 200 to 50, during the harvester lifetime period of 25 years. The load factor at 0.8 is obtained from Bak et al. (2003).

3.1.3 Machine pools

Stock
Different machinery data for machine pools is obtained from the Association of Danish Machine Pools (Danske Maskinstationer), see Association of Danish Machine Pools (2005). The 1985-2004 development in machinery stock is shown in Figure 10 from 1985-2004. Due to lack of data the engine size for tractors is assumed to be the same as the average engine size for agricultural diesel tractors in a given inventory year. More detailed data for the machinery stock is shown in Annex 1 for all inventory years.

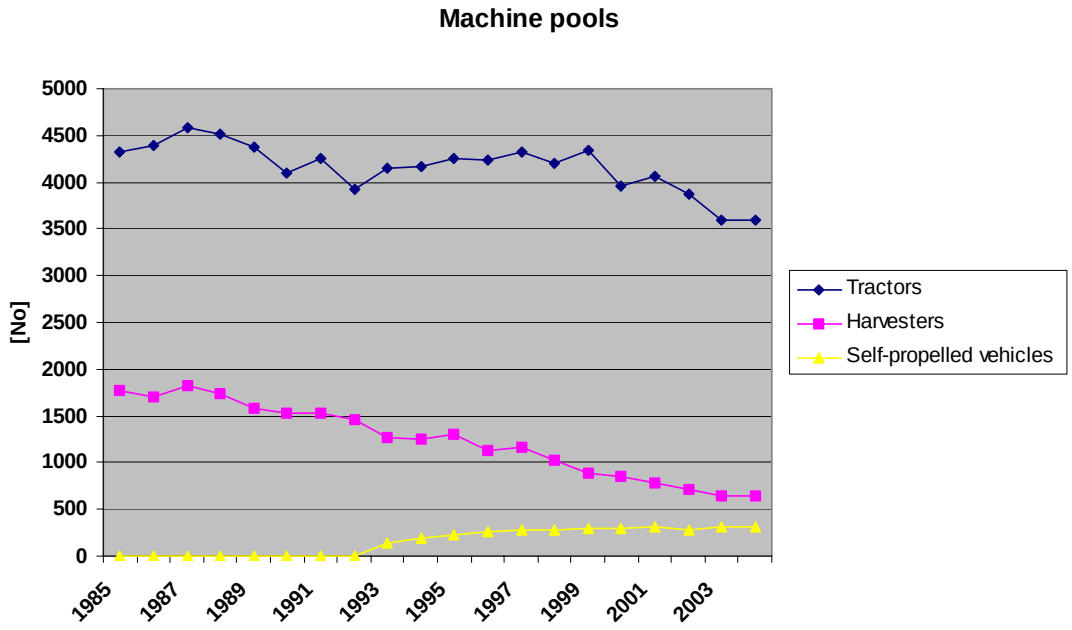


Figure 10 Machinery stock for machine pools from 1985 to 2004

Operational data

An overview of annual working hours and load factors used for machine pool machinery is given in Table 16 for all inventory years. Annual working hours and lifetime figures come from Kjelddal (2005), and load factors are from Bak et al. (2003).

Table 16 Annual working hours, load factors and lifetime for machine pool machinery

Tractor type	Hours/yr	Load factor	Lifetime (yrs)
Tractors	750	0.5	7
Harvesters	100	0.8	11
Self-propelled vehicles	500	0.75	6

3.1.4 Other machinery

Stock

Other machinery in agriculture mainly consists of units with small levels of activity. Stock numbers are from Teknologisk (1992). For bedding machines, fodder trucks and sweepers, today's stock is assumed to be 50% of the stock in 1990 (Høy, 2005).

All terrain vehicles (ATV) is however a fast growing segment of gasoline machinery. ATV's entered into use in 1992 and 2000 for professional and private purposes, respectively (Importørforeningen, 2005).

Table 17 Stock numbers for other machinery types in agriculture in selected years

Machinery type	Fuel type	1985	1990	1995	2000	2004
ATV private	Gasoline				1000	5000
ATV professional	Gasoline			1204	4342	6924
Bedding machines	Gasoline	1100	955	811	666	550
Fodder trucks	Gasoline	11000	9553	8105	6658	5500
Other (gasoline)	Gasoline	100	100	100	100	100
Scrapers	Gasoline	750	750	750	750	750
Self-propelled vehicles	Diesel	1100	1100	1100	1100	1100
Sweepers	Gasoline	2500	2171	1842	1513	1250

Operational data

Figures for load factors, lifetime, annual working hours and engine size are given in Table 18 for other machinery in agriculture (Teknologisk, 1992). No data is shown for ATV load factors and engine size. For ATV's, the fuel use and emission calculations use figures for fuel use per hour, and fuel related emission factors for conventional motor cycles.

Table 18 Operational data for other machinery types in agriculture

Machinery type	Fuel type	Load factor	Lifetime (yrs)	Hours	Size (kW)
ATV private	Gasoline	-	6	250	-
ATV professional	Gasoline	-	8	400	-
Bedding machines	Gasoline	0.3	10	50	3
Fodder trucks	Gasoline	0.4	10	200	8
Other (gasoline)	Gasoline	0.4	10	50	5
Scrapers	Gasoline	0.3	10	50	3
Self-propelled vehicles	Diesel	0.75	15	150	60
Sweepers	Gasoline	0.3	10	50	3

3.2 Forestry

Stock and operational data for forestry machinery are provided by KVL (2005) for all types of machinery.

Stock

In Table 19, stock numbers and engine sizes are given for forestry machinery in selected years.

Table 19 Stock and engine size for forestry machinery in selected years

Machinery type	Fuel type		1985	1990	1995	2000	2004
Chippers	Diesel	[No]	120	123	125	130	134
Tractors (other)	Diesel		750	650	550	511	480
Tractors (silvicultural)	Diesel		20	25	30	30	30
Harvesters	Diesel		20	33	45	48	50
Forwarders	Diesel		45	50	55	58	61
Chain saws (forestry)	Gasoline		8000	8000	5857	3714	2000
Chippers	Diesel	[kW]	47	51	56	64	71
Tractors (other)	Diesel		45	53	61	69	75
Tractors (silvicultural)	Diesel		105	123	142	160	175
Harvesters	Diesel		60	71	81	92	100
Forwarders	Diesel		60	71	81	92	100
Chain saws (forestry)	Gasoline		5	5	5	5	5

Operational data

Annual working hours, load factors and lifetimes for forestry machinery are given in Table 20 for selected years. The annual working hours for other tractors are expected to increase linearly from 100 to 400 from 1990 to 2004. For 1985-1989 the figures for 1990 are used.

Table 20 Annual working hours, load factors and lifetimes for forestry machinery

Machinery type	Hours	Load factors	Lifetime
Chippers	1200	0.5	6
Tractors (other)	100 (1990) 400 (2004)	0.5	15
Tractors (silvicultural)	800	0.5	6
Harvesters	1200	0.5	8
Forwarders	1200	0.5	8
Chain saws (forestry)	800	0.4	3

3.3 Industry

3.3.1 Fork lifts

Stock

The fork lift stock distribution into new sales year, fuel type and size classes is made by using 1976-2004 new sale figures from IFAG (Brancheforeningen for Importører og Fabrikanter af Gaffeltrucks i Danmark), see Teknologisk (2005) and IFAG (2005), and a lifetime of 20 years (Bak et al., 2003). For years before 1976, the 1976 new sales distribution is used.

New sales figures are given in groups per lifting capacity (tons). A transformation into engine size classes (kW) is made using a kW:tons ratio from Bak et al. (2003).

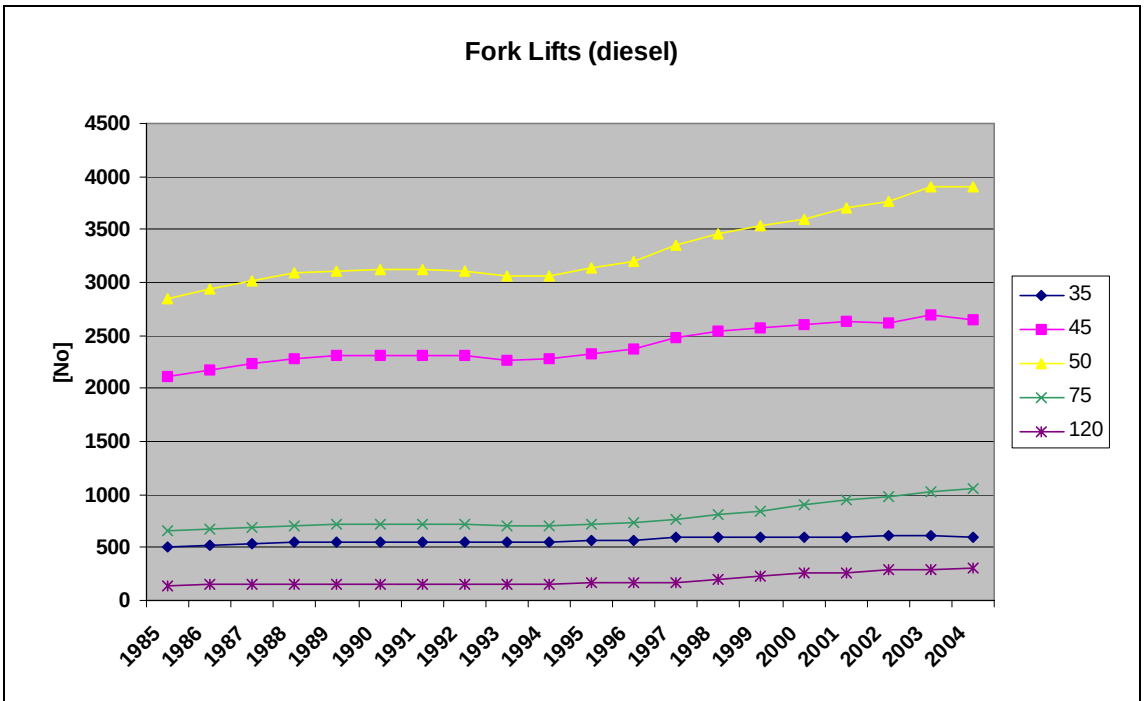


Figure 11 Total numbers of diesel fork lifts in kW classes from 1985 to 2004

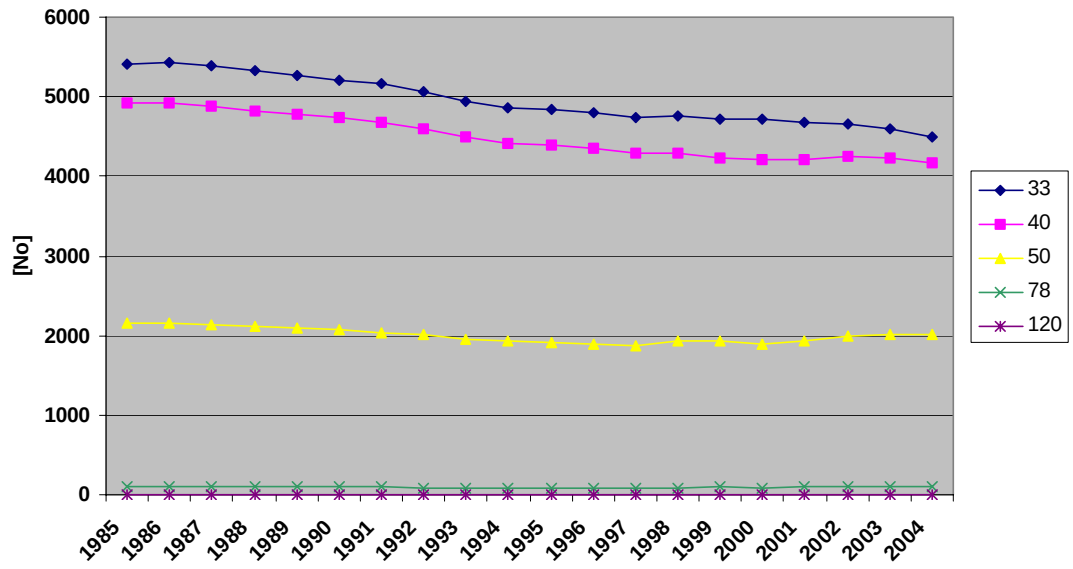


Figure 12 Total numbers of LPG fork lifts in kW classes from 1985 to 2004

The total numbers of fork lifts per year are shown in the Figures 11 and 12, for diesel and LPG fuelled types, respectively. In general the number of diesel fork lift increases from 1985 to 2004 for all engine size groups. In this period the overall stock increase is 36% for diesel, whereas for LPG there is a stock decrease of 14%, mainly driven by the stock decline for smaller fork lifts.

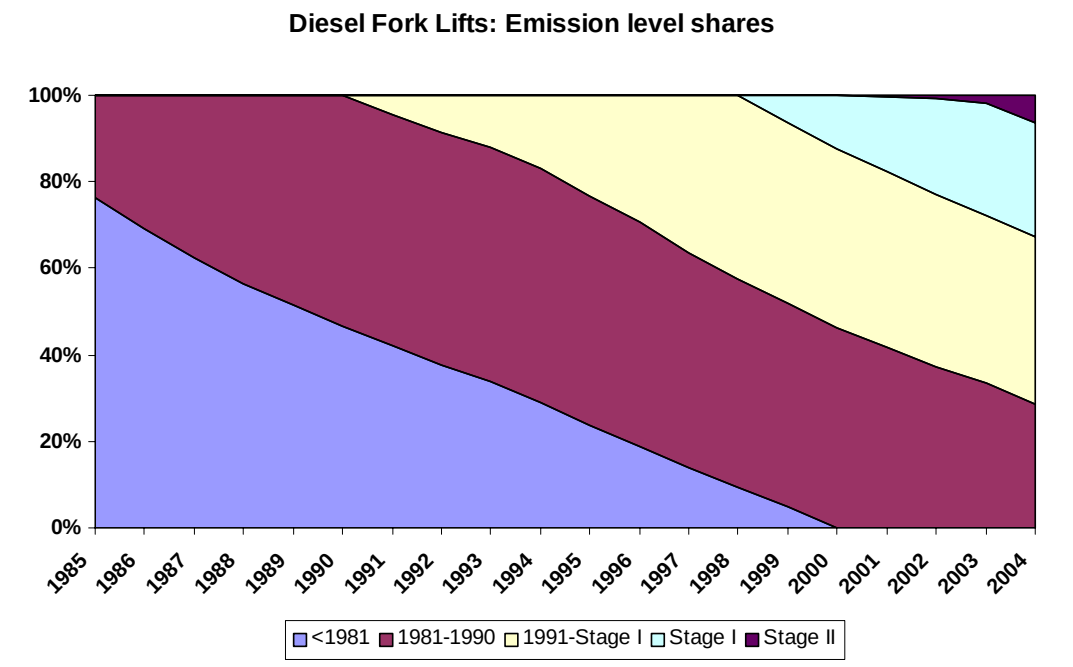


Figure 13 Emission level shares for diesel fork lifts from 1985 to 2004

The emission level shares for diesel trucks are shown in Figure 9. The Stage I and II implementation years rely on engine size, and therefore specific size segment shares will differ slightly from the picture shown in Figure 9. For LPG, no development in emission factors is taken into account in the emission calculations.
Annex I includes the number-engine size distribution of fork lifts used in the inventory from 1985-2004.

Operational data
The data for annual working hours, load factors and lifetime shown in Table 21 are based on information from Bak et al. (2003). The annual working hours for engine sizes larger than 50 kW are expected to decrease linearly from 1200 to 650 for vehicles between 0 and 10 years of age. For engines smaller than 50 kW the annual working hours are expected to be 650, irrespective of age.

Table 21 Annual working hours, load factors and lifetime for fork lifts

Hours/yr	Load factor	Lifetime (yrs)
1200 (>=50 kW and <=10 years old) 650 (>=50 kW and >10 years old) 650 (<50 kW)	0.27	20

3.3.2 Construction machinery

Stock
New sales figures covering the period 1996-2004 period is obtained from The Association of Danish Agricultural Machinery Dealers (2005c) for the construction machinery types shown in the Figures 14 and 15. Using the machinery lifetimes (see Table 8) and assumptions for machinery new sales for years before 1996, a set of stock numbers are estimated for 2004. These latter stock figures are used together with the 1990 stock figures given by Teknologisk (1992), to interpolate the 1991-2003 machinery stock.

Due to lack of data from 1985 to1989, the 1990 stock numbers are used for these years. Moreover, for a given inventory year and machinery type it is assumed that all ages of machinery have the same percentage share of the total stock. The described approach of stock estimation has been discussed with The Association of Danish Agricultural Machinery Dealers (Pedersen, 2005; Stjernqvist, 2005).

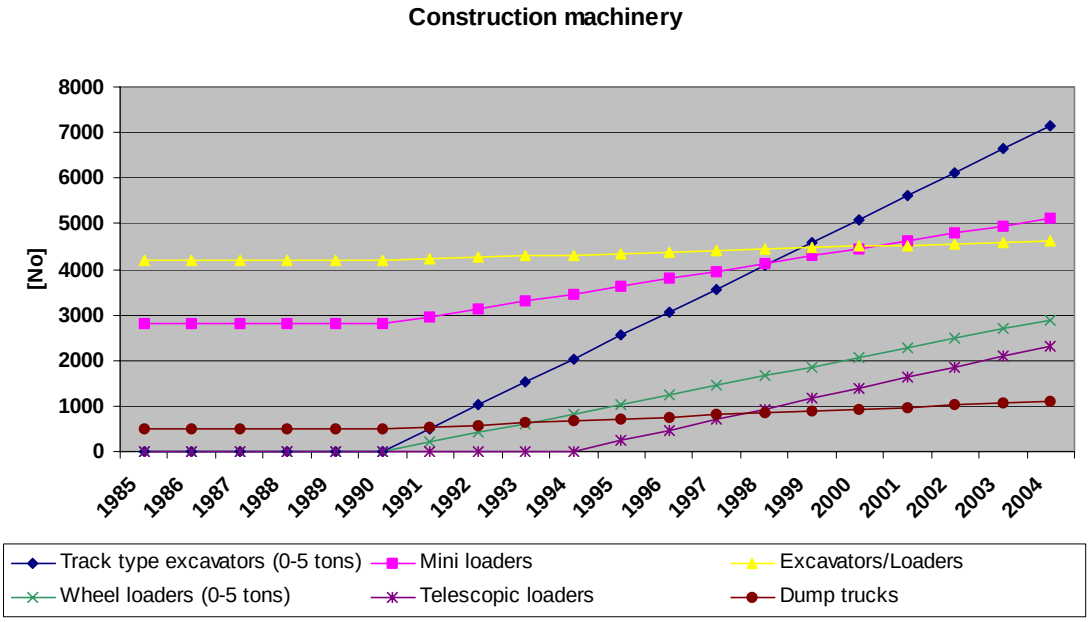


Figure 14 1985-2004 stock development for specific types of construction machinery

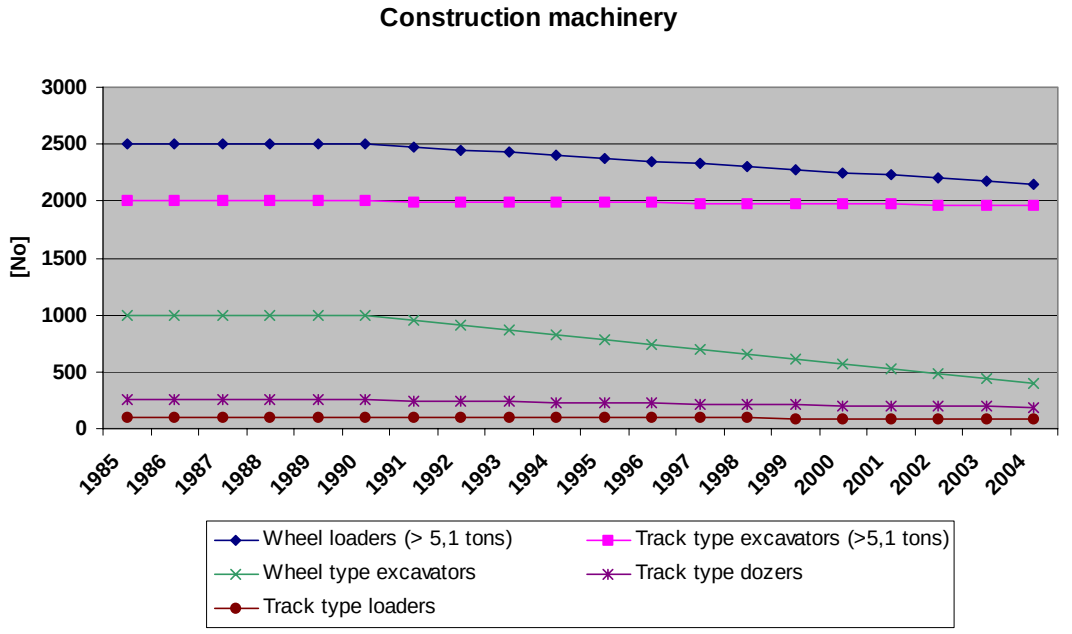


Figure 15 1985-2004 stock development for specific types of construction machinery

Figure 14 shows the 1985-2004 stock development for specific types of machinery with increasing stock numbers after 1990. The inventory assumes that track type excavators/ wheel type loaders (0-5 tons), and Telescopic loaders first enter into use in 1991 and 1995, respectively (Stjernqvist, 2005). In Figure 15 the 1985-2004 stock development is shown for machinery types with declining stock numbers after 1990.

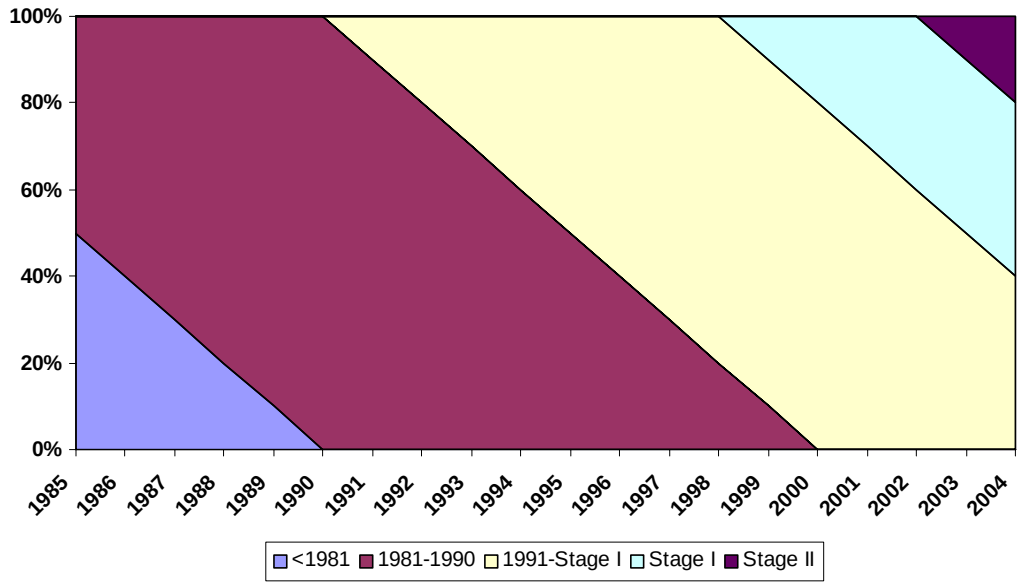


Figure 16 Emission level shares for wheel type loaders from 1985 to 2004

The emission level shares for each construction machinery type follow the pattern shown in Figure 16 for wheel type loaders. The emission level penetration rates are linear, and reflect the machinery age distribution assumptions explained in the above text.

The engine size-emission level distribution of the construction machinery stock from 1985-2004 is given in Annex 1.

Operational data

The data for annual working hours, load factors, lifetimes and engine sizes shown in Table 22 are provided by Stjernqvist (2005). Both annual working hours and engine sizes for dump trucks are expected to increase linearly from 1990 to 2004. Also for track type loaders an increase in the average engine size is expected in the same time interval, as given in Table 8.

Table 22 Operational data for construction machinery

Machinery type	Load factor	Lifetime	Hours	Size
Track type dozers	0.5	10	1100	140
Track type loaders	0.5	10	1100	100 (1990) 150 (2004)
Wheel loaders (0-5 tons)	0.5	10	1200	20
Wheel loaders (> 5,1 tons)	0.5	10	1200	120
Wheel type excavators	0.6	10	1200	100
Track type excavators (0-5 tons)	0.6	10	1100	20
Track type excavators (>5,1 tons)	0.6	10	1100	120
Excavators/Loaders	0.45	10	700	50
Dump trucks	0.4	10	900 (1990) 1200 (2004)	60 (1990) 180 (2004)
Mini loaders	0.5	14	700	30
Telescopic loaders	0.5	14	1000	35

3.3.3 Other

For industrial non road, a large group of individual machinery types exists for which stock and operational data are very scarce and for which fuel use and emission contributions are small. Due to project limitations it has therefore been decided for these types of equipment to use only the data from the Teknologisk (1992 and 1993) studies for all inventory years.

Table 23 Stock and operational data for other machinery types in industry

Sector	Fuel type	Machinery type	Size (kW)	No	Load Factor	Hours
Construction machinery	Diesel	Tampers/Land rollers	30	2800	0.45	600
Construction machinery	Diesel	Generators (diesel)	45	5000	0.5	200
Construction machinery	Diesel	Kompressors (diesel)	45	5000	0.5	500
Construction machinery	Diesel	Pumps (diesel)	75	1000	0.5	5
Construction machinery	Diesel	Asphalt pavers	80	300	0.35	700
Construction machinery	Diesel	Motor graders	100	100	0.4	700
Construction machinery	Diesel	Refuse compressors	160	100	0.25	1300
Construction machinery	Gasoline	Generators (gasoline)	2.5	11000	0.4	80
Construction machinery	Gasoline	Pumps (gasoline)	4	10000	0.4	300
Construction machinery	Gasoline	Kompressors (gasoline)	4	500	0.35	15
Industry	Diesel	Refrigerating units (distribution)	8	3000	0.5	1250
Industry	Diesel	Refrigerating units (long distance)	15	3500	0.5	200
Industry	Diesel	Tractors (transport, industry)	50	3000	0.4	500
Airport GSE and other	Diesel	Airport GSE and other (light duty)	100	500	0.5	400
Airport GSE and other	Diesel	Airport GSE and other (medium duty)	125	350	0.5	300
Airport GSE and other	Diesel	Airport GSE and other (Heavy duty)	175	650	0.5	200
Building and construction	Diesel	Vibratory plates	6	3500	0.6	300
Building and construction	Diesel	Aereal lifts (diesel)	30	150	0.4	400
Building and construction	Diesel	Sweepers (diesel)	30	200	0.4	300
Building and construction	Diesel	High pressure cleaners (diesel)	30	50	0.8	500
Building and construction	Gasoline	Rammers	2.5	3000	0.4	80
Building and construction	Gasoline	Drills	3	100	0.4	10
Building and construction	Gasoline	Vibratory plates (gasoline)	4	2500	0.5	200
Building and construction	Gasoline	Cutters	4	800	0.5	50
Building and construction	Gasoline	Other (gasoline)	5	1000	0.5	40
Building and construction	Gasoline	High pressure cleaners (gasoline)	5	500	0.6	200
Building and construction	Gasoline	Sweepers (gasoline)	10	500	0.4	150
Building and construction	Gasoline	Slicers	10	100	0.7	150
Building and construction	Gasoline	Aereal lifts (gasoline)	20	50	0.4	400

3.4 Household and gardening

For gasoline fuelled equipment used for household and gardening purposes the statistical information available is generally scarce. In the present project the data for stock and operational data are based on the reports Teknologisk (1993), Bak et al. (2003) and specific information from two manufacturers of working machinery with large Danish market shares (Petersen, 2005 and Hermansen, 2005). To obtain a sufficient degree of data consensus for household and gardening equipment, the listed figures for stock and operational data are validated by KVL (Kristoffersen, 2005).

3.4.1 Stock

Figure 17 shows the 1985-2004 stock development for which specific data have been gathered in the present project. For lawn movers and cultivators the machinery stock remain the same for all years, whereas the stock figures for riders, chain saws, shrub clearers, trimmers and hedge cutters increase from 1990 and onwards. According to the sources behind stock data, the yearly stock increase in most cases becomes larger after 2000, as shown in Figure 17.

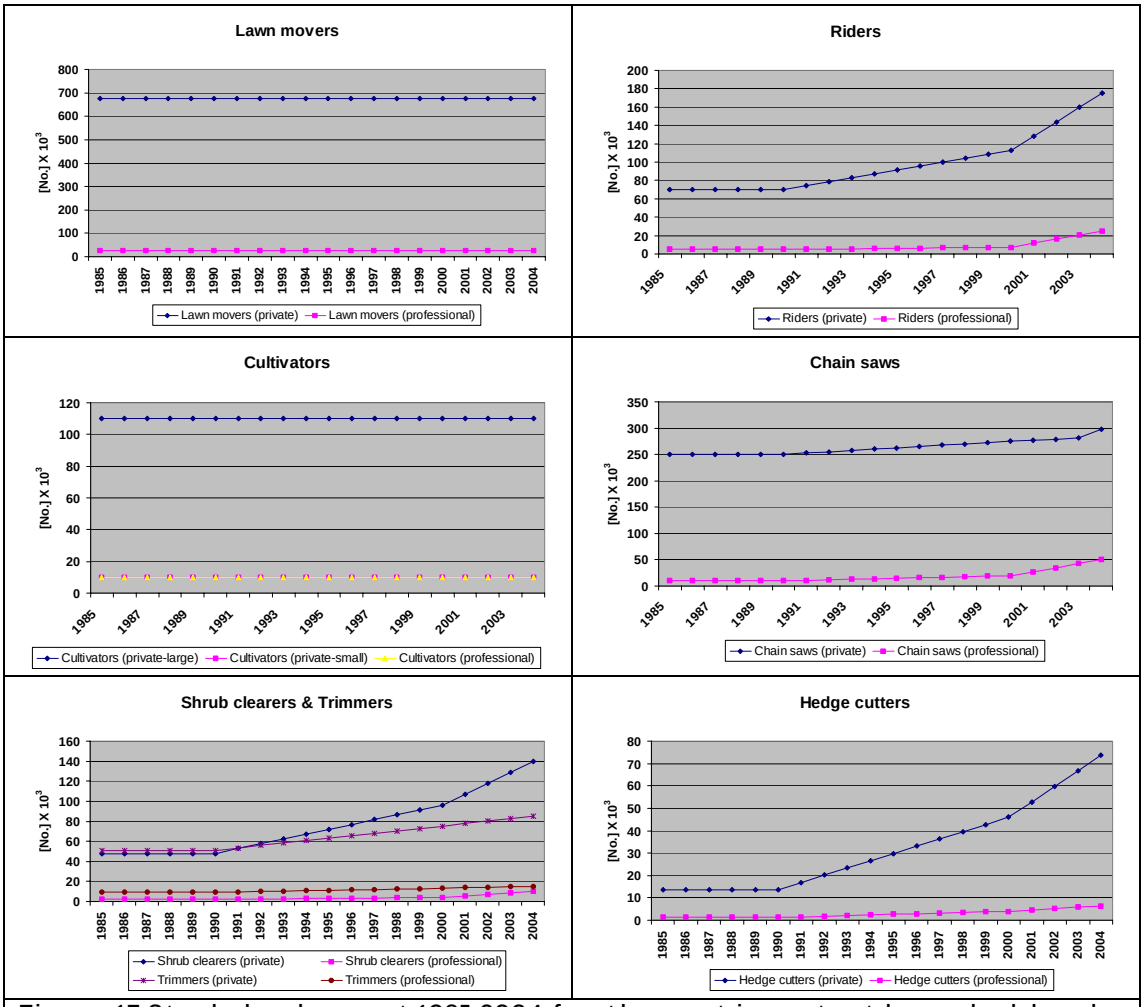


Figure 17 Stock development 1985-2004 for the most important household and gardening machinery types

The emission level distribution of household and gardening equipment numbers used in the inventory from 1985-2004 is given in Annex 1.

3.4.2 Operational data

The data for engine size, load factors, annual working hours and lifetimes listed in Table 24 are based on information from Petersen (2005), Hermansen (2005) and Kristoffersen (2005). The operational parameters are regarded as constant throughout the 1985-2004 time period, except for lawn movers. In the latter case the average engine size is assumed to increase during the latest years, and this is reflected in the calculations from 2000 and onwards.

Table 24 Operational data for the most important types of household and gardening machinery

Machinery type	Engine	Size (kW)	Hours	Load factor	Lifetime (yrs)
Chain saws (private)	2-stroke	2	5	0.3	10
Chain saws (professional)	2-stroke	3	270	0.4	3
Cultivators (private-large)	4-stroke	3.7	5	0.6	5
Cultivators (private-small)	4-stroke	1	5	0.6	15
Cultivators (professional)	4-stroke	7	360	0.6	8
Hedge cutters (private)	2-stroke	0.9	10	0.5	10
Hedge cutters (professional)	2-stroke	2	300	0.5	4
Lawn movers (private)	4-stroke	2.5 (2000) 3.5 (2004)	25	0.4	8
Lawn movers (professional)	4-stroke	2.5 (2000) 3.5 (2004)	250	0.4	4
Riders (private)	4-stroke	11	50	0.5	12
Riders (professional)	4-stroke	13	330	0.5	5
Shrub clearers (private)	2-stroke	1	15	0.6	10
Shrub clearers (professional)	2-stroke	2	300	0.6	4
Trimmers (private)	2-stroke	0.9	20	0.5	10
Trimmers (professional)	2-stroke	0.9	200	0.5	4

3.4.3 Other

For a few types of machinery with very small fuel use and emission contributions no stock and operational data has been gathered in the present project. Instead the data from the Teknologisk (1992 and 1993) studies have been used for all inventory years.

Table 25 Stock and operational data for other machines in household and gardening

Machinery type	Engine	No.	Size (kW)	Hours	Load factor	Lifetime (yrs)
Chippers	2-stroke	200	10	100	0.7	10
Garden shredders	2-stroke	500	3	20	0.7	10
Other (gasoline)	2-stroke	200	2	20	0.5	10
Suction machines	2-stroke	300	4	80	0.5	10
Wood cutters	4-stroke	100	4	15	0.5	10

3.5 Inland waterways

In the present project stock and operational data for recreational craft are based on Søsportens Brancheforening (1986), IFEU (2004), and Højenvang (2005).

3.5.1 Stock

Figure 18 shows the 1985-2004 stock and engine size developments for diesel boats and gasoline 2-stroke and 4-stroke vessels.

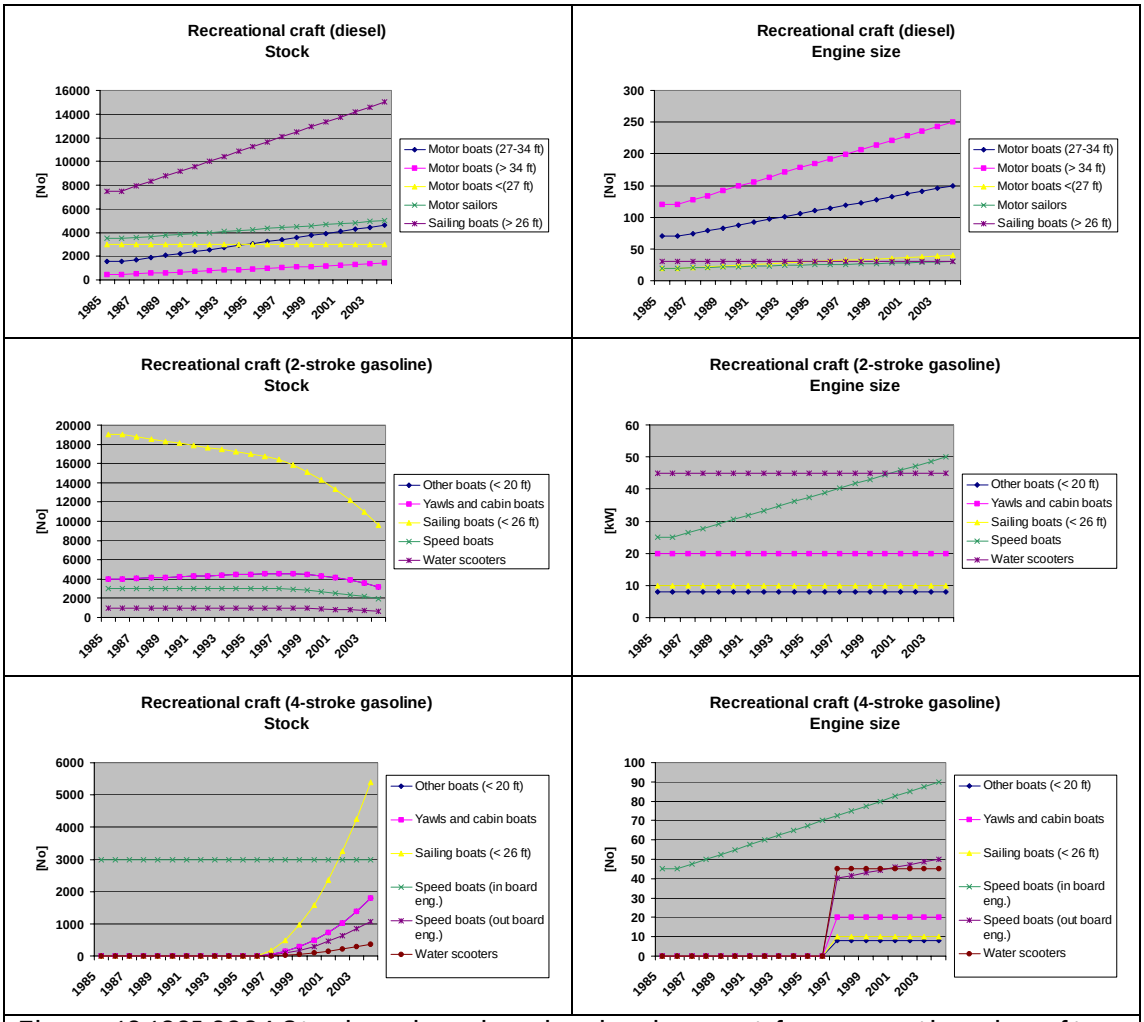


Figure 18 1985-2004 Stock and engine size development for recreational craft

For diesel boats, increases in stock and engine size are expected from 1986 to 2004, except for the stock of motor boats (< 27 ft.) and the engine sizes for sailing boats (<26 ft.) where figures remain unchanged (Højenvang, 2005). Based on the same source of information, a decrease in the total stock of sailing boats (<26 ft.) by 21%, and increases in the total stock of yawls and cabin boats, and other boats (<20 ft.) by around 25% are expected. Due to lack of specific Danish information the shifting rate from 2-stroke to 4-stroke gasoline engines is based on a German non road study (IFEU, 2004).

The type specific boat numbers used in the inventory from 1985-2004 is given in Annex 1.

3.5.2 Operational data

Table 26 Operational data for recreational craft

Fuel type	Vessel type	Engine type	Stroke	Hours	Lifetime	Load factor
Gasoline	Other boats (<20 ft)	Out board engine	2-stroke	30	10	0.5
Gasoline	Other boats (<20 ft)	Out board engine	4-stroke	30	10	0.5
Gasoline	Yawls and cabin boats	Out board engine	2-stroke	50	10	0.5
Gasoline	Yawls and cabin boats	Out board engine	4-stroke	50	10	0.5
Gasoline	Sailing boats (<26ft)	Out board engine	2-stroke	5	10	0.5
Gasoline	Sailing boats (<26ft)	Out board engine	4-stroke	5	10	0.5
Gasoline	Speed boats	In board engine	4-stroke	75	10	0.5
Gasoline	Speed boats	Out board engine	2-stroke	50	10	0.5
Gasoline	Speed boats	Out board engine	4-stroke	50	10	0.5
Gasoline	Water scooters	Built in	2-stroke	10	10	0.5
Gasoline	Water scooters	Built in	4-stroke	10	10	0.5
Diesel	Motor boats (27-34 ft)	In board engine		150	15	0.5
Diesel	Motor boats (>34 ft)	In board engine		100	15	0.5
Diesel	Motor boats (<27 ft)	In board engine		75	15	0.5
Diesel	Motor sailors	In board engine		75	15	0.5
Diesel	Sailing boats (<26ft)	In board engine		25	15	0.5

4 Calculation procedure

Prior to adjustments for deterioration effects and transient engine operations, the fuel use and emissions in year X, for a given machinery type, engine size and engine age, are calculated as:

$$E_{Basis}(X)_{i,j,k} = N_{i,j,k} \cdot HRS_{i,j,k} \cdot P \cdot LF_i \cdot EF_{y,z} \quad (1)$$

Where E_{Basis} = fuel use/emissions in the basis situation, N = number of engines, HRS = annual working hours, P = average rated engine size in kW, LF = load factor, EF = fuel use/emission factor in g/kWh, i = machinery type, j = engine size, k = engine age, y = engine size class and z = emission level.

The deterioration factor for a given machinery type, engine size and engine age in year X, depends on the engine size class (only for gasoline), y, and the emission level, z. The deterioration factors for diesel and gasoline 2-stroke engines are found from:

$$DF_{i,j,k}(X) = \frac{K_{i,j,k}}{LT_i} \cdot DF_{y,z} \quad (2)$$

Where DF = deterioration factor, K = engine age, LT = lifetime, i = machinery type, j = engine size, k = engine age, y = engine size class and z = emission level.

For gasoline 4-stroke engines the deterioration factors are calculated as:

$$DF_{i,j,k}(X) = \sqrt{\frac{K_{i,j,k}}{LT_i}} \cdot DF_{y,z} \quad (3)$$

No deterioration is assumed for fuel use (all fuel types) or for LPG engine emissions, and hence DF = 1 in these situations.

The transient factor for a given machinery type, engine size and engine age in year X, only rely on emission level and the load factor, and is denominated as:

$$TF_{i,j,k}(X) = TF_z \quad (4)$$

Where i = machinery type, j = engine size, k = engine age and z = emission level.

No transient corrections are made for gasoline and LPG engines, and hence TF_z = 1 for these fuel types.

The final calculation of fuel use and emissions in year X, for a given machinery type, engine size and engine age, are the product of the expressions 1-4:

$$E(X)_{i,j,k} = E_{Basis}(X)_{i,j,k} \cdot TF(X)_{i,j,k} \cdot (1 + DF(X)_{i,j,k}) \quad (5)$$

The evaporative hydrocarbon emissions from fuelling are calculated as:

$$E_{Evap,\,fueling,i} = FC_i \cdot EF_{Evap,\,fueling} \quad (6)$$

Where $E_{Evap,fueling}$, = hydrocarbon emissions from fuelling, i = machinery type, FC = fuel consumption in kg, $EF_{Evap,fueling}$ = emission factor in g NMVOC/kg fuel.

For tank evaporation the hydrocarbon emissions are found from:

$$E_{Evap,\tan k,i} = N_i \cdot EF_{Evap,\tan k,i} \quad (7)$$

Where $E_{Evap,tank,i}$ = hydrocarbon emissions from tank evaporation, N = number of engines, i = machinery type, $EF_{Evap,fueling}$ = emission factor in g NMVOC/year.

5 Fuel use and emissions

An overview of the fuel use and emission results for non road machinery in 2004 is given in Table 27 for agriculture, forestry, industry, and household and gardening. The diesel fuelled machinery in agriculture and industry are the most important source of fuel use and emissions of SO_2, NO_x, CO_2, N_2O, NH_3 and TSP, whereas for NMVOC, CH_4 and CO most of the emissions come from gasoline fuelled machinery. For the latter machinery types, household and gardening equipment are the most important source.

In Annex 2 the 1985-2004 fuel use and emission results are given in CollectER format (agriculture, forestry, industry, and household and gardening) together with fuel related emission factors. A more detailed description of the 2004 fuel use and emission results, and 1985-2004 emission trends are given in the following paragraphs.

Table 27 2004 Sectoral fuel use, emissions and percentage shares for land based non road machinery

Subsector	Fuel type	Fuel [TJ]	SO_2 [tons]	NO_x [tons]	NMVOC [tons]	CH_4 [tons]	CO [tons]	CO_2 [ktons]	N_2O [tons]	NH_3 [tons]	TSP [tons]
Agriculture	Diesel	13439	315	11811	1346	22	6393	994	42	2	991
Forestry	Diesel	159	4	131	10	0	58	12	1	0	7
Industry	Diesel	11229	263	9297	1276	21	5372	831	35	2	1029
Total diesel		24827	581	21239	2632	43	11823	1837	77	4	2027
Agriculture	Gasoline	311	1	27	322	40	8649	23	0	0	7
Forestry	Gasoline	78	0	4	496	4	1233	6	0	0	6
Industry	Gasoline	167	0	32	244	17	2116	12	0	0	2
Household	Gasoline	4078	9	317	8731	290	114073	298	5	0	87
Total gasoline		4634	11	380	9793	352	126071	338	6	1	102
Industry	LPG	1065	0	1415	156	8	112	69	4	0	5
Grand total		30526	592	23033	12580	403	138005	2245	86	5	2135
	Fuel type	FC [%]	SO_2 [%]	NO_x [%]	NMVOC [%]	CH_4 [%]	CO [%]	CO_2 [%]	N_2O [%]	NH_3 [%]	TSP [%]
Agriculture	Diesel	44	53	51	11	5	5	44	49	45	46
Forestry	Diesel	1	1	1	0	0	0	1	1	1	0
Industry	Diesel	37	44	40	10	5	4	37	40	37	48
Total diesel		81	98	92	21	11	9	82	89	83	95
Agriculture	Gasoline	1	0	0	3	10	6	1	1	6	0
Forestry	Gasoline	0	0	0	4	1	1	0	0	0	0
Industry	Gasoline	1	0	0	2	4	2	1	0	0	0
Household	Gasoline	13	2	1	69	72	83	13	6	7	4
Total gasoline		15	2	2	78	87	91	15	6	13	5
Industry	LPG	3	0	6	1	2	0	3	4	4	0
Grand total		100	100	100	100	100	100	100	100	100	100

For recreational craft Table 28 shows the total results of fuel use and emissions in 2004. The diesel engines are the most important source of fuel use and emissions of SO_2, NO_x, CO_2, N_2O, NH_3 and TSP, whereas for NMVOC, CH_4 and CO most of the emissions come from gasoline engines. In Annex 2 the 1985-2004 fuel use and emission results are

given in CollectER format together with fuel related emission factors. The 2004 fuel use and emission results, and 1985-2004 emission trends are described in more details later in this chapter.

Table 28 2004 Sectoral fuel use, emissions and percentage shares for recreational craft

Fuel type	Fuel [TJ]	SO_2 [tons]	NO_x [tons]	NMVOC [tons]	CH_4 [tons]	CO [tons]	CO_2 [ktons]	N_2O [tons]	NH_3 [tons]	TSP [tons]
Diesel	1002	94	879	170	3	454	74	3	0	105
Gasoline	404	1	161	1020	22	6411	30	0	0	49
Grand total	1406	95	1040	1191	25	6865	104	3	0	154
Diesel	71	99	85	14	11	7	72	87	83	68
Gasoline	29	1	15	86	89	93	28	13	17	32
Grand total	100	100	100	100	100	100	100	100	100	100

5.1 Agriculture

The subsectoral distribution of fuel use and emissions for agriculture in 2004 is shown in Table 29, together with the corresponding shares of the agricultural sector in total.

Table 29 2004 Subsectoral fuel use, emissions and percentage shares for agriculture

Subsector	Fuel type	Fuel [TJ]	SO_2 [tons]	NO_x [tons]	NMVOC [tons]	CH_4 [tons]	CO [tons]	CO_2 [ktons]	N_2O [tons]	NH_3 [tons]	TSP [tons]
Tractors	Diesel	9467	222	8398	1031	17	4713	701	29	2	748
Harvesters	Diesel	2019	47	1724	176	3	917	149	6	0	155
Machine pools	Diesel	1869	44	1620	131	2	727	138	6	0	84
Other machinery	Diesel	84	2	69	7	0	35	6	0	0	4
Diesel total		13439	315	11811	1346	22	6393	994	42	2	991
Other machinery	Gasoline	256	1	26	264	35	5730	19	0	0	6
Tractors	Gasoline	55	0	1	58	5	2919	4	0	0	0
Gasoline total		311	1	27	322	40	8649	23	0	0	7
Grand total		13750	315	11837	1667	62	15042	1017	42	3	998
Subsector	Fuel type	FC [%]	SO_2 [%]	NO_x [%]	NMVOC [%]	CH_4 [%]	CO [%]	CO_2 [%]	N_2O [%]	NH_3 [%]	TSP [%]
Tractors	Diesel	69	70	71	62	27	31	69	69	62	75
Harvesters	Diesel	15	15	15	11	5	6	15	15	13	16
Machine pools	Diesel	14	14	14	8	3	5	14	14	13	8
Other machinery	Diesel	1	1	1	0	0	0	1	1	1	0
Diesel total		98	100	100	81	35	43	98	99	89	99
Other machinery	Gasoline	2	0	0	16	56	38	2	1	11	1
Tractors	Gasoline	0	0	0	3	9	19	0	0	0	0
Gasoline total		2	0	0	19	65	57	2	1	11	1
Grand total		100	100	100	100	100	100	100	100	100	100

Diesel tractors account for most of the fuel use (69%) and have the largest shares of agricultural non road emissions for most of the emitted substances. In this respect the diesel tractor emission shares of TSP, NO_x, SO_2, CO_2, N_2O, NMVOC and NH_3 are 75, 71, 70, 69, 69, 62 and 62%, respectively. For CH_4 and CO the gasoline fuelled equipment in the subsector “other machinery” has the largest emission shares of 56 and 38%.

5.1.1 Tractors

In general, the total fuel use is determined as the product of the total kWh's produced and the aggregated specific fuel consumption in g/kWh. For diesel tractors, Figure 19 shows the 1985-2004 trends for these two parameters. In terms of total kWh's, the effect of increasing engine sizes is opposite the effect of, with some fluctations though, generally decreasing tractor numbers (see Figure 3). The end result is, however, a decline in the total kWh's produced from 1985 to 2004. The decrease in the average specific fuel consumption in g/kWh throughout the period is due to an increase in fuel efficiency as engines become larger and newer.

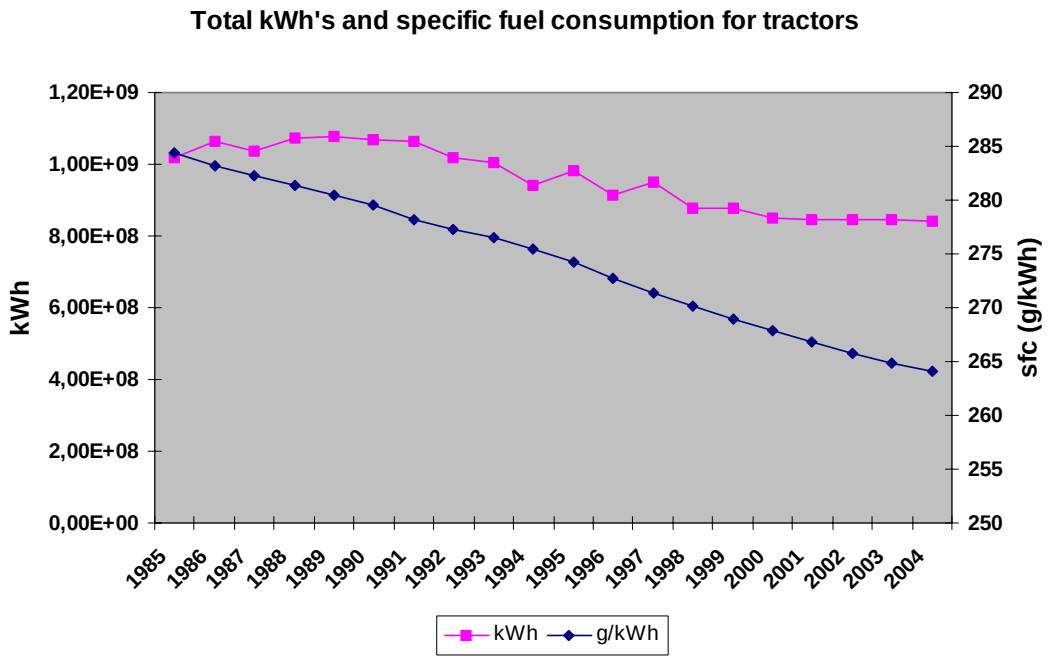


Figure 19 Total kWh's produced and aggregated specific fuel consumption (g/kWh) for diesel tractors from 1985-2004

The resulting total fuel use and emissions development from 1985 to 2004 is shown in Figure 20. The fuel use curve incorporates the effect from kWh fluctuations and fuel efficiency levels. From 1985 to 2004 the total fuel use and directly derived CO_2 emissions drop by 23%.

For N_2O and NH_3, the 1985-2004 emission declines at 17% are slightly smaller than the fuel use drop, because fuel efficiency increases and the N_2O and NH_3 emission factors in g/kWh are constant throughout the period. The significant reduction in SO_2 emissions from 1985 to 2004 (92%) is due to the step wise lowering of the sulphur content in diesel fuel used for non road purposes.

For NO_x the emission decrease is only 4% from 1985-2004, the main reason being the large emission contribution from 1991-Stage I engines (characterised by high NO_x emission factors) which more or less outbalances the emission effect of decreasing fuel use. The emission declines of 61, 50, 50 and 42% for TSP, NMVOC, CH_4 and CO, respectively, are larger than the decrease in fuel use. This is explained

by the gradually improved engine emission technology and the strenghtened EU emission standards from 2001.

The stock of gasoline tractors is almost phased out by the end of the 1985-2004 time period, and the fuel use and emission effect of this is clearly visible from the curves on Figure 20. Still, taking into account the figures for total diesel and gasoline fuel use, the emissions of CO og CH_4 from gasoline tractors, and to a smaller extend the NMVOC emissions, are still significant. This is due to the very high CO, CH_4 and NMVOC emission factors for old gasoline engines. For all other components, the emission contribution from gasoline tractors is only marginal.

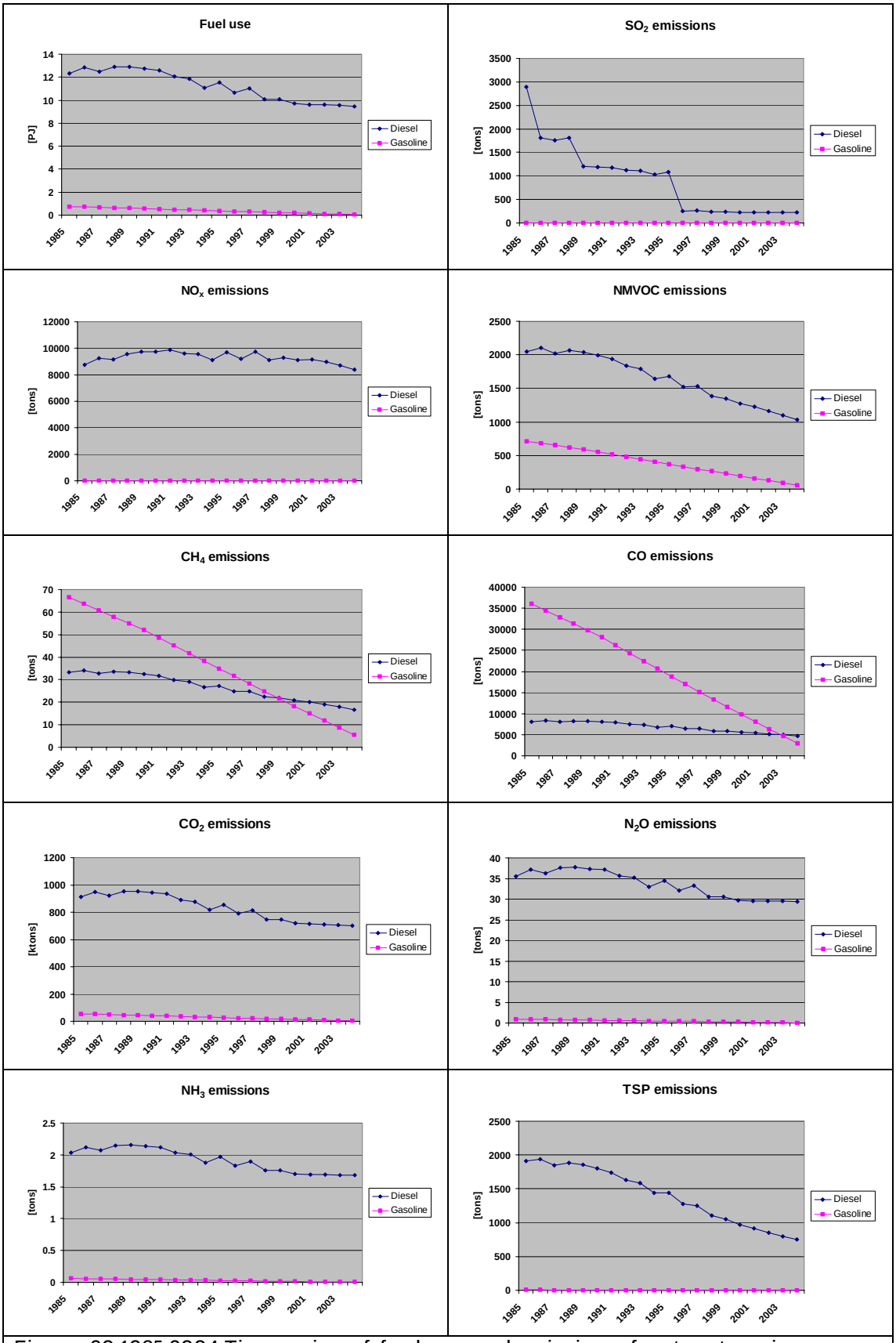


Figure 20 1985-2004 Time series of fuel use and emissions for tractors in agriculture

The EU strengthening of emission standards has a strong effect on the emission level specific shares of total emissions for diesel tractors (Figure 21). In this way the total fuel use share for stage I and II engines (20%) is larger than the emission shares of NO_x, NMVOC, CO and TSP, which are 12, 6, 8 and 5%, respectively. For 1991-stage I engines specifically, Figure 21 also show the difference in NO_x emissions and fuel use shares, being the main explanation for the small total NO_x decrease for diesel tractors.

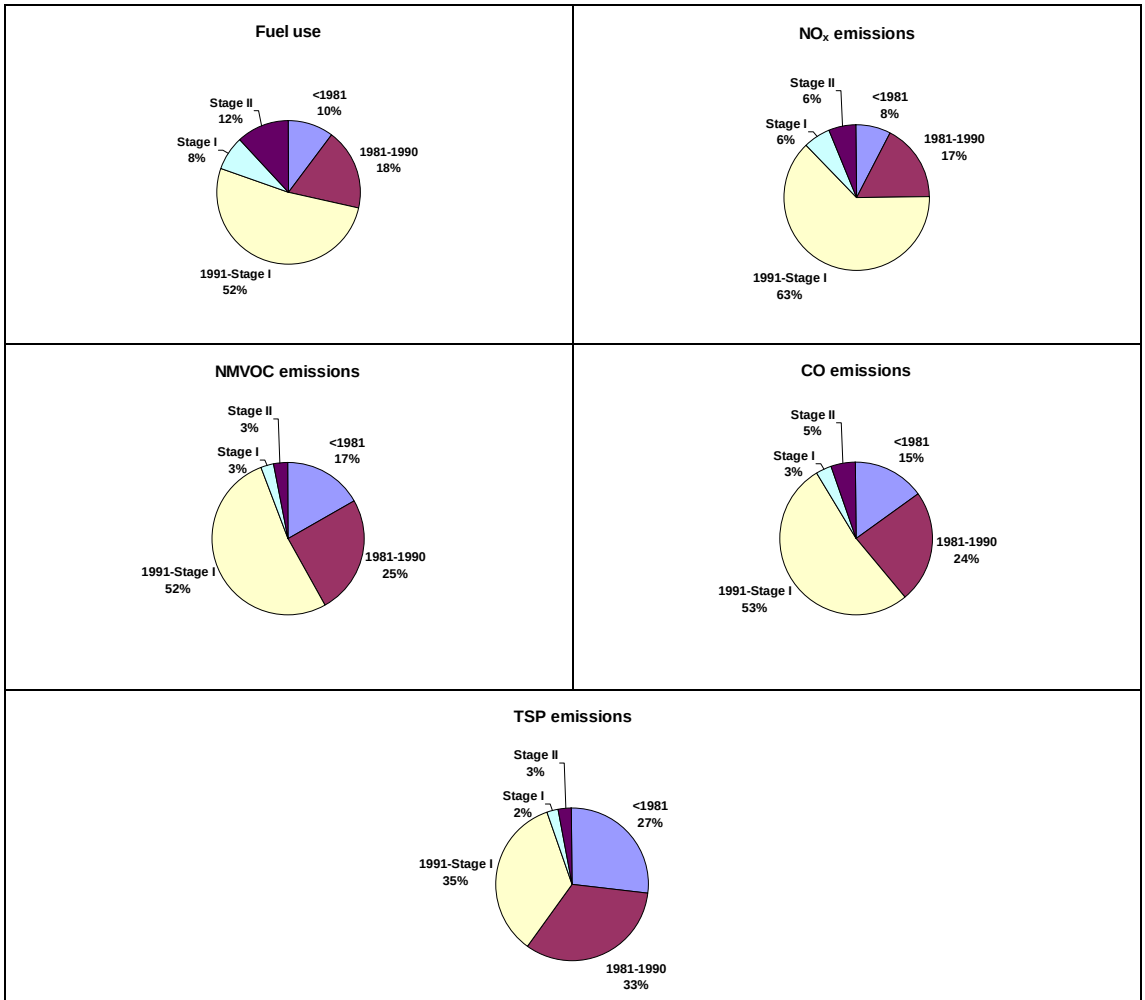


Figure 21 Fuel use and emissions for diesel tractors in 2004 split into emission levels

The emission level specific fuel use and emission developments from 1985-2004 are shown in Figure 22, and from this it becomes clear that the emission shares for newer emission levels are generally smaller than their corresponding shares of fuel use.

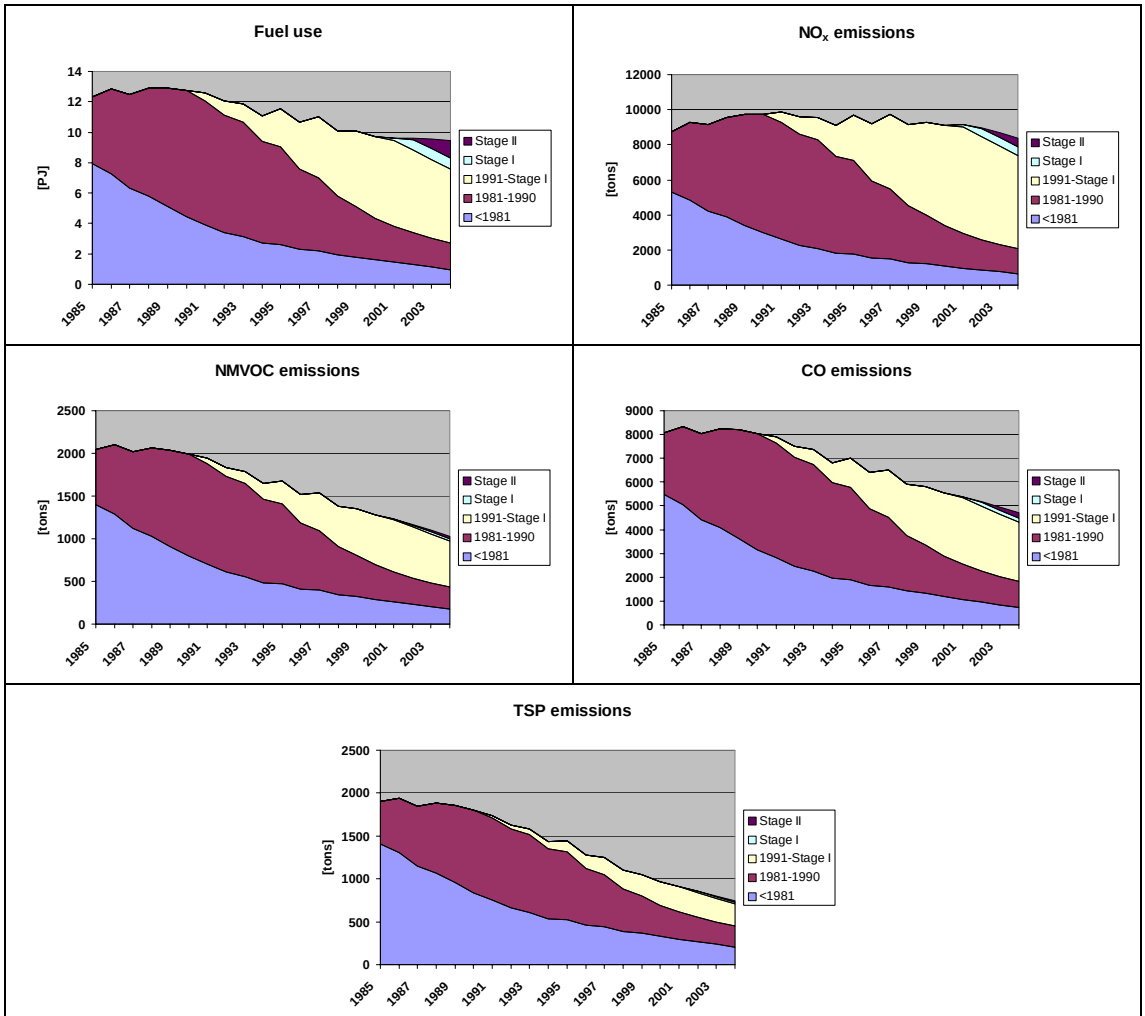


Figure 22 Fuel use and emissions for diesel tractors from 1985-2004 split into emission levels

In Annex 2 the 1985-2004 fuel use, emissions and fuel related emission factors are listed for diesel and gasoline tractors, respectively.

5.1.2 Harvesters

Figure 23 shows the 1985-2004 trends for total kWh's and aggregated specific fuel consumption in g/kWh for harvesters. The total kWh's produced are more or less maintained at the same level over this time period, as a balance between the decrease in total numbers and the increase in average engine size shown in Figure 8. The overall decrease in the average specific fuel consumption throughout the period is due to an increase in fuel efficiency for newer and larger engines.

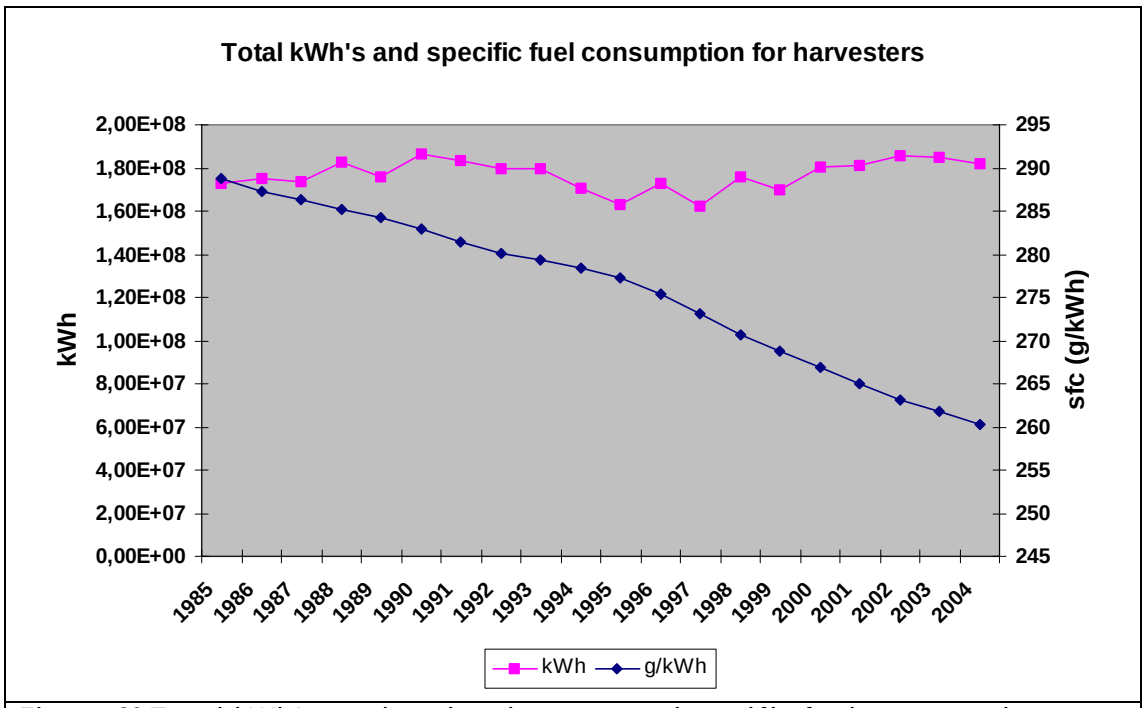


Figure 23 Total kWh's produced and aggregated specific fuel consumption (g/kWh) for diesel tractors from 1985-2004

The resulting total and emission level specific fuel use and emission developments from 1985 to 2004 are shown in Figure 24. The fuel use curve incorporates the effect from kWh fluctuations and fuel efficiency levels. From 1985 to 2004 the total fuel use and directly derived CO_2 emissions drop by 5%.

The emission explanations given for diesel tractors also apply for harvesters. Though especially for NO_x, the emission development for harvesters as a total is less positive than for tractors. This is mainly due to the large emission contribution from 1990-Stage I engines as a product of high emission factors and large fuel quantities being burned. For NO_x, N_2O and NH_3, the emissions increase with 25, 5 and 5% from 1985-2004, whereas the emission declines for SO_2, TSP, NMVOC, CH_4 and CO are 91, 62, 56, 56 and 42%, respectively.

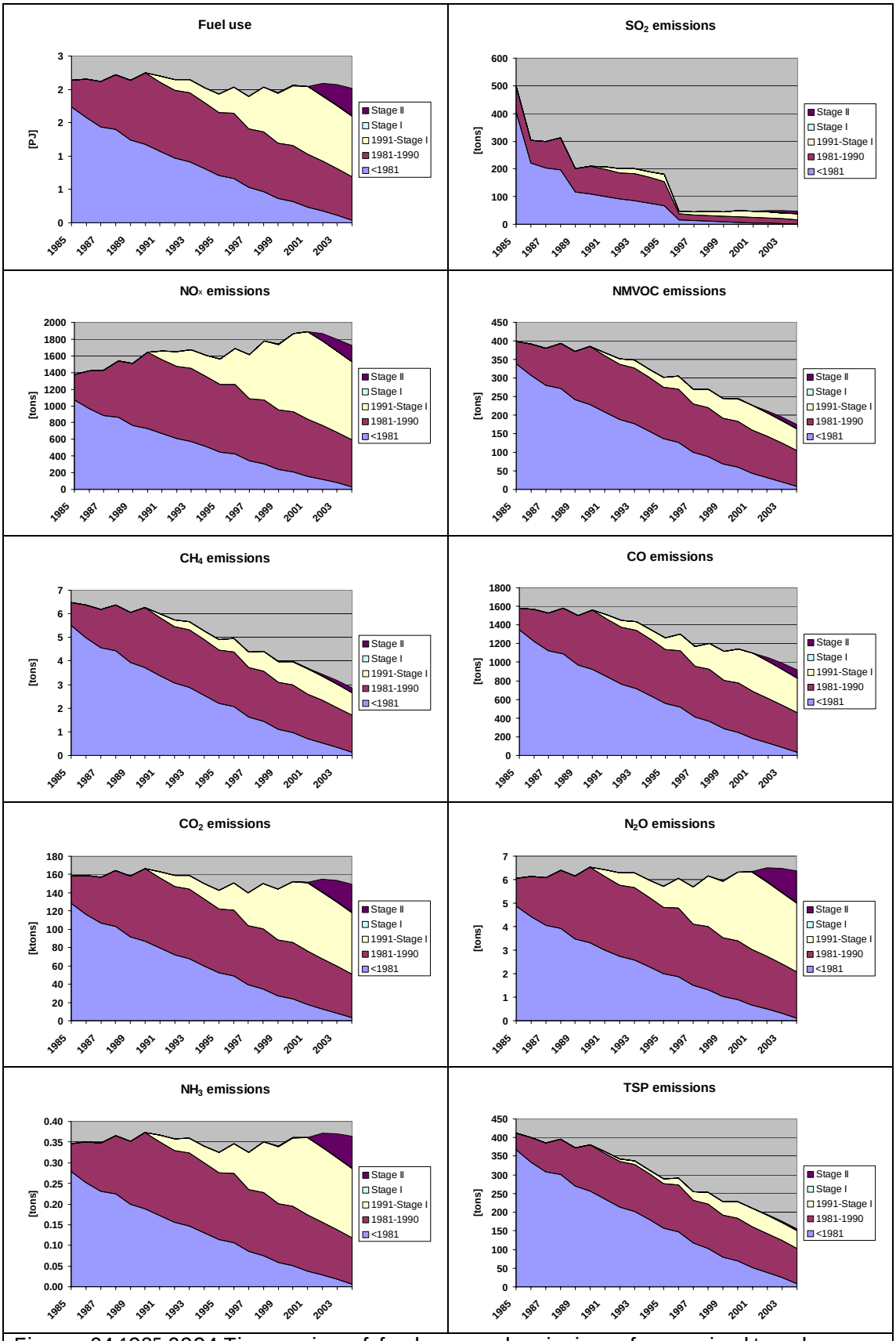


Figure 24 1985-2004 Time series of fuel use and emissions for agricultural harvesters

The EU strengthening of emission standards improves the emission levels from harvesters. Figure 25 shows that total fuel use share for Stage II engines (21%) in 2004 is larger than the emission shares of NO_x, NMVOC, CO and TSP, which are 11, 7, 10 and 3%, respectively. The reason for an almost zero fuel use and NO_x emissions for Stage I engines, is a very small number of harvesters complying with this emission level.

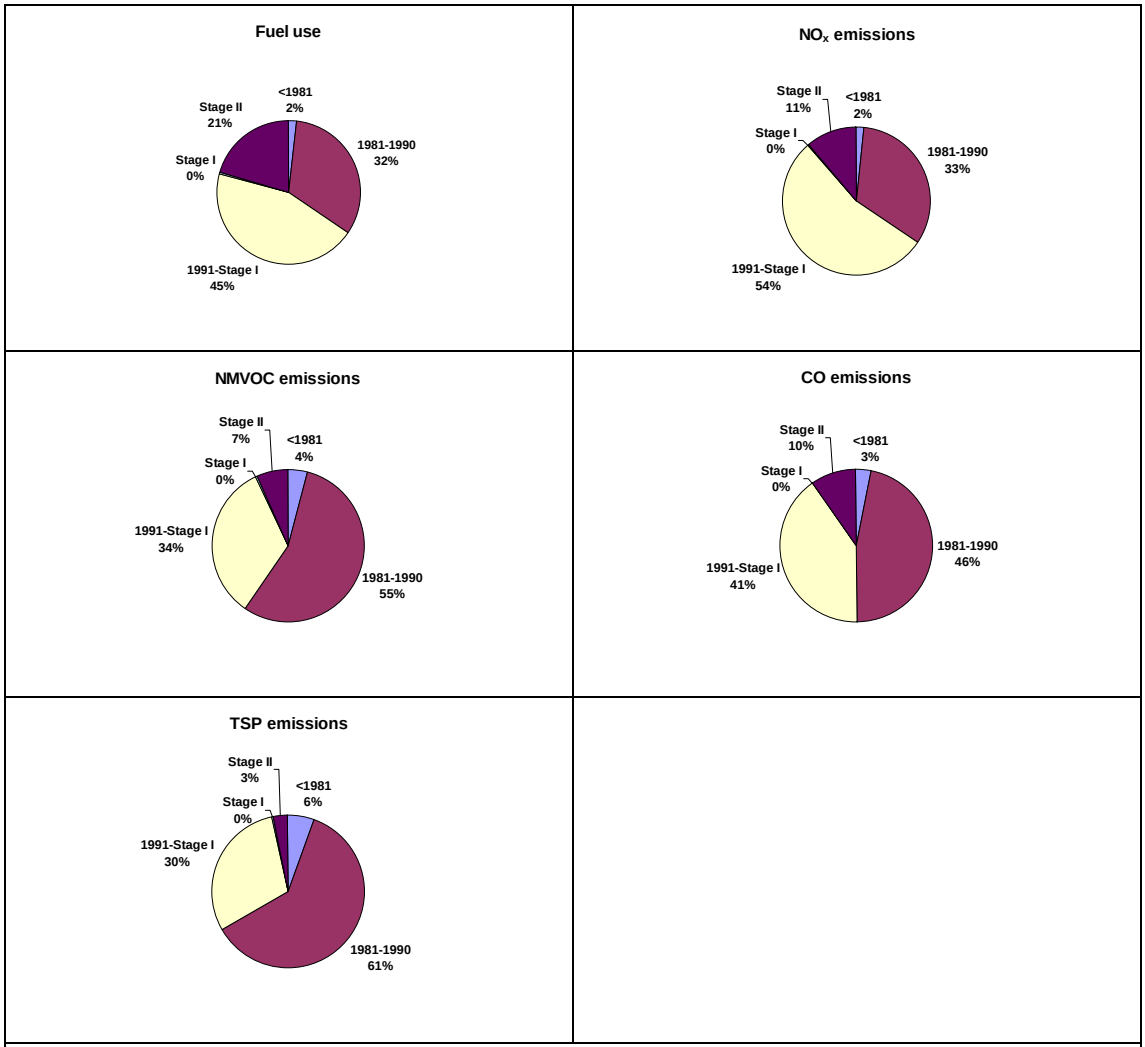


Figure 25 Fuel use and emissions for harvesters in 2004 divided into layers

In Annex 2 the 1985-2004 fuel use, emissions and fuel related emission factors are listed for harvesters.

5.1.3 Machine pools

For machine pools, the total fuel use and emissions development from 1985 to 2004 are shown in Figure 26. It must be noted that the large uncertainties on parameters such as engine age and size distributions and annual working hours, influence the certainty of the calculated results.

Tractors are the most important for fuel use and emissions. The fuel use and emission shares for self-propelled vehicles and harvesters are considerably smaller. The shares for self-propelled vehicles, though,

grow from zero in 1992 to around double the shares for harvesters in 2004.

The total fuel use and directly derived CO_2 emissions increase with 35%, and for NO_x, N_2O and NH_3 the emission increases are 67, 48 and 48%, respectively, from 1985-2004. For SO_2, TSP, NMVOC, CH_4 and CO the respective emission decreases are 87, 59, 38, 38 and 18%, in the same time period.

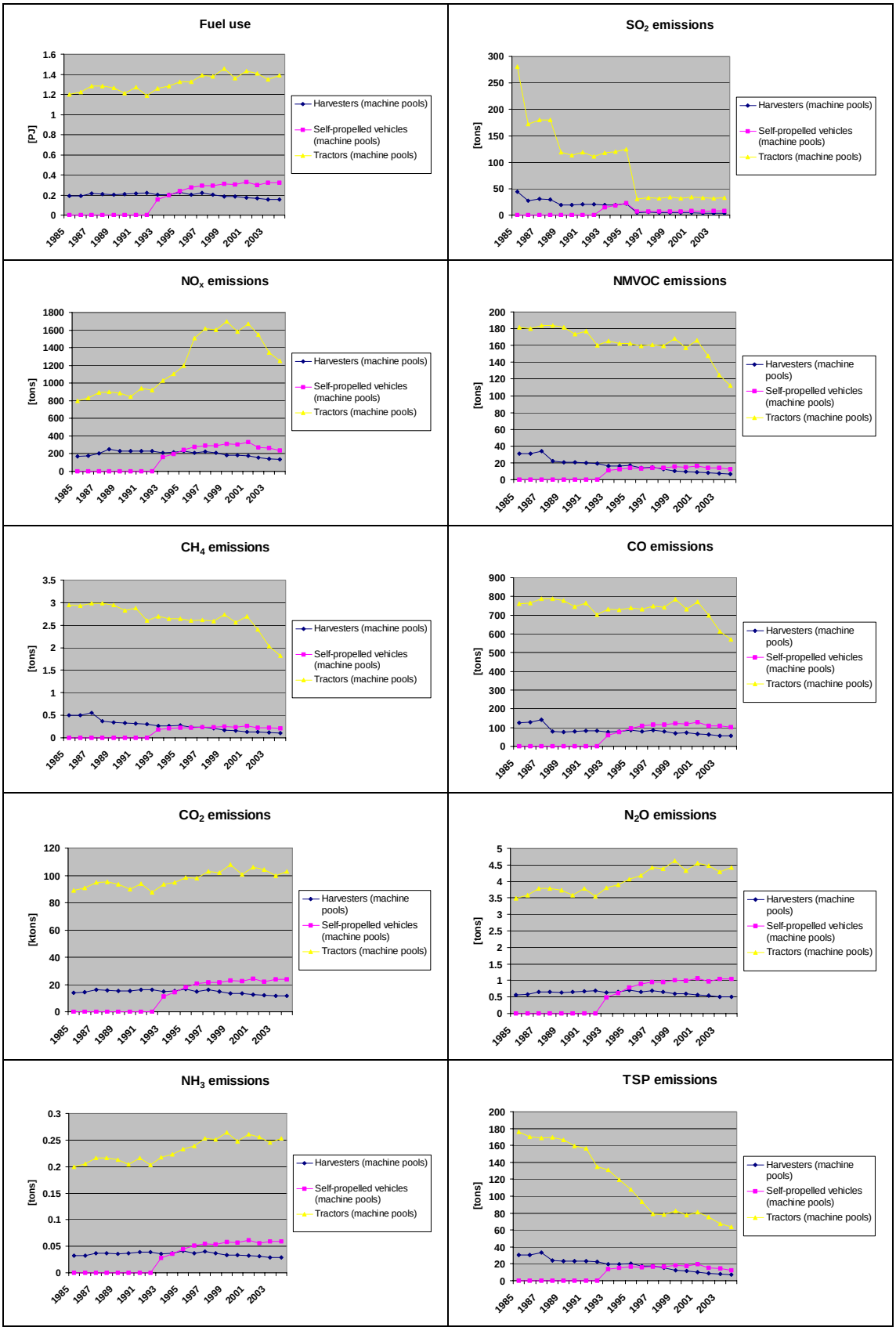


Figure 26 1985-2004 Time series of fuel use and emissions for machine pools

The lifetimes for machine pool machines are small, and the stock modernity means that the relative emissions are always low. This is reflected in the overall fuel use and emission split for 2004 on Figure 27, where only three emission levels are present.

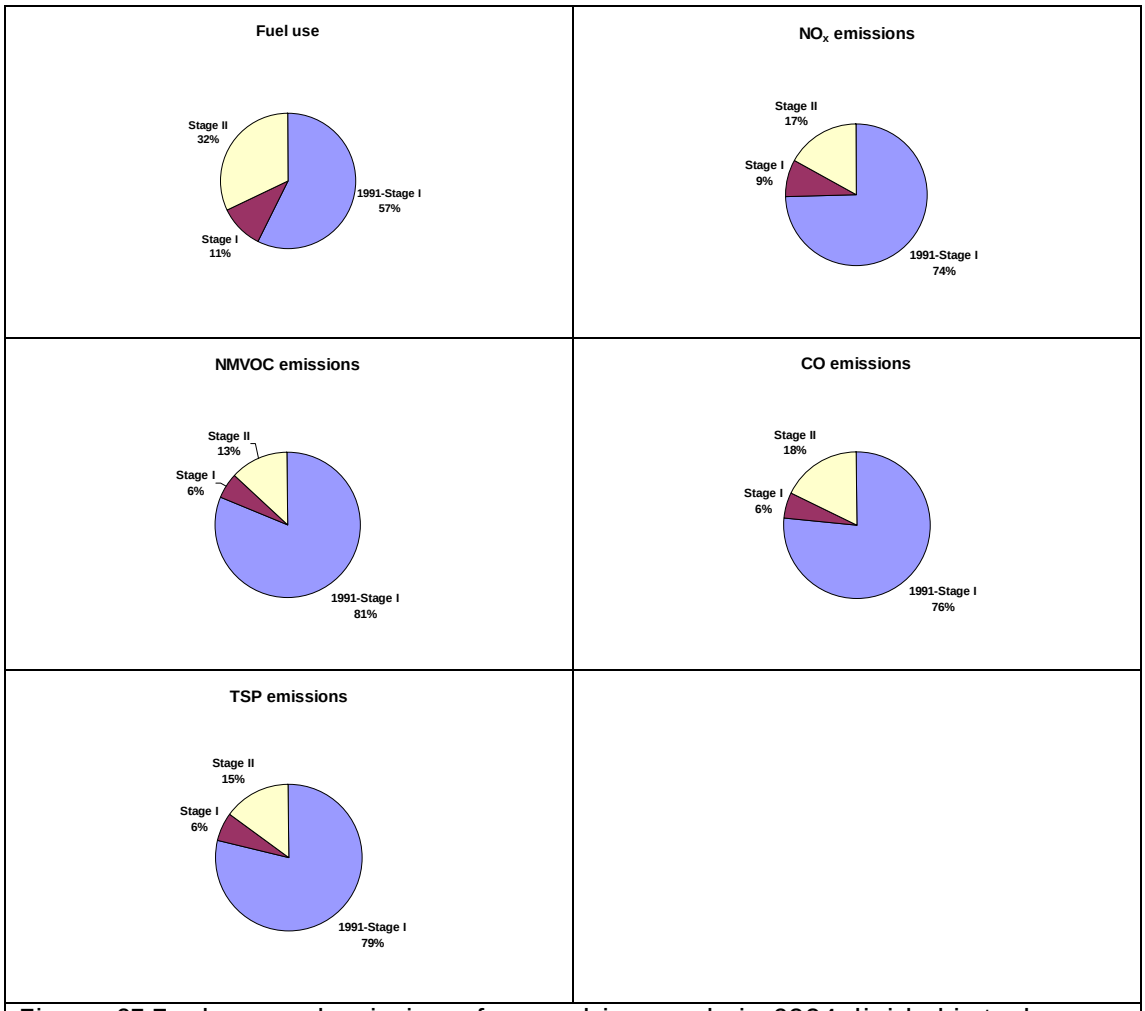


Figure 27 Fuel use and emissions for machine pools in 2004 divided into layers

In Annex 2 the 1985-2004 fuel use, emissions and fuel related emission factors are listed for machine pool tractors, harvesters and self-propelled vehicles.

5.1.4 Other machinery

The fuel use and emission shares for other machinery in agriculture are marginal compared with the non road totals. The results for 2004 are shown in Table 30 divided into types of machinery.

Table 30 Fuel use and emissions in 2004 for other machinery types

Machinery type	Fuel type	Fuel [TJ]	SO_2 [tons]	NO_X [tons]	NMVOC [tons]	CH_4 [tons]	CO [tons]	CO_2 [ktons]	N_2O [tons]	NH_3 [tons]	TSP [tons]
Self-propelled vehicles	Diesel	84	2	69	7	0	35	6	0	0	4
ATV professional	Gasoline	136	0	15	146	22	2225	10	0	0	4
Fodder trucks	Gasoline	76	0	5	53	5	2528	6	0	0	1
ATV private	Gasoline	41	0	5	61	8	905	3	0	0	2
Sweepers	Gasoline	1	0	0	1	0	32	0	0	0	0
Scrapers	Gasoline	1	0	0	1	0	19	0	0	0	0
Bedding machines	Gasoline	1	0	0	1	0	14	0	0	0	0
Other (gasoline)	Gasoline	0	0	0	0	0	6	0	0	0	0
Gasoline total		256	1	26	264	35	5730	19	0	0	6
Grand total		340	3	95	271	35	5764	25	1	0	11

It should be noted that the use of ATV's has increased during the later years; no driving was made with professional and private vehicles before 1992 and 2000, respectively. Going from zero in 1992/2000 the 2004 shares for ATV's are 69% for fuel use, CO_2 and SO_2, 78% for NO_X and NMVOC, and 55, 73, 92 and 98% for CO, N_2O, CH_4, TSP and NH_3, respectively.

In Annex 2 the 1985-2004 fuel use, emissions and fuel related emission factors are listed per fuel type for other machinery, and for ATV's as a single category.

5.2 Forestry

The subsectoral distribution of fuel use and emissions for forestry in 2004 is shown in Table 31, together with the corresponding shares of the forestry sector total.

Table 31 2004 Subsectoral fuel use, emissions and percentage shares for forestry

Subsector	Fuel type	Fuel [TJ]	SO_2 [tons]	NO_X [tons]	NMVOC [tons]	CH_4 [tons]	CO [tons]	CO_2 [ktons]	N_2O [tons]	NH_3 [tons]	TSP [tons]
Chippers	Diesel	43	1	33	2	0	14	3	0	0	2
Forwarders	Diesel	40	1	38	3	0	17	3	0	0	2
Harvesters (forestry)	Diesel	33	1	25	2	0	10	2	0	0	1
Tractors (silvicultural)	Diesel	23	1	15	1	0	6	2	0	0	1
Tractors (other)	Diesel	20	0	20	2	0	10	1	0	0	1
Diesel total		159	4	131	10	0	58	12	1	0	7
Chain saws (forestry)	Gasoline	78	0	4	496	4	1233	6	0	0	6
Grand total		237	4	135	506	4	1291	17	1	0	13
Subsector	Fuel type	Fuel [%]	SO_2 [%]	NO_X [%]	NMVOC [%]	CH_4 [%]	CO [%]	CO_2 [%]	N_2O [%]	NH_3 [%]	TSP [%]
Chippers	Diesel	18	26	24	0	1	1	18	26	23	17
Forwarders	Diesel	17	24	28	1	1	1	17	24	21	15
Harvesters (forestry)	Diesel	14	20	19	0	1	1	14	19	17	9
Tractors (silvicultural)	Diesel	10	14	11	0	0	1	10	14	12	6
Tractors (other)	Diesel	8	12	15	0	1	1	8	12	10	9
Diesel total	Diesel	67	95	97	2	4	4	68	94	82	56
Chain saws (forestry)		33	5	3	98	96	96	32	6	18	44
Grand total		100	100	100	100	100	100	100	100	100	100

Chain saws (2-stroke engines) account for 33% of all fuel use in forestry in 2004, and have very high emission shares of NMVOC (98%), CH_4 (96%) and CO (96%). For chain saws, the fuel use and emissions have been reduced by 75% from 1990 to 2004, because of similar reductions of in the number of forestry workers in the same time period.

For diesel, the largest emission shares are calculated for NO_x (97%), SO_2 (95%), N_2O (94%), NH_3 (82%), CO_2 (68%) and TSP (56%). The largest source of fuel use and emissions is chippers, followed by forwarders and harvesters.

In Annex 2 the 1985-2004 fuel use, emissions and fuel related emission factors are listed for diesel and gasoline fuelled machinery, respectively.

5.3 Industry

The subsectoral distribution of fuel use and emissions for industry in 2004 is shown in Table 32, together with the corresponding shares of the industry non road total.

Table 32 2004 Subsectoral fuel use, emissions and percentage shares for industry

Subsector	Fuel type	Fuel [TJ]	SO_2 [tons]	NO_x [tons]	NMVOC [tons]	CH_4 [tons]	CO [tons]	CO_2 [ktons]	N_2O [tons]	NH_3 [tons]	TSP [tons]
Construction machinery	Diesel	8857	207	7340	855	14	3835	655	28	2	740
Fork lifts	Diesel	1417	33	1144	285	5	1044	105	4	0	172
Industry	Diesel	584	14	495	106	2	354	43	2	0	93
Airport GSE and other	Diesel	305	7	256	18	0	107	23	1	0	13
Building and construction	Diesel	66	2	62	13	0	32	5	0	0	11
Diesel total		11229	263	9297	1276	21	5372	831	35	2	1029
Construction machinery	Gasoline	112	0	27	132	13	756	8	0	0	0
Building and construction	Gasoline	55	0	5	112	4	1361	4	0	0	2
Gasoline total		167	0	32	244	17	2116	12	0	0	2
Fork lifts	LPG	1065	0	1415	156	8	112	69	4	0	5
Grand total		12461	263	10744	1676	46	7600	912	39	2	1037

Subsector	Fuel type	Fuel [%]	SO_2 [%]	NO_x [%]	NMVOC [%]	CH_4 [%]	CO [%]	CO_2 [%]	N_2O [%]	NH_3 [%]	TSP [%]
Construction machinery	Diesel	71	79	68	51	30	50	72	72	72	71
Fork lifts	Diesel	11	13	11	17	10	14	11	10	10	17
Industry	Diesel	5	5	5	6	4	5	5	5	5	9
Airport GSE and other	Diesel	2	3	2	1	1	1	2	3	3	1
Building and construction	Diesel	1	1	1	1	0	0	1	1	1	1
Diesel total		90	100	87	76	45	71	91	90	89	99
Construction machinery	Gasoline	1	0	0	8	27	10	1	0	1	0
Building and construction	Gasoline	0	0	0	7	10	18	0	0	0	0
Gasoline total		1	0	0	15	37	28	1	1	1	0
Fork lifts	LPG	9	0	13	9	18	1	8	10	10	1
Grand total		100	100	100	100	100	100	100	100	100	100

Construction machinery accounts for most of the fuel use (71%) and is the most important source of emissions from industry. The emission shares for SO_2, TSP, NO_X, NMVOC, CO and CH_4 are 79, 71, 68, 51, 50 and 30%. For CO_2, N_2O and NH_3 the emission share is 72%.

5.3.1 Construction Machinery

Table 33 shows the fuel use and emissions in 2004 for the types of construction machinery where specific sales figures exist. This subgroup of machinery is a major diesel fuel consumer and accounts for 86% of the total diesel fuel used by construction machinery in 2004. The fuel use and emission results for the remaining construction machinery types are shown later in this chapter.

Table 33 2004 Fuel use, emissions and percentage shares for selected types of construction machinery

Machinery type	Fuel type	Fuel	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
		[TJ]	[tons]	[tons]	[tons]	[tons]	[tons]	[ktons]	[tons]	[tons]	[tons]
Track type excavators (>5,1 tons)	Diesel	1710	40	1439	116	2	607	127	5	0	70
Wheel loaders (> 5,1 tons)	Diesel	1705	40	1435	116	2	605	126	5	0	69
Track type excavators (0-5 tons)	Diesel	1065	25	769	132	2	574	79	3	0	153
Excavators/Loaders	Diesel	816	19	631	73	1	384	60	3	0	63
Mini loaders	Diesel	607	14	458	83	1	350	45	2	0	96
Telescopic loaders	Diesel	459	11	346	63	1	264	34	1	0	72
Wheel loaders (0-5 tons)	Diesel	392	9	283	49	1	211	29	1	0	56
Wheel type excavators	Diesel	320	7	269	22	0	114	24	1	0	13
Dump trucks	Diesel	267	6	207	18	0	93	20	1	0	11
Track type dozers	Diesel	156	4	131	7	0	54	12	1	0	7
Track type loaders	Diesel	78	2	66	3	0	27	6	0	0	4
Diesel total		7575	177	6036	682	11	3283	561	24	1	614
		[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]
Track type excavators (>5,1 tons)	Diesel	23	23	24	17	17	18	23	23	23	11
Wheel loaders (> 5,1 tons)	Diesel	23	23	24	17	17	18	23	23	23	11
Track type excavators (0-5 tons)	Diesel	14	14	13	19	19	17	14	14	14	25
Excavators/Loaders	Diesel	11	11	10	11	11	12	11	11	11	10
Mini loaders	Diesel	8	8	8	12	12	11	8	8	8	16
Telescopic loaders	Diesel	6	6	6	9	9	8	6	6	6	12
Wheel loaders (0-5 tons)	Diesel	5	5	5	7	7	6	5	5	5	9
Wheel type excavators	Diesel	4	4	4	3	3	3	4	4	4	2
Dump trucks	Diesel	4	4	3	3	3	3	4	4	4	2
Track type dozers	Diesel	2	2	2	1	1	2	2	2	2	1
Track type loaders	Diesel	1	1	1	0	0	1	1	1	1	1
Diesel total		100	100	100	100	100	100	100	100	100	100

The large track type excavators and wheel loaders (>5,1 tons) are equally important in terms of fuel use and emissions, and have the largest shares of fuel use and NO_x, SO_2, CO_2, N_2O, NH_3 and CO emissions in 2004. For NMVOC, CH_4 and TSP, small track type excavators (0-5 tons) are the largest emission source. The fuel use and emission shares for wheel type excavators, dump trucks and track type dozers and loaders are only 4% or less.

The total and emission level specific fuel use and emission developments from 1985 to 2004 are shown in Figure 28, for the machinery types listed in Table 19. The general machinery lifetime is 10 years, except for mini loaders where a lifetime of 14 years is expected. On Figure 28, small fuel use and emission contributions from mini loaders appear for four more years at any given emission level,

after the contributions from other machinery types have been phased out.

The total fuel use and directly derived CO_2 emissions increase by 8% from 1985 to 2004, and this is explained by the growth in the activity level for the machinery types as a whole. However, it should be noted that the total development incorporates both fuel use increases and decreases, cf. the stock development curves shown in the Figures 14 and 15. Prior to 1990, the 1990 stock and operational data are used, and the slight fuel use decrease from 1985 to 1990 is explained by the improved fuel efficiency for 1981-1990 machinery being phased in.

For the remaining components the emission explanations given for diesel tractors also appy for construction machinery. From 1985-2004, the emissions of N_2O and NH_3 increase by 16%, whereas the emissions decrease for SO_2, TSP, NMVOC, CH_4, CO and NO_x are 89, 45, 37, 37, 26 and 4% in the same time period.

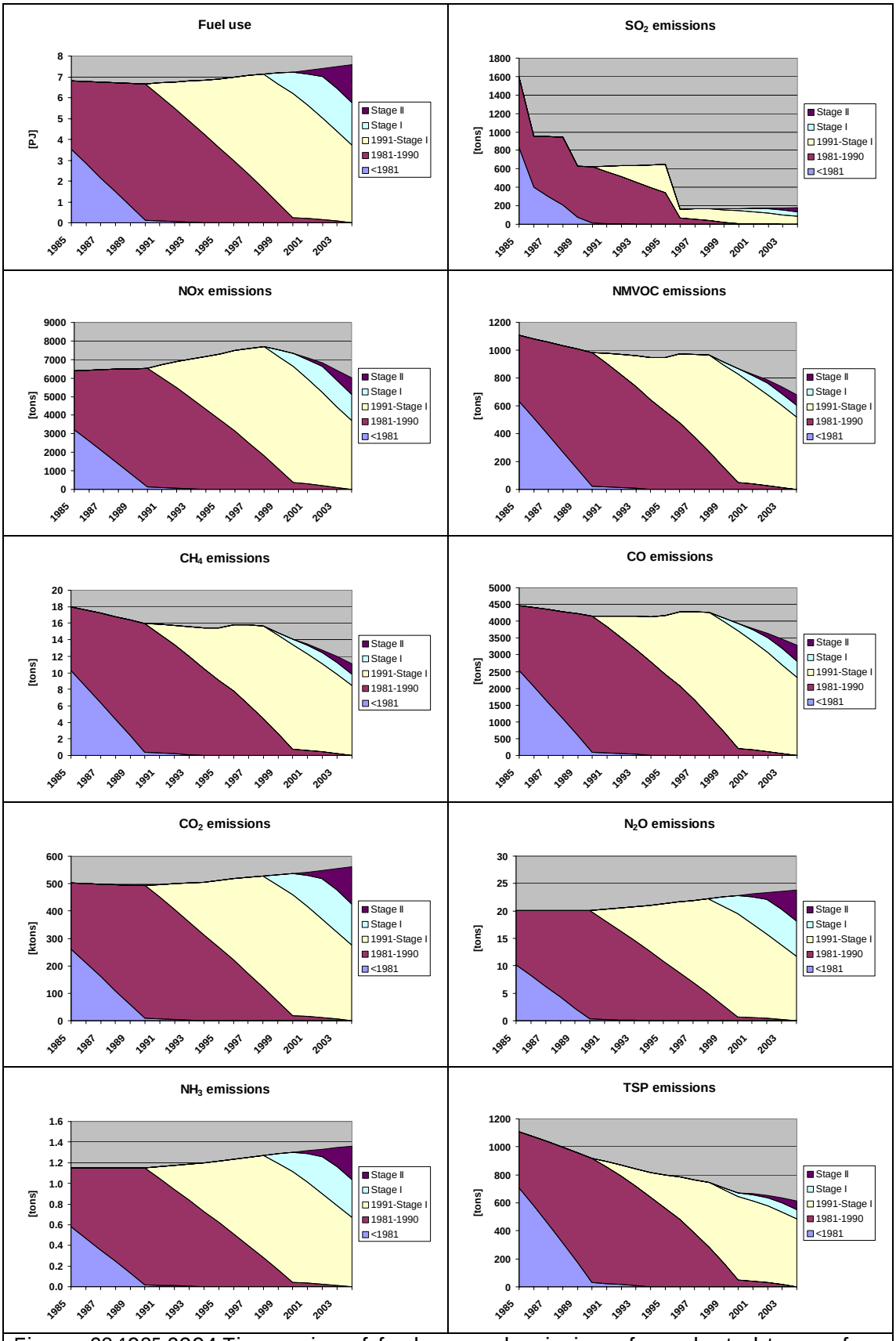


Figure 28 1985-2004 Time series of fuel use and emissions for selected types of construction machinery

The emission level specific shares of fuel use and emissions in 2004 are shown in Figure 29. The effect of the strengthened stage I and II emission standards is visible since fuel use shares per emission level are always higher than their corresponding emission shares. As for machine pool machinery, a quick penetration of new emission levels into the machinery stock occurs due to the relatively small lifetimes for the machinery types in question.

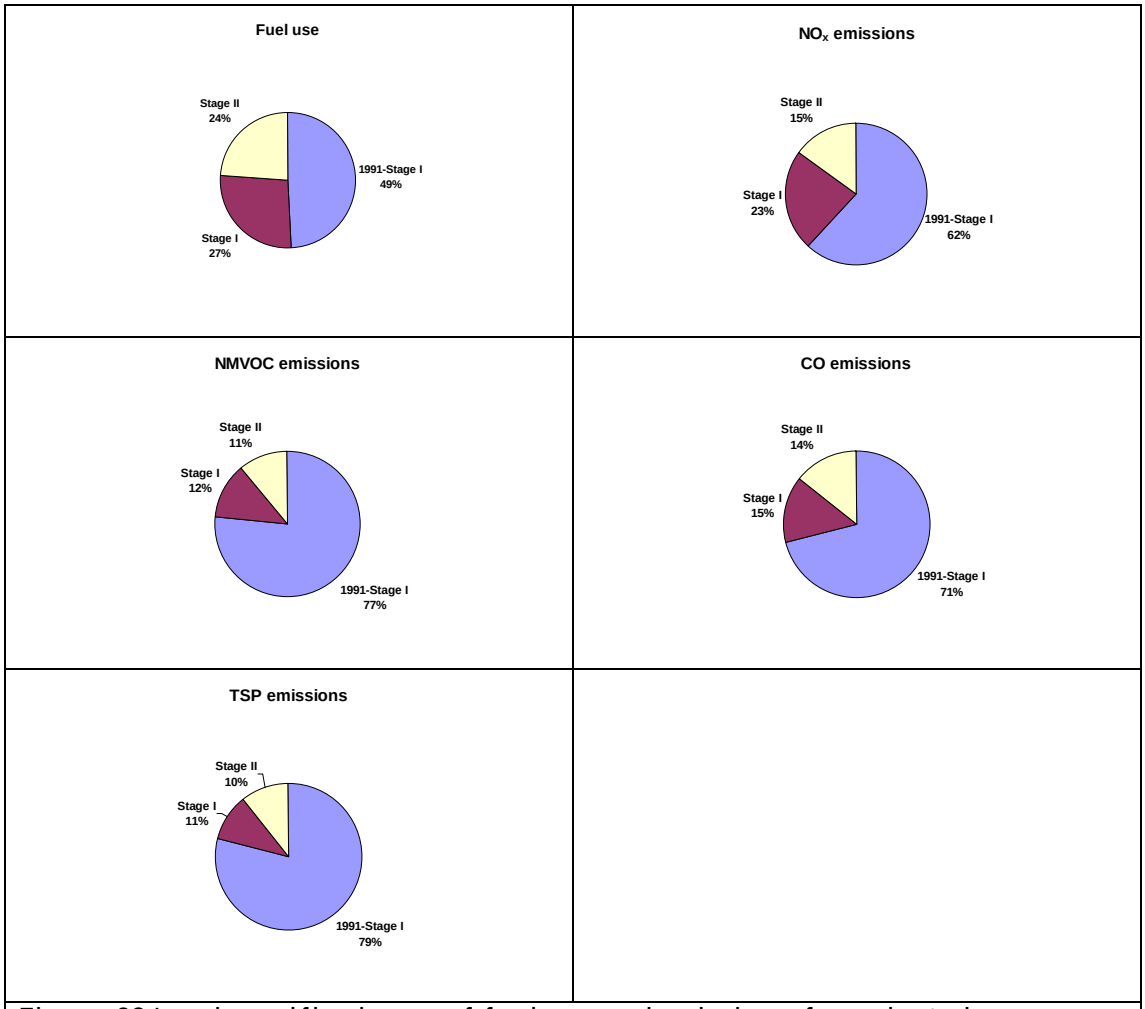


Figure 29 Level specific shares of fuel use and emissions for selected construction machinery in 2004

In Annex 2 the 1985-2004 fuel use, emissions and fuel related emission factors are listed for construction machinery.

5.3.2 Fork lifts

The 2004 fuel use and emission results for diesel and LPG fork lifts were shown in Table 13 in the beginning of this chapter. The 1985-2004 time series of results are shown in Figure 30.

For diesel fork lifts the total stock increases from 1985-2004 and causes the fuel use and CO_2 emissions to increase by 38%. In the same time period the emission increases of NO_x, N_2O and NH_3 are 58, 50 and 50%, whereas the emissions of SO_2, TSP, NMVOC, CH_4 and CO emission decrease by 86, 37, 22, 22 and 7%, respectively. The

explanations for the emission changes relative to the fuel use development are generally the same as for tractors (see Chapter 5.1.1).

For LPG fork lifts the fuel use and emissions decrease by 14% from 1985 to 2004, due to a decrease in stock numbers and the application of constant emission factors. Though, for LPG fuels the sulphur percentage is zero, and hence no SO_2 emissions occur related to the usage of LPG.

Compared with diesel, the LPG emissions for TSP, CO and NMVOC are generally low, but on the contrary high for NO_x, CH_4, N_2O and NH_3. The two emission tendencies rely on the values of the emission factors.

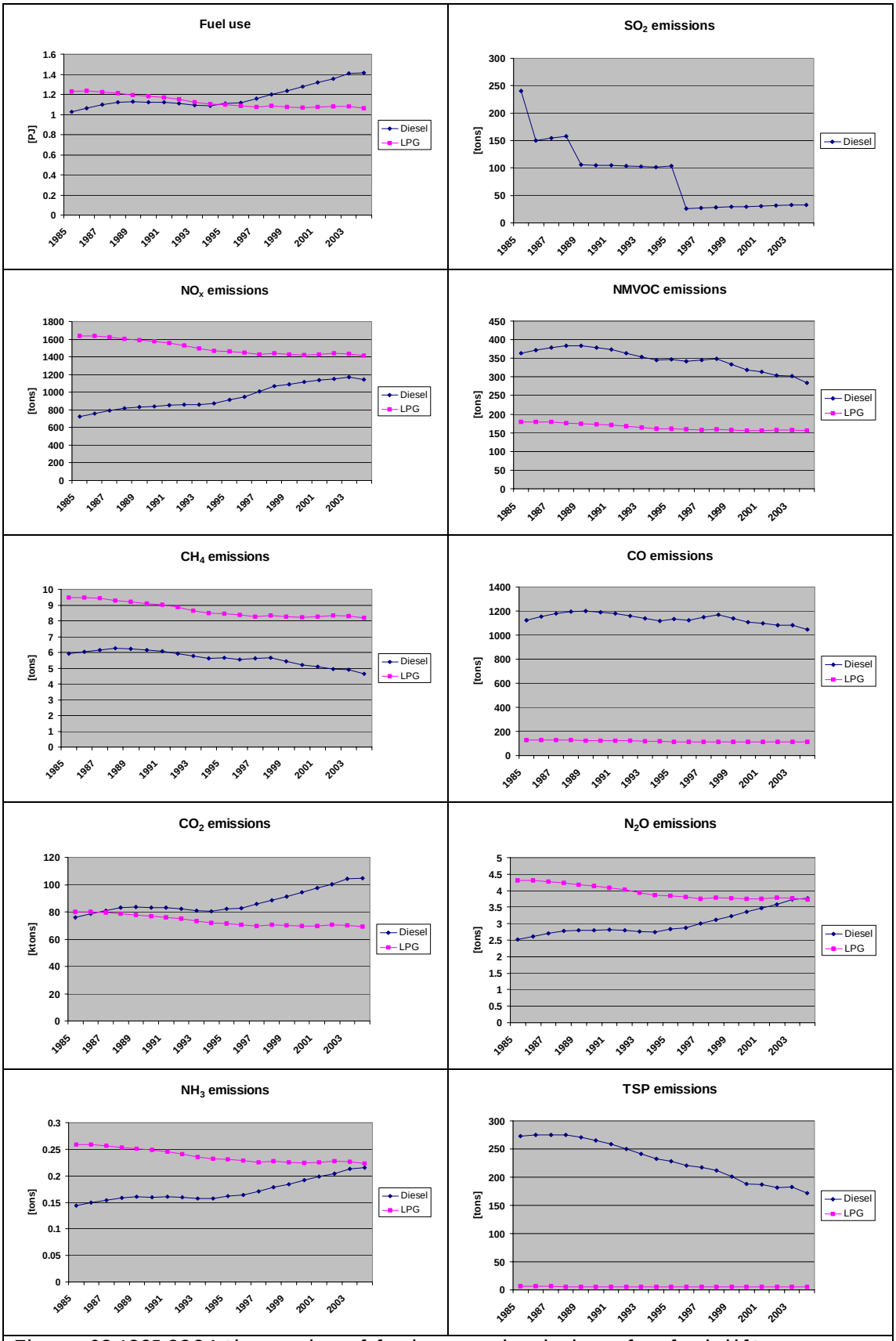


Figure 30 1985-2004 time series of fuel use and emissions for fork lifts

The emission level specific shares of fuel use and emissions in 2004 are shown in Figure 31. The effect of the strenghtened stage I and II

emission standards is visible since fuel use shares per emission level are always higher than their corresponding emission shares.

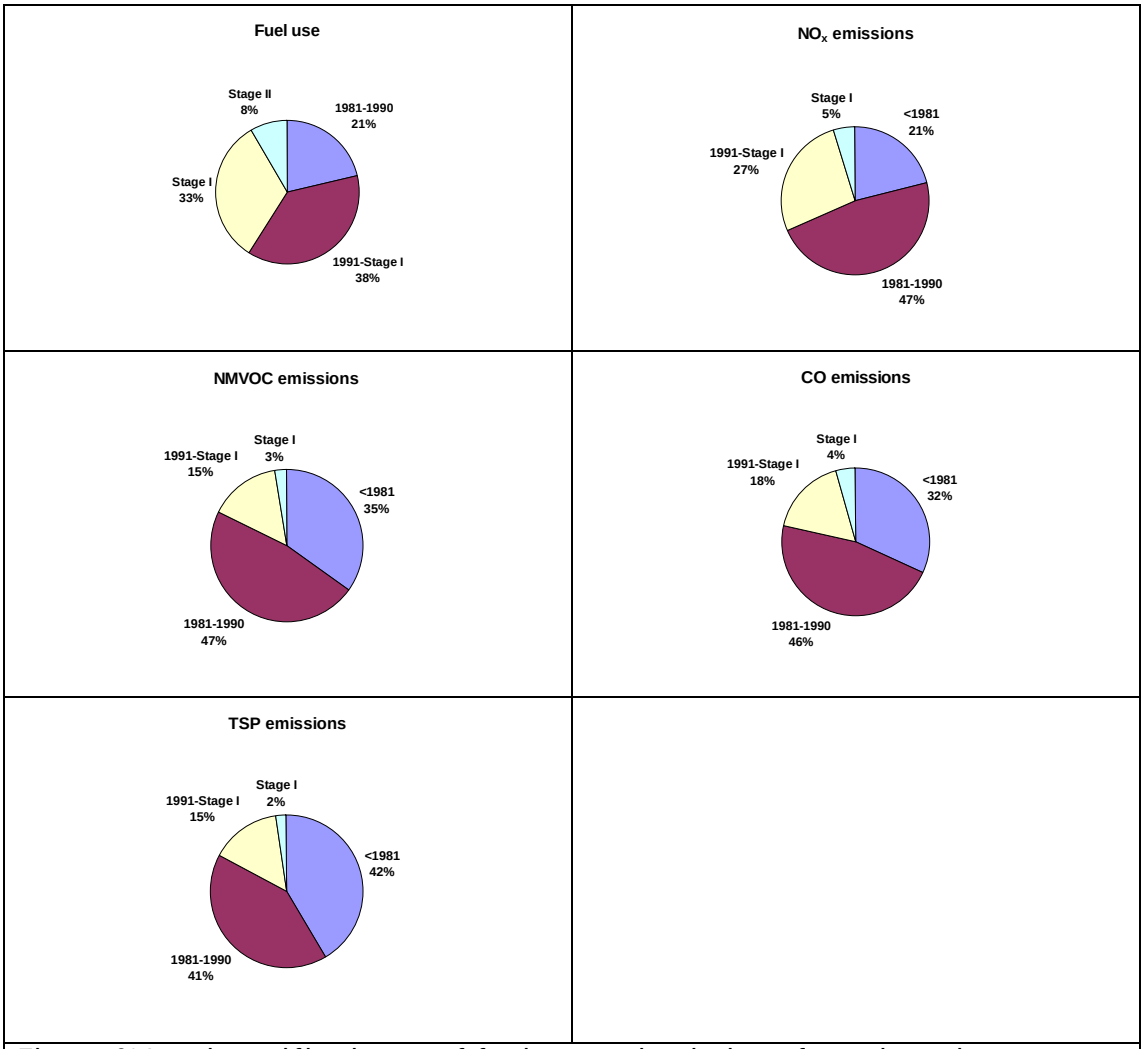


Figure 31 Level specific shares of fuel use and emissions for selected construction machinery in 2004

In Annex 2 the 1985-2004 fuel use, emissions and fuel related emission factors are listed for diesel and LPG fuelled fork lifts, respectively.

Other machinery

Fuel use and emissions estimates are listed in Table 34 for other mobile machinery in industry. Figures for individual percentage shares are listed in Table 35.

Table 34 2004 fuel use and emissions for other industrial non road machinery

Subsector	Machinery type	Fuel type	Fuel [TJ]	SO_2 [tons]	NO_X [tons]	NMVOC [tons]	CH_4 [tons]	CO [tons]	CO_2 [ktons]	N_2O [tons]	NH_3 [tons]	TSP [tons]
Construction machinery	Compressors (diesel)	Diesel	624	15	655	85	1	278	46	2	0	56
Industry	Tractors (transport, industry)	Diesel	351	8	265	55	1	242	26	1	0	51
Construction machinery	Tampers/Land rollers	Diesel	254	6	225	41	1	112	19	1	0	40
Construction machinery	Generators (diesel)	Diesel	251	6	258	35	1	113	19	1	0	23
Industry	Refrigerating units (distribution)	Diesel	173	4	170	38	1	83	13	1	0	31
Airport GSE and other	Airport GSE and other (Heavy duty)	Diesel	123	3	103	5	0	42	9	0	0	6
Airport GSE and other	Airport GSE and other (light duty)	Diesel	110	3	93	7	0	39	8	0	0	4
Airport GSE and other	Airport GSE and other (medium duty)	Diesel	72	2	61	5	0	26	5	0	0	3
Construction machinery	Asphalt pavers	Diesel	64	1	79	7	0	23	5	0	0	3
Industry	Refrigerating units (long distance)	Diesel	61	1	60	13	0	29	4	0	0	11
Construction machinery	Refuse compressors	Diesel	56	1	59	3	0	14	4	0	0	3
Building and construction	Vibratory plates	Diesel	44	1	43	10	0	21	3	0	0	8
Construction machinery	Motor graders	Diesel	31	1	26	2	0	11	2	0	0	1
Building and construction	Sweepers (diesel)	Diesel	8	0	6	1	0	4	1	0	0	1
Building and construction	Aerial lifts (diesel)	Diesel	8	0	7	1	0	4	1	0	0	1
Building and construction	High pressure cleaners (diesel)	Diesel	7	0	6	1	0	3	0	0	0	1
Construction machinery	Pumps (diesel)	Diesel	2	0	3	0	0	1	0	0	0	0
	Diesel total		2237	52	2118	310	5	1044	166	7	0	244
Construction machinery	Pumps (gasoline)	Gasoline	95	0	23	110	11	634	7	0	0	0
Building and construction	Vibratory plates (gasoline)	Gasoline	24	0	3	25	2	574	2	0	0	0
Construction machinery	Generators (gasoline)	Gasoline	17	0	4	21	2	116	1	0	0	0
Building and construction	High pressure cleaners (gasoline)	Gasoline	7	0	1	7	1	172	1	0	0	0
Building and construction	Rammers	Gasoline	7	0	0	48	0	150	1	0	0	1
Building and construction	Sweepers (gasoline)	Gasoline	6	0	0	5	0	215	0	0	0	0
Building and construction	Aerial lifts (gasoline)	Gasoline	3	0	0	2	0	115	0	0	0	0
Building and construction	Slicers	Gasoline	3	0	0	20	0	66	0	0	0	0
Building and construction	Other (gasoline)	Gasoline	2	0	0	3	0	57	0	0	0	0
Building and construction	Cutters	Gasoline	2	0	0	2	0	11	0	0	0	0
Construction machinery	Compressors (gasoline)	Gasoline	0	0	0	0	0	6	0	0	0	0
Building and construction	Drills	Gasoline	0	0	0	0	0	1	0	0	0	0
	Gasoline total		167	0	32	244	17	2116	12	0	0	2
	Grand total		2404	53	2150	554	22	3161	178	7	0	246

Table 35 2004 fuel use and emission percentage shares for other industrial non road machinery

			Fuel [%]	SO_2 [%]	NO_x [%]	NMVOC [%]	CH_4 [%]	CO [%]	CO_2 [%]	N_2O [%]	NH_3 [%]	TSP [%]
Construction machinery	Compressors (diesel)	Diesel	26	28	30	15	6	9	26	27	27	23
Industry	Tractors (transport, industry)	Diesel	15	16	12	10	4	8	15	15	14	21
Construction machinery	Tampers/Land rollers	Diesel	11	11	10	7	3	4	11	11	11	16
Construction machinery	Generators (diesel)	Diesel	10	11	12	6	3	4	10	11	11	10
Industry	Refrigerating units (distribution)	Diesel	7	8	8	7	3	3	7	7	7	12
Airport GSE and other	Airport GSE and other (Heavy duty)	Diesel	5	5	5	1	0	1	5	6	5	2
Airport GSE and other	Airport GSE and other (light duty)	Diesel	5	5	4	1	1	1	5	5	5	2
Airport GSE and other	Airport GSE and other (medium duty)	Diesel	3	3	3	1	0	1	3	3	3	1
Construction machinery	Asphalt pavers	Diesel	3	3	4	1	1	1	3	3	3	1
Industry	Refrigerating units (long distance)	Diesel	3	3	3	2	1	1	3	3	3	4
Construction machinery	Refuse compressors	Diesel	2	2	3	0	0	0	2	3	3	1
Building and construction	Vibratory plates	Diesel	2	2	2	2	1	1	2	2	2	3
Construction machinery	Motor graders	Diesel	1	1	1	0	0	0	1	1	1	1
Building and construction	Sweepers (diesel)	Diesel	0	0	0	0	0	0	0	0	0	0
Building and construction	Aerial lifts (diesel)	Diesel	0	0	0	0	0	0	0	0	0	1
Building and construction	High pressure cleaners (diesel)	Diesel	0	0	0	0	0	0	0	0	0	0
Construction machinery	Pumps (diesel)	Diesel	0	0	0	0	0	0	0	0	0	0
	Diesel total		93	99	99	56	23	33	93	97	96	99
Construction machinery	Pumps (gasoline)	Gasoline	4	0	1	20	48	20	4	2	2	0
Building and construction	Vibratory plates (gasoline)	Gasoline	1	0	0	5	10	18	1	0	0	0
Construction machinery	Generators (gasoline)	Gasoline	1	0	0	4	9	4	1	0	0	0
Building and construction	High pressure cleaners (gasoline)	Gasoline	0	0	0	1	3	5	0	0	0	0
Building and construction	Rammers	Gasoline	0	0	0	9	2	5	0	0	0	0
Building and construction	Sweepers (gasoline)	Gasoline	0	0	0	1	2	7	0	0	0	0
Building and construction	Aerial lifts (gasoline)	Gasoline	0	0	0	0	1	4	0	0	0	0
Building and construction	Slicers	Gasoline	0	0	0	4	1	2	0	0	0	0
Building and construction	Other (gasoline)	Gasoline	0	0	0	0	1	2	0	0	0	0
Building and construction	Cutters	Gasoline	0	0	0	0	1	0	0	0	0	0
Construction machinery	Compressors (gasoline)	Gasoline	0	0	0	0	0	0	0	0	0	0
Building and construction	Drills	Gasoline	0	0	0	0	0	0	0	0	0	0
	Gasoline total		7	1	1	44	77	67	7	3	4	1
	Grand total		100	100	100	100	100	100	100	100	100	100

5.4 Household and gardening

The subsectoral fuel use and emissions distributions in 2004 for household and gardening equipment are shown in Table 36, together with the corresponding shares of total results.

Table 36 2004 Fuel use, emissions and percentage shares for household and gardening equipment

Subsector	Fuel type	Machinery type	Fuel	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
			[TJ]	[tons]	[tons]	[tons]	[tons]	[tons]	[ktons]	[tons]	[tons]	[tons]
Riders (professional)	Gasoline	4-stroke	1151	3	77	739	72	39336	84	2	0	8
Riders (private)	Gasoline	4-stroke	1033	2	72	776	63	34427	75	1	0	7
Lawn movers (private)	Gasoline	4-stroke	565	1	68	1354	54	13632	41	1	0	3
Chain saws (professional)	Gasoline	2-stroke	393	1	19	2513	21	6242	29	0	0	29
Cultivators (professional)	Gasoline	4-stroke	362	1	44	364	34	8724	26	0	0	2
Lawn movers (professional)	Gasoline	4-stroke	209	0	24	301	21	5180	15	0	0	1
Shrub clearers (professional)	Gasoline	2-stroke	116	0	4	905	7	1875	8	0	0	13
Hedge cutters (professional)	Gasoline	2-stroke	62	0	2	483	4	1000	5	0	0	7
Trimmers (professional)	Gasoline	2-stroke	43	0	1	341	3	703	3	0	0	5
Shrub clearers (private)	Gasoline	2-stroke	41	0	1	330	3	648	3	0	0	4
Cultivators (private-large)	Gasoline	4-stroke	32	0	2	54	4	1121	2	0	0	0
Chain saws (private)	Gasoline	2-stroke	29	0	1	237	2	459	2	0	0	3
Trimmers (private)	Gasoline	2-stroke	25	0	1	200	2	393	2	0	0	3
Hedge cutters (private)	Gasoline	2-stroke	11	0	0	91	1	170	1	0	0	1
Cultivators (private-small)	Gasoline	4-stroke	1	0	0	2	0	27	0	0	0	0
Other machinery	Gasoline	2-stroke	6	0	0	41	0	133	0	0	0	1
Other machinery	Gasoline	4-stroke	0	0	0	0	0	2	0	0	0	0
	Total	2-stroke	719	2	30	5100	42	11491	52	0	0	65
	Total	4-stroke	3359	8	287	3631	249	102582	245	5	0	23
	Gasoline total		4078	9	317	8731	290	114073	298	5	0	87
			Fuel	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
			[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]
Riders (professional)	Gasoline	4-stroke	28	28	24	8	25	34	28	34	30	9
Riders (private)	Gasoline	4-stroke	25	25	23	9	22	30	25	30	27	8
Lawn movers (private)	Gasoline	4-stroke	14	14	22	16	19	12	14	15	13	4
Chain saws (professional)	Gasoline	2-stroke	10	10	6	29	7	5	10	3	9	33
Cultivators (professional)	Gasoline	4-stroke	9	9	14	4	12	8	9	9	9	2
Lawn movers (professional)	Gasoline	4-stroke	5	5	8	3	7	5	5	5	5	1
Shrub clearers (professional)	Gasoline	2-stroke	3	3	1	10	3	2	3	1	2	14
Hedge cutters (professional)	Gasoline	2-stroke	2	2	1	6	1	1	2	0	1	8
Trimmers (professional)	Gasoline	2-stroke	1	1	0	4	1	1	1	0	1	5
Shrub clearers (private)	Gasoline	2-stroke	1	1	0	4	1	1	1	0	1	5
Cultivators (private-large)	Gasoline	4-stroke	1	1	1	1	1	1	1	1	1	0
Chain saws (private)	Gasoline	2-stroke	1	1	0	3	1	0	1	0	1	4
Trimmers (private)	Gasoline	2-stroke	1	1	0	2	1	0	1	0	0	3
Hedge cutters (private)	Gasoline	2-stroke	0	0	0	1	0	0	0	0	0	1
Cultivators (private-small)	Gasoline	4-stroke	0	0	0	0	0	0	0	0	0	0
Other machinery	Gasoline	2-stroke	0	0	0	0	0	0	0	0	0	1
Other machinery	Gasoline	4-stroke	0	0	0	0	0	0	0	0	0	0
	Total	2-stroke	18	18	10	58	14	10	18	6	15	74
	Total	4-stroke	82	82	90	42	86	90	82	94	85	26
	Gasoline total		100	100	100	100	100	100	100	100	100	100

The 4-stroke engines have a fuel use share of 82% and emission shares between 80 and 90% for all components, except NMVOC and TSP. The 2-stroke engine emission shares for these two components are high, in the order of 58 and 74%, respectively, due to high emission factors. The fuel use and emission contributions are marginal from machinery types (other machinery) for which no specific data are gathered in the present project.

The largest individual emission sources for all other components than NMVOC and TSP are professional and private riders, whereas for NMVOC and TSP the highest emitters are chain saws, shrub clearers and lawn movers (NMVOC).

From 1985 to 2004 there has been a 113% increase in total fuel use, SO_2 and CO_2 emissions. For NO_x, NH_3, N_2O, TSP, NMVOC, CO and CH_4, the emissions have increased by 179, 132, 123, 117, 87, 78 and 51%, respectively.

Figure 32 shows the 1985-2004 fuel use and emission trends per machinery type.

Even though some fuel efficiency improvements have been obtained, per machinery type the fuel use more or less follow the activity level. Following this, it is clear from Figure 32 that the overall rise in total fuel use is to a large extent due to the increased use of riders which has been even more pronounced after 2000. The visible NMVOC, CH_4 and CO emission reductions for cultivators and lawn movers (1985-2000) and for chain saw TSP (1985-1993) are due to emission factor improvements.

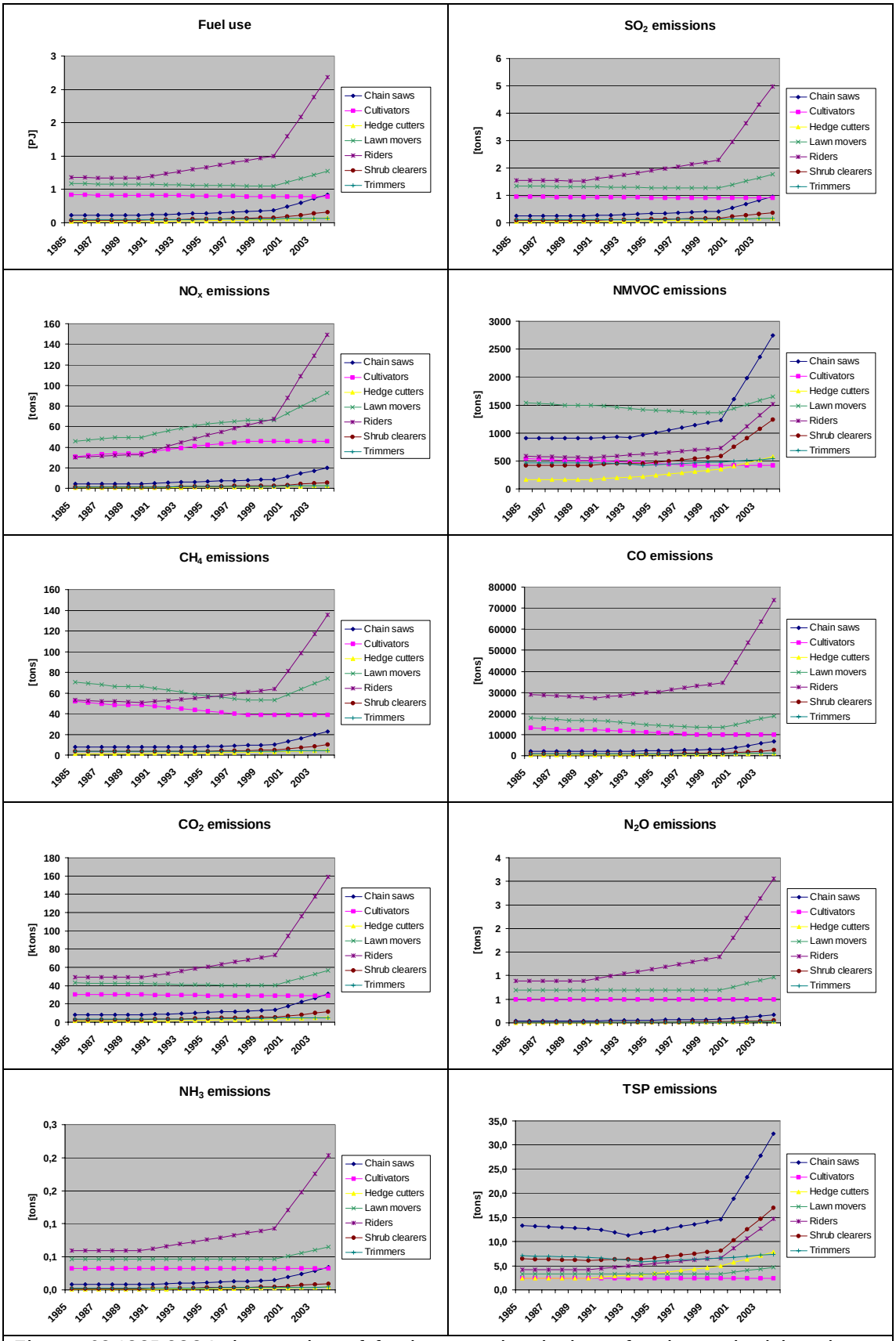


Figure 32 1985-2004 time series of fuel use and emissions for household and gardening equipment

Figure 33 shows the fuel use and emission developments per emission level from 1985-2004, split into 2-stroke and 4-stroke results. For 4-stroke NMVOC and CO, and for 2-stroke TSP the emission factors become gradually lower as engines become newer, whereas for 4-stroke NO_x the opposite situation occurs. These emission tendencies become clear when the emission and fuel use graphs are compared, for 2-stroke and 4-stroke engines individually.

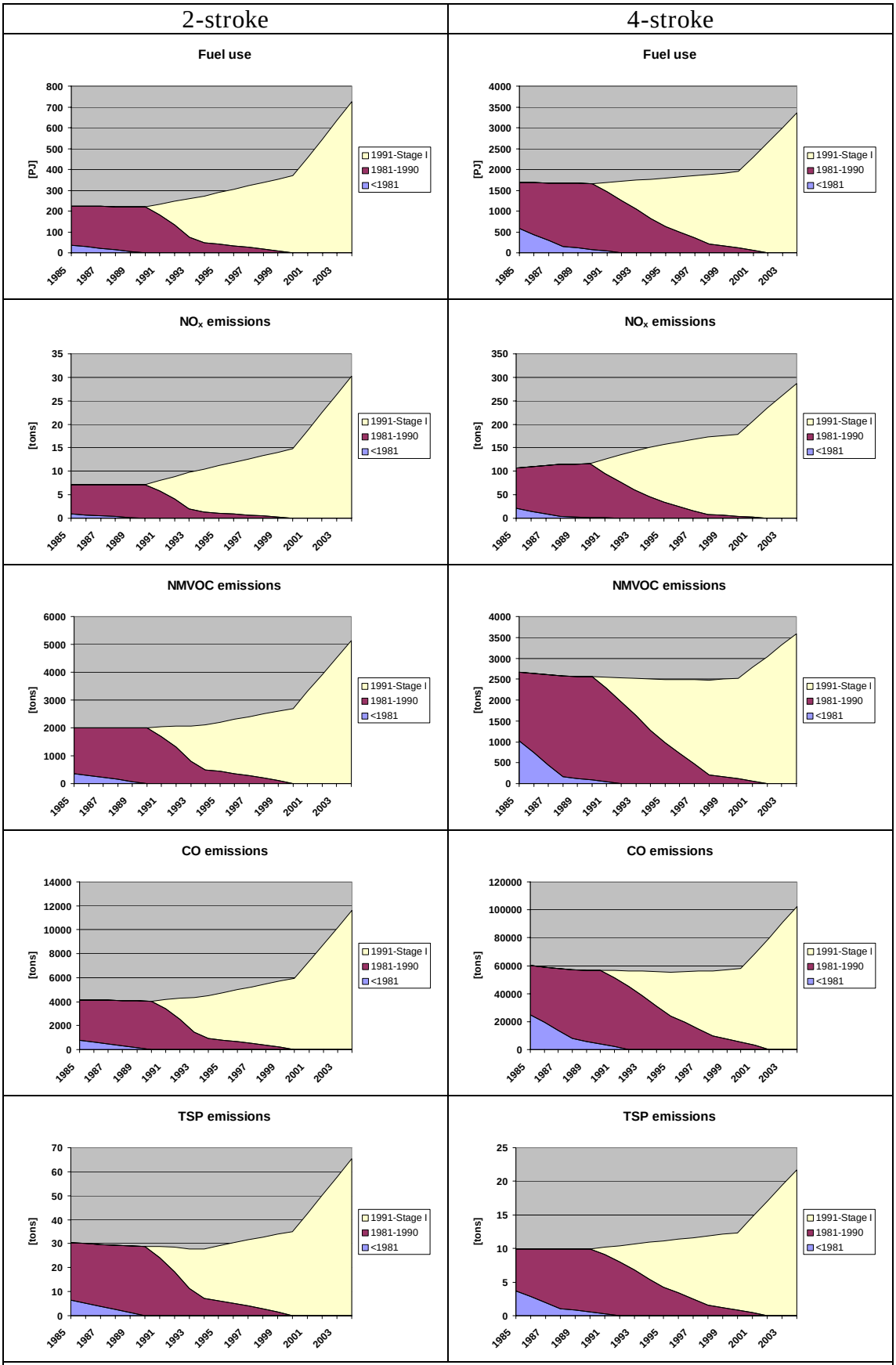


Figure 33 1985-2004 time series of fuel use and emissions per emission level for 2-stroke and 4-stroke household and gardening equipment

In Annex 2 the 1985-2004 fuel use, emissions and fuel related emission factors are listed for 2-stroke and 4-stroke gasoline engines, respectively.

5.5 Inland waterways

An overview of the fuel use and emission results for recreational craft in 2004 is given in Table 37. The diesel fuelled engines account for 71% of the total fuel use, and have SO_2, N_2O, NO_x, NH_3, CO_2, and TSP emission shares of 99, 87, 85, 83, 72 and 68%, respectively. The most important single source is motor boats (27-34 ft) followed by motor boats (>34 ft), motor sailors, sailing boats (<26 ft) and motor boats (<27 ft).

For CO, CH_4 and NMVOC most of the emissions come from gasoline fuelled machinery. The CO, CH_4 and NMVOC emission shares are 93, 89 and 8, respectively. Here the most important single sources are speed boats (4-stroke, in board engines), speed boats (2-stroke) and yawls/cabin boats (2-stroke).

Table 37 2004 Fuel use, emissions and percentage shares for recreational craft

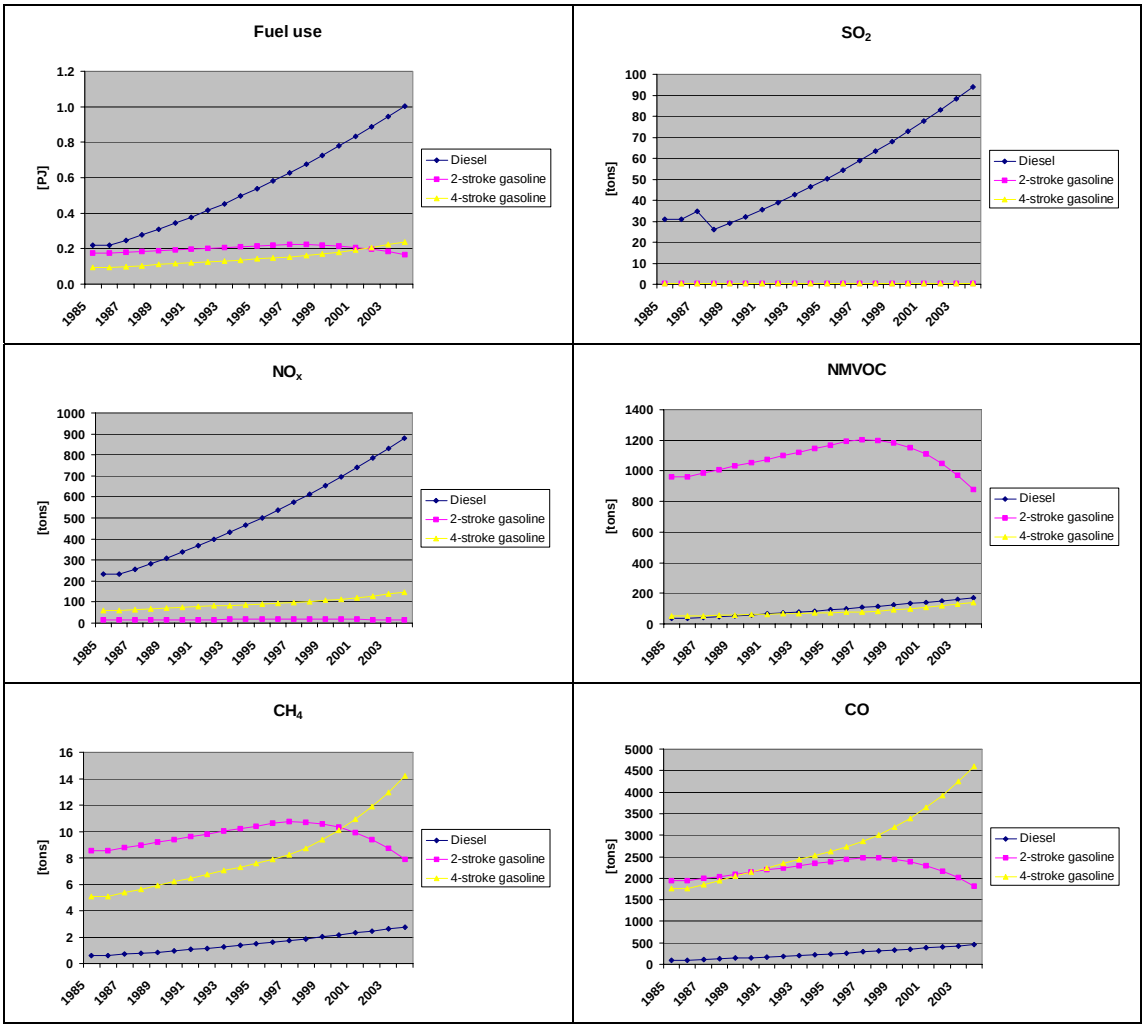
Subsector	Fuel type	Machinery type	Fuel	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
			[TJ]	[tons]	[tons]	[tons]	[tons]	[tons]	[ktons]	[tons]	[tons]	[tons]
Motor boats (27-34 ft)	Diesel		608	57	445	102	2	274	45	2	0	62
Motor boats (> 34 ft)	Diesel		205	19	151	34	1	93	15	1	0	21
Motor sailors	Diesel		67	6	101	12	0	31	5	0	0	8
Sailing boats (> 26 ft)	Diesel		67	6	101	12	0	31	5	0	0	8
Motor boats <(27 ft)	Diesel		54	5	81	10	0	25	4	0	0	6
	Diesel total		1002	94	879	170	3	454	74	3	0	105
Speed boats	Gasoline	2-stroke	83	0	7	412	4	898	6	0	0	24
Yawls and cabin boats	Gasoline	2-stroke	55	0	5	276	2	598	4	0	0	16
Other boats (< 20 ft)	Gasoline	2-stroke	13	0	1	100	1	164	1	0	0	4
Sailing boats (< 26 ft)	Gasoline	2-stroke	8	0	0	67	1	102	1	0	0	2
Water scooters	Gasoline	2-stroke	5	0	0	25	0	54	0	0	0	1
	2-stroke total		165	0	14	879	8	1816	12	0	0	48
Speed boats (in board eng.)	Gasoline	4-stroke	189	0	122	97	10	3503	14	0	0	1
Speed boats (out board eng)	Gasoline	4-stroke	25	0	14	18	2	527	2	0	0	0
Yawls and cabin boats	Gasoline	4-stroke	17	0	9	13	1	351	1	0	0	0
Other boats (< 20 ft)	Gasoline	4-stroke	4	0	2	6	1	112	0	0	0	0
Sailing boats (< 26 ft)	Gasoline	4-stroke	3	0	1	6	0	70	0	0	0	0
Water scooters	Gasoline	4-stroke	2	0	1	1	0	32	0	0	0	0
	4-stroke total		239	1	147	141	14	4595	17	0	0	1
	Gasoline total		404	1	161	1020	22	6411	30	0	0	49
	Grand total		1406	95	1040	1191	25	6865	104	3	0	154
			Fuel [%]	SO_2 [%]	NO_x [%]	NMVOC [%]	CH_4 [%]	CO [%]	CO_2 [%]	N_2O [%]	NH_3 [%]	TSP [%]
Motor boats (27-34 ft)	Diesel		43	60	43	9	7	4	43	53	50	40
Motor boats (> 34 ft)	Diesel		15	20	14	3	2	1	15	18	17	14
Motor sailors	Diesel		5	7	10	1	1	0	5	6	5	5
Sailing boats (> 26 ft)	Diesel		5	7	10	1	1	0	5	6	5	5
Motor boats <(27 ft)	Diesel		4	5	8	1	1	0	4	5	4	4
	Diesel total		71	99	85	14	11	7	72	87	83	68
Speed boats	Gasoline	2-stroke	6	0	1	35	15	13	6	1	2	16
Yawls and cabin boats	Gasoline	2-stroke	4	0	0	23	10	9	4	0	2	10
Other boats (< 20 ft)	Gasoline	2-stroke	1	0	0	8	4	2	1	0	0	2
Sailing boats (< 26 ft)	Gasoline	2-stroke	1	0	0	6	2	1	1	0	0	2
Water scooters	Gasoline	2-stroke	0	0	0	2	1	1	0	0	0	1
	2-stroke total		12	0	1	74	32	26	12	1	5	31
Speed boats (in board eng.)	Gasoline	4-stroke	13	0	12	8	41	51	13	9	10	1
Speed boats (out board eng)	Gasoline	4-stroke	2	0	1	2	8	8	2	1	1	0
Yawls and cabin boats	Gasoline	4-stroke	1	0	1	1	5	5	1	1	1	0
Other boats (< 20 ft)	Gasoline	4-stroke	0	0	0	0	2	2	0	0	0	0
Sailing boats (< 26 ft)	Gasoline	4-stroke	0	0	0	0	1	1	0	0	0	0
Water scooters	Gasoline	4-stroke	0	0	0	0	0	0	0	0	0	0
	4-stroke total		17	1	14	12	57	67	17	11	12	1
	Gasoline total		29	1	15	86	89	93	28	13	17	32
	Grand total		100	100	100	100	100	100	100	100	100	100

From 1985 to 2004 there has been a 188% increase in total fuel use. The N_2O, NH_3, NO_x, SO_2, CO_2, TSP, CO, CH_4 and NMVOC emissions have increased by 300, 258, 239, 201, 189, 106, 81, 75 and 13%, respectively.

Figure 34 shows the 1985-2004 fuel use and emission trends split into totals for diesel, 2-stroke gasoline and 4-stroke gasoline.

The EU directive 2003/44 strengthened emission standards apply for new engines in 2006 (diesel and gasoline 4-stroke) and 2007 (gasoline 2-stroke), and therefore the fuel use and emissions per boat type directly follow the activity level in the 1985-2004 time period. So, the main reason for the SO_2, NO_x, CO_2, N_2O, NH_3 and TSP emission growth is the overall rise in total diesel fuel use.

From 1998 and onwards the 2-stroke emission decreases and the 4-stroke emission increases even stronger due to the gradual shift towards the more environmentally friendly 4-stroke gasoline engine technology. In terms of NMVOC and TSP, the total gasoline engine result is a 1% increase for NMVOC and a 4% decrease for TSP from 1985 to 2004 set in relation to a fuel use increase of 50% in the same period.



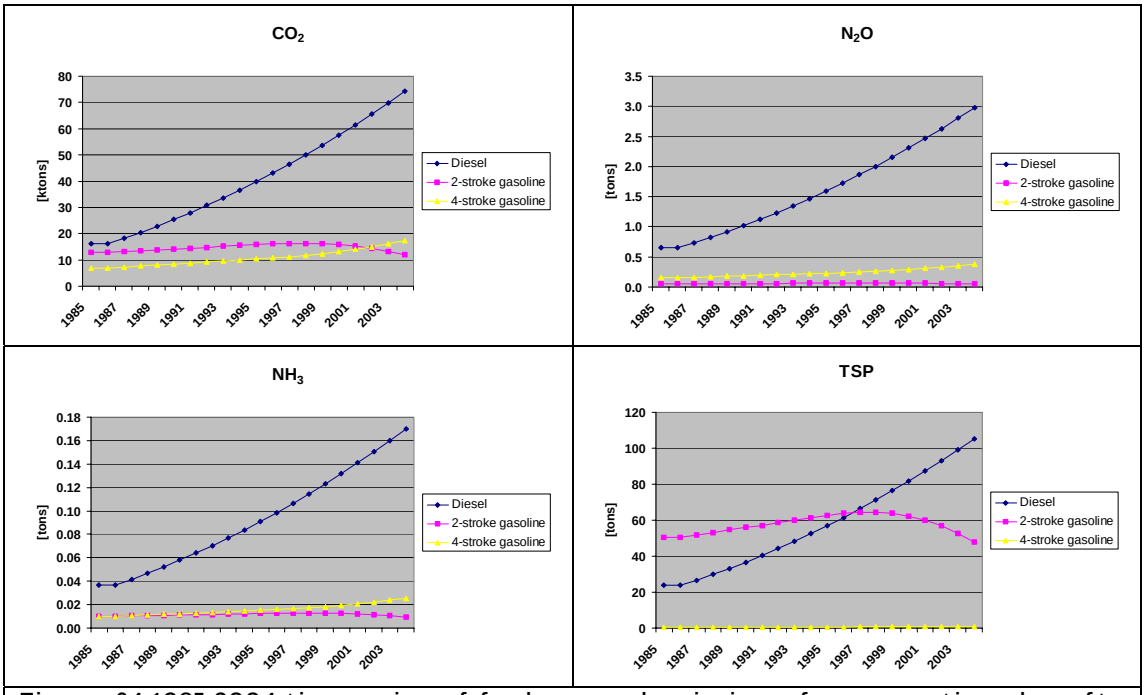


Figure 34 1985-2004 time series of fuel use and emissions for recreational craft

In Annex 2 the 1985-2004 fuel use, emissions and fuel related emission factors are listed for diesel engines and 2-stroke and 4-stroke gasoline engines, respectively.

5.6 Uncertainties

Uncertainty estimates for fuel use and emissions are made according to the guidelines formulated in the Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (IPCC, 2000).

For 2004, the detailed uncertainty calculation sheets are shown in Annex 6, and input for these are uncertainty factors for activity data and fuel use/emission factor uncertainties.

The uncertainty factors for activity data shown in Table 24 are calculated as:

$$U_A = \sqrt{U_S^2 + U_H^2 + U_L^2} \quad (8)$$

Where U_A = activity data uncertainty factor, U_S = stock uncertainty factor, U_H = working hours uncertainty factor, U_L = load uncertainty factor.

The determination of the stock, hours and load uncertainty factors shown in Table 38 are based on own judgements and are given as 95% confidence ratios.

Table 38 Uncertainty factors for machinery stock, working hours and engine loads

Category	Stock U_S	Hours U_H	Load factor U_L	Activity data uncertainty U_A
Agriculture	0,1	0,1	0,2	0,24
Forestry	0,1	0,2	0,2	0,30
Industry (constr. machinery, fork lifts)	0,2	0,2	0,2	0,35
Industry (other)	0,3	0,2	0,2	0,41
Household and gardening	0,2	0,2	0,2	0,35
Recreational craft	0,2	0,3	0,2	0,41

The fuel use and emission factor uncertainties given as 95% confidence ratios are shown in Table 39. For fuel use the uncertainty factors are based on own judgements. The emission factor uncertainties for CO_2, CH_4 and N_2O come from IPCC (2000) and for SO_2, NO_x, NMVOC, CO, NH_3 and TSP the uncertainty factors are used as proposed by the Good Practice Guidance for CLRTAP Emission Inventories (Pulles et al. 2001).

Table 39 Fuel use and emission factor uncertainties

Category	Fuel	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Agriculture	0,1	0,5	0,5	0,5	0,5	0,5	0,05	1000	1000	0,5
Forestry	0,1	0,5	0,5	0,5	0,5	0,5	0,05	1000	1000	0,5
Industry (constr. machinery, fork lifts)	0,1	0,5	0,5	0,5	0,5	0,5	0,05	1000	1000	0,5
Industry (other)	0,1	0,5	0,5	0,5	0,5	0,5	0,05	1000	1000	0,5
Household and gardening	0,1	0,5	0,5	0,5	0,5	0,5	0,05	1000	1000	0,5
Recreational craft	0,1	0,5	0,5	0,5	0,5	0,5	0,05	1000	1000	0,5

In Table 40 the uncertainty results are shown, expressed as the 95% confidence ratios.

Table 40 uncertainty results (95% confidence ratios) for fuel use and emissions in 2004

Category	Fuel	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Agriculture	26	56	56	56	56	56	26	1000	1000	56
Forestry	32	58	58	58	58	58	32	1000	1000	58
Industry (constr. machinery, fork lifts)	36	61	61	61	61	61	36	1001	1001	61
Industry (other)	42	65	65	65	65	65	42	1001	1001	65
Household and gardening	36	61	61	61	61	61	36	1001	1001	61
Recreational craft	42	65	65	65	65	65	42	1001	1001	65
Total	18	35	37	40	43	48	18	621	619	35

6 Projections 2005-2030

To provide stock data for the projection period 2005-2030 for tractors, harvesters and fork lifts the new sales figures per engine size for the year 2004 has been used for 2005 onwards as an assumption. The general lifetimes listed in Chapter 3 and historical stock data has subsequently been used to determine the total stock numbers per engine size, and numbers per new sales year and engine size for each year in the projection period.

For the remaining non road machinery types the 2004 machinery stock has been used also for future years. By assuming the same percentage share of the stock total for all new sales year present in the stock, the number-new sales year (and hence emission level) distribution can be established in any given forecast year.

The main driver for changes in the future as compard with the present emission level will therefore be the changes in emission factors. Changes in emission factors result from strengthened legislation with regard to emission standards.

The stock data behind the 2005-2030 fuel use and emission projections are shown in Annex 3. The 2005-2030 fuel use and emission results are given in CollectER format (agriculture, forestry, industry, household and gardening and inland waterways) together with fuel related emission factors.

6.1 Fuel use and emissions

6.1.1 Agriculture

In Table 41 the fuel use and emission results for agriculture are shown for 2010, 2015, 2020, 2025 and 2030, and as percentages of the 2004 results. In Annex 4 the 2005-2030 fuel use, emissions and fuel related emission factors are listed for tractors, harvesters, machine pool machinery types, other agriculture machinery (per fuel type) and ATV's.

Table 41 Fuel use and emissions for agriculture in selected forecast years

Year	Fuel [TJ]	SO_2 [tons]	NO_x [tons]	NMVOC [tons]	CH_4 [tons]	CO [tons]	CO_2 [ktons]	N_2O [tons]	NH_3 [tons]	TSP [tons]
2010	13217	6	8085	1059	48	10509	978	41	3	640
2015	12607	6	5308	745	43	9439	933	40	3	362
2020	12438	6	3300	602	40	8742	920	40	3	179
2025	12504	6	2080	544	39	8423	925	40	3	117
2030	12376	6	1151	477	38	8113	916	40	3	69
2010 (% of 2004)	96	2	68	63	77	70	96	98	98	64
2015 (% of 2004)	92	2	45	45	69	63	92	94	95	36
2020 (% of 2004)	90	2	28	36	65	58	90	93	94	18
2025 (% of 2004)	91	2	18	33	63	56	91	94	95	12
2030 (% of 2004)	90	2	10	29	62	54	90	93	94	7

The figures in Table 41 and the curves on Figure 35 show a fuel use and emission decrease from 2004-2030. For TSP, NO_x, NMVOC and CO this is due to the gradually strengthened emission legislation standards (see also Figure 36, tractors as an example). In this way the 2030 emissions become only 7, 10, 29 and 54 of the emission level in 2004. For fuel use, the total decrease is due to the decrease in tractor numbers and fuel efficiency improvements which all in all have a greater fuel use impact than the general engine size increase. The remarkable decrease in SO_2 emissions is due to the lowering of the sulphur percentage in the fuel from 500 to 10 ppm in 2005.

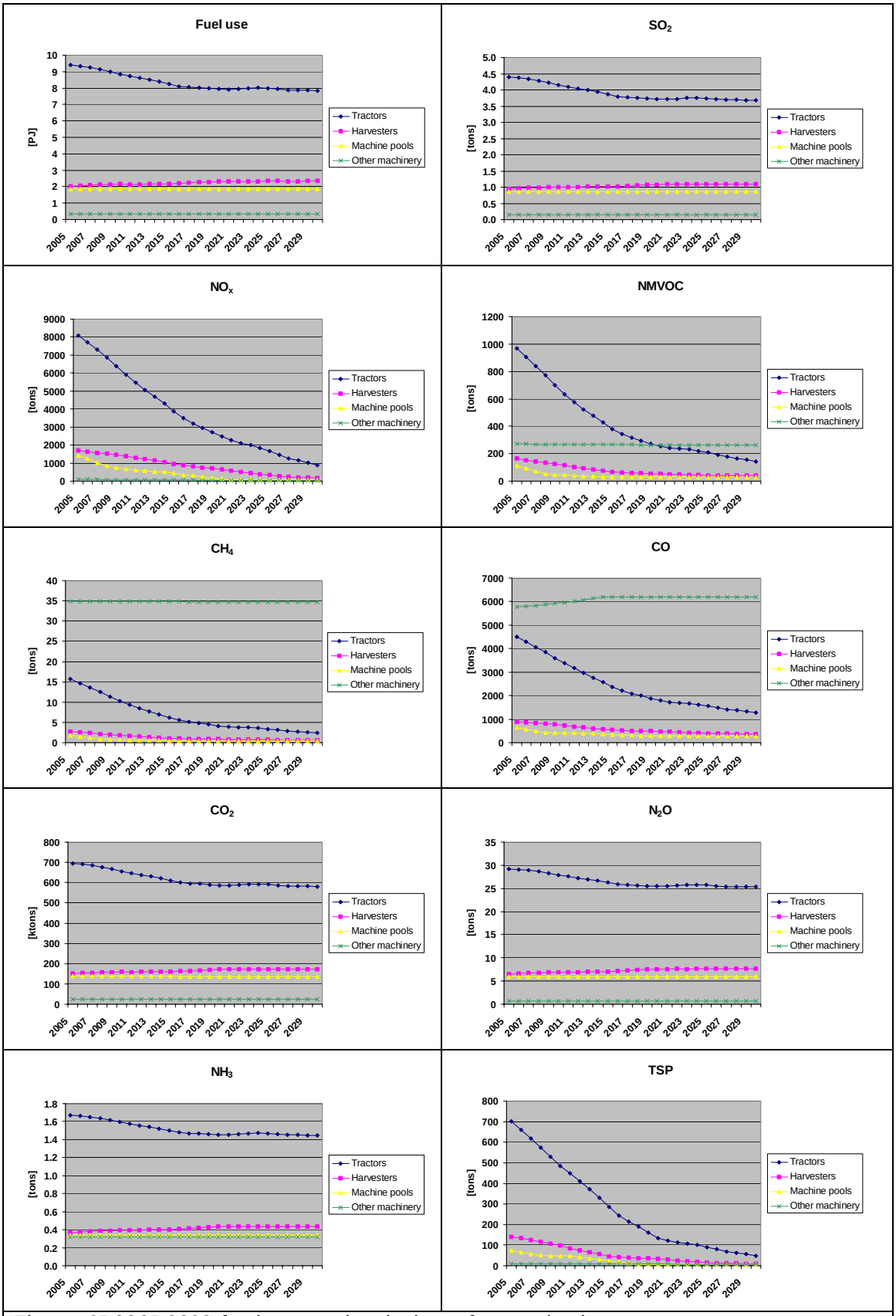


Figure 35 2005-2030 fuel use and emissions for agriculture

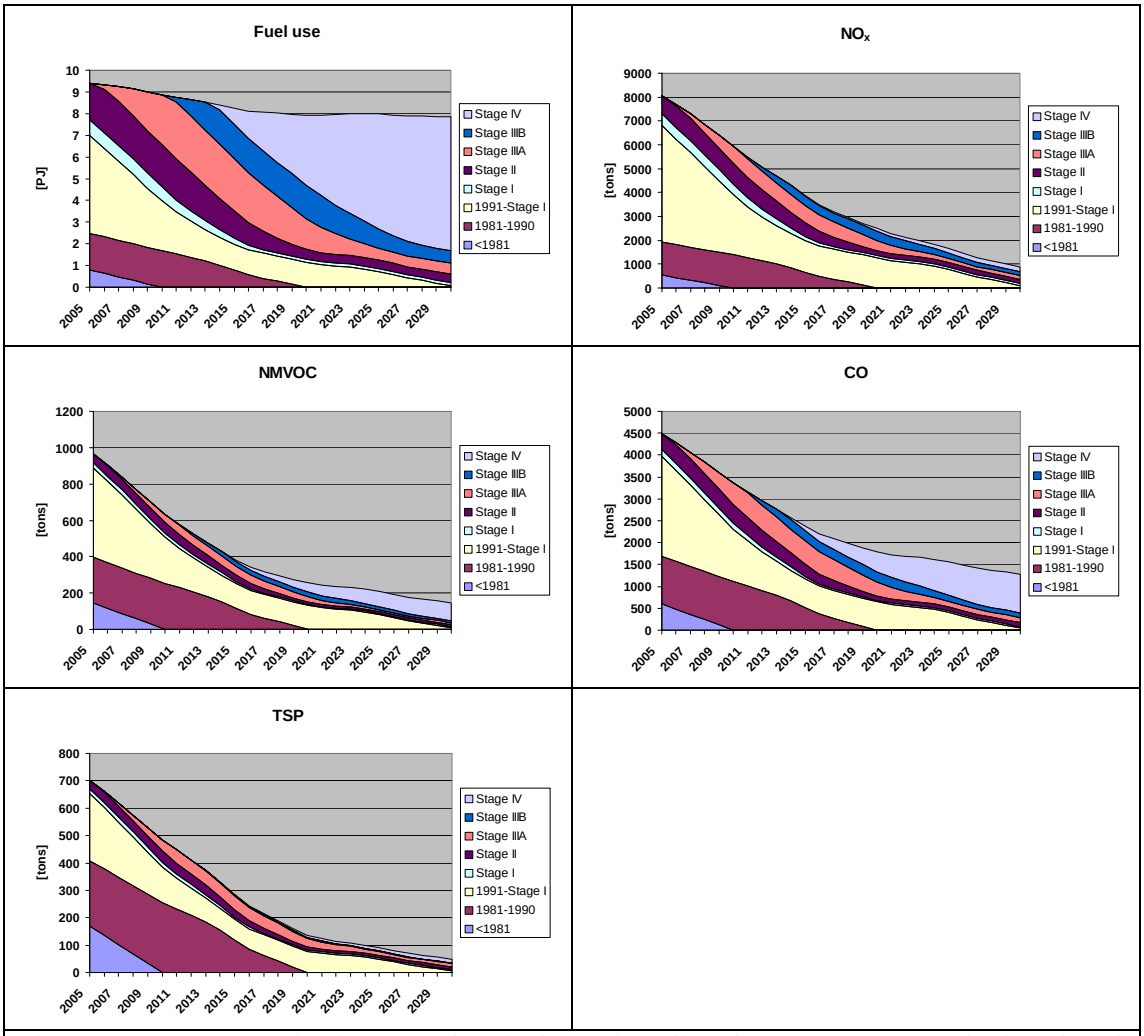


Figure 36 2005-2030 fuel use and emissions for diesel tractors per emission level

6.1.2 Forestry

Table 42 shows the 2010, 2015, 2020, 2025 and 2030 fuel use and emission results for forestry, together with the calculated percentages of the 2004 results. In Annex 4 the 2005-2030 fuel use, emissions and fuel related emission factors are listed for diesel and gasoline fuelled machinery, respectively.

Table 42 Fuel use and emissions for forestry in selected forecast years

Year	Fuel [TJ]	SO_2 [tons]	NO_x [tons]	NMVOC [tons]	CH_4 [tons]	CO [tons]	CO_2 [ktons]	N_2O [tons]	NH_3 [tons]	TSP [tons]
2010	230	0	70	366	3	1295	17	1	0	10
2015	228	0	42	281	2	1285	17	1	0	8
2020	228	0	19	281	2	1280	17	1	0	7
2025	228	0	13	280	2	1280	17	1	0	6
2030	228	0	12	280	2	1280	17	1	0	6
2010 (% of 2004)	97	3	52	72	70	100	97	100	100	78
2015 (% of 2004)	96	3	31	55	52	100	96	100	100	62
2020 (% of 2004)	96	3	14	55	52	99	96	100	100	51
2025 (% of 2004)	96	3	10	55	52	99	96	100	100	49
2030 (% of 2004)	96	3	9	55	52	99	96	100	100	49

The impact on total NMVOC, CO and TSP emissions due to the emission reductions for tractors, harvesters and other diesel fuelled machinery are to some extend compensated for by the emission development for chain saws. The latter types of machinery have a relatively large gasoline fuel use. For forestry as a total, the largest emission decreases are calculated for SO_2, NO_x and TSP. Their respective emission levels in 2030 are 3, 9 and 49% of the 2004 levels.

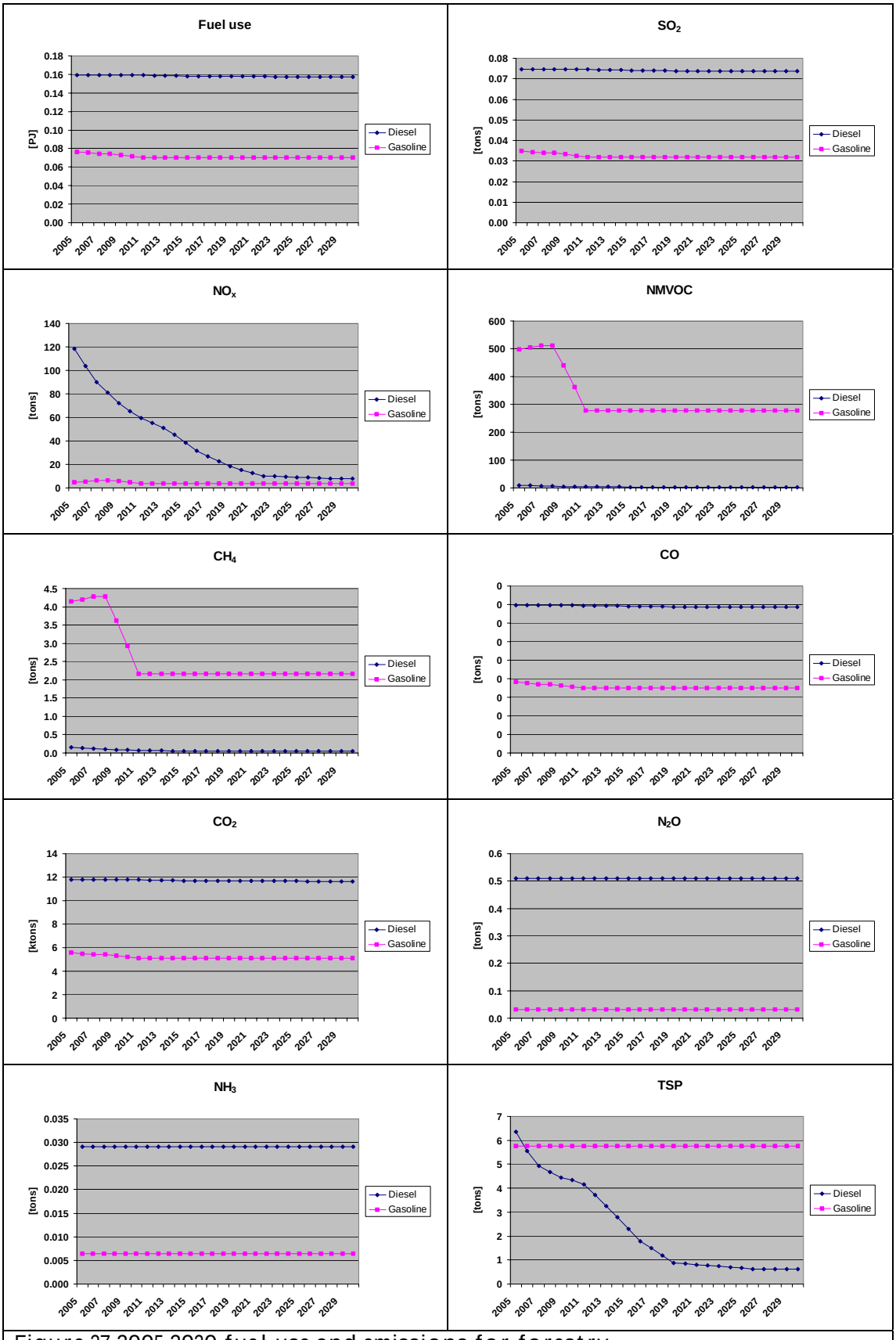


Figure 37 2005-2030 fuel use and emissions for forestry

6.1.3 Industry

Table 43 shows the 2010, 2015, 2020, 2025 and 2030 fuel use and emission results and calculated percentages of the 2004 results for non road machinery in industry. In Annex 4 the 2005-2030 fuel use, emissions and fuel related emission factors are listed for fork lifts (per fuel type) and for construction machinery.

Table 43 Fuel use and emissions for industry in selected forecast years

Year	Fuel [TJ]	SO_2 [tons]	NO_x [tons]	NMVOC [tons]	CH_4 [tons]	CO [tons]	CO_2 [ktons]	N_2O [tons]	NH_3 [tons]	TSP [tons]
2010	12336	5	7733	1124	37	6047	904	38	2	643
2015	12304	5	6218	922	33	5572	902	38	2	471
2020	12037	5	4845	773	30	4979	883	38	2	315
2025	11923	5	4156	734	29	4809	875	38	2	273
2030	11884	5	4077	719	29	4717	872	38	2	257
2010 (% of 2004)	99	2	72	67	80	80	99	99	99	62
2015 (% of 2004)	99	2	58	55	72	73	99	99	99	45
2020 (% of 2004)	97	2	45	46	65	66	97	98	98	30
2025 (% of 2004)	96	2	39	44	64	63	96	97	97	26
2030 (% of 2004)	95	2	38	43	63	62	96	97	97	25

The impact on total NMVOC, CO and TSP emissions coming from the generally large emission decreases for diesel fuelled machinery (construction machinery, fork lifts, other types) are to some extend compensated for by the emission development for LPG fuelled fork lifts. For industry as a total, the largest 2004-2030 emission decreases are 98, 75 and 62% for SO_2, TSP and NO_x.

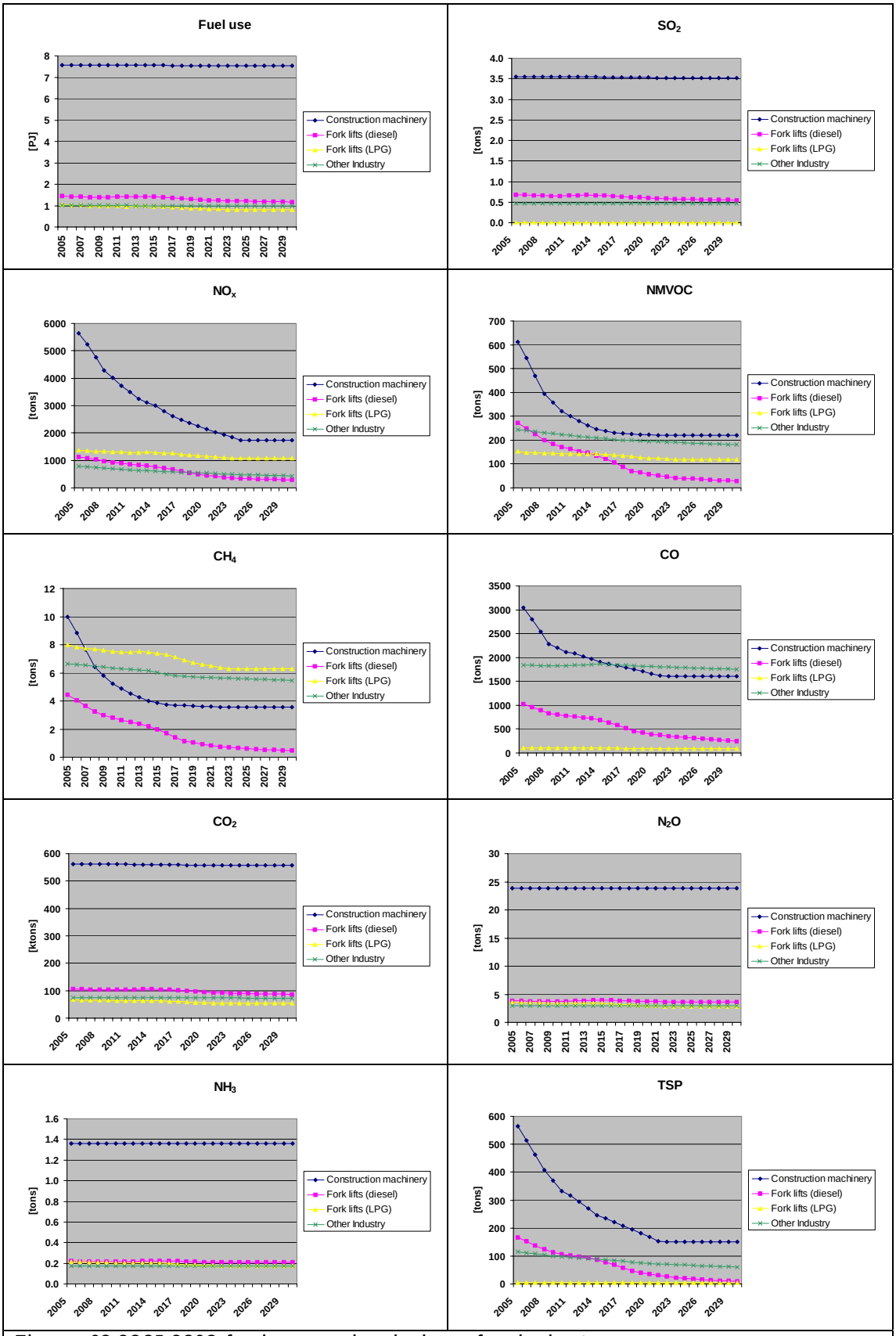


Figure 38 2005-2030 fuel use and emissions for industry

6.1.4 Household and gardening

Table 44 shows the 2010, 2015, 2020, 2025 and 2030 fuel use and emission results and calculated percentages of the 2004 results for household and gardening workg machines. In Annex 4 the 2005-2030 fuel use, emissions and fuel related emission factors are listed for 2-stroke and 4-stroke gasoline engines, respectively.

Table 44 Fuel use and emissions for household and gardening in selected forecast years

Year	Fuel [TJ]	SO_2 [tons]	NO_x [tons]	NMVOC [tons]	CH_4 [tons]	CO [tons]	CO_2 [ktons]	N_2O [tons]	NH_3 [tons]	TSP [tons]
2010	3974	2	367	6976	278	123951	290	5	0	89
2015	3934	2	377	5845	259	127421	287	5	0	90
2020	3928	2	377	5721	258	128134	287	5	0	90
2025	3928	2	377	5721	258	128134	287	5	0	90
2030	3928	2	377	5721	258	128134	287	5	0	90
2010 (% of 2004)	97	19	116	80	96	109	97	100	100	102
2015 (% of 2004)	96	19	119	67	89	112	96	100	100	103
2020 (% of 2004)	96	19	119	66	89	112	96	100	100	103
2025 (% of 2004)	96	19	119	66	89	112	96	100	100	103
2030 (% of 2004)	96	19	119	66	89	112	96	100	100	103

For household and gardening equipment, the largest emission declines are calculated for SO_2, NMVOC and CH_4; the 2004-2030 emission decreases are 81, 34 and 11%, respectively. For NO_x, CO and TSP, the emissions increase by 19, 12 and 3% in the same time period, mainly driven by the emission developments for lawn movers and cultivators (due to their specific emission deterioration patterns). Figure 39 shows the 2005-2030 fuel use and emission curves for the different types of household and gardening equipment.

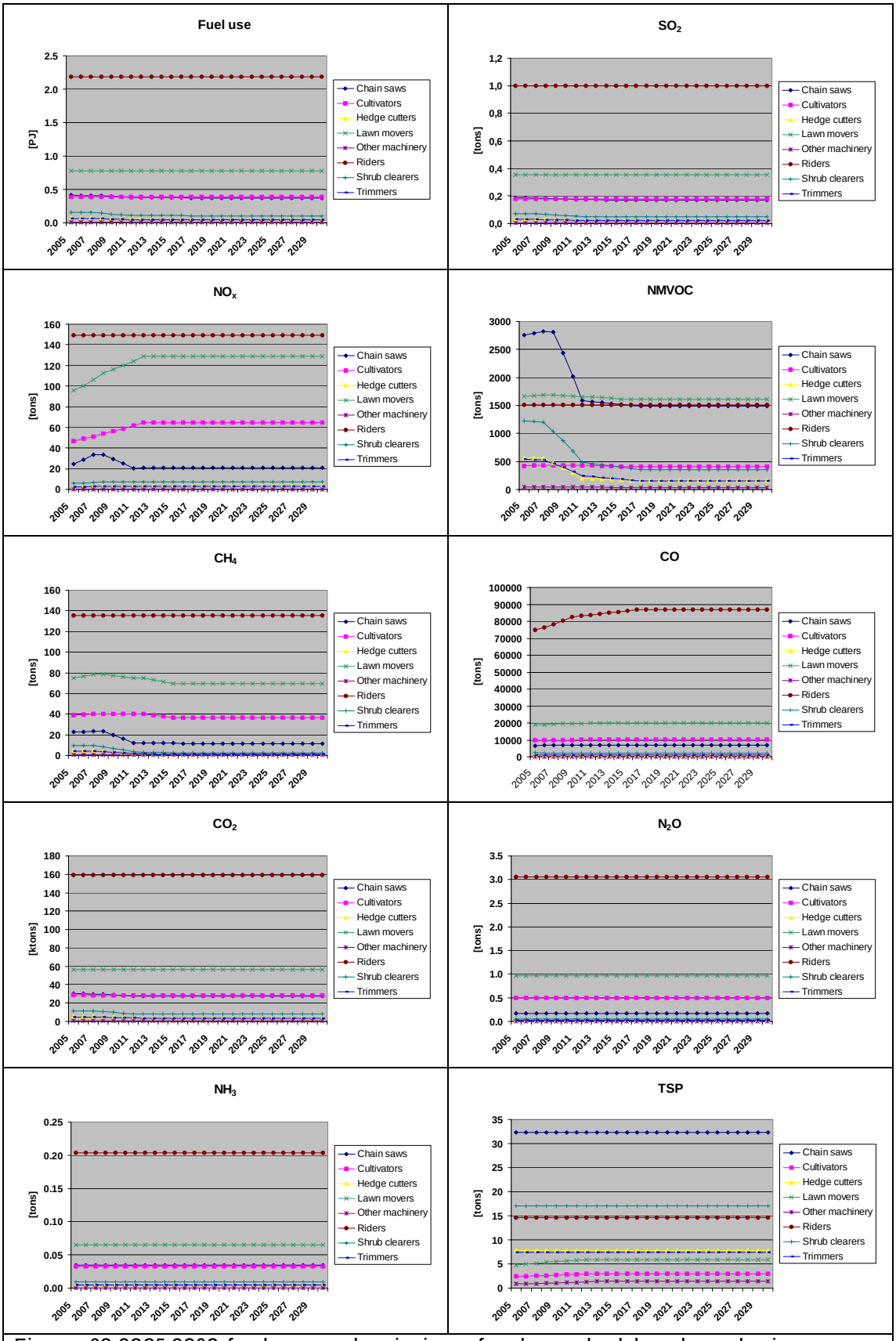


Figure 39 2005-2030 fuel use and emissions for household and gardening

In Figure 40 the emission level specific fuel use and emission curves for 2-stroke and 4-stroke engines are shown for the 2005-2030 forecast period. A complete shift to engines complying with the stage II emission legislation levels is finalised in 2017 and 2018, for 2-stroke and 4-stroke engines respectively.

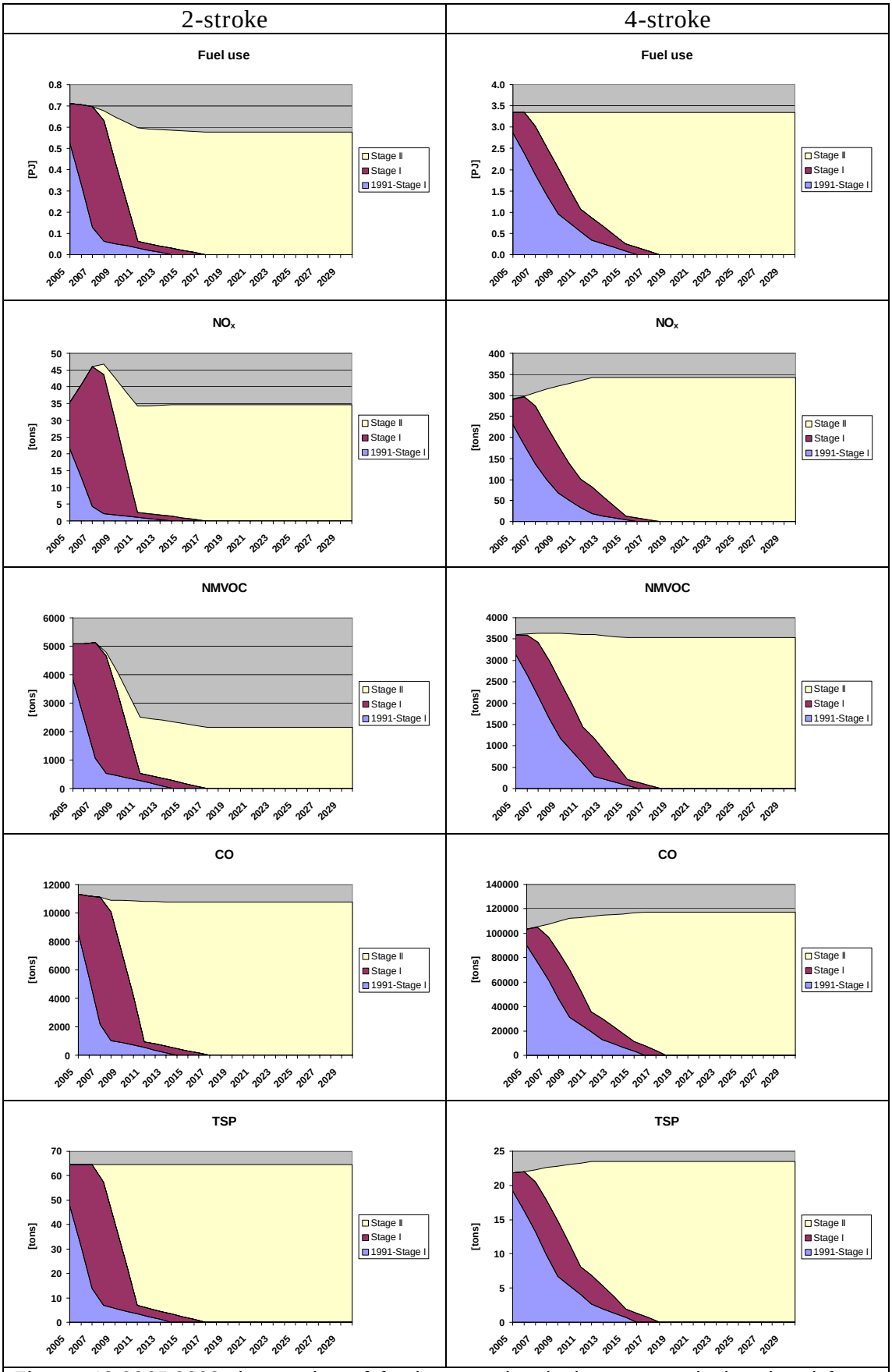


Figure 40 2005-2030 time series of fuel use and emissions per emission level for 2-stroke and 4-stroke household and gardening equipment

6.1.5 Inland waterways

Table 45 shows the 2010, 2015, 2020, 2025 and 2030 fuel use and emission results and calculated percentages of the 2004 results for recreational craft. In Annex 4 the 2005-2030 fuel use, emissions and fuel related emission factors are listed for diesel engines, and 2-stroke and 4-stroke gasoline engines, respectively.

Table 45 Fuel use and emissions for recreational craft in selected forecast years

Year	FC [TJ]	SO_2 [tons]	NO_x [tons]	NMVOC [tons]	CH_4 [tons]	CO [tons]	CO_2 [ktons]	N_2O [tons]	NH_3 [tons]	TSP [tons]
2010	1348	94	1022	567	24	4985	99	3	0	111
2015	1330	94	986	370	24	3039	98	4	0	93
2020	1330	94	943	360	24	3030	98	4	0	86
2025	1330	94	943	360	24	3030	98	4	0	86
2030	1330	94	943	360	24	3030	98	4	0	86
2010 (% of 2004)	96	99	98	48	98	73	96	102	100	72
2015 (% of 2004)	95	99	95	31	96	44	95	103	100	61
2020 (% of 2004)	95	99	91	30	96	44	95	103	100	56
2025 (% of 2004)	95	99	91	30	96	44	95	103	100	56
2030 (% of 2004)	95	99	91	30	96	44	95	103	100	56

The contemporary phase-out of 2-stroke engines and phase-in of 4-stroke engines, finalised in 2015, is clearly visible from the fuel use and emission curves shown in Figure 41. However, in spite of the increased use of 4-stroke engines for small boats, the emissions of CO decrease significantly for this motor type. This is due to markedly lower emission factors for engines complying with the EU 2003/44 emission directive compared with the conventional ones. For the same reason the NO_x and TSP emissions decline for diesel engines.

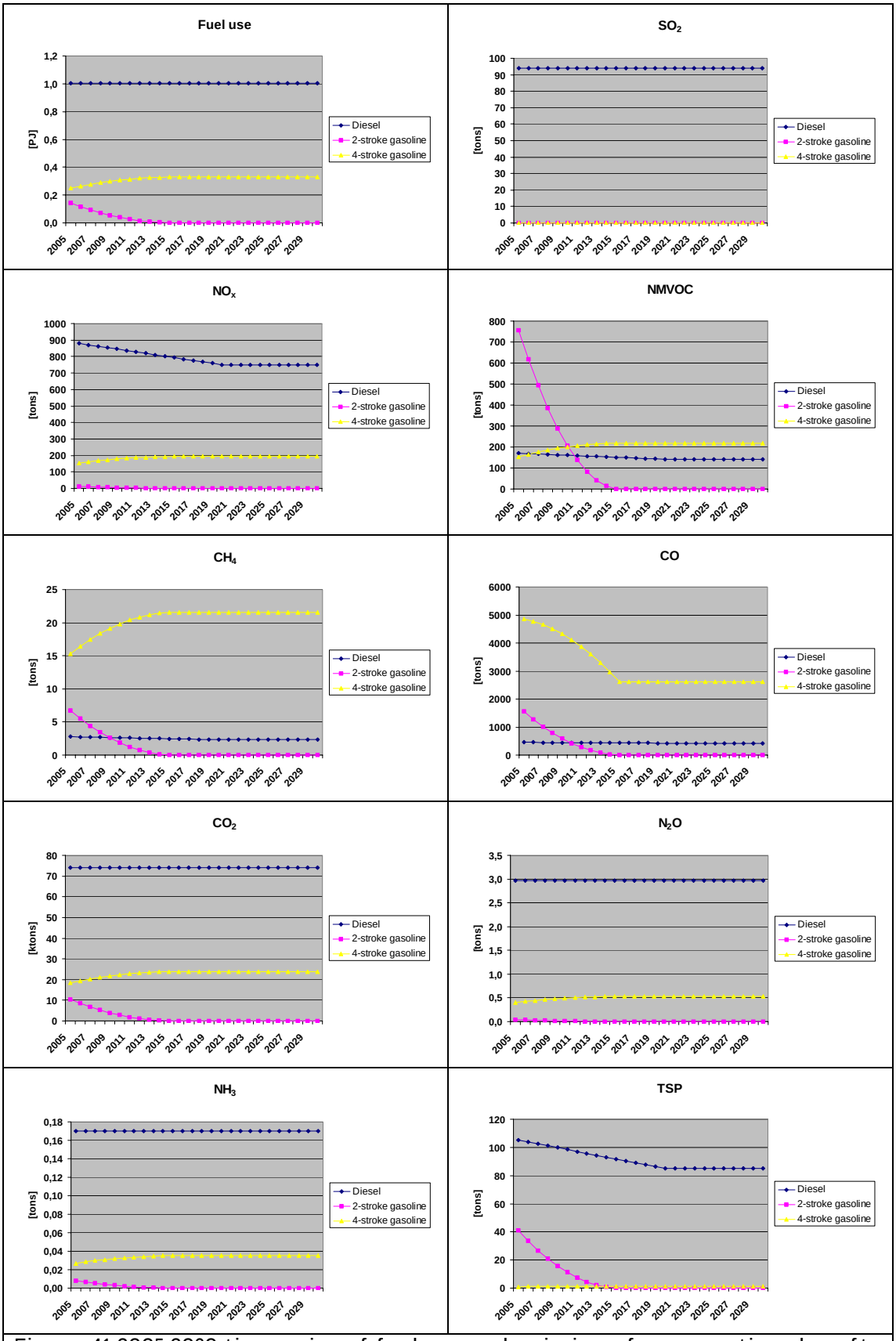


Figure 41 2005-2030 time series of fuel use and emissions for recreational craft

7 Conclusion

The diesel fuelled machinery in agriculture and industry are the most important sources of fuel use and emissions of SO_2, NO_x, CO_2, N_2O, NH_3 and TSP in 2004. Agricultural tractors is the most dominant single source, with fuel use and emission totals of around one third of the grand totals for land based non road machinery.

For diesel machinery as a total, the fuel use and emissions of SO_2, CO_2, NMVOC, CH4, CO and TSP decrease by 6, 91, 6, 43, 43, 33 and 54%, respectively, from 1985-2004. In the same time period the emissions of NO_x, N_2O and NH_3 increase by 4, 2 and 2%, respectively.

The trend in total diesel fuel use (and CO_2) is dominated by a decrease in fuel use for agricultural machinery, and an increase in fuel use especially for non road construction machinery and fork lifts. The significant SO_2 emission decline is caused by a large reduction of the sulphur content in non road diesel. For NO_x, the slight emission increase is due to the relatively large 1991-stage I emission factors, whereas the large emission reductions for NMVOC, CH_4, CO and TSP are due to the gradually improved engine emission techonology for these emission components.

The development towards cleaner diesel engines continues in the future, and for NO_x, NMVOC, CH_4, CO and TSP the total emissions decrease by 81, 78, 78, 63 and 85% from 2004-2030. This is due to the gradually strengthened future EU emission standards. A significant reduction of the sulphur content for diesel in 2005 cuts down the diesel related SO_2 emissions by as much as 98%. In the 2004-2030 time period there is a moderate decline in fuel use and CO_2, N_2O and NH_3 emissions, mainly due to a decrease in the use of agricultural tractors.

Most of the NMVOC, CH_4 and CO emissions come from gasoline fuelled working machinery. Set in relation to the total land based non road emissions, the NMVOC emission share is 26% for chain saws used in forestry and for household, and for CH_4 and CO the emission shares for riders (private and professional) are 34 and 53%, respectively.

From 1985-2004 the emissions of NMVOC, CH_4 and CO from gasoline machinery increase by 18, 12 and 8%, respectively. From a broad perspective the engines have become more emission efficient, since the total gasoline fuel use has increased by 39% in the same time period. In the forecast period from 2004-2030 the gasoline related fuel use and emissions of NMVOC and CH_4 are expected to decrease by 5, 34 and 11%, respectively, whereas an emission increase of 9% is calculated for CO. Here, small or zero emission factor reductions for stage I and II engines in combination with higher deterioration factors cause the CO emissions for gasoline machinery to increase even after the time of stage I and II engines entering the market.

For recreational craft, most of the fuel use, SO_2, NO_x, CO_2, N_2O, NH_3 and TSP emissions are attributed to the diesel engine category, while most of the NMVOC, CH_4 and CO emissions come from gasoline fuelled engines, as is the case for land based non road machinery. However, compared with the latter machinery group, the fuel use and emissions from sailing vessels are small.

From 1985 to 2004 there has been a large increase in sailing activities, most significantly for diesel fuelled boats, and a gradual shift from 2-stroke to 4-stroke technology for gasoline engines. These tendencies are reflected in the increases of fuel use (188%), N_2O (300%), NH_3 (258%), NO_x (239%), SO_2 (201%), CO_2 (189%), TSP (106%), CO (81%), CH_4 (75%) and NMVOC (13%). The overall diesel fuel increase is the main reason for the SO_2, NO_x, CO_2, N_2O, NH_3 and TSP emission growths, whereas the increase in gasoline fuel use explains the CO and CH_4 emission inclines. The small NMVOC emission increase is explained by the gasoline engine shift to the more environmentally friendly 4-stroke technology, since total gasoline fuel use has gone up with 50% from 1985 to 2004.

From 2004 to 2030 the emissions of NMVOC and CO are expected to significantly decrease due to the 2-stroke/4-stroke technology shift (NMVOC) and the relatively low future EU 2003/44 directive emission limit. The latter explanation also applies for the NO_x and TSP emission decreases, mainly ruled by the emission trend for diesel fuelled boats.

For non road machinery in 2004 the uncertainties (given in brackets)for fuel use and CO_2 emissions are determined with the highest accuracy (18%), followed by SO_2 and TSP (35%), NO_x (37%), NMVOC (40%), CH_4 (43%), CO (48%), NH_3 (619%) and N_2O (621%). The uncertainties are calculated as the 95% confidence ratios.

Since tractors are the largest individual source of fuel use and emissions it is important to increase the accuracy of the operational background data used in the inventory calculations for this non road machinery type. Data for the load factor assessment made in this report originates from a study carried out in 1987. Even though the agricultural machinery stock in principle must match the farm work requirements on a daily basis, the load factor assessment rely on old data and it would be useful to make the load factor calculation once again with an updated data set.

For machine pool machinery it is also important to further evaluate the operational parameters engine size and annual working hours, and specifically for harvesters the kW:ft ratio needs to be reassessed.

An important outcome of the present study has been the establishment of contacts with Danish experts dealing with statistical data and experts from research institutes, relevant professional bodies, machinery manufacturers, etc. It is the future goal to obtain information of new sales and total stock on an annual basis, in order to ensure continuously updated inventories. To the extent that statistical numbers are produced, new sales figures for tractors, harvesters, construction machinery and fork lifts should be gathered together with total stock data for household/gardening machinery, and recreational craft.

Specifically for agriculture, two major inventory improvements are envisaged in the nearest future. By all means, total stock data for tractors and harvesters will be published by Statistics Denmark for 2005. These figures go directly into the inventory for 2005, and will in addition improve the 2001-2004 total stock numbers by means of interpolation. On the energy side and starting from 2005, more detailed fuel sales information from the Danish Energy Authority classifies the amount of diesel fuel used for non road mobile purposes. The latter figure is an important tool for fuel use quality control and enables a regular fuel balance to be made for the agricultural part.

On a European level, the purpose of the EMEP/CORINAIR guidebook published by the European Environment Agency is to provide inventory support for country estimates. However, the guidebook data are more than ten years old and consequently the demand for new data is becoming more and more urgent. The fuel use and emission data used in the German inventory (IFEU, 2004) and in the present report are able to support this task, and an effort should therefore be made to include these data in the EMEP/CORINAIR guidebook.

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Annex 1: Stock data 1985-2004

Stock data for diesel tractors 1985-2004

Size (kW)	Emission Level	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
37	<1981	3882	3792	3542	3543	3403	3234	3106	2922	2861	2610	2605	2273	2193	1918	1796	1601	1442	1282	1121	961
37	1981-1990	635	731	760	835	855	879	889	883	915	887	945	883	918	869	888	871	871	871	871	871
37	1991-Stage I							25	107	153	201	278	354	445	496	554	568	569	569	569	569
37	Stage I																	33	55	81	81
37	Stage II																				26
45	<1981	25988	25387	23709	23718	22781	21650	20796	19563	19154	17475	17441	15219	14684	12840	12025	10715	9652	8580	7507	6435
45	1981-1990	5740	6808	7263	8075	8476	8770	8867	8805	9128	8848	9419	8807	9151	8668	8856	8681	8688	8688	8688	8688
45	1991-Stage I							203	202	209	203	216	202	210	199	203	199	199	199	199	199
49	1991-Stage I								154	281	485	602	618	702	749	765	750	750	750	750	750
52	1991-Stage I															247	358	359	359	359	359
52	Stage I																	132	239	368	368
52	Stage II																				129
56	1991-Stage I								201	338	428	747	943	1181	1280	1307	1281	1282	1282	1282	1282
60	<1981	54651	53387	49857	49877	47907	45529	43732	41140	40278	36747	36676	32004	30879	27001	25287	22533	20297	18042	15787	13532
60	1981-1990	11751	14613	15795	17797	19395	20542	20770	20624	21380	20725	22063	20628	21434	20304	20744	20333	20351	20351	20351	20351
60	1991-Stage I							863	857	888	861	917	857	891	844	862	845	846	846	846	846
63	1991-Stage I								468	855	1325	2014	2384	2837	3011	3076	3015	3018	3018	3018	3018
67	1991-Stage I															671	1343	1344	1344	1344	1344
67	Stage I																	530	824	1088	1088
67	Stage II																				263
71	1991-Stage I								411	715	1179	1949	2507	3344	3594	3672	3600	3603	3603	3603	3603
78	<1981	14558	14221	13281	13286	12761	12128	11649	10959	10729	9789	9770	8525	8226	7192	6736	6002	5407	4806	4205	3605
78	1981-1990	4592	6152	7196	8559	10026	11323	11448	11368	11785	11424	12162	11371	11815	11192	11434	11208	11218	11218	11218	11218
78	1991-Stage I							1233	1503	1713	1945	2429	2561	2946	2994	3287	3436	3709	3709	3709	3709
78	Stage I																		321	321	321
78	Stage II																			222	443
86	1991-Stage I								108	193	333	589	880	1364	1532	1718	1876	2013	2013	2013	2013

86	Stage I																			133	133	133
86	Stage II																				89	178
93	1991-Stage I																149	245	323	323	323	323
93	Stage I																			112	112	112
93	Stage II																				104	208
97	1991-Stage I								71	175	443	962	1556	2327	2638	2695	2642	2644	2644	2644	2644	2644
101	<1981	4659	4551	4250	4252	4084	3881	3728	3507	3433	3132	3126	2728	2632	2302	2156	1921	1730	1538	1346	1153	
101	1981-1990	1158	1434	1618	1921	2156	2377	2403	2387	2474	2398	2553	2387	2480	2350	2400	2353	2355	2355	2355	2355	
101	1991-Stage I							266	264	274	266	283	264	275	260	696	1116	1559	1559	1559	1559	
101	Stage I																			229	229	229
101	Stage II																				133	265
112	1991-Stage I								63	114	166	252	422	690	790	978	1265	1618	1618	1618	1618	
112	Stage I																			459	459	459
112	Stage II																				329	659
127	1991-Stage I								12	36	81	193	279	408	457	590	707	843	843	843	843	
127	Stage I																			150	150	150
127	Stage II																				77	153
131	<1981	798	780	728	728	700	665	639	601	588	537	536	467	451	394	369	329	296	263	231	198	
131	1981-1990	288	421	500	651	753	887	897	890	923	895	952	890	925	876	895	878	878	878	878	878	
131	1991-Stage I							97	97	100	97	103	97	100	95	97	95	95	95	95	95	
157	1981-1990		2	3	6	11	15	15	15	16	15	16	15	16	15	15	15	15	15	15	15	
157	1991-Stage I							9	23	39	102	232	357	545	648	784	900	901	901	901	901	
157	Stage I																	88	88	88	88	
157	Stage II																		147	406	665	
186	1991-Stage I															23	53	53	53	53	53	
186	Stage I																	47	47	47	47	
186	Stage II																		67	202	337	

Stock data for gasoline tractors 1985-2004

Size (kW)	Emission Level	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Certified	<1981	13176	12541	11906	11270	10635	10000	9053	8148	7285	6465	5687	4951	4258	3607	2998	2432	1908	1427	987	591
Non certified	<1981	26352	25082	23811	22541	21270	20000	19042	18041	16998	15913	14785	13616	12403	11149	9852	8512	7131	5707	4240	2732

Stock data for harvesters 1985-2004

Size Group	Emission Level	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
0<S<=50	<1981	26601	24394	22599	22144	19842	18915	17241	15607	14575	12673	10700	9491	6966	5446	3589	2873	1743	1169	659	217
0<S<=50	1981-1990	519	534	550	582	566	591	594	601	635	636	633	683	641	686	672	715	713	713	713	713
50<S<=60	<1981	2703	2648	2634	2785	2711	2828	2847	2876	3040	3044	3029	3271	3068	2930	2235	1999	1477	1155	784	316
50<S<=60	1981-1990	853	1102	1164	1275	1258	1333	1341	1355	1432	1434	1427	1541	1446	1548	1516	1612	1609	1609	1609	1609
50<S<=60	1991-Stage I							8	8	8	8	8	9	9	9	9	10	10	10	10	10
60<S<=70	<1981	1786	1750	1741	1841	1792	1869	1881	1901	2009	2012	2002	2162	2028	2171	2127	2073	1550	1228	857	390
60<S<=70	1981-1990	1138	1679	1943	2237	2213	2348	2363	2388	2524	2527	2515	2716	2547	2727	2671	2841	2834	2834	2834	2834
60<S<=70	1991-Stage I							8	16	18	21	22	24	23	24	24	25	25	25	25	25
70<S<=80	<1981	929	910	905	958	932	972	979	989	1045	1046	1041	1125	1055	1129	1106	1176	1174	1013	642	174
70<S<=80	1981-1990	383	699	1026	1165	1318	1493	1502	1518	1604	1606	1598	1726	1619	1733	1698	1806	1802	1802	1802	1802
70<S<=80	1991-Stage I							72	77	83	86	87	96	91	98	96	102	102	102	102	102
70<S<=80	Stage I															1	1	1	1	1	1
80<S<=90	<1981	323	317	315	333	324	338	340	344	363	364	362	391	367	393	385	409	408	408	408	174
80<S<=90	1981-1990	383	562	645	967	1107	1466	1475	1491	1575	1577	1570	1695	1590	1702	1667	1773	1769	1769	1769	1769
80<S<=90	1991-Stage I							61	158	181	200	200	217	207	222	217	231	231	231	231	231
80<S<=90	Stage I															1	1	1	1	1	1
90<S<=100	1981-1990	89	175	235	387	515	670	674	681	720	721	717	775	726	778	762	810	808	808	808	808
90<S<=100	1991-Stage I							180	257	320	329	351	382	367	393	385	410	409	409	409	409
90<S<=100	Stage I															1	1	1	1	1	1
100<S<=120	1981-1990		54	106	219	334	589	592	599	633	634	630	681	639	684	670	712	711	711	711	711
100<S<=120	1991-Stage I							129	253	316	375	440	567	586	673	660	702	700	700	700	700

100<S<=120	Stage I													2	2	2	2	2	2
120<S<=140	1981-1990	4	69	183	184	186	197	197	196	212	199	213	208	222	221	221	221	221	221
120<S<=140	1991-Stage I				70	148	189	215	319	484	626	804	860	918	920	920	920	920	920
120<S<=140	Stage I												21	26	30	30	30	30	30
120<S<=140	Stage II															5	8	10	
140<S<=160	1991-Stage I					8	36	69	112	271	354	554	632	715	747	747	747	747	747
140<S<=160	Stage II															24	41	55	
160<S<=180	1991-Stage I								26	69	200	374	440	534	566	566	566	566	566
160<S<=180	Stage II															39	66	89	
180<S<=200	1991-Stage I									20	67	117	193	249	282	282	282	282	282
180<S<=200	Stage II															59	86	109	
200<S<=220	1991-Stage I											45	92	143	175	175	175	175	175
200<S<=220	Stage II															39	66	89	
220<S<=240	1991-Stage I												3	48	142	142	142	142	142
220<S<=240	Stage II															74	113	146	
240<S<=260	1991-Stage I												3	71	133	133	133	133	133
240<S<=260	Stage II															74	125	168	
260<S<=280	1991-Stage I												14	61	123	123	123	123	123
260<S<=280	Stage II															74	125	168	
280<S<=300	1991-Stage I														31	31	31	31	31
280<S<=300	Stage II															74	125	168	
300<S<=320	Stage II																26	47	

Stock data for fork lifts 1985-2004

Fuel type	Size (kW)	Emission Level	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Diesel	35	<1981	387	361	336	311	285	260	234	209	183	158	133	107	84	58	30					
Diesel	35	1981-1990	120	162	202	239	270	297	297	297	297	297	297	297	297	297	297	297	277	249	232	198
Diesel	35	1991-Stage I							26	49	65	93	131	168	218	247	275	304	304	304	304	304
Diesel	35	Stage II																	23	53	75	89

Diesel	45	<1981	1612	1506	1400	1294	1188	1082	976	870	764	658	552	446	349	243	126					
Diesel	45	1981-1990	499	674	839	994	1122	1233	1233	1233	1233	1233	1233	1233	1233	1233	1233	1233	1151	1036	964	820
Diesel	45	1991-Stage I							108	203	270	386	544	699	905	1063	1063	1063	1063	1063	1063	1063
Diesel	45	Stage I															151	303	422	524	664	664
Diesel	45	Stage II																				104
Diesel	50	<1981	2173	2031	1888	1745	1602	1459	1316	1174	1031	888	745	602	471	328	170					
Diesel	50	1981-1990	673	909	1131	1340	1512	1662	1662	1662	1662	1662	1662	1662	1662	1662	1662	1662	1551	1396	1299	1105
Diesel	50	1991-Stage I							145	273	363	519	732	940	1217	1469	1469	1469	1469	1469	1469	1469
Diesel	50	Stage I															240	461	682	897	1135	1135
Diesel	50	Stage II																				187
Diesel	75	<1981	497	465	432	399	367	334	301	269	236	203	170	138	108	75	39					
Diesel	75	1981-1990	154	208	259	307	347	382	382	382	382	382	382	382	382	382	382	382	357	321	299	255
Diesel	75	1991-Stage I							33	63	84	120	169	217	281	354	354	354	354	354	354	354
Diesel	75	Stage I															70	162	234	311	311	311
Diesel	75	Stage II																			58	129
Diesel	120	<1981	111	103	96	89	81	74	67	60	52	45	38	31	24	17	9					
Diesel	120	1981-1990	34	46	57	68	77	85	85	85	85	85	85	85	85	85	85	85	80	72	67	57
Diesel	120	1991-Stage I							7	14	19	27	38	49	63	97	97	97	97	97	97	97
Diesel	120	Stage I															32	71	89	118	118	118
Diesel	120	Stage II																			16	38
LPG	33		5420	5427	5390	5323	5265	5215	5156	5068	4947	4863	4835	4792	4732	4765	4712	4718	4677	4655	4595	4494
LPG	40		4917	4923	4889	4828	4775	4730	4676	4596	4486	4410	4384	4344	4289	4295	4223	4218	4214	4244	4224	4166
LPG	50		2149	2151	2137	2110	2087	2067	2044	2008	1960	1926	1915	1897	1874	1926	1941	1897	1938	2003	2020	2018
LPG	78		97	97	96	95	94	93	92	91	89	88	88	87	86	90	92	88	95	98	99	104
LPG	120															1	2	2	2	3	3	3

Stock data for construction machinery 1985-2004

EquipmentName (Eng)	Emission Level	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Track type dozers	<1981	125	100	75	50	25															
Track type dozers	1981-1990	125	150	175	200	225	250	221	193	166	139	114	89	66	43	21					
Track type dozers	1991-Stage I							25	48	71	93	114	134	153	172	189	206	201	177	154	132
Track type dozers	Stage II																		20	38	56
Track type loaders	<1981	50	40	30	20	10															
Track type loaders	1981-1990	50	60	70	80	90	100	89	79	68	58	48	38	28	19	9					
Track type loaders	1991-Stage I							10	20	29	39	48	57	66	75	83	91	91	81	71	62
Track type loaders	Stage II																		9	18	26
Wheel loaders (0-5 tons)	1981-1990							186	331	434	496	517	496	434	331	186					
Wheel loaders (0-5 tons)	1991-Stage I							21	83	186	331	517	744	1013	1323	1674	2067	2046	1984	1881	1736
Wheel loaders (0-5 tons)	Stage II																	227	496	806	1158
Wheel loaders (> 5,1 tons)	<1981	1250	1000	750	500	250															
Wheel loaders (> 5,1 tons)	1981-1990	1250	1500	1750	2000	2250	2500	2228	1960	1698	1441	1188	941	698	460	228					
Wheel loaders (> 5,1 tons)	1991-Stage I							248	490	728	960	1188	1411	1629	1841	1822	1802	1559	1322	1089	861
Wheel loaders (> 5,1 tons)	Stage I															228	450	668	881	871	861
Wheel loaders (> 5,1 tons)	Stage II																			218	431
Wheel type excavators	<1981	500	400	300	200	100															
Wheel type excavators	1981-1990	500	600	700	800	900	1000	862	732	611	498	394	298	211	132	62					
Wheel type excavators	1991-Stage I							96	183	262	332	394	447	491	528	493	459	372	293	223	162
Wheel type excavators	Stage I															62	115	160	196	179	162
Wheel type excavators	Stage II																			45	81
Track type excavators (0-5 t)	1981-1990							459	816	1071	1224	1275	1224	1071	816	459					
Track type excavators (0-5 t)	1991-Stage I							51	204	459	816	1275	1837	2500	3265	4132	5101	5050	4897	4642	4285
Track type excavators (0-5 t)	Stage II																	561	1224	1990	2857
Track type excavators (> 5,1 t)	<1981	1000	800	600	400	200															
Track type excavators (> 5,1 t)	1981-1990	1000	1200	1400	1600	1800	2000	1798	1596	1394	1194	993	794	594	396	198					
Track type excavators (> 5,1 t)	1991-Stage I							200	399	598	796	993	1190	1387	1583	1581	1579	1380	1181	983	785
Track type excavators (> 5,1 t)	Stage I															198	395	591	787	786	785

Track type excavators (> 5,1 t)	Stage II																				197	393
Excavators/Loaders	<1981	2100	1680	1260	840	420																
Excavators/Loaders	1981-1990	2100	2520	2940	3360	3780	4200	3807	3408	3003	2592	2175	1752	1323	888	447						
Excavators/Loaders	1991-Stage I							423	852	1287	1728	2175	2628	3087	3552	3575	3599	3170	2735	2295	1848	
Excavators/Loaders	Stage I															447	900	1359	1824	2295	2310	
Excavators/Loaders	Stage II																				462	
Dump trucks	<1981	250	200	150	100	50																
Dump trucks	1981-1990	250	300	350	400	450	500	489	469	441	404	358	304	241	169	89						
Dump trucks	1991-Stage I							54	117	189	269	358	455	561	676	711	745	682	611	530	442	
Dump trucks	Stage I															89	186	292	407	530	552	
Dump trucks	Stage II																				110	
Mini loaders	<1981	1800	1600	1400	1200	1000	800	635	447	235												
Mini loaders	1981-1990	1000	1200	1400	1600	1800	2000	2118	2237	2355	2473	2332	2168	1980	1768	1532	1273	990	684	354		
Mini loaders	1991-Stage I							212	447	706	989	1296	1626	1980	2357	2758	3183	3301	3419	3537	3656	
Mini loaders	Stage II																	330	684	1061	1462	
Telescopic loaders	1981-1990											149	265	348	398	414	398	348	265	149		
Telescopic loaders	1991-Stage I											83	199	348	530	746	994	1160	1326	1491	1657	
Telescopic loaders	Stage II																	116	265	447	663	

Stock data for machine pools 1985-2004

Name	FuelCode	Emission Level	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Tractors	205B	<1981	1236	627																		
Tractors	205B	1981-1990	3091	3763	4575	4515	4370	4100	3643	2808	2368	1786	1214	604								
Tractors	205B	1991-Stage I							607	1123	1776	2382	3035	3624	4324	4210	4336	3956	4069	3323	2566	2053
Tractors	205B	Stage I																		554	513	513
Tractors	205B	Stage II																			513	1027
Harvesters	205B	<1981	969	776	661	472	287	139														
Harvesters	205B	1981-1990	807	932	1157	1257	1294	1385	1385	1197	927	794	712	512	421	282	162	78				
Harvesters	205B	1991-Stage I							139	266	348	454	593	615	737	751	729	778	779	651	531	472

Harvesters	205B	Stage II																	65	118	177
Self-propelled vehicles	205B	1981-1990							72	61	38										
Self-propelled vehicles	205B	1991-Stage I							72	122	190	263	278	277	295	289	314	237	203	153	
Self-propelled vehicles	205B	Stage II																47	102	153	

Stock data for household and gardening 1985-2004

Name	Emission Level	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Lawn movers (private)	<1981	253125	168750	84375																	
Lawn movers (private)	1981-1990	421875	506250	590625	675000	675000	675000	590625	506250	421875	337500	253125	168750	84375							
Lawn movers (private)	1991-Stage I							84375	168750	253125	337500	421875	506250	590625	675000	675000	675000	675000	675000	675000	675000
Lawn movers (professional)	1981-1990	25000	25000	25000	25000	25000	25000	18750	12500	6250											
Lawn movers (professional)	1991-Stage I							6250	12500	18750	25000	25000	25000	25000	25000	25000	25000	25000	25000	25000	25000
Cultivators (private-large)	1981-1990	110000	110000	110000	110000	110000	110000	88000	66000	44000	22000										
Cultivators (private-large)	1991-Stage I							22000	44000	66000	88000	110000	110000	110000	110000	110000	110000	110000	110000	110000	110000
Cultivators (private-small)	<1981	6667	6000	5333	4667	4000	3333	2667	2000	1333	667										
Cultivators (private-small)	1981-1990	3333	4000	4667	5333	6000	6667	6667	6667	6667	6667	6667	6000	5333	4667	4000	3333	2667	2000	1333	667
Cultivators (private-small)	1991-Stage I							667	1333	2000	2667	3333	4000	4667	5333	6000	6667	7333	8000	8667	9333
Cultivators (professional)	<1981	3750	2500	1250																	
Cultivators (professional)	1981-1990	6250	7500	8750	10000	10000	10000	8750	7500	6250	5000	3750	2500	1250							
Cultivators (professional)	1991-Stage I							1250	2500	3750	5000	6250	7500	8750	10000	10000	10000	10000	10000	10000	10000
Chain saws (private)	<1981	125000	100000	75000	50000	25000															
Chain saws (private)	1981-1990	125000	150000	175000	200000	225000	250000	227250	204000	180250	156000	131250	106000	80250	54000	27250					
Chain saws (private)	1991-Stage I							25250	51000	77250	104000	131250	159000	187250	216000	245250	275000	277003	279006	281009	298000
Chain saws (professional)	1981-1990	10000	10000	10000	10000	10000	10000	7333	4000												
Chain saws (professional)	1991-Stage I							3667	8000	13000	14000	15000	16000	17000	18000	19000	20000	27500	35000	42500	50000
Chain saws (forestry)	1981-1990	8000	8000	8000	8000	8000	8000	5048	2381												
Chain saws (forestry)	1991-Stage I							2524	4762	6714	6286	5857	5429	5000	4571	4143	3714	3286	2857	2429	2000

Riders (private)	<1981	40950	35100	29250	23400	17550	11700	6205													
Riders (private)	1981-1990	29250	35100	40950	46800	52650	58500	62050	65600	62235	58160	53375	47880	41675	34760	27135	18800	10696			
Riders (private)	1991-Stage I							6205	13120	20745	29080	38125	47880	58345	69520	81405	94000	117654	143900	159450	175000
Riders (professional)	1981-1990	4800	4800	4800	4800	4800	4800	4032	3168	2208	1152										
Riders (professional)	1991-Stage I							1008	2112	3312	4608	6000	6240	6480	6720	6960	7200	11650	16100	20550	25000
Shrub clearers (private)	<1981	24000	19200	14400	9600	4800															
Shrub clearers (private)	1981-1990	24000	28800	33600	38400	43200	48000	47520	46080	43680	40320	36000	30720	24480	17280	9120					
Shrub clearers (private)	1991-Stage I							5280	11520	18720	26880	36000	46080	57120	69120	82080	96000	107000	118000	129000	140000
Shrub clearers (professional)	1981-1990	2000	2000	2000	2000	2000	2000	1650	1200	650											
Shrub clearers (professional)	1991-Stage I							550	1200	1950	2800	3000	3200	3400	3600	3800	4000	5500	7000	8500	10000
Hedge cutters (private)	<1981	6850	5480	4110	2740	1370															
Hedge cutters (private)	1981-1990	6850	8220	9590	10960	12330	13700	15237	16128	16373	15972	14925	13232	10893	7908	4277					
Hedge cutters (private)	1991-Stage I							1693	4032	7017	10648	14925	19848	25417	31632	38493	46000	52900	59800	66700	73600
Hedge cutters (professional)	1981-1990	1300	1300	1300	1300	1300	1300	1178	920	528											
Hedge cutters (professional)	1991-Stage I							393	920	1583	2380	2650	2920	3190	3460	3730	4000	4600	5200	5800	6400
Trimmers (private)	<1981	25500	20400	15300	10200	5100															
Trimmers (private)	1981-1990	25500	30600	35700	40800	45900	51000	48086	44686	40800	36429	31571	26229	20400	14086	7286					
Trimmers (private)	1991-Stage I							5343	11171	17486	24286	31571	39343	47600	56343	65571	75286	77714	80143	82571	85000
Trimmers (professional)	1981-1990	9000	9000	9000	9000	9000	9000	7071	4929	2571											
Trimmers (professional)	1991-Stage I							2357	4929	7714	10714	11143	11571	12000	12429	12857	13286	13714	14143	14571	15000

Stock data for small boats and pleasure crafts 1985-2004

Motortype	Boat type	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Diesel	Motor boats (27-34 ft)	1550	1550	1719	1889	2058	2228	2397	2567	2736	2906	3075	3244	3414	3583	3753	3922	4092	4261	4431	4600
Diesel	Motor boats (> 34 ft)	450	450	503	556	608	661	714	767	819	872	925	978	1031	1083	1136	1189	1242	1294	1347	1400
Diesel	Motor boats <(27 ft)	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000
Diesel	Motor sailors	3500	3500	3583	3667	3750	3833	3917	4000	4083	4167	4250	4333	4417	4500	4583	4667	4750	4833	4917	5000
Diesel	Sailing boats (> 26 ft)	7500	7500	7917	8333	8750	9167	9583	10000	10417	10833	11250	11667	12083	12500	12917	13333	13750	14167	14583	15000
2-takt	Other boats (< 20 ft)	4000	4000	4056	4111	4167	4222	4278	4333	4389	4444	4500	4556	4564,89	4526,99	4438,68	4300,2	4108,05	3862,31	3559,68	3200
2-takt	Yawls and cabin boats	4000	4000	4056	4111	4167	4222	4278	4333	4389	4444	4500	4556	4564,89	4526,99	4438,68	4300,2	4108,05	3862,31	3559,68	3200
2-takt	Sailing boats (< 26 ft)	19000	19000	18778	18556	18333	18111	17889	17667	17444	17222	17000	16778	16390,44	15843,01	15144,34	14300,1	13316,95	12200,76	10959,84	9600
2-takt	Speed boats	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	2970	2910	2820	2700	2550	2370	2160	1920
2-takt	Water scooters	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	990	970	940	900	850	790	720	640
4-takt	Other boats (< 20 ft)													46,11	140,01	283,32	477,8	724,95	1026,69	1384,32	1800
4-takt	Yawls and cabin boats													46,11	140,01	283,32	477,8	724,95	1026,69	1384,32	1800
4-takt	Sailing boats (< 26 ft)													165,56	489,99	966,66	1588,9	2350,05	3243,24	4262,16	5400
4-takt	Speed boats (in board eng.)	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000
4-takt	Speed boats (out board eng.)													30	90	180	300	450	630	840	1080
4-takt	Water scooters													10	30	60	100	150	210	280	360
4-takt	Speed boats (out board eng.)													30	90	180	300	450	630	840	1080
4-takt	Water scooters													10	30	60	100	150	210	280	360

Engine sizes (kW) for small boats and pleasure crafts 1985-2004

Motortype	Boat type	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Diesel	Motor boats (27-34 ft)	70	70	74	79	83	88	92	97	101	106	110	114	119	123	128	132	137	141	146	150
Diesel	Motor boats (> 34 ft)	120	120	127	134	142	149	156	163	171	178	185	192	199	207	214	221	228	236	243	250
Diesel	Motor boats <(27 ft)	20	20	21.1	22.2	23.3	24.4	25.6	26.7	27.8	28.9	30	31.1	32.2	33.3	34.4	35.6	36.7	37.8	38.9	40
Diesel	Motor sailors	20	20	21	21	22	22	23	23	24	24	25	26	26	27	27	28	28	29	29	30
Diesel	Sailing boats (> 26 ft)	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
4-takt	Other boats (< 20 ft)													8	8	8	8	8	8	8	8
4-takt	Yawls and cabin boats													20	20	20	20	20	20	20	20
4-takt	Sailing boats (< 26 ft)													10	10	10	10	10	10	10	10
4-takt	Speed boats (in board eng.)	45	45	47.5	50	52.5	55	57.5	60	62.5	65	67.5	70	72.5	75	77.5	80	82.5	85	87.5	90
4-takt	Speed boats (out board eng.)													40.3	41.7	43.1	44.4	45.8	47.2	48.6	50
4-takt	Water scooters													45	45	45	45	45	45	45	45

Annex 2: Fuel use, emissions and emission factors 1985-2004

Fuel use and emissions (tons) for diesel tractors 1985-2004

Year	Fuel (TJ)	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
1985	12345	2891	8760	2048	33	8078	914	36	2	1907
1986	12842	1805	9267	2100	34	8322	950	37	2	1937
1987	12479	1754	9138	2018	33	8034	923	36	2	1851
1988	12892	1811	9576	2062	34	8248	954	38	2	1883
1989	12898	1208	9723	2041	33	8198	954	38	2	1854
1990	12739	1193	9742	1995	32	8048	943	37	2	1806
1991	12614	1182	9881	1942	32	7892	933	37	2	1737
1992	12050	1129	9592	1834	30	7502	892	36	2	1629
1993	11862	1111	9571	1789	29	7359	878	35	2	1582
1994	11063	1036	9096	1645	27	6812	819	33	2	1438
1995	11519	1079	9695	1680	27	7012	852	34	2	1443
1996	10660	250	9205	1522	25	6400	789	32	2	1277
1997	10999	258	9748	1533	25	6505	814	33	2	1252
1998	10106	237	9134	1382	22	5912	748	31	2	1104
1999	10066	236	9275	1350	22	5821	745	31	2	1052
2000	9712	227	9122	1276	21	5547	719	30	2	967
2001	9628	225	9140	1231	20	5392	713	30	2	910
2002	9596	225	8988	1165	19	5164	710	30	2	853
2003	9538	223	8714	1098	18	4940	706	30	2	799
2004	9467	222	8398	1031	17	4713	701	29	2	748

Emission factors (g/GJ) for diesel tractors 1985-2004

Year	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
1985	234	710	166	2.7	654	74	2.9	0.2	154
1986	141	722	164	2.7	648	74	2.9	0.2	151

1987	141	732	162	2.6	644	74	2.9	0.2	148
1988	141	743	160	2.6	640	74	2.9	0.2	146
1989	94	754	158	2.6	636	74	2.9	0.2	144
1990	94	765	157	2.5	632	74	2.9	0.2	142
1991	94	783	154	2.5	626	74	2.9	0.2	138
1992	94	796	152	2.5	623	74	3.0	0.2	135
1993	94	807	151	2.5	620	74	3.0	0.2	133
1994	94	822	149	2.4	616	74	3.0	0.2	130
1995	94	842	146	2.4	609	74	3.0	0.2	125
1996	23	864	143	2.3	600	74	3.0	0.2	120
1997	23	886	139	2.3	591	74	3.0	0.2	114
1998	23	904	137	2.2	585	74	3.0	0.2	109
1999	23	921	134	2.2	578	74	3.0	0.2	105
2000	23	939	131	2.1	571	74	3.1	0.2	100
2001	23	949	128	2.1	560	74	3.1	0.2	95
2002	23	937	121	2.0	538	74	3.1	0.2	89
2003	23	914	115	1.9	518	74	3.1	0.2	84
2004	23	887	109	1.8	498	74	3.1	0.2	79

Fuel use and emissions (tons) for gasoline tractors 1985-2004

EquipmentName (Eng)	Year	Emission Level	Fuel (TJ)	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Tractors (gasoline-certified)	1985	<1981	373	1	11	356	33	17999	27	0	0	2
Tractors (gasoline-certified)	1986	<1981	355	1	10	340	32	17228	26	0	0	2
Tractors (gasoline-certified)	1987	<1981	337	1	9	325	30	16446	25	0	0	2
Tractors (gasoline-certified)	1988	<1981	319	1	9	309	29	15652	23	0	0	2
Tractors (gasoline-certified)	1989	<1981	301	1	8	293	28	14847	22	0	0	2
Tractors (gasoline-certified)	1990	<1981	283	1	7	277	26	14032	21	0	0	2
Tractors (gasoline-certified)	1991	<1981	256	1	7	252	24	12766	19	0	0	2
Tractors (gasoline-certified)	1992	<1981	231	1	6	228	21	11545	17	0	0	2

Tractors (gasoline-certified)	1993	<1981	206	0	5	204	19	10372	15	0	0	1
Tractors (gasoline-certified)	1994	<1981	183	0	5	182	17	9247	13	0	0	1
Tractors (gasoline-certified)	1995	<1981	161	0	4	161	15	8172	12	0	0	1
Tractors (gasoline-certified)	1996	<1981	140	0	3	141	13	7147	10	0	0	1
Tractors (gasoline-certified)	1997	<1981	121	0	3	122	11	6173	9	0	0	1
Tractors (gasoline-certified)	1998	<1981	102	0	2	103	10	5252	7	0	0	1
Tractors (gasoline-certified)	1999	<1981	85	0	2	86	8	4385	6	0	0	1
Tractors (gasoline-certified)	2000	<1981	69	0	2	70	7	3571	5	0	0	0
Tractors (gasoline-certified)	2001	<1981	54	0	1	55	5	2814	4	0	0	0
Tractors (gasoline-certified)	2002	<1981	40	0	1	42	4	2112	3	0	0	0
Tractors (gasoline-certified)	2003	<1981	28	0	1	29	3	1468	2	0	0	0
Tractors (gasoline-certified)	2004	<1981	17	0	0	17	2	881	1	0	0	0
Tractors (gasoline-non certified)	1985	<1981	373	1	11	357	33	17999	27	0	0	2
Tractors (gasoline-non certified)	1986	<1981	355	1	10	342	32	17228	26	0	0	2
Tractors (gasoline-non certified)	1987	<1981	337	1	9	326	30	16446	25	0	0	2
Tractors (gasoline-non certified)	1988	<1981	319	1	9	310	29	15652	23	0	0	2
Tractors (gasoline-non certified)	1989	<1981	301	1	8	294	28	14847	22	0	0	2
Tractors (gasoline-non certified)	1990	<1981	283	1	7	278	26	14032	21	0	0	2
Tractors (gasoline-non certified)	1991	<1981	270	1	7	266	25	13426	20	0	0	2
Tractors (gasoline-non certified)	1992	<1981	256	1	7	253	24	12782	19	0	0	2
Tractors (gasoline-non certified)	1993	<1981	241	1	6	240	22	12101	18	0	0	2
Tractors (gasoline-non certified)	1994	<1981	225	1	6	225	21	11381	16	0	0	2
Tractors (gasoline-non certified)	1995	<1981	209	0	5	210	20	10623	15	0	0	1
Tractors (gasoline-non certified)	1996	<1981	193	0	5	194	18	9827	14	0	0	1
Tractors (gasoline-non certified)	1997	<1981	176	0	4	178	17	8991	13	0	0	1
Tractors (gasoline-non certified)	1998	<1981	158	0	4	160	15	8117	12	0	0	1
Tractors (gasoline-non certified)	1999	<1981	140	0	3	142	13	7203	10	0	0	1
Tractors (gasoline-non certified)	2000	<1981	121	0	3	123	12	6250	9	0	0	1
Tractors (gasoline-non certified)	2001	<1981	101	0	2	104	10	5257	7	0	0	1
Tractors (gasoline-non certified)	2002	<1981	81	0	2	83	8	4224	6	0	0	1

Tractors (gasoline-non certified)	2003	<1981	60	0	1	62	6	3151	4	0	0	0
Tractors (gasoline-non certified)	2004	<1981	39	0	1	40	4	2038	3	0	0	0

Emission factors (g/GJ) for gasoline tractors 1985-2004

EquipmentName (Eng)	Year	Emission Level	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Tractors (gasoline-certified)	1985	<1981	2.3	28	953	89	48219	73	1.3	0.1	6.4
Tractors (gasoline-certified)	1986	<1981	2.3	28	958	90	48492	73	1.3	0.1	6.5
Tractors (gasoline-certified)	1987	<1981	2.3	27	963	90	48759	73	1.3	0.1	6.5
Tractors (gasoline-certified)	1988	<1981	2.3	27	967	91	49021	73	1.3	0.1	6.5
Tractors (gasoline-certified)	1989	<1981	2.3	27	972	91	49278	73	1.3	0.1	6.6
Tractors (gasoline-certified)	1990	<1981	2.3	26	977	92	49529	73	1.3	0.1	6.6
Tractors (gasoline-certified)	1991	<1981	2.3	26	982	92	49776	73	1.3	0.1	6.7
Tractors (gasoline-certified)	1992	<1981	2.3	26	986	93	50019	73	1.3	0.1	6.7
Tractors (gasoline-certified)	1993	<1981	2.3	25	990	93	50258	73	1.3	0.1	6.7
Tractors (gasoline-certified)	1994	<1981	2.3	25	995	94	50493	73	1.3	0.1	6.8
Tractors (gasoline-certified)	1995	<1981	2.3	25	999	94	50724	73	1.3	0.1	6.8
Tractors (gasoline-certified)	1996	<1981	2.3	25	1003	95	50952	73	1.3	0.1	6.8
Tractors (gasoline-certified)	1997	<1981	2.3	24	1008	95	51177	73	1.3	0.1	6.9
Tractors (gasoline-certified)	1998	<1981	2.3	24	1012	96	51399	73	1.3	0.1	6.9
Tractors (gasoline-certified)	1999	<1981	2.3	24	1016	96	51618	73	1.3	0.1	6.9
Tractors (gasoline-certified)	2000	<1981	2.3	23	1020	97	51834	73	1.3	0.1	7.0
Tractors (gasoline-certified)	2001	<1981	2.3	23	1024	97	52047	73	1.3	0.1	7.0
Tractors (gasoline-certified)	2002	<1981	2.3	23	1028	97	52258	73	1.3	0.1	7.0
Tractors (gasoline-certified)	2003	<1981	2.3	23	1032	98	52466	73	1.3	0.1	7.1
Tractors (gasoline-certified)	2004	<1981	2.3	22	1035	98	52672	73	1.3	0.1	7.1
Tractors (gasoline-non certified)	1985	<1981	2.3	28	957	89	48219	73	1.3	0.1	6.4
Tractors (gasoline-non certified)	1986	<1981	2.3	28	962	90	48492	73	1.3	0.1	6.5
Tractors (gasoline-non certified)	1987	<1981	2.3	27	967	90	48759	73	1.3	0.1	6.5
Tractors (gasoline-non certified)	1988	<1981	2.3	27	972	91	49021	73	1.3	0.1	6.5

Tractors (gasoline-non certified)	1989	<1981	2.3	27	977	91	49278	73	1.3	0.1	6.6
Tractors (gasoline-non certified)	1990	<1981	2.3	26	981	92	49529	73	1.3	0.1	6.6
Tractors (gasoline-non certified)	1991	<1981	2.3	26	986	92	49776	73	1.3	0.1	6.7
Tractors (gasoline-non certified)	1992	<1981	2.3	26	990	93	50019	73	1.3	0.1	6.7
Tractors (gasoline-non certified)	1993	<1981	2.3	25	995	93	50258	73	1.3	0.1	6.7
Tractors (gasoline-non certified)	1994	<1981	2.3	25	999	94	50493	73	1.3	0.1	6.8
Tractors (gasoline-non certified)	1995	<1981	2.3	25	1004	94	50724	73	1.3	0.1	6.8
Tractors (gasoline-non certified)	1996	<1981	2.3	25	1008	95	50952	73	1.3	0.1	6.8
Tractors (gasoline-non certified)	1997	<1981	2.3	24	1012	95	51177	73	1.3	0.1	6.9
Tractors (gasoline-non certified)	1998	<1981	2.3	24	1016	96	51399	73	1.3	0.1	6.9
Tractors (gasoline-non certified)	1999	<1981	2.3	24	1020	96	51618	73	1.3	0.1	6.9
Tractors (gasoline-non certified)	2000	<1981	2.3	23	1024	97	51834	73	1.3	0.1	7.0
Tractors (gasoline-non certified)	2001	<1981	2.3	23	1028	97	52047	73	1.3	0.1	7.0
Tractors (gasoline-non certified)	2002	<1981	2.3	23	1032	97	52258	73	1.3	0.1	7.0
Tractors (gasoline-non certified)	2003	<1981	2.3	23	1036	98	52466	73	1.3	0.1	7.1
Tractors (gasoline-non certified)	2004	<1981	2.3	22	1040	98	52672	73	1.3	0.1	7.1

Fuel use and emissions (tons) for harvesters 1985-2004

Year	Fuel (TJ)	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
1985	2134	500	1376	398	6	1584	158	6	0	412
1986	2152	302	1424	392	6	1565	159	6	0	400
1987	2121	298	1430	380	6	1525	157	6	0	386
1988	2222	312	1536	393	6	1580	164	6	0	396
1989	2137	200	1512	372	6	1503	158	6	0	373
1990	2249	211	1642	385	6	1558	166	7	0	381
1991	2203	206	1655	369	6	1505	163	6	0	362
1992	2145	201	1651	352	6	1448	159	6	0	343
1993	2144	201	1676	348	6	1437	159	6	0	337
1994	2025	190	1606	324	5	1347	150	6	0	313

1995	1927	180	1561	301	5	1263	143	6	0	289
1996	2033	48	1688	305	5	1300	150	6	0	291
1997	1894	44	1614	269	4	1170	140	6	0	255
1998	2030	48	1776	270	4	1204	150	6	0	253
1999	1949	46	1740	244	4	1116	144	6	0	228
2000	2059	48	1868	244	4	1144	152	6	0	228
2001	2046	48	1892	227	4	1094	151	6	0	210
2002	2090	49	1863	212	3	1050	155	7	0	194
2003	2070	48	1803	195	3	990	153	6	0	176
2004	2019	47	1724	176	3	917	149	6	0	155

Emission factors (g/GJ) for harvesters 1985-2004

Year	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
1985	234	645	186	3.0	742	74	2.8	0.2	193
1986	141	662	182	3.0	727	74	2.9	0.2	186
1987	141	674	179	2.9	719	74	2.9	0.2	182
1988	141	691	177	2.9	711	74	2.9	0.2	178
1989	94	707	174	2.8	703	74	2.9	0.2	174
1990	94	730	171	2.8	693	74	2.9	0.2	169
1991	94	751	167	2.7	683	74	2.9	0.2	164
1992	94	769	164	2.7	675	74	2.9	0.2	160
1993	94	782	162	2.6	670	74	2.9	0.2	157
1994	94	793	160	2.6	665	74	2.9	0.2	155
1995	94	810	156	2.5	656	74	3.0	0.2	150
1996	23	830	150	2.4	639	74	3.0	0.2	143
1997	23	852	142	2.3	618	74	3.0	0.2	135
1998	23	875	133	2.2	593	74	3.0	0.2	125
1999	23	893	125	2.0	573	74	3.1	0.2	117
2000	23	907	119	1.9	555	74	3.1	0.2	111

2001	23	925	111	1.8	535	74	3.1	0.2	103
2002	23	892	101	1.6	502	74	3.1	0.2	93
2003	23	871	94	1.5	478	74	3.1	0.2	85
2004	23	854	87	1.4	454	74	3.1	0.2	77

Fuel use and emissions (tons) for machine pool machinery 1985-2004

Name	Year	Fuel (TJ)	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Harvesters	1985	188	44	170	31	0	126	14	1	0	30
Harvesters	1986	192	27	176	31	1	127	14	1	0	30
Harvesters	1987	217	30	201	34	1	142	16	1	0	33
Harvesters	1988	211	30	249	22	0	78	16	1	0	24
Harvesters	1989	204	19	233	21	0	76	15	1	0	23
Harvesters	1990	207	19	228	20	0	78	15	1	0	23
Harvesters	1991	217	20	230	20	0	82	16	1	0	23
Harvesters	1992	219	21	231	19	0	83	16	1	0	23
Harvesters	1993	201	19	210	17	0	76	15	1	0	20
Harvesters	1994	206	19	214	16	0	78	15	1	0	19
Harvesters	1995	225	21	233	17	0	86	17	1	0	20
Harvesters	1996	203	5	210	14	0	78	15	1	0	17
Harvesters	1997	218	5	224	14	0	84	16	1	0	17
Harvesters	1998	203	5	207	13	0	78	15	1	0	15
Harvesters	1999	183	4	185	11	0	71	14	1	0	13
Harvesters	2000	183	4	184	10	0	71	14	1	0	12
Harvesters	2001	173	4	173	8	0	67	13	1	0	10
Harvesters	2002	166	4	158	8	0	63	12	1	0	9
Harvesters	2003	157	4	141	7	0	57	12	1	0	8
Harvesters	2004	157	4	134	7	0	55	12	1	0	7
Self-propelled vehicles	1993	154	14	160	11	0	59	11	0	0	14
Self-propelled vehicles	1994	195	18	199	13	0	76	14	1	0	15

Self-propelled vehicles	1995	241	23	244	14	0	94	18	1	0	17
Self-propelled vehicles	1996	276	6	277	14	0	109	20	1	0	16
Self-propelled vehicles	1997	292	7	292	14	0	115	22	1	0	17
Self-propelled vehicles	1998	291	7	291	14	0	114	22	1	0	17
Self-propelled vehicles	1999	310	7	310	15	0	122	23	1	0	18
Self-propelled vehicles	2000	304	7	304	15	0	119	22	1	0	18
Self-propelled vehicles	2001	330	8	330	16	0	130	24	1	0	19
Self-propelled vehicles	2002	299	7	272	14	0	110	22	1	0	16
Self-propelled vehicles	2003	321	8	264	14	0	110	24	1	0	15
Self-propelled vehicles	2004	321	8	235	13	0	101	24	1	0	12
Tractors	1985	1201	281	801	181	3	761	89	3	0	176
Tractors	1986	1224	172	835	180	3	764	91	4	0	171
Tractors	1987	1282	180	895	184	3	786	95	4	0	169
Tractors	1988	1285	181	897	184	3	788	95	4	0	169
Tractors	1989	1266	119	884	181	3	777	94	4	0	167
Tractors	1990	1212	114	846	173	3	743	90	4	0	160
Tractors	1991	1271	119	937	177	3	766	94	4	0	157
Tractors	1992	1185	111	921	160	3	702	88	4	0	135
Tractors	1993	1262	118	1032	165	3	732	93	4	0	131
Tractors	1994	1283	120	1102	163	3	729	95	4	0	119
Tractors	1995	1327	124	1196	163	3	737	98	4	0	108
Tractors	1996	1325	31	1507	160	3	733	98	4	0	93
Tractors	1997	1390	33	1619	161	3	749	103	4	0	79
Tractors	1998	1377	32	1604	159	3	741	102	4	0	78
Tractors	1999	1455	34	1695	168	3	784	108	5	0	83
Tractors	2000	1360	32	1584	157	3	732	101	4	0	77
Tractors	2001	1433	34	1669	166	3	772	106	5	0	81
Tractors	2002	1407	33	1548	148	2	700	104	4	0	75
Tractors	2003	1348	32	1348	125	2	613	100	4	0	67
Tractors	2004	1392	33	1251	112	2	572	103	4	0	64

Emission factors (g/GJ) for machine pool machinery 1985-2004

Name	Year	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Harvesters	1985	234	901	163	2.6	668	74	3.0	0.2	162
Harvesters	1986	141	914	160	2.6	662	74	3.0	0.2	158
Harvesters	1987	141	928	158	2.6	655	74	3.0	0.2	153
Harvesters	1988	141	1179	106	1.7	372	74	3.1	0.2	113
Harvesters	1989	94	1141	103	1.7	373	74	3.1	0.2	113
Harvesters	1990	94	1103	99	1.6	374	74	3.1	0.2	111
Harvesters	1991	94	1059	91	1.5	377	74	3.1	0.2	107
Harvesters	1992	94	1053	87	1.4	378	74	3.1	0.2	103
Harvesters	1993	94	1047	83	1.3	380	74	3.2	0.2	98
Harvesters	1994	94	1042	79	1.3	381	74	3.2	0.2	94
Harvesters	1995	94	1036	75	1.2	382	74	3.2	0.2	89
Harvesters	1996	23	1030	70	1.1	384	74	3.2	0.2	85
Harvesters	1997	23	1024	66	1.1	385	74	3.2	0.2	80
Harvesters	1998	23	1018	62	1.0	386	74	3.2	0.2	74
Harvesters	1999	23	1012	58	0.9	388	74	3.2	0.2	69
Harvesters	2000	23	1006	54	0.9	389	74	3.2	0.2	63
Harvesters	2001	23	1000	49	0.8	391	74	3.2	0.2	57
Harvesters	2002	23	952	47	0.8	377	74	3.2	0.2	54
Harvesters	2003	23	903	46	0.7	364	74	3.2	0.2	51
Harvesters	2004	23	855	44	0.7	350	74	3.2	0.2	47
Self-propelled vehicles	1993	94	1034	73	1.2	385	74	3.2	0.2	88
Self-propelled vehicles	1994	94	1023	65	1.1	388	74	3.2	0.2	79
Self-propelled vehicles	1995	94	1012	57	0.9	390	74	3.2	0.2	69
Self-propelled vehicles	1996	23	1001	49	0.8	393	74	3.2	0.2	58
Self-propelled vehicles	1997	23	1001	49	0.8	393	74	3.2	0.2	58
Self-propelled vehicles	1998	23	1001	49	0.8	393	74	3.2	0.2	58
Self-propelled vehicles	1999	23	1001	49	0.8	393	74	3.2	0.2	58
Self-propelled vehicles	2000	23	1001	49	0.8	393	74	3.2	0.2	58

Self-propelled vehicles	2001	23	1001	49	0.8	393	74	3.2	0.2	58
Self-propelled vehicles	2002	23	912	46	0.7	368	74	3.2	0.2	52
Self-propelled vehicles	2003	23	823	43	0.7	342	74	3.2	0.2	45
Self-propelled vehicles	2004	23	733	39	0.6	315	74	3.2	0.2	38
Tractors	1985	234	667	151	2.5	634	74	2.9	0.2	147
Tractors	1986	141	682	147	2.4	624	74	2.9	0.2	139
Tractors	1987	141	698	143	2.3	613	74	3.0	0.2	132
Tractors	1988	141	698	143	2.3	613	74	3.0	0.2	132
Tractors	1989	94	698	143	2.3	613	74	3.0	0.2	132
Tractors	1990	94	698	143	2.3	613	74	3.0	0.2	132
Tractors	1991	94	737	139	2.3	603	74	3.0	0.2	123
Tractors	1992	94	777	135	2.2	592	74	3.0	0.2	114
Tractors	1993	94	818	131	2.1	580	74	3.0	0.2	104
Tractors	1994	94	859	127	2.1	568	74	3.0	0.2	93
Tractors	1995	94	901	123	2.0	555	74	3.1	0.2	81
Tractors	1996	23	1137	121	2.0	553	74	3.2	0.2	70
Tractors	1997	23	1165	116	1.9	538	74	3.2	0.2	57
Tractors	1998	23	1165	116	1.9	538	74	3.2	0.2	57
Tractors	1999	23	1165	116	1.9	538	74	3.2	0.2	57
Tractors	2000	23	1165	116	1.9	538	74	3.2	0.2	57
Tractors	2001	23	1165	116	1.9	538	74	3.2	0.2	57
Tractors	2002	23	1100	105	1.7	497	74	3.2	0.2	53
Tractors	2003	23	1000	93	1.5	455	74	3.2	0.2	50
Tractors	2004	23	898	80	1.3	411	74	3.2	0.2	46

Fuel use and emissions (tons) for other machinery in agriculture 1985-2004

Fuel type	Year	Fuel (TJ)	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Diesel	1985	91	21	57	15	0	60	7	0	0	15
Diesel	1986	91	13	58	14	0	59	7	0	0	14
Diesel	1987	91	13	58	14	0	59	7	0	0	14
Diesel	1988	90	13	58	14	0	58	7	0	0	14
Diesel	1989	90	8	59	14	0	57	7	0	0	13
Diesel	1990	90	8	59	14	0	57	7	0	0	13
Diesel	1991	89	8	61	13	0	56	7	0	0	12
Diesel	1992	88	8	63	13	0	54	7	0	0	12
Diesel	1993	88	8	65	12	0	53	6	0	0	11
Diesel	1994	87	8	66	12	0	52	6	0	0	10
Diesel	1995	86	8	68	12	0	51	6	0	0	9
Diesel	1996	86	2	70	11	0	50	6	0	0	9
Diesel	1997	86	2	71	11	0	49	6	0	0	9
Diesel	1998	85	2	72	11	0	49	6	0	0	8
Diesel	1999	85	2	72	10	0	46	6	0	0	8
Diesel	2000	85	2	72	10	0	44	6	0	0	7
Diesel	2001	85	2	71	9	0	42	6	0	0	6
Diesel	2002	84	2	71	8	0	40	6	0	0	6
Diesel	2003	84	2	70	8	0	37	6	0	0	5
Diesel	2004	84	2	69	7	0	35	6	0	0	4
Gasoline	1985	168	0	7	149	14	7180	12	0	0	1
Gasoline	1986	162	0	7	142	13	6862	12	0	0	1
Gasoline	1987	157	0	7	136	12	6547	11	0	0	1
Gasoline	1988	152	0	7	130	12	6236	11	0	0	1
Gasoline	1989	147	0	7	124	11	5928	11	0	0	1
Gasoline	1990	142	0	7	118	11	5625	10	0	0	1
Gasoline	1991	137	0	8	113	10	5370	10	0	0	1
Gasoline	1992	132	0	8	108	10	5112	10	0	0	1

Gasoline	1993	128	0	8	103	9	4855	9	0	0	1
Gasoline	1994	123	0	8	98	9	4599	9	0	0	1
Gasoline	1995	118	0	7	93	8	4346	9	0	0	1
Gasoline	1996	113	0	7	88	8	4096	8	0	0	1
Gasoline	1997	109	0	7	83	7	3850	8	0	0	1
Gasoline	1998	104	0	7	78	7	3608	8	0	0	1
Gasoline	1999	99	0	7	73	6	3372	7	0	0	1
Gasoline	2000	95	0	7	69	6	3141	7	0	0	1
Gasoline	2001	91	0	6	66	6	3006	7	0	0	1
Gasoline	2002	87	0	6	63	5	2870	6	0	0	1
Gasoline	2003	83	0	6	60	5	2735	6	0	0	1
Gasoline	2004	79	0	6	57	5	2599	6	0	0	1

Emission factors (g/GJ) for other machinery in agriculture 1985-2004

Fuel type	Year	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Diesel	1985	234	626	161	3	654	74	2.8	0.2	161
Diesel	1986	141	633	159	3	650	74	2.9	0.2	158
Diesel	1987	141	640	158	3	646	74	2.9	0.2	155
Diesel	1988	141	647	156	3	642	74	2.9	0.2	153
Diesel	1989	94	654	154	3	637	74	2.9	0.2	150
Diesel	1990	94	661	152	2	633	74	2.9	0.2	147
Diesel	1991	94	686	149	2	624	74	2.9	0.2	140
Diesel	1992	94	711	145	2	614	74	2.9	0.2	133
Diesel	1993	94	737	141	2	605	74	3.0	0.2	125
Diesel	1994	94	763	137	2	595	74	3.0	0.2	117
Diesel	1995	94	790	134	2	584	74	3.0	0.2	109
Diesel	1996	23	809	132	2	579	74	3.0	0.2	105
Diesel	1997	23	828	130	2	574	74	3.0	0.2	100

Diesel	1998	23	847	128	2	568	74	3.0	0.2	95
Diesel	1999	23	846	121	2	544	74	3.1	0.2	88
Diesel	2000	23	844	114	2	520	74	3.1	0.2	81
Diesel	2001	23	842	107	2	495	74	3.1	0.2	74
Diesel	2002	23	841	100	2	469	74	3.1	0.2	67
Diesel	2003	23	839	93	2	443	74	3.1	0.2	59
Diesel	2004	23	825	85	1	416	74	3.1	0.2	51
Gasoline	1985	2	44	886	81	42831	73	1.3	0.1	6
Gasoline	1986	2	46	876	80	42235	73	1.3	0.1	6
Gasoline	1987	2	47	866	79	41606	73	1.3	0.1	6
Gasoline	1988	2	49	855	77	40946	73	1.3	0.1	6
Gasoline	1989	2	51	844	76	40257	73	1.3	0.1	6
Gasoline	1990	2	52	832	75	39539	73	1.3	0.1	6
Gasoline	1991	2	55	825	74	39097	73	1.3	0.1	6
Gasoline	1992	2	57	816	73	38593	73	1.3	0.1	6
Gasoline	1993	2	59	807	72	38040	73	1.3	0.1	6
Gasoline	1994	2	61	797	71	37444	73	1.4	0.1	6
Gasoline	1995	2	63	786	70	36809	73	1.4	0.1	6
Gasoline	1996	2	65	775	68	36138	73	1.4	0.1	6
Gasoline	1997	2	67	762	67	35432	73	1.4	0.1	7
Gasoline	1998	2	68	750	66	34693	73	1.4	0.1	7
Gasoline	1999	2	70	736	64	33922	73	1.4	0.1	7
Gasoline	2000	2	71	722	63	33120	73	1.4	0.1	7
Gasoline	2001	2	71	722	63	33115	73	1.4	0.1	7
Gasoline	2002	2	71	723	63	33110	73	1.4	0.1	7
Gasoline	2003	2	71	723	63	33105	73	1.4	0.1	7
Gasoline	2004	2	72	723	63	33099	73	1.4	0.1	7

Fuel use and emissions (tons) for ATV's 1985-2004

FuelType	Year	Emission Level	Fuel (TJ)	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Gasoline	1992	Conv. MC urban	5	0	0	5	1	74	0	0	0	0
Gasoline	1993	Conv. MC urban	10	0	1	10	2	159	1	0	0	0
Gasoline	1994	Conv. MC urban	16	0	2	17	3	262	1	0	0	1
Gasoline	1995	Conv. MC urban	24	0	3	25	4	387	2	0	0	1
Gasoline	1996	Conv. MC urban	32	0	4	35	5	530	2	0	0	1
Gasoline	1997	Conv. MC urban	42	0	5	45	7	691	3	0	0	1
Gasoline	1998	Conv. MC urban	54	0	6	58	9	887	4	0	0	2
Gasoline	1999	Conv. MC urban	70	0	8	75	11	1148	5	0	0	2
Gasoline	2000	Conv. MC urban	94	0	10	104	15	1576	7	0	0	3
Gasoline	2001	Conv. MC urban	116	0	13	132	19	1993	9	0	0	4
Gasoline	2002	Conv. MC urban	138	0	15	158	23	2393	10	0	0	5
Gasoline	2003	Conv. MC urban	158	0	18	183	26	2771	12	0	0	5
Gasoline	2004	Conv. MC urban	178	0	20	207	30	3130	13	0	0	6

Emission factors (g/GJ) for ATV's 1985-2004

FuelType	Year	Emission Level	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Gasoline	1992	Conv. MC urban	2.3	108	1070	160	16306	73	1.6	1.6	32
Gasoline	1993	Conv. MC urban	2.3	108	1070	160	16306	73	1.6	1.6	32
Gasoline	1994	Conv. MC urban	2.3	108	1070	160	16306	73	1.6	1.6	32
Gasoline	1995	Conv. MC urban	2.3	108	1070	160	16306	73	1.6	1.6	32
Gasoline	1996	Conv. MC urban	2.3	108	1070	160	16306	73	1.6	1.6	32
Gasoline	1997	Conv. MC urban	2.3	108	1070	160	16306	73	1.6	1.6	32
Gasoline	1998	Conv. MC urban	2.3	108	1070	160	16306	73	1.6	1.6	32
Gasoline	1999	Conv. MC urban	2.3	108	1070	160	16306	73	1.6	1.6	32
Gasoline	2000	Conv. MC urban	2.3	110	1107	163	16808	73	1.6	1.6	33
Gasoline	2001	Conv. MC urban	2.3	111	1129	165	17115	73	1.6	1.6	33

Gasoline	2002	Conv. MC urban	2.3	112	1145	166	17329	73	1.7	1.7	33
Gasoline	2003	Conv. MC urban	2.3	113	1157	167	17496	73	1.7	1.7	33
Gasoline	2004	Conv. MC urban	2.3	113	1167	168	17633	73	1.7	1.7	34

Fuel use and emissions (tons) for Forestry 1985-2004

FuelType	Year	Fuel (TJ)	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Diesel	1985	141	33	102	25	0	102	10	0	0	26
Diesel	1986	142	20	107	25	0	100	10	0	0	25
Diesel	1987	142	20	112	24	0	98	11	0	0	24
Diesel	1988	143	20	116	23	0	96	11	0	0	23
Diesel	1989	144	14	121	23	0	95	11	0	0	22
Diesel	1990	145	14	125	23	0	94	11	0	0	22
Diesel	1991	146	14	130	22	0	91	11	0	0	20
Diesel	1992	146	14	136	21	0	89	11	0	0	19
Diesel	1993	147	14	141	20	0	87	11	0	0	17
Diesel	1994	148	14	146	19	0	85	11	0	0	16
Diesel	1995	148	14	150	18	0	83	11	0	0	14
Diesel	1996	149	3	154	17	0	81	11	0	0	13
Diesel	1997	150	4	158	17	0	79	11	0	0	12
Diesel	1998	151	4	161	16	0	78	11	0	0	11
Diesel	1999	152	4	161	15	0	76	11	0	0	11
Diesel	2000	153	4	161	15	0	74	11	0	0	10
Diesel	2001	155	4	161	14	0	72	11	0	0	10
Diesel	2002	156	4	153	13	0	68	12	0	0	9
Diesel	2003	158	4	142	12	0	63	12	1	0	8
Diesel	2004	159	4	131	10	0	58	12	1	0	7
Gasoline	1985	341	1	14	2461	21	6165	25	0	0	35
Gasoline	1986	341	1	14	2461	21	6165	25	0	0	35
Gasoline	1987	341	1	14	2461	21	6165	25	0	0	35

Gasoline	1988	341	1	14	2461	21	6165	25	0	0	35
Gasoline	1989	341	1	14	2461	21	6165	25	0	0	35
Gasoline	1990	341	1	14	2461	21	6165	25	0	0	35
Gasoline	1991	313	1	13	2187	18	5469	23	0	0	29
Gasoline	1992	286	1	13	1921	16	4792	21	0	0	24
Gasoline	1993	261	1	13	1665	14	4140	19	0	0	19
Gasoline	1994	244	1	12	1559	13	3875	18	0	0	18
Gasoline	1995	227	1	11	1452	12	3611	17	0	0	17
Gasoline	1996	211	0	10	1346	11	3347	15	0	0	16
Gasoline	1997	194	0	9	1240	10	3083	14	0	0	14
Gasoline	1998	177	0	9	1133	9	2818	13	0	0	13
Gasoline	1999	161	0	8	1027	9	2554	12	0	0	12
Gasoline	2000	144	0	7	921	8	2290	11	0	0	11
Gasoline	2001	128	0	6	815	7	2026	9	0	0	9
Gasoline	2002	111	0	5	708	6	1762	8	0	0	8
Gasoline	2003	94	0	5	602	5	1497	7	0	0	7
Gasoline	2004	78	0	4	496	4	1233	6	0	0	6

Emission factors (g/GJ) for Forestry 1985-2004

FuelType	Year	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Diesel	1985	234	722	179	2.9	725	74	2.9	0.2	182
Diesel	1986	141	756	174	2.8	706	74	2.9	0.2	173
Diesel	1987	141	784	169	2.7	689	74	2.9	0.2	166
Diesel	1988	141	812	164	2.7	673	74	2.9	0.2	159
Diesel	1989	94	836	160	2.6	659	74	3.0	0.2	154
Diesel	1990	94	857	156	2.5	646	74	3.0	0.2	149
Diesel	1991	94	894	150	2.4	627	74	3.0	0.2	139

Diesel	1992	94	927	143	2.3	608	74	3.0	0.2	129
Diesel	1993	94	959	136	2.2	591	74	3.1	0.2	119
Diesel	1994	94	987	129	2.1	573	74	3.1	0.2	108
Diesel	1995	94	1014	122	2.0	556	74	3.1	0.2	97
Diesel	1996	23	1034	115	1.9	543	74	3.1	0.2	87
Diesel	1997	23	1052	111	1.8	530	74	3.2	0.2	80
Diesel	1998	23	1069	106	1.7	517	74	3.2	0.2	72
Diesel	1999	23	1061	101	1.6	501	74	3.2	0.2	69
Diesel	2000	23	1053	96	1.6	486	74	3.2	0.2	66
Diesel	2001	23	1038	91	1.5	467	74	3.2	0.2	63
Diesel	2002	23	981	83	1.3	433	74	3.2	0.2	57
Diesel	2003	23	904	74	1.2	398	74	3.2	0.2	52
Diesel	2004	23	823	65	1.1	362	74	3.2	0.2	46
Gasoline	1985	2.3	40	7207	60	18057	73	0.4	0.1	101
Gasoline	1986	2.3	40	7207	60	18057	73	0.4	0.1	101
Gasoline	1987	2.3	40	7207	60	18057	73	0.4	0.1	101
Gasoline	1988	2.3	40	7207	60	18057	73	0.4	0.1	101
Gasoline	1989	2.3	40	7207	60	18057	73	0.4	0.1	101
Gasoline	1990	2.3	40	7207	60	18057	73	0.4	0.1	101
Gasoline	1991	2.3	43	6978	58	17450	73	0.4	0.1	93
Gasoline	1992	2.3	46	6706	56	16728	73	0.4	0.1	84
Gasoline	1993	2.3	48	6386	53	15880	73	0.4	0.1	74
Gasoline	1994	2.3	48	6386	53	15880	73	0.4	0.1	74
Gasoline	1995	2.3	48	6386	53	15880	73	0.4	0.1	74
Gasoline	1996	2.3	48	6386	53	15880	73	0.4	0.1	74
Gasoline	1997	2.3	48	6386	53	15880	73	0.4	0.1	74
Gasoline	1998	2.3	48	6386	53	15880	73	0.4	0.1	74
Gasoline	1999	2.3	48	6386	53	15880	73	0.4	0.1	74
Gasoline	2000	2.3	48	6386	53	15880	73	0.4	0.1	74
Gasoline	2001	2.3	48	6386	53	15880	73	0.4	0.1	74

Gasoline	2002	2.3	48	6386	53	15880	73	0.4	0.1	74
Gasoline	2003	2.3	48	6386	53	15880	73	0.4	0.1	74
Gasoline	2004	2.3	48	6386	53	15880	73	0.4	0.1	74

Fuel use and emissions (tons) for fork lifts 1985-2004

FuelType	Year	Fuel (TJ)	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Diesel	1985	1027	241	724	364	6	1124	76	3	0	273
Diesel	1986	1064	149	760	372	6	1153	79	3	0	275
Diesel	1987	1096	154	791	379	6	1178	81	3	0	275
Diesel	1988	1121	157	818	384	6	1197	83	3	0	275
Diesel	1989	1128	106	831	383	6	1199	83	3	0	271
Diesel	1990	1124	105	836	379	6	1190	83	3	0	265
Diesel	1991	1124	105	854	374	6	1181	83	3	0	259
Diesel	1992	1112	104	861	364	6	1161	82	3	0	250
Diesel	1993	1092	102	859	354	6	1136	81	3	0	242
Diesel	1994	1085	102	872	346	6	1118	80	3	0	233
Diesel	1995	1112	104	917	347	6	1132	82	3	0	229
Diesel	1996	1119	26	946	342	6	1125	83	3	0	221
Diesel	1997	1159	27	1007	346	6	1148	86	3	0	217
Diesel	1998	1199	28	1070	348	6	1168	89	3	0	212
Diesel	1999	1234	29	1091	334	5	1137	91	3	0	201
Diesel	2000	1275	30	1117	320	5	1107	94	3	0	188
Diesel	2001	1317	31	1134	314	5	1099	97	3	0	187
Diesel	2002	1354	32	1147	305	5	1080	100	4	0	182
Diesel	2003	1407	33	1169	302	5	1084	104	4	0	182
Diesel	2004	1417	33	1144	285	5	1044	105	4	0	172
LPG	1985	1232	0	1636	180	9	129	80	4	0	6
LPG	1986	1233	0	1638	180	9	129	80	4	0	6
LPG	1987	1225	0	1626	179	9	128	80	4	0	6

LPG	1988	1209	0	1606	177	9	127	79	4	0	6
LPG	1989	1196	0	1589	175	9	125	78	4	0	6
LPG	1990	1185	0	1574	173	9	124	77	4	0	6
LPG	1991	1172	0	1556	171	9	123	76	4	0	6
LPG	1992	1151	0	1529	168	9	121	75	4	0	6
LPG	1993	1124	0	1492	164	9	118	73	4	0	5
LPG	1994	1105	0	1467	161	8	116	72	4	0	5
LPG	1995	1099	0	1459	160	8	115	71	4	0	5
LPG	1996	1088	0	1446	159	8	114	71	4	0	5
LPG	1997	1075	0	1428	157	8	113	70	4	0	5
LPG	1998	1086	0	1442	159	8	114	71	4	0	5
LPG	1999	1077	0	1430	157	8	113	70	4	0	5
LPG	2000	1071	0	1422	156	8	112	70	4	0	5
LPG	2001	1073	0	1425	157	8	113	70	4	0	5
LPG	2002	1084	0	1439	158	8	114	70	4	0	5
LPG	2003	1079	0	1433	158	8	113	70	4	0	5
LPG	2004	1065	0	1415	156	8	112	69	4	0	5

Emission factors (g/GJ) for fork lifts 1985-2004

FuelType	Year	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Diesel	1985	234	705	354	5.8	1094	74	2.4	0.1	266
Diesel	1986	141	714	350	5.7	1084	74	2.5	0.1	258
Diesel	1987	141	722	346	5.6	1076	74	2.5	0.1	251
Diesel	1988	141	730	343	5.6	1068	74	2.5	0.1	245
Diesel	1989	94	737	340	5.5	1063	74	2.5	0.1	240
Diesel	1990	94	744	337	5.5	1059	74	2.5	0.1	236
Diesel	1991	94	760	332	5.4	1051	74	2.5	0.1	230

Diesel	1992	94	774	328	5.3	1044	74	2.5	0.1	225
Diesel	1993	94	786	324	5.3	1040	74	2.5	0.1	221
Diesel	1994	94	804	319	5.2	1031	74	2.5	0.1	215
Diesel	1995	94	825	312	5.1	1018	74	2.6	0.1	206
Diesel	1996	23	845	306	5.0	1005	74	2.6	0.1	197
Diesel	1997	23	869	298	4.8	991	74	2.6	0.1	187
Diesel	1998	23	893	290	4.7	974	74	2.6	0.1	177
Diesel	1999	23	884	271	4.4	922	74	2.6	0.1	163
Diesel	2000	23	876	251	4.1	868	74	2.6	0.2	148
Diesel	2001	23	861	238	3.9	835	74	2.6	0.2	142
Diesel	2002	23	848	225	3.7	798	74	2.6	0.2	134
Diesel	2003	23	831	214	3.5	770	74	2.6	0.2	129
Diesel	2004	23	807	201	3.3	737	74	2.7	0.2	122
LPG	1985	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	1986	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	1987	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	1988	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	1989	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	1990	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	1991	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	1992	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	1993	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	1994	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	1995	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	1996	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	1997	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	1998	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	1999	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	2000	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	2001	0	1328	146	7.7	105	65	3.5	0.2	5

LPG	2002	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	2003	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	2004	0	1328	146	7.7	105	65	3.5	0.2	5

Fuel use and emissions (tons) for construction machinery 1985-2004

Year	Fuel (TJ)	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
1985	6806	1594	6399	1106	18	4470	504	20	1	1107
1986	6776	952	6424	1082	18	4409	501	20	1	1072
1987	6746	948	6449	1057	17	4347	499	20	1	1035
1988	6715	944	6475	1033	17	4284	497	20	1	997
1989	6685	626	6500	1008	16	4220	495	20	1	958
1990	6655	623	6526	983	16	4156	492	20	1	917
1991	6706	628	6713	976	16	4160	496	20	1	895
1992	6752	633	6879	968	16	4159	500	21	1	870
1993	6792	636	7022	958	16	4152	503	21	1	844
1994	6826	639	7144	948	15	4139	505	21	1	816
1995	6906	647	7304	947	15	4162	511	21	1	799
1996	6992	164	7479	974	16	4273	517	22	1	786
1997	7061	165	7597	970	16	4275	522	22	1	765
1998	7125	167	7689	965	16	4271	527	22	1	744
1999	7183	168	7518	914	15	4097	532	23	1	708
2000	7238	170	7338	868	14	3932	536	23	1	672
2001	7326	172	7095	828	13	3791	542	23	1	665
2002	7410	174	6829	785	13	3634	548	23	1	654
2003	7497	176	6429	736	12	3465	555	24	1	637
2004	7575	177	6036	682	11	3283	561	24	1	614

Emission factors (g/GJ) for construction machinery 1985-2004

Year	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
1985	234	940	163	2.6	657	74	3.0	0.2	163
1986	141	948	160	2.6	651	74	3.0	0.2	158
1987	141	956	157	2.5	644	74	3.0	0.2	153
1988	141	964	154	2.5	638	74	3.0	0.2	148
1989	94	972	151	2.5	631	74	3.0	0.2	143
1990	94	981	148	2.4	624	74	3.0	0.2	138
1991	94	1001	146	2.4	620	74	3.0	0.2	133
1992	94	1019	143	2.3	616	74	3.0	0.2	129
1993	94	1034	141	2.3	611	74	3.1	0.2	124
1994	94	1047	139	2.3	606	74	3.1	0.2	120
1995	94	1058	137	2.2	603	74	3.1	0.2	116
1996	23	1070	139	2.3	611	74	3.1	0.2	112
1997	23	1076	137	2.2	605	74	3.1	0.2	108
1998	23	1079	135	2.2	599	74	3.1	0.2	104
1999	23	1047	127	2.1	570	74	3.1	0.2	99
2000	23	1014	120	1.9	543	74	3.1	0.2	93
2001	23	969	113	1.8	517	74	3.1	0.2	91
2002	23	922	106	1.7	490	74	3.1	0.2	88
2003	23	858	98	1.6	462	74	3.1	0.2	85
2004	23	797	90	1.5	433	74	3.1	0.2	81

Fuel use and emissions (tons) for household and gardening 1985-2004

FuelType	Engine	Year	Fuel (TJ)	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Gasoline	2-stroke	1985	218	0	7	1961	16	4020	16	0	0	29
Gasoline	2-stroke	1986	217	0	7	1959	16	3998	16	0	0	29
Gasoline	2-stroke	1987	216	0	7	1958	16	3975	16	0	0	29
Gasoline	2-stroke	1988	216	0	7	1957	16	3953	16	0	0	29
Gasoline	2-stroke	1989	215	0	7	1955	16	3929	16	0	0	28
Gasoline	2-stroke	1990	215	0	7	1954	16	3906	16	0	0	28
Gasoline	2-stroke	1991	228	1	8	2004	17	4049	17	0	0	28
Gasoline	2-stroke	1992	241	1	9	2029	17	4148	18	0	0	28
Gasoline	2-stroke	1993	252	1	10	2027	17	4200	18	0	0	27
Gasoline	2-stroke	1994	267	1	10	2060	17	4365	19	0	0	27
Gasoline	2-stroke	1995	283	1	11	2165	18	4614	21	0	0	28
Gasoline	2-stroke	1996	299	1	12	2267	18	4861	22	0	0	29
Gasoline	2-stroke	1997	315	1	13	2366	19	5104	23	0	0	31
Gasoline	2-stroke	1998	331	1	13	2463	20	5345	24	0	0	32
Gasoline	2-stroke	1999	348	1	14	2558	21	5583	25	0	0	33
Gasoline	2-stroke	2000	364	1	15	2650	21	5818	27	0	0	34
Gasoline	2-stroke	2001	452	1	19	3260	26	7230	33	0	0	42
Gasoline	2-stroke	2002	541	1	22	3869	31	8643	39	0	0	49
Gasoline	2-stroke	2003	629	1	26	4479	36	10055	46	0	0	57
Gasoline	2-stroke	2004	719	2	30	5100	42	11491	52	0	0	65
Gasoline	4-stroke	1985	1686	4	107	2664	176	59999	123	2	0	10
Gasoline	4-stroke	1986	1680	4	109	2636	173	59093	123	2	0	10
Gasoline	4-stroke	1987	1673	4	112	2606	170	58155	122	2	0	10
Gasoline	4-stroke	1988	1666	4	115	2575	166	57190	122	2	0	10
Gasoline	4-stroke	1989	1665	4	115	2570	166	56877	122	2	0	10
Gasoline	4-stroke	1990	1663	4	116	2565	165	56557	121	2	0	10
Gasoline	4-stroke	1991	1688	4	126	2554	164	56491	123	2	0	10

Gasoline	4-stroke	1992	1714	4	135	2538	162	56178	125	2	0	10
Gasoline	4-stroke	1993	1740	4	143	2523	159	56044	127	2	0	11
Gasoline	4-stroke	1994	1766	4	150	2504	157	55745	129	2	0	11
Gasoline	4-stroke	1995	1794	4	157	2493	155	55563	131	2	0	11
Gasoline	4-stroke	1996	1823	4	162	2490	154	55890	133	2	0	11
Gasoline	4-stroke	1997	1853	4	167	2486	154	56147	135	2	0	12
Gasoline	4-stroke	1998	1883	4	173	2480	152	56336	137	2	0	12
Gasoline	4-stroke	1999	1917	4	176	2499	154	57143	140	3	0	12
Gasoline	4-stroke	2000	1950	4	179	2517	155	57900	142	3	0	12
Gasoline	4-stroke	2001	2300	5	206	2782	178	68850	168	3	0	15
Gasoline	4-stroke	2002	2649	6	234	3044	201	79639	193	4	0	17
Gasoline	4-stroke	2003	3001	7	260	3317	225	91043	219	4	0	19
Gasoline	4-stroke	2004	3353	8	287	3589	248	102447	245	5	0	22

Emission factors (g/GJ) for household and gardening 1985-2004

FuelType	Engine	Year	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Gasoline	2-stroke	1985	2.3	33	9014	74	18482	73	0.3	0.1	135
Gasoline	2-stroke	1986	2.3	33	9031	75	18426	73	0.3	0.1	134
Gasoline	2-stroke	1987	2.3	33	9047	75	18369	73	0.3	0.1	133
Gasoline	2-stroke	1988	2.3	33	9064	75	18309	73	0.3	0.1	132
Gasoline	2-stroke	1989	2.3	33	9081	75	18247	73	0.3	0.1	131
Gasoline	2-stroke	1990	2.3	33	9097	75	18183	73	0.3	0.1	130
Gasoline	2-stroke	1991	2.3	35	8783	72	17747	73	0.3	0.1	123
Gasoline	2-stroke	1992	2.3	36	8431	69	17240	73	0.3	0.1	115
Gasoline	2-stroke	1993	2.3	38	8037	66	16654	73	0.3	0.1	106
Gasoline	2-stroke	1994	2.3	39	7729	63	16376	73	0.3	0.1	101
Gasoline	2-stroke	1995	2.3	39	7652	62	16313	73	0.3	0.1	100
Gasoline	2-stroke	1996	2.3	40	7577	61	16250	73	0.4	0.1	99

Gasoline	2-stroke	1997	2.3	40	7504	61	16188	73	0.4	0.1	97
Gasoline	2-stroke	1998	2.3	40	7432	60	16125	73	0.4	0.1	96
Gasoline	2-stroke	1999	2.3	40	7361	60	16063	73	0.4	0.1	95
Gasoline	2-stroke	2000	2.3	40	7290	59	16001	73	0.4	0.1	94
Gasoline	2-stroke	2001	2.3	41	7211	58	15994	73	0.4	0.1	92
Gasoline	2-stroke	2002	2.3	41	7159	58	15990	73	0.4	0.1	91
Gasoline	2-stroke	2003	2.3	42	7121	58	15987	73	0.4	0.1	90
Gasoline	2-stroke	2004	2.3	42	7095	58	15984	73	0.4	0.1	90
Gasoline	4-stroke	1985	2.3	63	1580	104	35579	73	1.2	0.1	6
Gasoline	4-stroke	1986	2.3	65	1569	103	35181	73	1.2	0.1	6
Gasoline	4-stroke	1987	2.3	67	1558	101	34761	73	1.2	0.1	6
Gasoline	4-stroke	1988	2.3	69	1545	100	34320	73	1.2	0.1	6
Gasoline	4-stroke	1989	2.3	69	1544	100	34169	73	1.2	0.1	6
Gasoline	4-stroke	1990	2.3	70	1542	99	34013	73	1.2	0.1	6
Gasoline	4-stroke	1991	2.3	74	1513	97	33456	73	1.3	0.1	6
Gasoline	4-stroke	1992	2.3	79	1481	94	32785	73	1.3	0.1	6
Gasoline	4-stroke	1993	2.3	82	1450	92	32209	73	1.3	0.1	6
Gasoline	4-stroke	1994	2.3	85	1418	89	31565	73	1.3	0.1	6
Gasoline	4-stroke	1995	2.3	87	1390	87	30979	73	1.3	0.1	6
Gasoline	4-stroke	1996	2.3	89	1366	85	30651	73	1.3	0.1	6
Gasoline	4-stroke	1997	2.3	90	1342	83	30300	73	1.3	0.1	6
Gasoline	4-stroke	1998	2.3	92	1317	81	29925	73	1.3	0.1	6
Gasoline	4-stroke	1999	2.3	92	1304	80	29816	73	1.3	0.1	6
Gasoline	4-stroke	2000	2.3	92	1291	80	29688	73	1.3	0.1	6
Gasoline	4-stroke	2001	2.3	90	1210	77	29936	73	1.3	0.1	6
Gasoline	4-stroke	2002	2.3	88	1149	76	30067	73	1.3	0.1	6
Gasoline	4-stroke	2003	2.3	87	1105	75	30341	73	1.3	0.1	6
Gasoline	4-stroke	2004	2.3	86	1071	74	30557	73	1.3	0.1	6

Fuel use and emissions (tons) for small boats and pleasure crafts 1985-2004

Engine	Fuel type	Year	Fuel (TJ)	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
	Diesel	1985	219	31	232	38	1	100	16	1	0	24
	Diesel	1986	219	31	232	38	1	100	16	1	0	24
	Diesel	1987	247	35	256	43	1	112	18	1	0	27
	Diesel	1988	277	26	281	48	1	126	21	1	0	30
	Diesel	1989	309	29	309	53	1	140	23	1	0	33
	Diesel	1990	343	32	337	59	1	155	25	1	0	37
	Diesel	1991	378	35	367	65	1	171	28	1	0	40
	Diesel	1992	415	39	398	71	1	188	31	1	0	44
	Diesel	1993	454	43	431	78	1	206	34	1	0	48
	Diesel	1994	495	46	465	85	1	224	37	1	0	53
	Diesel	1995	537	50	500	92	1	243	40	2	0	57
	Diesel	1996	581	54	537	99	2	263	43	2	0	61
	Diesel	1997	628	59	575	107	2	284	46	2	0	66
	Diesel	1998	676	63	614	115	2	306	50	2	0	71
	Diesel	1999	726	68	655	124	2	329	54	2	0	77
	Diesel	2000	777	73	697	132	2	352	58	2	0	82
	Diesel	2001	831	78	740	142	2	376	62	2	0	87
	Diesel	2002	886	83	786	151	2	401	66	3	0	93
	Diesel	2003	944	88	831	161	3	427	70	3	0	99
	Diesel	2004	1002	94	879	170	3	454	74	3	0	105
2-stroke	Gasoline	1985	175	0	14	963	9	1941	13	0	0	51
2-stroke	Gasoline	1986	175	0	14	963	9	1941	13	0	0	51
2-stroke	Gasoline	1987	180	0	15	986	9	1991	13	0	0	52
2-stroke	Gasoline	1988	184	0	15	1009	9	2041	13	0	0	53
2-stroke	Gasoline	1989	189	0	15	1032	9	2092	14	0	0	55
2-stroke	Gasoline	1990	194	0	16	1055	9	2142	14	0	0	56
2-stroke	Gasoline	1991	198	0	16	1077	10	2189	14	0	0	57

2-stroke	Gasoline	1992	203	0	17	1100	10	2239	15	0	0	59
2-stroke	Gasoline	1993	207	0	17	1123	10	2289	15	0	0	60
2-stroke	Gasoline	1994	212	0	17	1145	10	2339	15	0	0	61
2-stroke	Gasoline	1995	217	0	18	1168	10	2390	16	0	0	63
2-stroke	Gasoline	1996	221	1	18	1191	11	2440	16	0	0	64
2-stroke	Gasoline	1997	224	1	18	1202	11	2465	16	0	0	65
2-stroke	Gasoline	1998	224	1	18	1200	11	2464	16	0	0	65
2-stroke	Gasoline	1999	221	1	18	1185	11	2435	16	0	0	64
2-stroke	Gasoline	2000	216	0	18	1154	10	2374	16	0	0	62
2-stroke	Gasoline	2001	208	0	17	1109	10	2284	15	0	0	60
2-stroke	Gasoline	2002	197	0	16	1049	9	2163	14	0	0	57
2-stroke	Gasoline	2003	182	0	15	973	9	2007	13	0	0	53
2-stroke	Gasoline	2004	165	0	14	879	8	1816	12	0	0	48
4-stroke	Gasoline	1985	94	0	61	49	5	1752	7	0	0	0
4-stroke	Gasoline	1986	94	0	61	49	5	1752	7	0	0	0
4-stroke	Gasoline	1987	100	0	64	52	5	1849	7	0	0	0
4-stroke	Gasoline	1988	105	0	68	55	6	1946	8	0	0	0
4-stroke	Gasoline	1989	110	0	71	57	6	2044	8	0	0	0
4-stroke	Gasoline	1990	115	0	74	60	6	2141	8	0	0	0
4-stroke	Gasoline	1991	121	0	78	63	6	2238	9	0	0	1
4-stroke	Gasoline	1992	126	0	81	65	7	2336	9	0	0	1
4-stroke	Gasoline	1993	131	0	84	68	7	2433	10	0	0	1
4-stroke	Gasoline	1994	136	0	88	71	7	2530	10	0	0	1
4-stroke	Gasoline	1995	142	0	91	73	8	2627	10	0	0	1
4-stroke	Gasoline	1996	147	0	95	76	8	2725	11	0	0	1
4-stroke	Gasoline	1997	153	0	98	80	8	2849	11	0	0	1
4-stroke	Gasoline	1998	161	0	103	85	9	3001	12	0	0	1
4-stroke	Gasoline	1999	170	0	109	91	9	3183	12	0	0	1
4-stroke	Gasoline	2000	181	0	115	98	10	3396	13	0	0	1
4-stroke	Gasoline	2001	193	0	122	107	11	3643	14	0	0	1
4-stroke	Gasoline	2002	207	0	129	117	12	3923	15	0	0	1

4-stroke	Gasoline	2003	222	1	138	128	13	4240	16	0	0	1
4-stroke	Gasoline	2004	239	1	147	141	14	4595	17	0	0	1

Emission factors (g/GJ) for small boats and pleasure crafts 1985-2004

Engine	Fuel type	Year	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
	Diesel	1985	141	1055	173	2.8	454	74	3.0	0.2	108
	Diesel	1986	141	1055	173	2.8	454	74	3.0	0.2	108
	Diesel	1987	141	1036	173	2.8	454	74	3.0	0.2	108
	Diesel	1988	94	1015	172	2.8	454	74	3.0	0.2	108
	Diesel	1989	94	1001	172	2.8	454	74	3.0	0.2	107
	Diesel	1990	94	984	172	2.8	454	74	3.0	0.2	107
	Diesel	1991	94	973	172	2.8	454	74	3.0	0.2	107
	Diesel	1992	94	959	171	2.8	453	74	3.0	0.2	106
	Diesel	1993	94	950	171	2.8	453	74	3.0	0.2	106
	Diesel	1994	94	938	171	2.8	453	74	3.0	0.2	106
	Diesel	1995	94	931	171	2.8	453	74	3.0	0.2	106
	Diesel	1996	94	924	171	2.8	453	74	3.0	0.2	106
	Diesel	1997	94	915	171	2.8	453	74	3.0	0.2	106
	Diesel	1998	94	910	171	2.8	453	74	3.0	0.2	106
	Diesel	1999	94	902	170	2.8	453	74	3.0	0.2	105
	Diesel	2000	94	897	170	2.8	453	74	3.0	0.2	105
	Diesel	2001	94	891	170	2.8	453	74	3.0	0.2	105
	Diesel	2002	94	886	170	2.8	453	74	3.0	0.2	105
	Diesel	2003	94	881	170	2.8	453	74	3.0	0.2	105
	Diesel	2004	94	877	170	2.8	453	74	3.0	0.2	105
2-stroke	Gasoline	1985	2.3	81	5499	49	11084	73	0.3	0.1	289
2-stroke	Gasoline	1986	2.3	81	5499	49	11084	73	0.3	0.1	289
2-stroke	Gasoline	1987	2.3	81	5485	49	11077	73	0.3	0.1	289

2-stroke	Gasoline	1988	2.3	81	5472	49	11070	73	0.3	0.1	289
2-stroke	Gasoline	1989	2.3	82	5459	49	11064	73	0.3	0.1	289
2-stroke	Gasoline	1990	2.3	82	5447	48	11057	73	0.3	0.1	289
2-stroke	Gasoline	1991	2.3	82	5436	48	11052	73	0.3	0.1	289
2-stroke	Gasoline	1992	2.3	82	5425	48	11046	73	0.3	0.1	289
2-stroke	Gasoline	1993	2.3	82	5414	48	11041	73	0.3	0.1	289
2-stroke	Gasoline	1994	2.3	82	5404	48	11036	73	0.3	0.1	289
2-stroke	Gasoline	1995	2.3	82	5394	48	11031	73	0.3	0.1	289
2-stroke	Gasoline	1996	2.3	82	5385	48	11026	73	0.3	0.1	289
2-stroke	Gasoline	1997	2.3	82	5376	48	11022	73	0.3	0.1	289
2-stroke	Gasoline	1998	2.3	82	5367	48	11018	73	0.3	0.1	289
2-stroke	Gasoline	1999	2.3	82	5359	48	11013	73	0.3	0.1	289
2-stroke	Gasoline	2000	2.3	83	5352	48	11010	73	0.3	0.1	289
2-stroke	Gasoline	2001	2.3	83	5344	48	11006	73	0.3	0.1	289
2-stroke	Gasoline	2002	2.3	83	5337	48	11002	73	0.3	0.1	289
2-stroke	Gasoline	2003	2.3	83	5329	48	10999	73	0.3	0.1	289
2-stroke	Gasoline	2004	2.3	83	5323	48	10995	73	0.3	0.1	289
4-stroke	Gasoline	1985	2.3	643	523	54	18544	73	1.6	0.1	4
4-stroke	Gasoline	1986	2.3	643	523	54	18544	73	1.6	0.1	4
4-stroke	Gasoline	1987	2.3	643	522	54	18544	73	1.6	0.1	4
4-stroke	Gasoline	1988	2.3	643	521	54	18544	73	1.6	0.1	4
4-stroke	Gasoline	1989	2.3	643	520	54	18544	73	1.6	0.1	4
4-stroke	Gasoline	1990	2.3	643	519	54	18544	73	1.6	0.1	4
4-stroke	Gasoline	1991	2.3	643	519	54	18544	73	1.6	0.1	4
4-stroke	Gasoline	1992	2.3	643	518	54	18544	73	1.6	0.1	4
4-stroke	Gasoline	1993	2.3	643	518	54	18544	73	1.6	0.1	4
4-stroke	Gasoline	1994	2.3	643	517	54	18544	73	1.6	0.1	4
4-stroke	Gasoline	1995	2.3	643	517	54	18544	73	1.6	0.1	4
4-stroke	Gasoline	1996	2.3	643	516	54	18544	73	1.6	0.1	4
4-stroke	Gasoline	1997	2.3	642	519	54	18570	73	1.6	0.1	4
4-stroke	Gasoline	1998	2.3	640	525	54	18621	73	1.6	0.1	4

4-stroke	Gasoline	1999	2.3	637	532	55	18693	73	1.6	0.1	4
4-stroke	Gasoline	2000	2.3	634	542	56	18782	73	1.6	0.1	4
4-stroke	Gasoline	2001	2.3	630	553	57	18883	73	1.6	0.1	4
4-stroke	Gasoline	2002	2.3	626	565	58	18993	73	1.6	0.1	4
4-stroke	Gasoline	2003	2.3	621	577	59	19109	73	1.6	0.1	4
4-stroke	Gasoline	2004	2.3	616	590	60	19228	73	1.6	0.1	4

Fuel use and emissions (tons) in CollectER format 1985-2004

Sector	Fuel type	Year	Fuel (TJ)	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Agriculture	Diesel	1985	15960	3738	11164	2673	43	10608	1181	46	3	2540
Agriculture	Diesel	1986	16501	2319	11759	2717	44	10837	1221	48	3	2552
Agriculture	Diesel	1987	16189	2275	11722	2631	43	10546	1198	47	3	2453
Agriculture	Diesel	1988	16700	2347	12316	2675	44	10752	1236	49	3	2486
Agriculture	Diesel	1989	16595	1555	12411	2629	43	10612	1228	48	3	2430
Agriculture	Diesel	1990	16496	1545	12518	2587	42	10484	1221	48	3	2383
Agriculture	Diesel	1991	16394	1536	12765	2520	41	10301	1213	48	3	2291
Agriculture	Diesel	1992	15688	1470	12458	2379	39	9789	1161	46	3	2141
Agriculture	Diesel	1993	15711	1472	12713	2342	38	9717	1163	47	3	2095
Agriculture	Diesel	1994	14858	1392	12284	2172	35	9093	1099	44	3	1916
Agriculture	Diesel	1995	15326	1436	12997	2186	36	9244	1134	46	3	1887
Agriculture	Diesel	1996	14584	342	12956	2026	33	8670	1079	44	3	1703
Agriculture	Diesel	1997	14880	348	13568	2003	33	8672	1101	45	3	1629
Agriculture	Diesel	1998	14092	330	13085	1850	30	8099	1043	43	2	1476
Agriculture	Diesel	1999	14048	329	13277	1799	29	7960	1040	43	2	1401
Agriculture	Diesel	2000	13703	321	13134	1712	28	7657	1014	42	2	1309
Agriculture	Diesel	2001	13695	321	13275	1657	27	7497	1013	42	2	1238
Agriculture	Diesel	2002	13642	319	12900	1555	25	7126	1010	42	2	1152
Agriculture	Diesel	2003	13518	317	12340	1447	24	6747	1000	42	2	1070
Agriculture	Diesel	2004	13439	315	11811	1346	22	6393	994	42	2	991

Agriculture	Gasoline	1985	914	2	28	861	80	43177	67	1	0	6
Agriculture	Gasoline	1986	873	2	27	824	77	41319	64	1	0	6
Agriculture	Gasoline	1987	832	2	26	787	73	39439	61	1	0	5
Agriculture	Gasoline	1988	791	2	25	749	70	37539	58	1	0	5
Agriculture	Gasoline	1989	750	2	24	711	66	35622	55	1	0	5
Agriculture	Gasoline	1990	709	2	22	673	63	33688	52	1	0	5
Agriculture	Gasoline	1991	664	2	21	631	59	31561	48	1	0	4
Agriculture	Gasoline	1992	623	1	21	594	56	29514	46	1	0	4
Agriculture	Gasoline	1993	585	1	20	557	52	27488	43	1	0	4
Agriculture	Gasoline	1994	547	1	20	523	50	25490	40	1	0	4
Agriculture	Gasoline	1995	512	1	19	489	47	23528	37	1	0	4
Agriculture	Gasoline	1996	479	1	19	458	45	21599	35	1	0	4
Agriculture	Gasoline	1997	447	1	19	427	42	19705	33	1	0	4
Agriculture	Gasoline	1998	418	1	19	400	40	17864	31	1	0	4
Agriculture	Gasoline	1999	394	1	20	377	39	16108	29	1	0	4
Agriculture	Gasoline	2000	378	1	22	366	40	14539	28	1	0	5
Agriculture	Gasoline	2001	362	1	23	356	40	13070	26	1	0	6
Agriculture	Gasoline	2002	346	1	24	346	40	11599	25	1	0	6
Agriculture	Gasoline	2003	329	1	26	334	40	10124	24	0	0	6
Agriculture	Gasoline	2004	311	1	27	322	40	8649	23	0	0	7
Forestry	Diesel	1985	141	33	102	25	0	102	10	0	0	26
Forestry	Diesel	1986	142	20	107	25	0	100	10	0	0	25
Forestry	Diesel	1987	142	20	112	24	0	98	11	0	0	24
Forestry	Diesel	1988	143	20	116	23	0	96	11	0	0	23
Forestry	Diesel	1989	144	14	121	23	0	95	11	0	0	22
Forestry	Diesel	1990	145	14	125	23	0	94	11	0	0	22
Forestry	Diesel	1991	146	14	130	22	0	91	11	0	0	20
Forestry	Diesel	1992	146	14	136	21	0	89	11	0	0	19
Forestry	Diesel	1993	147	14	141	20	0	87	11	0	0	17
Forestry	Diesel	1994	148	14	146	19	0	85	11	0	0	16

Forestry	Diesel	1995	148	14	150	18	0	83	11	0	0	14
Forestry	Diesel	1996	149	3	154	17	0	81	11	0	0	13
Forestry	Diesel	1997	150	4	158	17	0	79	11	0	0	12
Forestry	Diesel	1998	151	4	161	16	0	78	11	0	0	11
Forestry	Diesel	1999	152	4	161	15	0	76	11	0	0	11
Forestry	Diesel	2000	153	4	161	15	0	74	11	0	0	10
Forestry	Diesel	2001	155	4	161	14	0	72	11	0	0	10
Forestry	Diesel	2002	156	4	153	13	0	68	12	0	0	9
Forestry	Diesel	2003	158	4	142	12	0	63	12	1	0	8
Forestry	Diesel	2004	159	4	131	10	0	58	12	1	0	7
Forestry	Gasoline	1985	341	1	14	2461	21	6165	25	0	0	35
Forestry	Gasoline	1986	341	1	14	2461	21	6165	25	0	0	35
Forestry	Gasoline	1987	341	1	14	2461	21	6165	25	0	0	35
Forestry	Gasoline	1988	341	1	14	2461	21	6165	25	0	0	35
Forestry	Gasoline	1989	341	1	14	2461	21	6165	25	0	0	35
Forestry	Gasoline	1990	341	1	14	2461	21	6165	25	0	0	35
Forestry	Gasoline	1991	313	1	13	2187	18	5469	23	0	0	29
Forestry	Gasoline	1992	286	1	13	1921	16	4792	21	0	0	24
Forestry	Gasoline	1993	261	1	13	1665	14	4140	19	0	0	19
Forestry	Gasoline	1994	244	1	12	1559	13	3875	18	0	0	18
Forestry	Gasoline	1995	227	1	11	1452	12	3611	17	0	0	17
Forestry	Gasoline	1996	211	0	10	1346	11	3347	15	0	0	16
Forestry	Gasoline	1997	194	0	9	1240	10	3083	14	0	0	14
Forestry	Gasoline	1998	177	0	9	1133	9	2818	13	0	0	13
Forestry	Gasoline	1999	161	0	8	1027	9	2554	12	0	0	12
Forestry	Gasoline	2000	144	0	7	921	8	2290	11	0	0	11
Forestry	Gasoline	2001	128	0	6	815	7	2026	9	0	0	9
Forestry	Gasoline	2002	111	0	5	708	6	1762	8	0	0	8
Forestry	Gasoline	2003	94	0	5	602	5	1497	7	0	0	7
Forestry	Gasoline	2004	78	0	4	496	4	1233	6	0	0	6

Industry	Diesel	1985	10256	2402	9244	1952	32	6970	759	30	2	1815
Industry	Diesel	1986	10252	1441	9304	1927	31	6923	759	30	2	1770
Industry	Diesel	1987	10245	1440	9361	1903	31	6876	758	30	2	1725
Industry	Diesel	1988	10232	1438	9414	1877	31	6821	757	30	2	1678
Industry	Diesel	1989	10201	956	9453	1846	30	6747	755	30	2	1626
Industry	Diesel	1990	10158	952	9484	1811	29	6662	752	30	2	1569
Industry	Diesel	1991	10194	955	9701	1784	29	6636	754	30	2	1525
Industry	Diesel	1992	10211	957	9884	1753	28	6591	756	30	2	1476
Industry	Diesel	1993	10216	957	10037	1719	28	6537	756	31	2	1425
Industry	Diesel	1994	10229	958	10180	1688	27	6487	757	31	2	1375
Industry	Diesel	1995	10324	967	10392	1676	27	6505	764	31	2	1342
Industry	Diesel	1996	10406	244	10603	1686	27	6592	770	31	2	1310
Industry	Diesel	1997	10506	246	10789	1678	27	6603	777	32	2	1277
Industry	Diesel	1998	10600	248	10951	1668	27	6605	784	32	2	1242
Industry	Diesel	1999	10685	250	10799	1594	26	6382	791	33	2	1185
Industry	Diesel	2000	10773	252	10643	1525	25	6166	797	33	2	1127
Industry	Diesel	2001	10896	255	10411	1473	24	5998	806	34	2	1113
Industry	Diesel	2002	11010	258	10146	1413	23	5800	815	34	2	1090
Industry	Diesel	2003	11145	261	9749	1353	22	5612	825	34	2	1067
Industry	Diesel	2004	11229	263	9297	1276	21	5372	831	35	2	1029
Industry	Gasoline	1985	177	0	23	290	22	2764	13	0	0	2
Industry	Gasoline	1986	176	0	23	288	22	2732	13	0	0	2
Industry	Gasoline	1987	176	0	23	287	22	2698	13	0	0	2
Industry	Gasoline	1988	176	0	24	285	21	2664	13	0	0	2
Industry	Gasoline	1989	176	0	24	284	21	2629	13	0	0	2
Industry	Gasoline	1990	175	0	24	282	21	2593	13	0	0	2
Industry	Gasoline	1991	174	0	25	276	20	2536	13	0	0	2
Industry	Gasoline	1992	173	0	27	270	20	2476	13	0	0	2
Industry	Gasoline	1993	171	0	28	264	19	2415	13	0	0	2
Industry	Gasoline	1994	170	0	30	258	18	2353	12	0	0	2

Industry	Gasoline	1995	169	0	31	251	18	2289	12	0	0	2
Industry	Gasoline	1996	169	0	31	250	18	2257	12	0	0	2
Industry	Gasoline	1997	168	0	31	248	17	2223	12	0	0	2
Industry	Gasoline	1998	168	0	32	247	17	2188	12	0	0	2
Industry	Gasoline	1999	168	0	32	245	17	2153	12	0	0	2
Industry	Gasoline	2000	167	0	32	244	17	2116	12	0	0	2
Industry	Gasoline	2001	167	0	32	244	17	2116	12	0	0	2
Industry	Gasoline	2002	167	0	32	244	17	2116	12	0	0	2
Industry	Gasoline	2003	167	0	32	244	17	2116	12	0	0	2
Industry	Gasoline	2004	167	0	32	244	17	2116	12	0	0	2
Industry	LPG	1985	1232	0	1636	180	9	129	80	4	0	6
Industry	LPG	1986	1233	0	1638	180	9	129	80	4	0	6
Industry	LPG	1987	1225	0	1626	179	9	128	80	4	0	6
Industry	LPG	1988	1209	0	1606	177	9	127	79	4	0	6
Industry	LPG	1989	1196	0	1589	175	9	125	78	4	0	6
Industry	LPG	1990	1185	0	1574	173	9	124	77	4	0	6
Industry	LPG	1991	1172	0	1556	171	9	123	76	4	0	6
Industry	LPG	1992	1151	0	1529	168	9	121	75	4	0	6
Industry	LPG	1993	1124	0	1492	164	9	118	73	4	0	5
Industry	LPG	1994	1105	0	1467	161	8	116	72	4	0	5
Industry	LPG	1995	1099	0	1459	160	8	115	71	4	0	5
Industry	LPG	1996	1088	0	1446	159	8	114	71	4	0	5
Industry	LPG	1997	1075	0	1428	157	8	113	70	4	0	5
Industry	LPG	1998	1086	0	1442	159	8	114	71	4	0	5
Industry	LPG	1999	1077	0	1430	157	8	113	70	4	0	5
Industry	LPG	2000	1071	0	1422	156	8	112	70	4	0	5
Industry	LPG	2001	1073	0	1425	157	8	113	70	4	0	5
Industry	LPG	2002	1084	0	1439	158	8	114	70	4	0	5
Industry	LPG	2003	1079	0	1433	158	8	113	70	4	0	5
Industry	LPG	2004	1065	0	1415	156	8	112	69	4	0	5

Household/gardening	Gasoline	1985	1910	4	114	4667	192	64155	139	2	0	40
Household/gardening	Gasoline	1986	1903	4	117	4637	189	63226	139	2	0	40
Household/gardening	Gasoline	1987	1896	4	119	4606	186	62266	138	2	0	40
Household/gardening	Gasoline	1988	1888	4	122	4574	183	61278	138	2	0	39
Household/gardening	Gasoline	1989	1886	4	122	4567	182	60942	138	2	0	39
Household/gardening	Gasoline	1990	1884	4	123	4560	182	60598	138	2	0	39
Household/gardening	Gasoline	1991	1923	4	134	4600	181	60675	140	2	0	39
Household/gardening	Gasoline	1992	1960	4	143	4609	178	60462	143	2	0	39
Household/gardening	Gasoline	1993	1998	5	152	4592	176	60379	146	2	0	38
Household/gardening	Gasoline	1994	2039	5	161	4606	174	60245	149	2	0	39
Household/gardening	Gasoline	1995	2083	5	168	4699	173	60312	152	2	0	40
Household/gardening	Gasoline	1996	2129	5	174	4798	173	60886	155	2	0	42
Household/gardening	Gasoline	1997	2175	5	180	4894	173	61386	159	3	0	43
Household/gardening	Gasoline	1998	2220	5	186	4985	173	61815	162	3	0	45
Household/gardening	Gasoline	1999	2270	5	190	5099	175	62860	166	3	0	46
Household/gardening	Gasoline	2000	2320	5	194	5209	177	63852	169	3	0	47
Household/gardening	Gasoline	2001	2758	6	225	6083	205	76214	201	3	0	57
Household/gardening	Gasoline	2002	3195	7	256	6955	233	88416	233	4	0	67
Household/gardening	Gasoline	2003	3636	8	287	7837	261	101233	265	4	0	77
Household/gardening	Gasoline	2004	4078	9	317	8731	290	114073	298	5	0	87
Inland waterways	Diesel	1985	219	31	232	38	1	100	16	1	0	24
Inland waterways	Diesel	1986	219	31	232	38	1	100	16	1	0	24
Inland waterways	Diesel	1987	247	35	256	43	1	112	18	1	0	27
Inland waterways	Diesel	1988	277	26	281	48	1	126	21	1	0	30
Inland waterways	Diesel	1989	309	29	309	53	1	140	23	1	0	33
Inland waterways	Diesel	1990	343	32	337	59	1	155	25	1	0	37
Inland waterways	Diesel	1991	378	35	367	65	1	171	28	1	0	40
Inland waterways	Diesel	1992	415	39	398	71	1	188	31	1	0	44
Inland waterways	Diesel	1993	454	43	431	78	1	206	34	1	0	48
Inland waterways	Diesel	1994	495	46	465	85	1	224	37	1	0	53

Inland waterways	Diesel	1995	537	50	500	92	1	243	40	2	0	57
Inland waterways	Diesel	1996	581	54	537	99	2	263	43	2	0	61
Inland waterways	Diesel	1997	628	59	575	107	2	284	46	2	0	66
Inland waterways	Diesel	1998	676	63	614	115	2	306	50	2	0	71
Inland waterways	Diesel	1999	726	68	655	124	2	329	54	2	0	77
Inland waterways	Diesel	2000	777	73	697	132	2	352	58	2	0	82
Inland waterways	Diesel	2001	831	78	740	142	2	376	62	2	0	87
Inland waterways	Diesel	2002	886	83	786	151	2	401	66	3	0	93
Inland waterways	Diesel	2003	944	88	831	161	3	427	70	3	0	99
Inland waterways	Diesel	2004	1002	94	879	170	3	454	74	3	0	105
Inland waterways	Gasoline	1985	270	1	75	1012	14	3693	20	0	0	51
Inland waterways	Gasoline	1986	270	1	75	1012	14	3693	20	0	0	51
Inland waterways	Gasoline	1987	279	1	79	1038	14	3840	20	0	0	52
Inland waterways	Gasoline	1988	289	1	83	1064	15	3988	21	0	0	54
Inland waterways	Gasoline	1989	299	1	86	1089	15	4135	22	0	0	55
Inland waterways	Gasoline	1990	309	1	90	1115	16	4283	23	0	0	56
Inland waterways	Gasoline	1991	319	1	94	1139	16	4427	23	0	0	58
Inland waterways	Gasoline	1992	329	1	98	1165	17	4575	24	0	0	59
Inland waterways	Gasoline	1993	339	1	101	1191	17	4722	25	0	0	60
Inland waterways	Gasoline	1994	348	1	105	1216	18	4869	25	0	0	62
Inland waterways	Gasoline	1995	358	1	109	1242	18	5017	26	0	0	63
Inland waterways	Gasoline	1996	368	1	113	1267	19	5165	27	0	0	64
Inland waterways	Gasoline	1997	377	1	117	1282	19	5314	28	0	0	65
Inland waterways	Gasoline	1998	385	1	122	1285	19	5465	28	0	0	65
Inland waterways	Gasoline	1999	391	1	127	1275	20	5618	29	0	0	65
Inland waterways	Gasoline	2000	396	1	132	1252	20	5770	29	0	0	63
Inland waterways	Gasoline	2001	400	1	139	1216	21	5927	29	0	0	61
Inland waterways	Gasoline	2002	403	1	145	1166	21	6086	29	0	0	58
Inland waterways	Gasoline	2003	404	1	153	1101	22	6247	30	0	0	54
Inland waterways	Gasoline	2004	404	1	161	1020	22	6411	30	0	0	49

Emission factors (g/GJ) in CollectER format 1985-2004

Sector	Fuel type	Year	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Agriculture	Diesel	1985	234	699	167	2.7	665	74	2.9	0.2	159
Agriculture	Diesel	1986	141	713	165	2.7	657	74	2.9	0.2	155
Agriculture	Diesel	1987	141	724	162	2.6	651	74	2.9	0.2	152
Agriculture	Diesel	1988	141	737	160	2.6	644	74	2.9	0.2	149
Agriculture	Diesel	1989	94	748	158	2.6	639	74	2.9	0.2	146
Agriculture	Diesel	1990	94	759	157	2.6	636	74	2.9	0.2	144
Agriculture	Diesel	1991	94	779	154	2.5	628	74	2.9	0.2	140
Agriculture	Diesel	1992	94	794	152	2.5	624	74	3.0	0.2	136
Agriculture	Diesel	1993	94	809	149	2.4	618	74	3.0	0.2	133
Agriculture	Diesel	1994	94	827	146	2.4	612	74	3.0	0.2	129
Agriculture	Diesel	1995	94	848	143	2.3	603	74	3.0	0.2	123
Agriculture	Diesel	1996	23	888	139	2.3	594	74	3.0	0.2	117
Agriculture	Diesel	1997	23	912	135	2.2	583	74	3.0	0.2	109
Agriculture	Diesel	1998	23	928	131	2.1	575	74	3.1	0.2	105
Agriculture	Diesel	1999	23	945	128	2.1	567	74	3.1	0.2	100
Agriculture	Diesel	2000	23	958	125	2.0	559	74	3.1	0.2	95
Agriculture	Diesel	2001	23	969	121	2.0	547	74	3.1	0.2	90
Agriculture	Diesel	2002	23	946	114	1.9	522	74	3.1	0.2	84
Agriculture	Diesel	2003	23	913	107	1.7	499	74	3.1	0.2	79
Agriculture	Diesel	2004	23	879	100	1.6	476	74	3.1	0.2	74
Agriculture	Gasoline	1985	2	31	942	87.6	47231	73	1.3	0.1	6
Agriculture	Gasoline	1986	2	31	944	87.9	47327	73	1.3	0.1	6
Agriculture	Gasoline	1987	2	31	946	88.1	47406	73	1.3	0.1	6
Agriculture	Gasoline	1988	2	31	948	88.2	47466	73	1.3	0.1	6
Agriculture	Gasoline	1989	2	31	949	88.3	47506	73	1.3	0.1	7
Agriculture	Gasoline	1990	2	32	950	88.4	47524	73	1.3	0.1	7

Agriculture	Gasoline	1991	2	32	951	88.6	47566	73	1.3	0.1	7
Agriculture	Gasoline	1992	2	33	952	89.1	47346	73	1.3	0.1	7
Agriculture	Gasoline	1993	2	34	954	89.8	47023	73	1.3	0.1	7
Agriculture	Gasoline	1994	2	36	954	90.6	46561	73	1.3	0.1	7
Agriculture	Gasoline	1995	2	38	955	91.7	45923	73	1.3	0.2	8
Agriculture	Gasoline	1996	2	40	956	92.9	45096	73	1.3	0.2	8
Agriculture	Gasoline	1997	2	43	956	94.5	44050	73	1.3	0.2	9
Agriculture	Gasoline	1998	2	46	956	96.5	42687	73	1.3	0.3	10
Agriculture	Gasoline	1999	2	50	956	99.4	40851	73	1.4	0.4	11
Agriculture	Gasoline	2000	2	57	968	104.5	38451	73	1.4	0.5	13
Agriculture	Gasoline	2001	2	64	983	110.2	36074	73	1.4	0.6	15
Agriculture	Gasoline	2002	2	71	999	116.2	33522	73	1.5	0.7	17
Agriculture	Gasoline	2003	2	78	1015	122.5	30773	73	1.5	0.9	20
Agriculture	Gasoline	2004	2	86	1032	129.2	27767	73	1.5	1.0	22
Forestry	Diesel	1985	234	722	179	2.9	725	74	2.9	0.2	182
Forestry	Diesel	1986	141	756	174	2.8	706	74	2.9	0.2	173
Forestry	Diesel	1987	141	784	169	2.7	689	74	2.9	0.2	166
Forestry	Diesel	1988	141	812	164	2.7	673	74	2.9	0.2	159
Forestry	Diesel	1989	94	836	160	2.6	659	74	3.0	0.2	154
Forestry	Diesel	1990	94	857	156	2.5	646	74	3.0	0.2	149
Forestry	Diesel	1991	94	894	150	2.4	627	74	3.0	0.2	139
Forestry	Diesel	1992	94	927	143	2.3	608	74	3.0	0.2	129
Forestry	Diesel	1993	94	959	136	2.2	591	74	3.1	0.2	119
Forestry	Diesel	1994	94	987	129	2.1	573	74	3.1	0.2	108
Forestry	Diesel	1995	94	1014	122	2.0	556	74	3.1	0.2	97
Forestry	Diesel	1996	23	1034	115	1.9	543	74	3.1	0.2	87
Forestry	Diesel	1997	23	1052	111	1.8	530	74	3.2	0.2	80
Forestry	Diesel	1998	23	1069	106	1.7	517	74	3.2	0.2	72
Forestry	Diesel	1999	23	1061	101	1.6	501	74	3.2	0.2	69
Forestry	Diesel	2000	23	1053	96	1.6	486	74	3.2	0.2	66
Forestry	Diesel	2001	23	1038	91	1.5	467	74	3.2	0.2	63

Forestry	Diesel	2002	23	981	83	1.3	433	74	3.2	0.2	57
Forestry	Diesel	2003	23	904	74	1.2	398	74	3.2	0.2	52
Forestry	Diesel	2004	23	823	65	1.1	362	74	3.2	0.2	46
Forestry	Gasoline	1985	2	40	7207	60.4	18057	73	0.4	0.1	101
Forestry	Gasoline	1986	2	40	7207	60.4	18057	73	0.4	0.1	101
Forestry	Gasoline	1987	2	40	7207	60.4	18057	73	0.4	0.1	101
Forestry	Gasoline	1988	2	40	7207	60.4	18057	73	0.4	0.1	101
Forestry	Gasoline	1989	2	40	7207	60.4	18057	73	0.4	0.1	101
Forestry	Gasoline	1990	2	40	7207	60.4	18057	73	0.4	0.1	101
Forestry	Gasoline	1991	2	43	6978	58.3	17450	73	0.4	0.1	93
Forestry	Gasoline	1992	2	46	6706	55.9	16728	73	0.4	0.1	84
Forestry	Gasoline	1993	2	48	6386	53.0	15880	73	0.4	0.1	74
Forestry	Gasoline	1994	2	48	6386	53.0	15880	73	0.4	0.1	74
Forestry	Gasoline	1995	2	48	6386	53.0	15880	73	0.4	0.1	74
Forestry	Gasoline	1996	2	48	6386	53.0	15880	73	0.4	0.1	74
Forestry	Gasoline	1997	2	48	6386	53.0	15880	73	0.4	0.1	74
Forestry	Gasoline	1998	2	48	6386	53.0	15880	73	0.4	0.1	74
Forestry	Gasoline	1999	2	48	6386	53.0	15880	73	0.4	0.1	74
Forestry	Gasoline	2000	2	48	6386	53.0	15880	73	0.4	0.1	74
Forestry	Gasoline	2001	2	48	6386	53.0	15880	73	0.4	0.1	74
Forestry	Gasoline	2002	2	48	6386	53.0	15880	73	0.4	0.1	74
Forestry	Gasoline	2003	2	48	6386	53.0	15880	73	0.4	0.1	74
Forestry	Gasoline	2004	2	48	6386	53.0	15880	73	0.4	0.1	74
Industry	Diesel	1985	234	901	190	3.1	680	74	2.9	0.2	177
Industry	Diesel	1986	141	908	188	3.1	675	74	2.9	0.2	173
Industry	Diesel	1987	141	914	186	3.0	671	74	2.9	0.2	168
Industry	Diesel	1988	141	920	183	3.0	667	74	2.9	0.2	164
Industry	Diesel	1989	94	927	181	2.9	661	74	2.9	0.2	159
Industry	Diesel	1990	94	934	178	2.9	656	74	2.9	0.2	155
Industry	Diesel	1991	94	952	175	2.8	651	74	3.0	0.2	150
Industry	Diesel	1992	94	968	172	2.8	645	74	3.0	0.2	145

Industry	Diesel	1993	94	983	168	2.7	640	74	3.0	0.2	139
Industry	Diesel	1994	94	995	165	2.7	634	74	3.0	0.2	134
Industry	Diesel	1995	94	1007	162	2.6	630	74	3.0	0.2	130
Industry	Diesel	1996	23	1019	162	2.6	634	74	3.0	0.2	126
Industry	Diesel	1997	23	1027	160	2.6	629	74	3.0	0.2	122
Industry	Diesel	1998	23	1033	157	2.6	623	74	3.0	0.2	117
Industry	Diesel	1999	23	1011	149	2.4	597	74	3.1	0.2	111
Industry	Diesel	2000	23	988	142	2.3	572	74	3.1	0.2	105
Industry	Diesel	2001	23	956	135	2.2	550	74	3.1	0.2	102
Industry	Diesel	2002	23	921	128	2.1	527	74	3.1	0.2	99
Industry	Diesel	2003	23	875	121	2.0	504	74	3.1	0.2	96
Industry	Diesel	2004	23	828	114	1.8	478	74	3.1	0.2	92
Industry	Gasoline	1985	2	129	1638	124.0	15635	73	1.3	0.1	12
Industry	Gasoline	1986	2	131	1633	123.4	15478	73	1.3	0.1	12
Industry	Gasoline	1987	2	132	1628	122.7	15316	73	1.3	0.1	12
Industry	Gasoline	1988	2	134	1622	122.0	15148	73	1.3	0.1	12
Industry	Gasoline	1989	2	135	1617	121.3	14975	73	1.3	0.1	12
Industry	Gasoline	1990	2	136	1611	120.6	14797	73	1.3	0.1	12
Industry	Gasoline	1991	2	146	1588	117.7	14577	73	1.3	0.1	12
Industry	Gasoline	1992	2	155	1564	114.8	14341	73	1.3	0.1	13
Industry	Gasoline	1993	2	164	1539	111.7	14092	73	1.4	0.1	13
Industry	Gasoline	1994	2	174	1514	108.6	13832	73	1.4	0.1	13
Industry	Gasoline	1995	2	183	1489	105.4	13560	73	1.4	0.1	13
Industry	Gasoline	1996	2	185	1483	104.7	13391	73	1.4	0.1	13
Industry	Gasoline	1997	2	187	1477	104.0	13214	73	1.4	0.1	13
Industry	Gasoline	1998	2	188	1471	103.2	13032	73	1.4	0.1	13
Industry	Gasoline	1999	2	190	1465	102.5	12845	73	1.4	0.1	13
Industry	Gasoline	2000	2	191	1458	101.7	12652	73	1.4	0.1	13
Industry	Gasoline	2001	2	191	1458	101.7	12652	73	1.4	0.1	13
Industry	Gasoline	2002	2	191	1458	101.7	12652	73	1.4	0.1	13
Industry	Gasoline	2003	2	191	1458	101.7	12652	73	1.4	0.1	13

Industry	Gasoline	2004	2	191	1458	101.7	12652	73	1.4	0.1	13
Industry	LPG	1985	0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	1986	0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	1987	0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	1988	0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	1989	0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	1990	0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	1991	0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	1992	0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	1993	0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	1994	0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	1995	0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	1996	0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	1997	0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	1998	0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	1999	0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	2000	0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	2001	0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	2002	0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	2003	0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	2004	0	1328	146	7.7	105	65	3.5	0.2	5
Household/gardening	Gasoline	1985	2	60	2443	100.7	33588	73	1.1	0.1	21
Household/gardening	Gasoline	1986	2	61	2437	99.5	33227	73	1.1	0.1	21
Household/gardening	Gasoline	1987	2	63	2430	98.2	32847	73	1.1	0.1	21
Household/gardening	Gasoline	1988	2	65	2422	96.8	32449	73	1.1	0.1	21
Household/gardening	Gasoline	1989	2	65	2421	96.6	32311	73	1.1	0.1	21
Household/gardening	Gasoline	1990	2	65	2421	96.5	32168	73	1.1	0.1	21
Household/gardening	Gasoline	1991	2	69	2392	93.9	31555	73	1.1	0.1	20
Household/gardening	Gasoline	1992	2	73	2351	91.1	30842	73	1.2	0.1	20
Household/gardening	Gasoline	1993	2	76	2298	88.3	30214	73	1.2	0.1	19
Household/gardening	Gasoline	1994	2	79	2259	85.4	29549	73	1.2	0.1	19

Household/gardening	Gasoline	1995	2	81	2256	83.1	28960	73	1.2	0.1	19
Household/gardening	Gasoline	1996	2	82	2254	81.4	28602	73	1.2	0.1	20
Household/gardening	Gasoline	1997	2	83	2250	79.6	28229	73	1.2	0.1	20
Household/gardening	Gasoline	1998	2	84	2245	77.8	27843	73	1.2	0.1	20
Household/gardening	Gasoline	1999	2	84	2246	77.0	27689	73	1.2	0.1	20
Household/gardening	Gasoline	2000	2	83	2245	76.3	27522	73	1.2	0.1	20
Household/gardening	Gasoline	2001	2	81	2206	74.3	27633	73	1.2	0.1	21
Household/gardening	Gasoline	2002	2	80	2176	72.8	27670	73	1.2	0.1	21
Household/gardening	Gasoline	2003	2	79	2155	71.9	27843	73	1.2	0.1	21
Household/gardening	Gasoline	2004	2	78	2141	71.2	27975	73	1.2	0.1	21
Inland waterways	Diesel	1985	141	1055	173	2.8	454	74	3.0	0.2	108
Inland waterways	Diesel	1986	141	1055	173	2.8	454	74	3.0	0.2	108
Inland waterways	Diesel	1987	141	1036	173	2.8	454	74	3.0	0.2	108
Inland waterways	Diesel	1988	94	1015	172	2.8	454	74	3.0	0.2	108
Inland waterways	Diesel	1989	94	1001	172	2.8	454	74	3.0	0.2	107
Inland waterways	Diesel	1990	94	984	172	2.8	454	74	3.0	0.2	107
Inland waterways	Diesel	1991	94	973	172	2.8	454	74	3.0	0.2	107
Inland waterways	Diesel	1992	94	959	171	2.8	453	74	3.0	0.2	106
Inland waterways	Diesel	1993	94	950	171	2.8	453	74	3.0	0.2	106
Inland waterways	Diesel	1994	94	938	171	2.8	453	74	3.0	0.2	106
Inland waterways	Diesel	1995	94	931	171	2.8	453	74	3.0	0.2	106
Inland waterways	Diesel	1996	94	924	171	2.8	453	74	3.0	0.2	106
Inland waterways	Diesel	1997	94	915	171	2.8	453	74	3.0	0.2	106
Inland waterways	Diesel	1998	94	910	171	2.8	453	74	3.0	0.2	106
Inland waterways	Diesel	1999	94	902	170	2.8	453	74	3.0	0.2	105
Inland waterways	Diesel	2000	94	897	170	2.8	453	74	3.0	0.2	105
Inland waterways	Diesel	2001	94	891	170	2.8	453	74	3.0	0.2	105
Inland waterways	Diesel	2002	94	886	170	2.8	453	74	3.0	0.2	105
Inland waterways	Diesel	2003	94	881	170	2.8	453	74	3.0	0.2	105
Inland waterways	Diesel	2004	94	877	170	2.8	453	74	3.0	0.2	105
Inland waterways	Gasoline	1985	2	278	3756	50.5	13698	73	0.8	0.1	189

Inland waterways	Gasoline	1986	2	278	3756	50.5	13698	73	0.8	0.1	189
Inland waterways	Gasoline	1987	2	282	3714	50.5	13741	73	0.8	0.1	187
Inland waterways	Gasoline	1988	2	285	3676	50.4	13781	73	0.8	0.1	185
Inland waterways	Gasoline	1989	2	288	3640	50.4	13818	73	0.8	0.1	184
Inland waterways	Gasoline	1990	2	291	3607	50.4	13853	73	0.8	0.1	182
Inland waterways	Gasoline	1991	2	294	3574	50.4	13889	73	0.8	0.1	181
Inland waterways	Gasoline	1992	2	297	3544	50.3	13920	73	0.8	0.1	180
Inland waterways	Gasoline	1993	2	299	3517	50.3	13948	73	0.8	0.1	178
Inland waterways	Gasoline	1994	2	302	3490	50.3	13976	73	0.8	0.1	177
Inland waterways	Gasoline	1995	2	304	3465	50.3	14002	73	0.8	0.1	176
Inland waterways	Gasoline	1996	2	306	3442	50.2	14026	73	0.8	0.1	175
Inland waterways	Gasoline	1997	2	310	3400	50.3	14093	73	0.8	0.1	173
Inland waterways	Gasoline	1998	2	316	3339	50.6	14202	73	0.8	0.1	170
Inland waterways	Gasoline	1999	2	324	3259	50.9	14355	73	0.9	0.1	165
Inland waterways	Gasoline	2000	2	334	3158	51.4	14555	73	0.9	0.1	159
Inland waterways	Gasoline	2001	2	346	3036	52.0	14800	73	0.9	0.1	152
Inland waterways	Gasoline	2002	2	361	2892	52.7	15097	73	1.0	0.1	143
Inland waterways	Gasoline	2003	2	378	2722	53.6	15449	73	1.0	0.1	133
Inland waterways	Gasoline	2004	2	398	2524	54.7	15863	73	1.1	0.1	121

Annex 3: Stock data 2005-2030

Stock data for diesel tractors 2005-2030

Size (kW)	Emission Level	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2025	2030
37	<1981	801	641	481	320	160													
37	1981-1990	871	871	871	871	871	871	711	551	430	315	216	130	80	41	26			
37	1991-Stage I	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	569	312	
37	Stage I	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81
37	Stage II	52	77	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103
37	Stage IIIA				26	52	77	103	129	129	129	129	129	129	129	129	129	129	129
37	Stage IIIB									26	52	77	103	129	155	181	206	336	465
45	<1981	5362	4290	3217	2145	1072													
45	1981-1990	8688	8688	8688	8688	8688	8688	7616	6543	5261	4043	2766	1786	1132	656	309			
45	1991-Stage I	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199		
49	1991-Stage I	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	195	
52	1991-Stage I	359	359	359	359	359	359	359	359	359	359	359	359	359	359	359	359	359	
52	Stage I	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368	368
52	Stage II	258	387	516	516	516	516	516	516	516	516	516	516	516	516	516	516	516	516
52	Stage IIIA				129	258	387	516	645	645	645	645	645	645	645	645	645	645	645
52	Stage IIIB									129	258	387	516	645	774	903	1032	1678	2323
56	1991-Stage I	1282	1282	1282	1282	1282	1282	1282	1282	1282	1282	1282	1282	1282	1282	1282	1282	594	
60	<1981	11276	9021	6766	4511	2255													
60	1981-1990	20351	20351	20351	20351	20351	20351	18095	15840	13544	11204	8228	5536	3918	2647	1177			
60	1991-Stage I	846	846	846	846	846	846	846	846	846	846	846	846	846	846	846	846		
63	1991-Stage I	3018	3018	3018	3018	3018	3018	3018	3018	3018	3018	3018	3018	3018	3018	3018	3018	1161	
67	1991-Stage I	1344	1344	1344	1344	1344	1344	1344	1344	1344	1344	1344	1344	1344	1344	1344	1344	1344	
67	Stage I	1088	1088	1088	1088	1088	1088	1088	1088	1088	1088	1088	1088	1088	1088	1088	1088	1088	1088
67	Stage II	527	790	1054	1054	1054	1054	1054	1054	1054	1054	1054	1054	1054	1054	1054	1054	1054	1054
67	Stage IIIA				263	527	790	1054	1054	1054	1054	1054	1054	1054	1054	1054	1054	1054	1054

67	Stage IIIB								263	527	790	790	790	790	790	790	790	790	790
67	Stage IV											263	527	790	1054	1317	1581	2898	4215
71	1991-Stage I	3603	3603	3603	3603	3603	3603	3603	3603	3603	3603	3603	3603	3603	3603	3603	3603	1805	
78	<1981	3004	2403	1802	1202	601													
78	1981-1990	11218	11218	11218	11218	11218	11218	10617	10016	9188	8013	6480	4980	3731	2703	1306			
78	1991-Stage I	3709	3709	3709	3709	3709	3709	3709	3709	3709	3709	3709	3709	3709	3709	3709	3709	1469	270
78	Stage I	321	321	321	321	321	321	321	321	321	321	321	321	321	321	321	321	321	321
78	Stage II	665	886	886	886	886	886	886	886	886	886	886	886	886	886	886	886	886	886
78	Stage IIIA			222	443	665	886	1108	1108	1108	1108	1108	1108	1108	1108	1108	1108	1108	1108
78	Stage IIIB								222	443	665	665	665	665	665	665	665	665	665
78	Stage IV											222	443	665	886	1108	1330	2438	3546
86	1991-Stage I	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	1470	135
86	Stage I	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
86	Stage II	267	356	356	356	356	356	356	356	356	356	356	356	356	356	356	356	356	356
86	Stage IIIA			89	178	267	356	445	445	445	445	445	445	445	445	445	445	445	445
86	Stage IIIB								89	178	267	267	267	267	267	267	267	267	267
86	Stage IV											89	178	267	356	445	534	979	1424
93	1991-Stage I	323	323	323	323	323	323	323	323	323	323	323	323	323	323	323	323	323	77
93	Stage I	112	112	112	112	112	112	112	112	112	112	112	112	112	112	112	112	112	112
93	Stage II	312	417	417	417	417	417	417	417	417	417	417	417	417	417	417	417	417	417
93	Stage IIIA			104	208	312	417	521	521	521	521	521	521	521	521	521	521	521	521
93	Stage IIIB								104	208	312	312	312	312	312	312	312	312	312
93	Stage IV											104	208	312	417	521	625	1145	1666
97	1991-Stage I	2644	2644	2644	2644	2644	2644	2644	2644	2644	2644	2644	2644	2644	2644	2644	2644	1757	
101	<1981	961	769	577	384	192													
101	1981-1990	2355	2355	2355	2355	2355	2355	2163	1970	1742	1489	1161	901	672	444	223			
101	1991-Stage I	1559	1559	1559	1559	1559	1559	1559	1559	1559	1559	1559	1559	1559	1559	1559	1559	1299	442
101	Stage I	229	229	229	229	229	229	229	229	229	229	229	229	229	229	229	229	229	229
101	Stage II	398	530	530	530	530	530	530	530	530	530	530	530	530	530	530	530	530	530
101	Stage IIIA			133	265	398	530	663	663	663	663	663	663	663	663	663	663	663	663

101	Stage IIIB								133	265	398	398	398	398	398	398	398	398	398
101	Stage IV											133	265	398	530	663	796	1459	2122
112	1991-Stage I	1618	1618	1618	1618	1618	1618	1618	1618	1618	1618	1618	1618	1618	1618	1618	1618	1386	352
112	Stage I	459	459	459	459	459	459	459	459	459	459	459	459	459	459	459	459	459	459
112	Stage II	988	1317	1317	1317	1317	1317	1317	1317	1317	1317	1317	1317	1317	1317	1317	1317	1317	1317
112	Stage IIIA			329	659	988	1317	1647	1647	1647	1647	1647	1647	1647	1647	1647	1647	1647	1647
112	Stage IIIB								329	659	988	988	988	988	988	988	988	988	988
112	Stage IV											329	659	988	1317	1647	1976	3622	5269
127	1991-Stage I	843	843	843	843	843	843	843	843	843	843	843	843	843	843	843	843	665	135
127	Stage I	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
127	Stage II	230	306	306	306	306	306	306	306	306	306	306	306	306	306	306	306	306	306
127	Stage IIIA			77	153	230	306	383	383	383	383	383	383	383	383	383	383	383	383
127	Stage IIIB								77	153	230	230	230	230	230	230	230	230	230
127	Stage IV											77	153	230	306	383	459	842	1225
131	<1981	165	132	99	66	33													
131	1981-1990	878	878	878	878	878	878	846	813	765	684	581	451	359	231	134			
131	1991-Stage I	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95		
157	1981-1990	15	15	15	15	15	15	15	15	15	15	15	13	12	9	4			
157	1991-Stage I	901	901	901	901	901	901	901	901	901	901	901	901	901	901	901	901	687	
157	Stage I	88	88	88	88	88	88	88	88	88	88	88	88	88	88	88	88	88	88
157	Stage II	924	924	924	924	924	924	924	924	924	924	924	924	924	924	924	924	924	924
157	Stage IIIA		259	518	777	1036	1295	1295	1295	1295	1295	1295	1295	1295	1295	1295	1295	1295	1295
157	Stage IIIB							259	518	777	777	777	777	777	777	777	777	777	777
157	Stage IV										259	518	777	1036	1295	1554	1813	3108	4403
186	1991-Stage I	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	
186	Stage I	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47
186	Stage II	473	473	473	473	473	473	473	473	473	473	473	473	473	473	473	473	473	473
186	Stage IIIA		135	271	406	541	676	676	676	676	676	676	676	676	676	676	676	676	676
186	Stage IIIB							135	271	406	406	406	406	406	406	406	406	406	406
186	Stage IV										135	271	406	541	676	812	947	1623	2300

Stock data for harvesters 2005-2030

Size Group	Emission Level	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2025	2030
0<S<=50	1981-1990	713	611	496	350	203	57	24											
50<S<=60	1981-1990	1609	1455	1299	1043	787	530	188	100	46	24								
50<S<=60	1991-Stage I	10	10	10	10	10	10	10	10	10	10	10							
60<S<=70	1981-1990	2834	2622	2419	2078	1738	1397	670	315	93	48								
60<S<=70	1991-Stage I	25	25	25	25	25	25	25	25	25	25	25	16	6	5	2			
70<S<=80	1981-1990	1802	1697	1614	1515	1416	1318	901	472	374	143								
70<S<=80	1991-Stage I	102	102	102	102	102	102	102	102	102	102	102	16	11	9	6	5		
70<S<=80	Stage I	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
80<S<=90	1981-1990	1769	1665	1581	1483	1384	1285	1045	933	584	375								
80<S<=90	1991-Stage I	231	231	231	231	231	231	231	231	231	231	231	158	44	28	6	5		
80<S<=90	Stage I	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
90<S<=100	1981-1990	808	808	808	771	733	696	582	504	334	160								
90<S<=100	1991-Stage I	409	409	409	409	409	409	409	409	409	409	409	193	103	50	40	13		
90<S<=100	Stage I	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
100<S<=120	1981-1990	711	711	711	711	711	711	641	573	442	290								
100<S<=120	1991-Stage I	700	700	700	700	700	700	700	700	700	700	700	545	400	345	279	204		
100<S<=120	Stage I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2		
120<S<=140	1981-1990	221	221	221	221	221	221	221	221	217	135								
120<S<=140	1991-Stage I	920	920	920	920	920	920	920	920	920	920	920	835	744	707	678	560	4	
120<S<=140	Stage I	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	4	
120<S<=140	Stage II	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	
120<S<=140	Stage IIIA		4	7	11	14	18	18	18	18	18	18	18	18	18	18	18	18	18
120<S<=140	Stage IIIB							4	7	11	11	11	11	11	11	11	11	11	11
120<S<=140	Stage IV										4	7	11	14	18	22	25	43	61
140<S<=160	1991-Stage I	747	747	747	747	747	747	747	747	747	747	747	747	738	707	670	621	33	
140<S<=160	Stage II	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	
140<S<=160	Stage IIIA		20	40	61	81	101	101	101	101	101	101	101	101	101	101	101	101	101

140<S<=160	Stage IIIB							20	40	61	61	61	61	61	61	61	61	61	61
140<S<=160	Stage IV										20	40	61	81	101	121	141	242	343
160<S<=180	1991-Stage I	566	566	566	566	566	566	566	566	566	566	566	566	566	566	566	536	33	
160<S<=180	Stage II	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	
160<S<=180	Stage IIIA		33	66	100	133	166	166	166	166	166	166	166	166	166	166	166	166	166
160<S<=180	Stage IIIB							33	66	100	100	100	100	100	100	100	100	100	100
160<S<=180	Stage IV										33	66	100	133	166	199	232	398	564
180<S<=200	1991-Stage I	282	282	282	282	282	282	282	282	282	282	282	282	282	282	282	282	33	
180<S<=200	Stage II	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	
180<S<=200	Stage IIIA		33	66	100	133	166	166	166	166	166	166	166	166	166	166	166	166	166
180<S<=200	Stage IIIB							33	66	100	100	100	100	100	100	100	100	100	100
180<S<=200	Stage IV										33	66	100	133	166	199	232	398	564
200<S<=220	1991-Stage I	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	33	
200<S<=220	Stage II	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	
200<S<=220	Stage IIIA		33	66	100	133	166	166	166	166	166	166	166	166	166	166	166	166	166
200<S<=220	Stage IIIB							33	66	100	100	100	100	100	100	100	100	100	100
200<S<=220	Stage IV										33	66	100	133	166	199	232	398	564
220<S<=240	1991-Stage I	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	94	
220<S<=240	Stage II	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190	
220<S<=240	Stage IIIA		44	88	132	177	221	221	221	221	221	221	221	221	221	221	221	221	221
220<S<=240	Stage IIIB							44	88	132	132	132	132	132	132	132	132	132	132
220<S<=240	Stage IV										44	88	132	177	221	265	309	530	751
240<S<=260	1991-Stage I	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	63	
240<S<=260	Stage II	223	223	223	223	223	223	223	223	223	223	223	223	223	223	223	223	223	
240<S<=260	Stage IIIA		55	110	165	221	276	276	276	276	276	276	276	276	276	276	276	276	276
240<S<=260	Stage IIIB							55	110	165	165	165	165	165	165	165	165	165	165
240<S<=260	Stage IV										55	110	165	221	276	331	386	662	937
260<S<=280	1991-Stage I	123	123	123	123	123	123	123	123	123	123	123	123	123	123	123	123	63	
260<S<=280	Stage II	223	223	223	223	223	223	223	223	223	223	223	223	223	223	223	223	223	
260<S<=280	Stage IIIA		55	110	165	221	276	276	276	276	276	276	276	276	276	276	276	276	276

260<S<=280	Stage IIIB							55	110	165	165	165	165	165	165	165	165	165	165
260<S<=280	Stage IV										55	110	165	221	276	331	386	662	937
280<S<=300	1991-Stage I	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	
280<S<=300	Stage II	223	223	223	223	223	223	223	223	223	223	223	223	223	223	223	223	223	
280<S<=300	Stage IIIA		55	110	165	221	276	276	276	276	276	276	276	276	276	276	276	276	276
280<S<=300	Stage IIIB							55	110	165	165	165	165	165	165	165	165	165	165
280<S<=300	Stage IV										55	110	165	221	276	331	386	662	937
300<S<=320	Stage II	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	
300<S<=320	Stage IIIA		28	55	83	110	138	138	138	138	138	138	138	138	138	138	138	138	138
300<S<=320	Stage IIIB							28	55	83	83	83	83	83	83	83	83	83	83
300<S<=320	Stage IV										28	55	83	110	138	165	193	331	469

Stock data for fork lifts 2005-2030

EquipmentName (Eng)	Size (kW)	Emission Level	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2025	2030
Fork lifts 0-2 tons (diesel)	35	1981-1990	177	135	95	58	27													
Fork lifts 0-2 tons (diesel)	35	1991-Stage I	304	304	304	304	304	304	278	255	239	211	173	136	86	57	29			
Fork lifts 0-2 tons (diesel)	35	Stage II	103	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	14	
Fork lifts 0-2 tons (diesel)	35	Stage IIIA			14	28	42	56	70	84	98	112	126	140	154	168	182	196	266	280
Fork lifts 2-3 tons (diesel)	45	1981-1990	734	559	394	239	111													
Fork lifts 2-3 tons (diesel)	45	1991-Stage I	1063	1063	1063	1063	1063	1063	955	860	793	677	519	364	158					
Fork lifts 2-3 tons (diesel)	45	Stage I	664	664	664	664	664	664	664	664	664	664	664	664	664	664	513	361		
Fork lifts 2-3 tons (diesel)	45	Stage II	208	312	416	416	416	416	416	416	416	416	416	416	416	416	416	416	208	
Fork lifts 2-3 tons (diesel)	45	Stage IIIA				104	208	312	416	520	520	520	520	520	520	520	520	520	520	208
Fork lifts 2-3 tons (diesel)	45	Stage IIIB									104	208	312	416	520	624	728	832	1352	1872
Fork lifts 3-5 tons (diesel)	50	1981-1990	989	753	531	322	150													
Fork lifts 3-5 tons (diesel)	50	1991-Stage I	1469	1469	1469	1469	1469	1469	1324	1196	1106	950	737	529	252					
Fork lifts 3-5 tons (diesel)	50	Stage I	1135	1135	1135	1135	1135	1135	1135	1135	1135	1135	1135	1135	1135	1135	895	674		
Fork lifts 3-5 tons (diesel)	50	Stage II	374	561	748	748	748	748	748	748	748	748	748	748	748	748	748	748	374	

Fork lifts 3-5 tons (diesel)	50	Stage IIIA				187	374	561	748	935	935	935	935	935	935	935	935	935	935	374
Fork lifts 3-5 tons (diesel)	50	Stage IIIB									187	374	561	748	935	1122	1309	1496	2431	3366
Fork lifts 5-10 tons (diesel)	75	1981-1990	228	174	123	75	35													
Fork lifts 5-10 tons (diesel)	75	1991-Stage I	354	354	354	354	354	354	321	291	270	234	185	137	73					
Fork lifts 5-10 tons (diesel)	75	Stage I	311	311	311	311	311	311	311	311	311	311	311	311	311	311	241	149		
Fork lifts 5-10 tons (diesel)	75	Stage II	200	271	271	271	271	271	271	271	271	271	271	271	271	271	271	271	71	
Fork lifts 5-10 tons (diesel)	75	Stage IIIA			71	142	213	284	355	355	355	355	355	355	355	355	355	355	355	71
Fork lifts 5-10 tons (diesel)	75	Stage IIIB								71	142	213	213	213	213	213	213	213	213	213
Fork lifts 5-10 tons (diesel)	75	Stage IV											71	142	213	284	355	426	781	1136
Fork lifts >10 tons (diesel)	120	1981-1990	51	39	28	17	8													
Fork lifts >10 tons (diesel)	120	1991-Stage I	97	97	97	97	97	97	90	83	78	70	59	48	34					
Fork lifts >10 tons (diesel)	120	Stage I	118	118	118	118	118	118	118	118	118	118	118	118	118	118	86	47		
Fork lifts >10 tons (diesel)	120	Stage II	60	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	22	
Fork lifts >10 tons (diesel)	120	Stage IIIA			22	44	66	88	110	110	110	110	110	110	110	110	110	110	110	22
Fork lifts >10 tons (diesel)	120	Stage IIIB								22	44	66	66	66	66	66	66	66	66	66
Fork lifts >10 tons (diesel)	120	Stage IV											22	44	66	88	110	132	242	352
Fork lifts 0-2 tons (LPG)	33		4339	4197	4098	4029	3952	3866	3789	3742	3727	3675	3567	3475	3329	3188	3060	2916	2760	2760
Fork lifts 2-3 tons (LPG)	40		4060	3965	3909	3881	3845	3801	3765	3756	3777	3764	3700	3651	3553	3483	3424	3338	3180	3180
Fork lifts 3-5 tons (LPG)	50		1995	1977	1976	1987	1995	1999	2007	2027	2060	2078	2074	2076	2056	2000	1951	1979	1860	1860
Fork lifts 5-10 tons (LPG)	78		107	111	116	121	126	131	136	142	148	153	157	162	166	167	168	176	180	180
Fork lifts >10 tons (LPG)	120		3	3	3	3	3	3	3	3	3	3	3	3	3	2	1	1		

Stock data for construction machinery 2005-2030

Name	Size (kW)	Emission Level	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2025	2030
Track type dozers	140	1991-Stage I	113	94	75	56	38	19												
Track type dozers	140	Stage II	75	75	75	75	75	75	75	56	38	19								
Track type dozers	140	Stage IIIA		19	38	56	75	94	94	94	94	94	94	75	56	38	19			
Track type dozers	140	Stage IIIB							19	38	56	56	56	56	56	56	56	56		

Track type dozers	140	Stage IV										19	38	56	75	94	113	132	188	188
Track type loaders	150	1991-Stage I	53	44	35	26	18	9												
Track type loaders	150	Stage II	35	35	35	35	35	35	35	26	18	9								
Track type loaders	150	Stage IIIA		9	18	26	35	44	44	44	44	44	44	35	26	18	9			
Track type loaders	150	Stage IIIB							9	18	26	26	26	26	26	26	26	26		
Track type loaders	150	Stage IV										9	18	26	35	44	53	62	88	88
Wheel loaders (0-5 tons)	20	1991-Stage I	1447	1158	868	579	289													
Wheel loaders (0-5 tons)	20	Stage II	1447	1736	1736	1736	1736	1736	1447	1158	868	579	289							
Wheel loaders (0-5 tons)	20	Stage IIIA			289	579	868	1158	1447	1736	2026	2315	2605	2894	2894	2894	2894	2894	2894	2894
Wheel loaders (> 5,1 tons)	120	1991-Stage I	646	431	215															
Wheel loaders (> 5,1 tons)	120	Stage I	861	861	861	861	646	431	215											
Wheel loaders (> 5,1 tons)	120	Stage II	646	861	861	861	861	861	861	861	646	431	215							
Wheel loaders (> 5,1 tons)	120	Stage IIIA			215	431	646	861	1077	1077	1077	1077	1077	1077	861	646	431	215		
Wheel loaders (> 5,1 tons)	120	Stage IIIB								215	431	646	646	646	646	646	646	646		
Wheel loaders (> 5,1 tons)	120	Stage IV											215	431	646	861	1077	1292	2153	2153
Wheel type excavators	100	1991-Stage I	121	81	40															
Wheel type excavators	100	Stage I	162	162	162	162	121	81	40											
Wheel type excavators	100	Stage II	121	162	162	162	162	162	162	162	121	81	40							
Wheel type excavators	100	Stage IIIA			40	81	121	162	202	202	202	202	202	202	162	121	81	40		
Wheel type excavators	100	Stage IIIB								40	81	121	121	121	121	121	121	121		
Wheel type excavators	100	Stage IV											40	81	121	162	202	242	404	404
Track type excavators (0-5 t)	20	1991-Stage I	3571	2857	2143	1428	714													
Track type excavators (0-5 t)	20	Stage II	3571	4285	4285	4285	4285	4285	3571	2857	2143	1428	714							
Track type excavators (0-5 t)	20	Stage IIIA			714	1428	2143	2857	3571	4285	4999	5714	6428	7142	7142	7142	7142	7142	7142	7142
Track type excavators (>5,1t)	120	1991-Stage I	589	393	196															
Track type excavators (>5,1t)	120	Stage I	785	785	785	785	589	393	196											
Track type excavators (>5,1t)	120	Stage II	589	785	785	785	785	785	785	785	589	393	196							
Track type excavators (>5,1t)	120	Stage IIIA			196	393	589	785	982	982	982	982	982	982	785	589	393	196		
Track type excavators (>5,1t)	120	Stage IIIB								196	393	589	589	589	589	589	589	589		
Track type excavators (>5,1t)	120	Stage IV											196	393	589	785	982	1178	1963	1963

Excavators/Loaders	50	1991-Stage I	1386	924	462																
Excavators/Loaders	50	Stage I	2310	2310	2310	2310	1848	1386	924	462											
Excavators/Loaders	50	Stage II	924	1386	1848	1848	1848	1848	1848	1848	1848	1386	924	462							
Excavators/Loaders	50	Stage IIIA				462	924	1386	1848	2310	2310	2310	2310	2310	2310	1848	1386	924			
Excavators/Loaders	50	Stage IIIB									462	924	1386	1848	2310	2771	3233	3695	4619	4619	
Dump trucks	60	1991-Stage I	331	221	110																
Dump trucks	60	Stage I	552	552	552	552	442	331	221	110											
Dump trucks	60	Stage II	221	331	442	442	442	442	442	442	442	331	221	110							
Dump trucks	60	Stage IIIA				110	221	331	442	442	442	442	442	442	442	442	331	221	110		
Dump trucks	60	Stage IIIB								110	221	331	331	331	331	331	331	331	331		
Dump trucks	60	Stage IV											110	221	331	442	552	662	1104	1104	
Mini loaders	30	1991-Stage I	3290	2925	2559	2193	1828	1462	1097	731	366										
Mini loaders	30	Stage II	1828	2193	2193	2193	2193	2193	2193	2193	2193	2193	1828	1462	1097	731	366				
Mini loaders	30	Stage IIIA			366	731	1097	1462	1828	2193	2559	2925	3290	3656	4021	4387	4752	5118	5118	5118	
Telescopic loaders	35	1991-Stage I	1491	1326	1160	994	829	663	497	331	166										
Telescopic loaders	35	Stage II	829	994	994	994	994	994	994	994	994	994	829	663	497	331	166				
Telescopic loaders	35	Stage IIIA			166	331	497	663	829	994	1160	1326	1491	1657	1823	1989	2154	2320	2320	2320	

Stock data for machine pools 2005-2030

Name	Emission Level	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2025	2030
Tractors	1991-Stage I	1540	1027	513															
Tractors	Stage I	513	513	513	513														
Tractors	Stage II	1540	2053	2053	2053	2053	1540	1027	513										
Tractors	Stage IIIA			513	1027	1540	2053	2566	2566	2566	2053	1540	1027	513					
Tractors	Stage IIIB								513	1027	1540	1540	1540	1540	1540	1027	513		
Tractors	Stage IV											513	1027	1540	2053	2566	3080	3593	3593
Harvesters	1991-Stage I	413	354	295	236	177	118	59											
Harvesters	Stage II	236	236	236	236	236	236	236	236	177	118	59							
Harvesters	Stage IIIA		59	118	177	236	295	295	295	295	295	295	295	236	177	118	59		

Harvesters	Stage IIIB							59	118	177	177	177	177	177	177	177			
Harvesters	Stage IV										59	118	177	236	295	354	413	649	649
Self-propelled vehicles	1991-Stage I	102	51																
Self-propelled vehicles	Stage II	203	203	203	153	102	51												
Self-propelled vehicles	Stage IIIA		51	102	153	203	254	254	203	153	102	51							
Self-propelled vehicles	Stage IIIB							51	102	153	153	153	153	102	51				
Self-propelled vehicles	Stage IV										51	102	153	203	254	305	305	305	305

Stock data for household and gardening 2005-2030

Name	Size (kW)	Emission Level	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2025	2030
Lawn movers (private)	4	1991-Stage I	590625	506250	421875	337500	253125	168750	84375											
Lawn movers (private)	4	Stage I	84375	168750	253125	253125	253125	253125	253125	253125	168750	84375								
Lawn movers (private)	4	Stage II				84375	168750	253125	337500	421875	506250	590625	675000	675000	675000	675000	675000	675000	675000	675000
Lawn movers (professional)	4	1991-Stage I	18750	12500	6250															
Lawn movers (professional)	4	Stage I	6250	12500	18750	18750	12500	6250												
Lawn movers (professional)	4	Stage II				6250	12500	18750	25000	25000	25000	25000	25000	25000	25000	25000	25000	25000	25000	25000
Cultivators (private-large)	4	1991-Stage I	88000	66000	44000	22000														
Cultivators (private-large)	4	Stage II	22000	44000	66000	88000	110000	110000	110000	110000	110000	110000	110000	110000	110000	110000	110000	110000	110000	110000
Cultivators (private-small)	1	1991-Stage I	9333	8667	8000	7333	6667	6000	5333	4667	4000	3333	2667	2000	1333	667				
Cultivators (private-small)	1	Stage II	667	1333	2000	2667	3333	4000	4667	5333	6000	6667	7333	8000	8667	9333	10000	10000	10000	10000
Cultivators (professional)	7	1991-Stage I	8750	7500	6250	5000	3750	2500	1250											
Cultivators (professional)	7	Stage I	1250	2500	3750	3750	3750	3750	3750	3750	2500	1250								
Cultivators (professional)	7	Stage II				1250	2500	3750	5000	6250	7500	8750	10000	10000	10000	10000	10000	10000	10000	10000
Chain saws (private)	2	1991-Stage I	268200	238400	208600	178800	149000	119200	89400	59600	29800									
Chain saws (private)	2	Stage I	29800	59600	89400	89400	89400	89400	89400	89400	89400	89400	59600	29800						
Chain saws (private)	2	Stage II				29800	59600	89400	119200	149000	178800	208600	238400	268200	298000	298000	298000	298000	298000	298000

Chain saws (professional)	3	1991-Stage I	33333	16667																
Chain saws (professional)	3	Stage I	16667	33333	50000	50000	33333	16667												
Chain saws (professional)	3	Stage II					16667	33333	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000
Chain saws (forestry)	5	1991-Stage I	1333	667																
Chain saws (forestry)	5	Stage I	667	1333	2000	2000	1333	667												
Chain saws (forestry)	5	Stage II					667	1333	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Riders (private)	11	1991-Stage I	160417	145833	131250	116667	102083	87500	72917	58333	43750	29167	14583							
Riders (private)	11	Stage I	14583	29167	29167	29167	29167	29167	29167	29167	29167	29167	29167	29167	14583					
Riders (private)	11	Stage II			14583	29167	43750	58333	72917	87500	102083	116667	131250	145833	160417	175000	175000	175000	175000	175000
Riders (professional)	13	1991-Stage I	20000	15000	10000	5000														
Riders (professional)	13	Stage I	5000	10000	10000	10000	10000	5000												
Riders (professional)	13	Stage II			5000	10000	15000	20000	25000	25000	25000	25000	25000	25000	25000	25000	25000	25000	25000	25000
Shrub clearers (private)	1	1991-Stage I	126000	112000	98000	84000	70000	56000	42000	28000	14000									
Shrub clearers (private)	1	Stage I	14000	28000	42000	42000	42000	42000	42000	42000	42000	42000	28000	14000						
Shrub clearers (private)	1	Stage II				14000	28000	42000	56000	70000	84000	98000	112000	126000	140000	140000	140000	140000	140000	140000
Shrub clearers (professional)	2	1991-Stage I	7500	5000	2500															
Shrub clearers (professional)	2	Stage I	2500	5000	7500	7500	5000	2500												
Shrub clearers (professional)	2	Stage II				2500	5000	7500	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
Hedge cutters (private)	1	1991-Stage I	66240	58880	51520	44160	36800	29440	22080	14720	7360									
Hedge cutters (private)	1	Stage I	7360	14720	22080	22080	22080	22080	22080	22080	22080	22080	14720	7360						
Hedge cutters (private)	1	Stage II				7360	14720	22080	29440	36800	44160	51520	58880	66240	73600	73600	73600	73600	73600	73600
Hedge cutters (professional)	2	1991-Stage I	4800	3200	1600															
Hedge cutters (professional)	2	Stage I	1600	3200	4800	4800	3200	1600												
Hedge cutters (professional)	2	Stage II				1600	3200	4800	6400	6400	6400	6400	6400	6400	6400	6400	6400	6400	6400	6400
Trimmers (private)	1	1991-Stage I	76500	68000	59500	51000	42500	34000	25500	17000	8500									
Trimmers (private)	1	Stage I	8500	17000	25500	25500	25500	25500	25500	25500	25500	25500	17000	8500						
Trimmers (private)	1	Stage II				8500	17000	25500	34000	42500	51000	59500	68000	76500	85000	85000	85000	85000	85000	85000
Trimmers (professional)	1	1991-Stage I	11250	7500	3750															
Trimmers (professional)	1	Stage I	3750	7500	11250	11250	7500	3750												
Trimmers (professional)	1	Stage II				3750	7500	11250	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000

Stock data for small boats and pleasure crafts 2005-2030

Motor type	Boat type	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Diesel	Motor boats (27-34 ft)	4600	4600	4600	4600	4600	4600	4600	4600	4600	4600	4600	4600	4600	4600	4600	4600	4600	4600	4600	4600	4600	4600	4600	4600	4600	4600
Diesel	Motor boats (> 34 ft)	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400
Diesel	Motor boats <(27 ft)	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000
Diesel	Motor sailors	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000
Diesel	Sailing boats (> 26 ft)	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000
2-takt	Other boats (< 20 ft)	2750	2250	1800	1400	1050	750	500	300	150	50																
2-takt	Yawls and cabin boats	2750	2250	1800	1400	1050	750	500	300	150	50																
2-takt	Sailing boats (< 26 ft)	8250	6750	5400	4200	3150	2250	1500	900	450	150																
2-takt	Speed boats	1650	1350	1080	840	630	450	300	180	90	30																
2-takt	Water scooters	550	450	360	280	210	150	100	60	30	10																
4-takt	Other boats (< 20 ft)	2250	2750	3200	3600	3950	4250	4500	4700	4850	4950	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000
4-takt	Yawls and cabin boats	2250	2750	3200	3600	3950	4250	4500	4700	4850	4950	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000
4-takt	Sailing boats (< 26 ft)	6750	8250	9600	10800	11850	12750	13500	14100	14550	14850	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000
4-takt	Speed boats (in board eng.)	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000
4-takt	Speed boats (out board eng.)	1350	1650	1920	2160	2370	2550	2700	2820	2910	2970	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000
4-takt	Water scooters	450	550	640	720	790	850	900	940	970	990	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000

Annex 4: Fuel use, emissions and emission factors 2005-2030

Fuel use and emissions (tons) for diesel tractors 2005-2030

Year	Fuel (TJ)	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH3	TSP
2005	9393	4	8066	967	16	4492	695	29	2	701
2006	9326	4	7705	904	15	4283	690	29	2	660
2007	9245	4	7298	839	14	4069	684	29	2	618
2008	9140	4	6853	770	13	3842	676	29	2	575
2009	9004	4	6378	699	11	3603	666	28	2	529
2010	8858	4	5920	632	10	3374	656	28	2	484
2011	8730	4	5465	575	9	3164	646	28	2	450
2012	8622	4	5055	523	9	2958	638	27	2	411
2013	8520	4	4689	475	8	2764	630	27	2	372
2014	8400	4	4310	429	7	2572	622	27	2	331
2015	8240	4	3867	381	6	2368	610	26	1	285
2016	8110	4	3490	342	6	2200	600	26	1	244
2017	8049	4	3204	317	5	2087	596	26	1	215
2018	8018	4	2963	296	5	1992	593	26	1	189
2019	7970	4	2719	274	4	1886	590	26	1	161
2020	7934	4	2495	254	4	1792	587	25	1	135
2021	7924	4	2280	242	4	1727	586	25	1	123
2022	7952	4	2120	235	4	1685	588	26	1	114
2023	7999	4	1994	230	4	1658	592	26	1	108
2024	8007	4	1838	221	4	1613	593	26	1	100
2025	7980	4	1656	208	3	1552	591	26	1	90
2026	7933	4	1463	192	3	1482	587	26	1	80
2027	7881	4	1272	177	3	1413	583	25	1	70
2028	7876	4	1145	167	3	1370	583	25	1	63
2029	7866	4	1019	156	3	1324	582	25	1	56
2030	7847	4	892	144	2	1273	581	25	1	49

Emission factors (g/GJ) for diesel tractors 2005-2030

Year	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH3	TSP
2005	0.5	859	103	1.7	478	74	3.1	0.2	75
2006	0.5	826	97	1.6	459	74	3.1	0.2	71
2007	0.5	789	91	1.5	440	74	3.1	0.2	67
2008	0.5	750	84	1.4	420	74	3.1	0.2	63
2009	0.5	708	78	1.3	400	74	3.1	0.2	59
2010	0.5	668	71	1.2	381	74	3.1	0.2	55
2011	0.5	626	66	1.1	362	74	3.2	0.2	52
2012	0.5	586	61	1.0	343	74	3.2	0.2	48
2013	0.5	550	56	0.9	324	74	3.2	0.2	44
2014	0.5	513	51	0.8	306	74	3.2	0.2	39
2015	0.5	469	46	0.8	287	74	3.2	0.2	35
2016	0.5	430	42	0.7	271	74	3.2	0.2	30
2017	0.5	398	39	0.6	259	74	3.2	0.2	27
2018	0.5	370	37	0.6	248	74	3.2	0.2	24
2019	0.5	341	34	0.6	237	74	3.2	0.2	20
2020	0.5	314	32	0.5	226	74	3.2	0.2	17
2021	0.5	288	31	0.5	218	74	3.2	0.2	16
2022	0.5	267	30	0.5	212	74	3.2	0.2	14
2023	0.5	249	29	0.5	207	74	3.2	0.2	13
2024	0.5	230	28	0.4	201	74	3.2	0.2	12
2025	0.5	208	26	0.4	194	74	3.2	0.2	11
2026	0.5	184	24	0.4	187	74	3.2	0.2	10
2027	0.5	161	22	0.4	179	74	3.2	0.2	9
2028	0.5	145	21	0.3	174	74	3.2	0.2	8
2029	0.5	130	20	0.3	168	74	3.2	0.2	7
2030	0.5	114	18	0.3	162	74	3.2	0.2	6

Fuel use and emissions (tons) for harvesters 2005-2030

Year	Fuel (TJ)	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH3	TSP
2005	2033	1	1683	163	3	875	150	6	0	141
2006	2064	1	1629	154	2	850	153	7	0	133
2007	2095	1	1576	144	2	827	155	7	0	125
2008	2115	1	1517	134	2	797	156	7	0	116
2009	2133	1	1459	124	2	768	158	7	0	107
2010	2150	1	1403	115	2	740	159	7	0	98
2011	2135	1	1302	101	2	682	158	7	0	83
2012	2145	1	1224	91	1	643	159	7	0	73
2013	2156	1	1147	83	1	607	160	7	0	64
2014	2169	1	1055	75	1	574	160	7	0	55
2015	2170	1	954	66	1	536	161	7	0	46
2016	2194	1	875	62	1	518	162	7	0	42
2017	2222	1	807	59	1	503	164	7	0	39
2018	2258	1	753	57	1	495	167	7	0	37
2019	2291	1	701	55	1	487	170	7	0	34
2020	2314	1	642	53	1	476	171	8	0	32
2021	2324	1	575	51	1	460	172	8	0	28
2022	2326	1	505	48	1	443	172	8	0	25
2023	2322	1	435	45	1	424	172	8	0	21
2024	2329	1	380	44	1	412	172	8	0	18
2025	2334	1	328	42	1	400	173	8	0	15
2026	2333	1	275	41	1	387	173	8	0	12
2027	2326	1	241	40	1	380	172	8	0	11
2028	2331	1	216	39	1	376	173	8	0	11
2029	2340	1	193	39	1	374	173	8	0	10
2030	2339	1	169	38	1	369	173	8	0	9

Emission factors (g/GJ) for harvesters 2005-2030

Year	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH3	TSP
2005	0.5	828	80	1.3	431	74	3.2	0.2	69
2006	0.5	789	74	1.2	412	74	3.2	0.2	64
2007	0.5	752	69	1.1	395	74	3.2	0.2	60
2008	0.5	717	63	1.0	377	74	3.2	0.2	55
2009	0.5	684	58	0.9	360	74	3.2	0.2	50
2010	0.5	652	53	0.9	344	74	3.2	0.2	46
2011	0.5	610	47	0.8	320	74	3.2	0.2	39
2012	0.5	571	43	0.7	300	74	3.2	0.2	34
2013	0.5	532	38	0.6	282	74	3.2	0.2	30
2014	0.5	486	35	0.6	265	74	3.2	0.2	26
2015	0.5	440	30	0.5	247	74	3.3	0.2	21
2016	0.5	399	28	0.5	236	74	3.3	0.2	19
2017	0.5	363	26	0.4	227	74	3.3	0.2	18
2018	0.5	333	25	0.4	219	74	3.3	0.2	16
2019	0.5	306	24	0.4	213	74	3.3	0.2	15
2020	0.5	277	23	0.4	206	74	3.3	0.2	14
2021	0.5	248	22	0.4	198	74	3.3	0.2	12
2022	0.5	217	21	0.3	190	74	3.3	0.2	11
2023	0.5	187	20	0.3	183	74	3.3	0.2	9
2024	0.5	163	19	0.3	177	74	3.3	0.2	8
2025	0.5	140	18	0.3	172	74	3.3	0.2	7
2026	0.5	118	17	0.3	166	74	3.3	0.2	5
2027	0.5	104	17	0.3	163	74	3.3	0.2	5
2028	0.5	92	17	0.3	161	74	3.3	0.2	5
2029	0.5	83	17	0.3	160	74	3.3	0.2	4
2030	0.5	72	16	0.3	158	74	3.3	0.2	4

Fuel use and emissions (tons) for machine pool machinery 2005-2030

Machinery type	Year	Fuel (TJ)	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH3	TSP
Harvesters	2005	157	0	126	7	0	53	12	1	0	7
Harvesters	2006	157	0	116	6	0	50	12	1	0	6
Harvesters	2007	157	0	106	6	0	48	12	1	0	6
Harvesters	2008	157	0	96	5	0	45	12	1	0	5
Harvesters	2009	157	0	86	5	0	43	12	1	0	4
Harvesters	2010	157	0	76	4	0	41	12	1	0	4
Harvesters	2011	156	0	64	4	0	37	12	1	0	3
Harvesters	2012	156	0	52	4	0	33	12	1	0	2
Harvesters	2013	156	0	48	3	0	32	12	1	0	2
Harvesters	2014	156	0	42	3	0	31	12	1	0	2
Harvesters	2015	156	0	36	3	0	30	12	1	0	1
Harvesters	2016	156	0	30	3	0	29	12	1	0	1
Harvesters	2017	156	0	26	3	0	28	12	1	0	1
Harvesters	2018	155	0	22	3	0	27	12	1	0	1
Harvesters	2019	155	0	19	3	0	26	11	1	0	1
Harvesters	2020	155	0	15	3	0	25	11	1	0	1
Harvesters	2021	155	0	11	2	0	24	11	1	0	0
Harvesters	2022	155	0	9	2	0	24	11	1	0	0
Harvesters	2023	155	0	7	2	0	24	11	1	0	0
Harvesters	2024	155	0	5	2	0	24	11	1	0	0
Harvesters	2025	155	0	5	2	0	24	11	1	0	0
Harvesters	2026	155	0	5	2	0	24	11	1	0	0
Harvesters	2027	155	0	5	2	0	24	11	1	0	0
Harvesters	2028	155	0	5	2	0	24	11	1	0	0
Harvesters	2029	155	0	5	2	0	24	11	1	0	0
Harvesters	2030	155	0	5	2	0	24	11	1	0	0
Self-propelled vehicles	2005	321	0	206	12	0	92	24	1	0	10
Self-propelled vehicles	2006	321	0	168	10	0	82	24	1	0	7

Self-propelled vehicles	2007	321	0	131	8	0	73	24	1	0	5
Self-propelled vehicles	2008	321	0	122	8	0	73	24	1	0	5
Self-propelled vehicles	2009	321	0	114	7	0	73	24	1	0	5
Self-propelled vehicles	2010	321	0	105	7	0	74	24	1	0	5
Self-propelled vehicles	2011	320	0	89	6	0	70	24	1	0	4
Self-propelled vehicles	2012	320	0	82	6	0	66	24	1	0	4
Self-propelled vehicles	2013	319	0	75	6	0	62	24	1	0	3
Self-propelled vehicles	2014	319	0	61	5	0	58	24	1	0	2
Self-propelled vehicles	2015	318	0	47	5	0	53	24	1	0	2
Self-propelled vehicles	2016	317	0	32	5	0	49	23	1	0	1
Self-propelled vehicles	2017	317	0	25	5	0	49	23	1	0	1
Self-propelled vehicles	2018	317	0	18	5	0	49	23	1	0	1
Self-propelled vehicles	2019	317	0	11	5	0	49	23	1	0	1
Self-propelled vehicles	2020	317	0	11	5	0	49	23	1	0	1
Self-propelled vehicles	2021	317	0	11	5	0	49	23	1	0	1
Self-propelled vehicles	2022	317	0	11	5	0	49	23	1	0	1
Self-propelled vehicles	2023	317	0	11	5	0	49	23	1	0	1
Self-propelled vehicles	2024	317	0	11	5	0	49	23	1	0	1
Self-propelled vehicles	2025	317	0	11	5	0	49	23	1	0	1
Self-propelled vehicles	2026	317	0	11	5	0	49	23	1	0	1
Self-propelled vehicles	2027	317	0	11	5	0	49	23	1	0	1
Self-propelled vehicles	2028	317	0	11	5	0	49	23	1	0	1
Self-propelled vehicles	2029	317	0	11	5	0	49	23	1	0	1
Self-propelled vehicles	2030	317	0	11	5	0	49	23	1	0	1
Tractors	2005	1392	1	1109	95	2	509	103	4	0	58
Tractors	2006	1392	1	967	77	1	443	103	4	0	52
Tractors	2007	1392	1	794	58	1	377	103	4	0	46
Tractors	2008	1392	1	619	38	1	308	103	4	0	40
Tractors	2009	1392	1	536	34	1	309	103	4	0	40
Tractors	2010	1392	1	505	32	1	310	103	4	0	40

Tractors	2011	1392	1	474	30	0	312	103	4	0	40
Tractors	2012	1390	1	438	28	0	299	103	4	0	35
Tractors	2013	1388	1	402	25	0	286	103	4	0	31
Tractors	2014	1386	1	397	24	0	271	103	4	0	26
Tractors	2015	1384	1	345	24	0	255	102	4	0	21
Tractors	2016	1382	1	293	23	0	239	102	4	0	15
Tractors	2017	1380	1	241	22	0	223	102	4	0	10
Tractors	2018	1378	1	188	22	0	206	102	4	0	4
Tractors	2019	1378	1	141	22	0	206	102	4	0	4
Tractors	2020	1378	1	93	22	0	206	102	4	0	4
Tractors	2021	1378	1	46	22	0	206	102	4	0	4
Tractors	2022	1378	1	46	22	0	206	102	4	0	4
Tractors	2023	1378	1	46	22	0	206	102	4	0	4
Tractors	2024	1378	1	46	22	0	206	102	4	0	4
Tractors	2025	1378	1	46	22	0	206	102	4	0	4
Tractors	2026	1378	1	46	22	0	206	102	4	0	4
Tractors	2027	1378	1	46	22	0	206	102	4	0	4
Tractors	2028	1378	1	46	22	0	206	102	4	0	4
Tractors	2029	1378	1	46	22	0	206	102	4	0	4
Tractors	2030	1378	1	46	22	0	206	102	4	0	4

Emission factors (g/GJ) for machine pool machinery 2005-2030

Machinery type	Year	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH3	TSP
Harvesters	2005	0.5	806	42	0.7	335	74	3.2	0.2	44
Harvesters	2006	0.5	743	39	0.6	321	74	3.2	0.2	40
Harvesters	2007	0.5	679	37	0.6	306	74	3.2	0.2	36
Harvesters	2008	0.5	616	34	0.6	291	74	3.2	0.2	32
Harvesters	2009	0.5	552	31	0.5	275	74	3.2	0.2	28
Harvesters	2010	0.5	488	29	0.5	259	74	3.2	0.2	23
Harvesters	2011	0.5	412	26	0.4	237	74	3.2	0.2	18
Harvesters	2012	0.5	336	22	0.4	214	74	3.3	0.2	13
Harvesters	2013	0.5	309	21	0.3	208	74	3.3	0.2	12
Harvesters	2014	0.5	271	20	0.3	202	74	3.3	0.2	11
Harvesters	2015	0.5	232	19	0.3	195	74	3.3	0.2	10
Harvesters	2016	0.5	193	18	0.3	189	74	3.3	0.2	9
Harvesters	2017	0.5	169	17	0.3	182	74	3.3	0.2	7
Harvesters	2018	0.5	144	17	0.3	175	74	3.3	0.2	6
Harvesters	2019	0.5	120	17	0.3	167	74	3.3	0.2	5
Harvesters	2020	0.5	95	16	0.3	160	74	3.3	0.2	4
Harvesters	2021	0.5	71	16	0.3	152	74	3.3	0.2	3
Harvesters	2022	0.5	59	16	0.3	152	74	3.3	0.2	3
Harvesters	2023	0.5	46	16	0.3	152	74	3.3	0.2	3
Harvesters	2024	0.5	34	16	0.3	152	74	3.3	0.2	3
Harvesters	2025	0.5	34	16	0.3	152	74	3.3	0.2	3
Harvesters	2026	0.5	34	16	0.3	152	74	3.3	0.2	3
Harvesters	2027	0.5	34	16	0.3	152	74	3.3	0.2	3
Harvesters	2028	0.5	34	16	0.3	152	74	3.3	0.2	3
Harvesters	2029	0.5	34	16	0.3	152	74	3.3	0.2	3
Harvesters	2030	0.5	34	16	0.3	152	74	3.3	0.2	3
Self-propelled vehicles	2005	0.5	643	36	0.6	286	74	3.2	0.2	31
Self-propelled vehicles	2006	0.5	526	31	0.5	257	74	3.2	0.2	23

Self-propelled vehicles	2007	0.5	408	26	0.4	226	74	3.2	0.2	15
Self-propelled vehicles	2008	0.5	381	24	0.4	227	74	3.2	0.2	15
Self-propelled vehicles	2009	0.5	355	23	0.4	228	74	3.2	0.2	15
Self-propelled vehicles	2010	0.5	328	21	0.3	230	74	3.2	0.2	15
Self-propelled vehicles	2011	0.5	280	19	0.3	219	74	3.3	0.2	13
Self-propelled vehicles	2012	0.5	258	18	0.3	207	74	3.3	0.2	11
Self-propelled vehicles	2013	0.5	236	18	0.3	194	74	3.3	0.2	9
Self-propelled vehicles	2014	0.5	191	17	0.3	181	74	3.3	0.2	7
Self-propelled vehicles	2015	0.5	147	17	0.3	167	74	3.3	0.2	5
Self-propelled vehicles	2016	0.5	102	16	0.3	153	74	3.3	0.2	3
Self-propelled vehicles	2017	0.5	79	16	0.3	153	74	3.3	0.2	3
Self-propelled vehicles	2018	0.5	57	16	0.3	153	74	3.3	0.2	3
Self-propelled vehicles	2019	0.5	34	16	0.3	153	74	3.3	0.2	3
Self-propelled vehicles	2020	0.5	34	16	0.3	153	74	3.3	0.2	3
Self-propelled vehicles	2021	0.5	34	16	0.3	153	74	3.3	0.2	3
Self-propelled vehicles	2022	0.5	34	16	0.3	153	74	3.3	0.2	3
Self-propelled vehicles	2023	0.5	34	16	0.3	153	74	3.3	0.2	3
Self-propelled vehicles	2024	0.5	34	16	0.3	153	74	3.3	0.2	3
Self-propelled vehicles	2025	0.5	34	16	0.3	153	74	3.3	0.2	3
Self-propelled vehicles	2026	0.5	34	16	0.3	153	74	3.3	0.2	3
Self-propelled vehicles	2027	0.5	34	16	0.3	153	74	3.3	0.2	3
Self-propelled vehicles	2028	0.5	34	16	0.3	153	74	3.3	0.2	3
Self-propelled vehicles	2029	0.5	34	16	0.3	153	74	3.3	0.2	3
Self-propelled vehicles	2030	0.5	34	16	0.3	153	74	3.3	0.2	3
Tractors	2005	0.5	797	68	1.1	365	74	3.2	0.2	42
Tractors	2006	0.5	695	55	0.9	319	74	3.2	0.2	38
Tractors	2007	0.5	570	41	0.7	271	74	3.2	0.2	33
Tractors	2008	0.5	445	27	0.4	221	74	3.2	0.2	28
Tractors	2009	0.5	385	25	0.4	222	74	3.2	0.2	28
Tractors	2010	0.5	362	23	0.4	223	74	3.2	0.2	28

Tractors	2011	0.5	340	22	0.4	224	74	3.2	0.2	28
Tractors	2012	0.5	315	20	0.3	215	74	3.2	0.2	25
Tractors	2013	0.5	289	18	0.3	206	74	3.2	0.2	22
Tractors	2014	0.5	286	18	0.3	195	74	3.2	0.2	19
Tractors	2015	0.5	249	17	0.3	184	74	3.2	0.2	15
Tractors	2016	0.5	212	17	0.3	173	74	3.2	0.2	11
Tractors	2017	0.5	174	16	0.3	161	74	3.2	0.2	7
Tractors	2018	0.5	137	16	0.3	150	74	3.2	0.2	3
Tractors	2019	0.5	102	16	0.3	150	74	3.2	0.2	3
Tractors	2020	0.5	68	16	0.3	150	74	3.2	0.2	3
Tractors	2021	0.5	33	16	0.3	150	74	3.2	0.2	3
Tractors	2022	0.5	33	16	0.3	150	74	3.2	0.2	3
Tractors	2023	0.5	33	16	0.3	150	74	3.2	0.2	3
Tractors	2024	0.5	33	16	0.3	150	74	3.2	0.2	3
Tractors	2025	0.5	33	16	0.3	150	74	3.2	0.2	3
Tractors	2026	0.5	33	16	0.3	150	74	3.2	0.2	3
Tractors	2027	0.5	33	16	0.3	150	74	3.2	0.2	3
Tractors	2028	0.5	33	16	0.3	150	74	3.2	0.2	3
Tractors	2029	0.5	33	16	0.3	150	74	3.2	0.2	3
Tractors	2030	0.5	33	16	0.3	150	74	3.2	0.2	3

Fuel use and emissions (tons) for other machinery in agriculture 2005-2030

Fuel type	Year	Fuel (TJ)	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Diesel	2005	83	0	67	6	0	32	6	0	0	4
Diesel	2006	83	0	65	6	0	31	6	0	0	3
Diesel	2007	83	0	62	5	0	29	6	0	0	3
Diesel	2008	83	0	58	5	0	27	6	0	0	3
Diesel	2009	83	0	55	4	0	25	6	0	0	3
Diesel	2010	83	0	51	4	0	24	6	0	0	3
Diesel	2011	83	0	47	3	0	22	6	0	0	3
Diesel	2012	83	0	43	3	0	20	6	0	0	2
Diesel	2013	83	0	39	2	0	17	6	0	0	2
Diesel	2014	83	0	37	2	0	17	6	0	0	2
Diesel	2015	83	0	34	2	0	16	6	0	0	2
Diesel	2016	83	0	30	2	0	16	6	0	0	2
Diesel	2017	83	0	27	2	0	16	6	0	0	2
Diesel	2018	83	0	23	2	0	15	6	0	0	1
Diesel	2019	83	0	21	2	0	15	6	0	0	1
Diesel	2020	83	0	18	2	0	15	6	0	0	1
Diesel	2021	83	0	16	1	0	14	6	0	0	1
Diesel	2022	83	0	13	1	0	14	6	0	0	1
Diesel	2023	83	0	12	1	0	13	6	0	0	1
Diesel	2024	83	0	10	1	0	13	6	0	0	1
Diesel	2025	82	0	8	1	0	12	6	0	0	0
Diesel	2026	82	0	7	1	0	12	6	0	0	0
Diesel	2027	82	0	5	1	0	12	6	0	0	0
Diesel	2028	82	0	4	1	0	12	6	0	0	0
Diesel	2029	82	0	3	1	0	12	6	0	0	0
Diesel	2030	82	0	3	1	0	12	6	0	0	0
Gasoline	2005	79	0	6	57	5	2619	6	0	0	1
Gasoline	2006	79	0	6	57	5	2648	6	0	0	1

Gasoline	2007	79	0	6	57	5	2682	6	0	0	1
Gasoline	2008	79	0	6	57	5	2722	6	0	0	1
Gasoline	2009	79	0	6	57	5	2767	6	0	0	1
Gasoline	2010	79	0	6	57	5	2816	6	0	0	1
Gasoline	2011	79	0	6	57	5	2869	6	0	0	1
Gasoline	2012	79	0	6	57	5	2926	6	0	0	1
Gasoline	2013	79	0	6	57	5	2986	6	0	0	1
Gasoline	2014	79	0	6	57	5	3050	6	0	0	1
Gasoline	2015	79	0	6	57	5	3050	6	0	0	1
Gasoline	2016	79	0	6	57	5	3050	6	0	0	1
Gasoline	2017	79	0	6	57	5	3050	6	0	0	1
Gasoline	2018	79	0	6	57	5	3050	6	0	0	1
Gasoline	2019	79	0	6	57	5	3050	6	0	0	1
Gasoline	2020	79	0	6	57	5	3050	6	0	0	1
Gasoline	2021	79	0	6	57	5	3050	6	0	0	1
Gasoline	2022	79	0	6	57	5	3050	6	0	0	1
Gasoline	2023	79	0	6	57	5	3050	6	0	0	1
Gasoline	2024	79	0	6	57	5	3050	6	0	0	1
Gasoline	2025	79	0	6	57	5	3050	6	0	0	1
Gasoline	2026	79	0	6	57	5	3050	6	0	0	1
Gasoline	2027	79	0	6	57	5	3050	6	0	0	1
Gasoline	2028	79	0	6	57	5	3050	6	0	0	1
Gasoline	2029	79	0	6	57	5	3050	6	0	0	1
Gasoline	2030	79	0	6	57	5	3050	6	0	0	1

Emission factors (g/GJ) for other machinery in agriculture 2005-2030

Fuel type	Year	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Diesel	2005	0.5	811	77	1.3	389	74	3.1	0.2	43
Diesel	2006	0.5	776	72	1.2	368	74	3.1	0.2	42
Diesel	2007	0.5	742	66	1.1	347	74	3.1	0.2	40
Diesel	2008	0.5	699	60	1.0	326	74	3.1	0.2	38
Diesel	2009	0.5	656	53	0.9	305	74	3.1	0.2	36
Diesel	2010	0.5	613	47	0.8	283	74	3.1	0.2	34
Diesel	2011	0.5	570	41	0.7	261	74	3.1	0.2	32
Diesel	2012	0.5	522	34	0.6	234	74	3.1	0.2	28
Diesel	2013	0.5	474	28	0.4	207	74	3.1	0.2	25
Diesel	2014	0.5	447	26	0.4	203	74	3.1	0.2	23
Diesel	2015	0.5	406	25	0.4	198	74	3.1	0.2	22
Diesel	2016	0.5	364	23	0.4	194	74	3.1	0.2	20
Diesel	2017	0.5	322	22	0.4	190	74	3.1	0.2	19
Diesel	2018	0.5	279	20	0.3	185	74	3.1	0.2	17
Diesel	2019	0.5	250	19	0.3	181	74	3.1	0.2	15
Diesel	2020	0.5	221	19	0.3	176	74	3.1	0.2	14
Diesel	2021	0.5	192	18	0.3	172	74	3.1	0.2	12
Diesel	2022	0.5	163	17	0.3	167	74	3.1	0.2	10
Diesel	2023	0.5	142	16	0.3	162	74	3.1	0.2	8
Diesel	2024	0.5	121	16	0.3	157	74	3.1	0.2	6
Diesel	2025	0.5	101	16	0.3	151	74	3.2	0.2	5
Diesel	2026	0.5	80	15	0.2	146	74	3.2	0.2	3
Diesel	2027	0.5	64	15	0.2	146	74	3.2	0.2	3
Diesel	2028	0.5	48	15	0.2	146	74	3.2	0.2	3
Diesel	2029	0.5	33	15	0.2	146	74	3.2	0.2	3
Diesel	2030	0.5	33	15	0.2	146	74	3.2	0.2	3
Gasoline	2005	0.5	72	723	63	33354	73	1.4	0.1	7
Gasoline	2006	0.5	72	723	63	33715	73	1.4	0.1	7

Gasoline	2007	0.5	72	724	63	34157	73	1.4	0.1	7
Gasoline	2008	0.5	72	724	63	34668	73	1.4	0.1	7
Gasoline	2009	0.5	72	723	63	35239	73	1.4	0.1	7
Gasoline	2010	0.5	72	723	63	35865	73	1.4	0.1	7
Gasoline	2011	0.5	73	723	63	36540	73	1.4	0.1	7
Gasoline	2012	0.5	73	723	63	37262	73	1.4	0.1	7
Gasoline	2013	0.5	73	723	63	38028	73	1.4	0.1	7
Gasoline	2014	0.5	73	722	63	38836	73	1.4	0.1	7
Gasoline	2015	0.5	73	722	63	38836	73	1.4	0.1	7
Gasoline	2016	0.5	73	721	62	38836	73	1.4	0.1	7
Gasoline	2017	0.5	73	720	62	38836	73	1.4	0.1	7
Gasoline	2018	0.5	73	720	62	38836	73	1.4	0.1	7
Gasoline	2019	0.5	73	720	62	38836	73	1.4	0.1	7
Gasoline	2020	0.5	73	720	62	38836	73	1.4	0.1	7
Gasoline	2021	0.5	73	720	62	38836	73	1.4	0.1	7
Gasoline	2022	0.5	73	720	62	38836	73	1.4	0.1	7
Gasoline	2023	0.5	73	720	62	38836	73	1.4	0.1	7
Gasoline	2024	0.5	73	720	62	38836	73	1.4	0.1	7
Gasoline	2025	0.5	73	720	62	38836	73	1.4	0.1	7
Gasoline	2026	0.5	73	720	62	38836	73	1.4	0.1	7
Gasoline	2027	0.5	73	720	62	38836	73	1.4	0.1	7
Gasoline	2028	0.5	73	720	62	38836	73	1.4	0.1	7
Gasoline	2029	0.5	73	720	62	38836	73	1.4	0.1	7
Gasoline	2030	0.5	73	720	62	38836	73	1.4	0.1	7

Fuel use and emissions (tons) for ATV's 2005-2030

Year	Emission Level	Fuel (TJ)	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
2005	Conv. MC urban	178	0	20	207	30	3130	13	0	0	6
2006	Conv. MC urban	178	0	20	207	30	3130	13	0	0	6
2007	Conv. MC urban	178	0	20	207	30	3130	13	0	0	6
2008	Conv. MC urban	178	0	20	207	30	3130	13	0	0	6
2009	Conv. MC urban	178	0	20	207	30	3130	13	0	0	6
2010	Conv. MC urban	178	0	20	207	30	3130	13	0	0	6
2011	Conv. MC urban	178	0	20	207	30	3130	13	0	0	6
2012	Conv. MC urban	178	0	20	207	30	3130	13	0	0	6
2013	Conv. MC urban	178	0	20	207	30	3130	13	0	0	6
2014	Conv. MC urban	178	0	20	207	30	3130	13	0	0	6
2015	Conv. MC urban	178	0	20	207	30	3130	13	0	0	6
2016	Conv. MC urban	178	0	20	207	30	3130	13	0	0	6
2017	Conv. MC urban	178	0	20	207	30	3130	13	0	0	6
2018	Conv. MC urban	178	0	20	207	30	3130	13	0	0	6
2019	Conv. MC urban	178	0	20	207	30	3130	13	0	0	6
2020	Conv. MC urban	178	0	20	207	30	3130	13	0	0	6
2021	Conv. MC urban	178	0	20	207	30	3130	13	0	0	6
2022	Conv. MC urban	178	0	20	207	30	3130	13	0	0	6
2023	Conv. MC urban	178	0	20	207	30	3130	13	0	0	6
2024	Conv. MC urban	178	0	20	207	30	3130	13	0	0	6
2025	Conv. MC urban	178	0	20	207	30	3130	13	0	0	6
2026	Conv. MC urban	178	0	20	207	30	3130	13	0	0	6
2027	Conv. MC urban	178	0	20	207	30	3130	13	0	0	6
2028	Conv. MC urban	178	0	20	207	30	3130	13	0	0	6
2029	Conv. MC urban	178	0	20	207	30	3130	13	0	0	6
2030	Conv. MC urban	178	0	20	207	30	3130	13	0	0	6

Emission factors (g/GJ) for ATV's 2005-2030

Year	Emission Level	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
2005	Conv. MC urban	0.5	113	1167	168	17633	73	1.7	1.7	34
2006	Conv. MC urban	0.5	113	1167	168	17633	73	1.7	1.7	34
2007	Conv. MC urban	0.5	113	1167	168	17633	73	1.7	1.7	34
2008	Conv. MC urban	0.5	113	1167	168	17633	73	1.7	1.7	34
2009	Conv. MC urban	0.5	113	1167	168	17633	73	1.7	1.7	34
2010	Conv. MC urban	0.5	113	1167	168	17633	73	1.7	1.7	34
2011	Conv. MC urban	0.5	113	1167	168	17633	73	1.7	1.7	34
2012	Conv. MC urban	0.5	113	1167	168	17633	73	1.7	1.7	34
2013	Conv. MC urban	0.5	113	1167	168	17633	73	1.7	1.7	34
2014	Conv. MC urban	0.5	113	1167	168	17633	73	1.7	1.7	34
2015	Conv. MC urban	0.5	113	1167	168	17633	73	1.7	1.7	34
2016	Conv. MC urban	0.5	113	1167	168	17633	73	1.7	1.7	34
2017	Conv. MC urban	0.5	113	1167	168	17633	73	1.7	1.7	34
2018	Conv. MC urban	0.5	113	1167	168	17633	73	1.7	1.7	34
2019	Conv. MC urban	0.5	113	1167	168	17633	73	1.7	1.7	34
2020	Conv. MC urban	0.5	113	1167	168	17633	73	1.7	1.7	34
2021	Conv. MC urban	0.5	113	1167	168	17633	73	1.7	1.7	34
2022	Conv. MC urban	0.5	113	1167	168	17633	73	1.7	1.7	34
2023	Conv. MC urban	0.5	113	1167	168	17633	73	1.7	1.7	34
2024	Conv. MC urban	0.5	113	1167	168	17633	73	1.7	1.7	34
2025	Conv. MC urban	0.5	113	1167	168	17633	73	1.7	1.7	34
2026	Conv. MC urban	0.5	113	1167	168	17633	73	1.7	1.7	34
2027	Conv. MC urban	0.5	113	1167	168	17633	73	1.7	1.7	34
2028	Conv. MC urban	0.5	113	1167	168	17633	73	1.7	1.7	34
2029	Conv. MC urban	0.5	113	1167	168	17633	73	1.7	1.7	34
2030	Conv. MC urban	0.5	113	1167	168	17633	73	1.7	1.7	34

Fuel use and emissions (tons) for forestry 2005-2030

FuelType	Year	Fuel (TJ)	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Diesel	2005	159	0	118	9	0	52	12	1	0	6
Diesel	2006	159	0	104	8	0	47	12	1	0	6
Diesel	2007	159	0	90	7	0	44	12	1	0	5
Diesel	2008	159	0	81	6	0	42	12	1	0	5
Diesel	2009	159	0	72	5	0	39	12	1	0	4
Diesel	2010	159	0	65	5	0	39	12	1	0	4
Diesel	2011	159	0	60	4	0	38	12	1	0	4
Diesel	2012	159	0	55	4	0	36	12	1	0	4
Diesel	2013	159	0	51	4	0	34	12	1	0	3
Diesel	2014	158	0	45	3	0	32	12	1	0	3
Diesel	2015	158	0	38	3	0	30	12	1	0	2
Diesel	2016	158	0	32	3	0	27	12	1	0	2
Diesel	2017	158	0	27	3	0	26	12	1	0	1
Diesel	2018	158	0	23	3	0	26	12	1	0	1
Diesel	2019	158	0	18	3	0	25	12	1	0	1
Diesel	2020	158	0	15	3	0	25	12	1	0	1
Diesel	2021	158	0	13	3	0	25	12	1	0	1
Diesel	2022	158	0	10	3	0	24	12	1	0	1
Diesel	2023	158	0	10	3	0	24	12	1	0	1
Diesel	2024	158	0	9	3	0	24	12	1	0	1
Diesel	2025	158	0	9	3	0	24	12	1	0	1
Diesel	2026	158	0	9	3	0	24	12	1	0	1
Diesel	2027	158	0	8	3	0	24	12	1	0	1
Diesel	2028	158	0	8	3	0	24	12	1	0	1
Diesel	2029	158	0	8	3	0	24	12	1	0	1
Diesel	2030	158	0	8	3	0	24	12	1	0	1
Gasoline	2005	76	0	5	498	4	1237	6	0	0	6
Gasoline	2006	75	0	6	503	4	1244	5	0	0	6

Gasoline	2007	74	0	6	512	4	1256	5	0	0	6
Gasoline	2008	74	0	6	512	4	1256	5	0	0	6
Gasoline	2009	73	0	6	439	4	1256	5	0	0	6
Gasoline	2010	71	0	5	362	3	1256	5	0	0	6
Gasoline	2011	70	0	4	278	2	1256	5	0	0	6
Gasoline	2012	70	0	4	278	2	1256	5	0	0	6
Gasoline	2013	70	0	4	278	2	1256	5	0	0	6
Gasoline	2014	70	0	4	278	2	1256	5	0	0	6
Gasoline	2015	70	0	4	278	2	1256	5	0	0	6
Gasoline	2016	70	0	4	278	2	1256	5	0	0	6
Gasoline	2017	70	0	4	278	2	1256	5	0	0	6
Gasoline	2018	70	0	4	278	2	1256	5	0	0	6
Gasoline	2019	70	0	4	278	2	1256	5	0	0	6
Gasoline	2020	70	0	4	278	2	1256	5	0	0	6
Gasoline	2021	70	0	4	278	2	1256	5	0	0	6
Gasoline	2022	70	0	4	278	2	1256	5	0	0	6
Gasoline	2023	70	0	4	278	2	1256	5	0	0	6
Gasoline	2024	70	0	4	278	2	1256	5	0	0	6
Gasoline	2025	70	0	4	278	2	1256	5	0	0	6
Gasoline	2026	70	0	4	278	2	1256	5	0	0	6
Gasoline	2027	70	0	4	278	2	1256	5	0	0	6
Gasoline	2028	70	0	4	278	2	1256	5	0	0	6
Gasoline	2029	70	0	4	278	2	1256	5	0	0	6
Gasoline	2030	70	0	4	278	2	1256	5	0	0	6

Emission factors (g/GJ) for forestry 2005-2030

FuelType	Year	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Diesel	2005	0.5	743	58	0.9	329	74	3.2	0.2	40
Diesel	2006	0.5	651	50	0.8	296	74	3.2	0.2	35
Diesel	2007	0.5	567	44	0.7	275	74	3.2	0.2	31
Diesel	2008	0.5	510	39	0.6	262	74	3.2	0.2	29
Diesel	2009	0.5	453	33	0.5	248	74	3.2	0.2	28
Diesel	2010	0.5	411	31	0.5	246	74	3.2	0.2	27
Diesel	2011	0.5	375	28	0.5	239	74	3.2	0.2	26
Diesel	2012	0.5	348	26	0.4	226	74	3.2	0.2	23
Diesel	2013	0.5	321	24	0.4	214	74	3.2	0.2	21
Diesel	2014	0.5	285	22	0.4	201	74	3.2	0.2	18
Diesel	2015	0.5	243	20	0.3	187	74	3.2	0.2	14
Diesel	2016	0.5	200	18	0.3	173	74	3.2	0.2	11
Diesel	2017	0.5	170	18	0.3	168	74	3.2	0.2	9
Diesel	2018	0.5	143	18	0.3	162	74	3.2	0.2	8
Diesel	2019	0.5	115	17	0.3	157	74	3.2	0.2	6
Diesel	2020	0.5	98	17	0.3	157	74	3.2	0.2	5
Diesel	2021	0.5	81	17	0.3	156	74	3.2	0.2	5
Diesel	2022	0.5	64	17	0.3	155	74	3.2	0.2	5
Diesel	2023	0.5	62	17	0.3	155	74	3.2	0.2	5
Diesel	2024	0.5	60	17	0.3	154	74	3.2	0.2	4
Diesel	2025	0.5	58	17	0.3	153	74	3.2	0.2	4
Diesel	2026	0.5	56	17	0.3	153	74	3.2	0.2	4
Diesel	2027	0.5	54	17	0.3	153	74	3.2	0.2	4
Diesel	2028	0.5	52	17	0.3	153	74	3.2	0.2	4
Diesel	2029	0.5	50	17	0.3	153	74	3.2	0.2	4
Diesel	2030	0.5	50	17	0.3	153	74	3.2	0.2	4
Gasoline	2005	0.5	61	6514	54	16172	73	0.4	0.1	75
Gasoline	2006	0.5	73	6684	56	16522	73	0.4	0.1	76

Gasoline	2007	0.5	86	6899	58	16934	73	0.4	0.1	78
Gasoline	2008	0.5	86	6899	58	16934	73	0.4	0.1	78
Gasoline	2009	0.5	76	6037	50	17249	73	0.4	0.1	79
Gasoline	2010	0.5	66	5061	41	17576	73	0.4	0.1	81
Gasoline	2011	0.5	55	3964	31	17916	73	0.5	0.1	82
Gasoline	2012	0.5	55	3964	31	17916	73	0.5	0.1	82
Gasoline	2013	0.5	55	3964	31	17916	73	0.5	0.1	82
Gasoline	2014	0.5	55	3964	31	17916	73	0.5	0.1	82
Gasoline	2015	0.5	55	3964	31	17916	73	0.5	0.1	82
Gasoline	2016	0.5	55	3964	31	17916	73	0.5	0.1	82
Gasoline	2017	0.5	55	3964	31	17916	73	0.5	0.1	82
Gasoline	2018	0.5	55	3964	31	17916	73	0.5	0.1	82
Gasoline	2019	0.5	55	3964	31	17916	73	0.5	0.1	82
Gasoline	2020	0.5	55	3964	31	17916	73	0.5	0.1	82
Gasoline	2021	0.5	55	3964	31	17916	73	0.5	0.1	82
Gasoline	2022	0.5	55	3964	31	17916	73	0.5	0.1	82
Gasoline	2023	0.5	55	3964	31	17916	73	0.5	0.1	82
Gasoline	2024	0.5	55	3964	31	17916	73	0.5	0.1	82
Gasoline	2025	0.5	55	3964	31	17916	73	0.5	0.1	82
Gasoline	2026	0.5	55	3964	31	17916	73	0.5	0.1	82
Gasoline	2027	0.5	55	3964	31	17916	73	0.5	0.1	82
Gasoline	2028	0.5	55	3964	31	17916	73	0.5	0.1	82
Gasoline	2029	0.5	55	3964	31	17916	73	0.5	0.1	82
Gasoline	2030	0.5	55	3964	31	17916	73	0.5	0.1	82

Fuel use and emissions (tons) for fork lifts 2005-2030

FuelType	Year	Fuel (TJ)	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Diesel	2005	1439	1	1127	273	4	1021	107	4	0	166
Diesel	2006	1430	1	1085	250	4	961	106	4	0	152
Diesel	2007	1415	1	1030	225	4	895	105	4	0	137
Diesel	2008	1400	1	968	200	3	831	104	4	0	123
Diesel	2009	1396	1	930	185	3	800	103	4	0	114
Diesel	2010	1396	1	896	172	3	774	103	4	0	106
Diesel	2011	1408	1	861	163	3	760	104	4	0	102
Diesel	2012	1415	1	827	154	3	742	105	4	0	97
Diesel	2013	1429	1	807	147	2	722	106	4	0	93
Diesel	2014	1427	1	774	136	2	686	106	4	0	87
Diesel	2015	1410	1	720	121	2	635	104	4	0	78
Diesel	2016	1395	1	667	107	2	584	103	4	0	69
Diesel	2017	1362	1	599	88	1	515	101	4	0	57
Diesel	2018	1331	1	533	70	1	450	98	4	0	46
Diesel	2019	1304	1	495	64	1	422	96	4	0	41
Diesel	2020	1273	1	454	57	1	393	94	4	0	35
Diesel	2021	1255	1	422	52	1	371	93	4	0	30
Diesel	2022	1237	1	390	47	1	351	92	4	0	26
Diesel	2023	1223	1	362	42	1	335	91	4	0	22
Diesel	2024	1215	1	347	40	1	323	90	4	0	20
Diesel	2025	1208	1	334	38	1	311	89	4	0	18
Diesel	2026	1200	1	321	35	1	299	89	4	0	16
Diesel	2027	1192	1	311	34	1	286	88	4	0	14
Diesel	2028	1185	1	305	32	1	273	88	4	0	12
Diesel	2029	1177	1	299	31	1	260	87	4	0	10
Diesel	2030	1169	1	294	30	0	246	87	4	0	8
LPG	2005	1040	0	1381	152	8	109	68	4	0	5
LPG	2006	1017	0	1350	149	8	107	66	4	0	5

LPG	2007	1004	0	1333	147	8	105	65	4	0	5
LPG	2008	998	0	1325	146	8	105	65	3	0	5
LPG	2009	990	0	1314	145	8	104	64	3	0	5
LPG	2010	980	0	1301	143	8	103	64	3	0	5
LPG	2011	972	0	1290	142	7	102	63	3	0	5
LPG	2012	970	0	1289	142	7	102	63	3	0	5
LPG	2013	977	0	1297	143	8	102	63	3	0	5
LPG	2014	974	0	1294	142	7	102	63	3	0	5
LPG	2015	959	0	1274	140	7	101	62	3	0	5
LPG	2016	948	0	1259	138	7	99	62	3	0	5
LPG	2017	924	0	1227	135	7	97	60	3	0	5
LPG	2018	898	0	1193	131	7	94	58	3	0	4
LPG	2019	876	0	1163	128	7	92	57	3	0	4
LPG	2020	860	0	1142	126	7	90	56	3	0	4
LPG	2021	844	0	1120	123	6	88	55	3	0	4
LPG	2022	829	0	1100	121	6	87	54	3	0	4
LPG	2023	817	0	1085	119	6	86	53	3	0	4
LPG	2024	817	0	1085	119	6	86	53	3	0	4
LPG	2025	817	0	1085	119	6	86	53	3	0	4
LPG	2026	817	0	1085	119	6	86	53	3	0	4
LPG	2027	817	0	1085	119	6	86	53	3	0	4
LPG	2028	817	0	1085	119	6	86	53	3	0	4
LPG	2029	817	0	1085	119	6	86	53	3	0	4
LPG	2030	817	0	1085	119	6	86	53	3	0	4

Emission factors (g/GJ) for fork lifts 2005-2030

FuelType	Year	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Diesel	2005	0	783	189	3.1	709	74	2.7	0.2	115
Diesel	2006	0	759	175	2.8	672	74	2.7	0.2	106
Diesel	2007	0	728	159	2.6	633	74	2.7	0.2	97
Diesel	2008	0	691	143	2.3	594	74	2.7	0.2	88
Diesel	2009	0	666	133	2.2	573	74	2.7	0.2	81
Diesel	2010	0	641	123	2.0	554	74	2.7	0.2	76
Diesel	2011	0	612	116	1.9	540	74	2.7	0.2	72
Diesel	2012	0	584	109	1.8	524	74	2.7	0.2	69
Diesel	2013	0	565	103	1.7	505	74	2.7	0.2	65
Diesel	2014	0	543	95	1.5	481	74	2.7	0.2	61
Diesel	2015	0	511	86	1.4	450	74	2.8	0.2	55
Diesel	2016	0	478	76	1.2	419	74	2.8	0.2	50
Diesel	2017	0	440	64	1.0	378	74	2.8	0.2	42
Diesel	2018	0	401	53	0.9	338	74	2.9	0.2	35
Diesel	2019	0	380	49	0.8	324	74	2.9	0.2	31
Diesel	2020	0	356	45	0.7	309	74	2.9	0.2	27
Diesel	2021	0	336	41	0.7	295	74	2.9	0.2	24
Diesel	2022	0	315	38	0.6	283	74	3.0	0.2	21
Diesel	2023	0	296	35	0.6	274	74	3.0	0.2	18
Diesel	2024	0	285	33	0.5	266	74	3.0	0.2	16
Diesel	2025	0	276	31	0.5	257	74	3.0	0.2	15
Diesel	2026	0	267	30	0.5	249	74	3.1	0.2	13
Diesel	2027	0	261	28	0.5	240	74	3.1	0.2	12
Diesel	2028	0	258	27	0.4	230	74	3.1	0.2	10
Diesel	2029	0	254	26	0.4	221	74	3.1	0.2	9
Diesel	2030	0	251	25	0.4	211	74	3.1	0.2	7
LPG	2005	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	2006	0	1328	146	7.7	105	65	3.5	0.2	5

LPG	2007	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	2008	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	2009	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	2010	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	2011	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	2012	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	2013	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	2014	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	2015	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	2016	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	2017	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	2018	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	2019	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	2020	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	2021	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	2022	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	2023	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	2024	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	2025	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	2026	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	2027	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	2028	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	2029	0	1328	146	7.7	105	65	3.5	0.2	5
LPG	2030	0	1328	146	7.7	105	65	3.5	0.2	5

Fuel use and emissions (tons) for construction machinery 2005-2030

Year	Fuel (TJ)	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
2005	7575	4	5639	613	10	3041	561	24	1	565
2006	7575	4	5236	543	9	2794	561	24	1	514
2007	7575	4	4769	469	8	2543	561	24	1	462
2008	7575	4	4285	394	6	2287	561	24	1	408
2009	7575	4	4009	357	6	2201	561	24	1	371
2010	7575	4	3731	321	5	2114	561	24	1	333
2011	7575	4	3491	300	5	2084	561	24	1	317
2012	7571	4	3253	279	5	2029	560	24	1	295
2013	7566	4	3115	261	4	1965	560	24	1	269
2014	7561	4	2994	245	4	1901	560	24	1	246
2015	7556	4	2801	238	4	1867	559	24	1	234
2016	7551	4	2611	231	4	1833	559	24	1	222
2017	7546	4	2483	228	4	1793	558	24	1	209
2018	7541	4	2370	226	4	1751	558	24	1	196
2019	7536	4	2257	224	4	1708	558	24	1	182
2020	7531	4	2144	222	4	1665	557	24	1	168
2021	7526	4	2036	220	4	1622	557	24	1	154
2022	7525	4	1939	220	4	1613	557	24	1	151
2023	7525	4	1840	220	4	1613	557	24	1	151
2024	7525	4	1744	220	4	1613	557	24	1	151
2025	7525	4	1744	220	4	1613	557	24	1	151
2026	7525	4	1744	220	4	1613	557	24	1	151
2027	7525	4	1744	220	4	1613	557	24	1	151
2028	7525	4	1744	220	4	1613	557	24	1	151
2029	7525	4	1744	220	4	1613	557	24	1	151
2030	7525	4	1744	220	4	1613	557	24	1	151

Emission factors (g/GJ) for construction machinery 2005-2030

Year	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
2005	0.5	744	81	1.3	401	74	3.1	0.2	75
2006	0.5	691	72	1.2	369	74	3.1	0.2	68
2007	0.5	629	62	1.0	336	74	3.1	0.2	61
2008	0.5	566	52	0.8	302	74	3.1	0.2	54
2009	0.5	529	47	0.8	291	74	3.1	0.2	49
2010	0.5	492	42	0.7	279	74	3.1	0.2	44
2011	0.5	461	40	0.6	275	74	3.1	0.2	42
2012	0.5	430	37	0.6	268	74	3.1	0.2	39
2013	0.5	412	35	0.6	260	74	3.2	0.2	36
2014	0.5	396	32	0.5	251	74	3.2	0.2	32
2015	0.5	371	31	0.5	247	74	3.2	0.2	31
2016	0.5	346	31	0.5	243	74	3.2	0.2	29
2017	0.5	329	30	0.5	238	74	3.2	0.2	28
2018	0.5	314	30	0.5	232	74	3.2	0.2	26
2019	0.5	300	30	0.5	227	74	3.2	0.2	24
2020	0.5	285	29	0.5	221	74	3.2	0.2	22
2021	0.5	270	29	0.5	216	74	3.2	0.2	20
2022	0.5	258	29	0.5	214	74	3.2	0.2	20
2023	0.5	244	29	0.5	214	74	3.2	0.2	20
2024	0.5	232	29	0.5	214	74	3.2	0.2	20
2025	0.5	232	29	0.5	214	74	3.2	0.2	20
2026	0.5	232	29	0.5	214	74	3.2	0.2	20
2027	0.5	232	29	0.5	214	74	3.2	0.2	20
2028	0.5	232	29	0.5	214	74	3.2	0.2	20
2029	0.5	232	29	0.5	214	74	3.2	0.2	20
2030	0.5	232	29	0.5	214	74	3.2	0.2	20

Fuel use and emissions (tons) for household and gardening 2005-2030

FuelType	Engine	Year	Fuel (TJ)	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Gasoline	2-stroke	2005	712	0	35	5087	41	11338	52	0	0	65
Gasoline	2-stroke	2006	704	0	41	5095	42	11203	51	0	0	65
Gasoline	2-stroke	2007	697	0	46	5124	42	11086	51	0	0	65
Gasoline	2-stroke	2008	676	0	47	4792	39	10911	49	0	0	65
Gasoline	2-stroke	2009	649	0	43	4080	33	10884	47	0	0	65
Gasoline	2-stroke	2010	623	0	38	3320	26	10856	45	0	0	65
Gasoline	2-stroke	2011	596	0	34	2511	19	10828	43	0	0	65
Gasoline	2-stroke	2012	592	0	34	2454	18	10801	43	0	0	65
Gasoline	2-stroke	2013	589	0	34	2397	18	10773	43	0	0	65
Gasoline	2-stroke	2014	586	0	35	2338	17	10745	43	0	0	65
Gasoline	2-stroke	2015	583	0	35	2279	17	10745	43	0	0	65
Gasoline	2-stroke	2016	580	0	35	2218	16	10745	42	0	0	65
Gasoline	2-stroke	2017	576	0	35	2156	16	10745	42	0	0	65
Gasoline	2-stroke	2018	576	0	35	2156	16	10745	42	0	0	65
Gasoline	2-stroke	2019	576	0	35	2156	16	10745	42	0	0	65
Gasoline	2-stroke	2020	576	0	35	2156	16	10745	42	0	0	65
Gasoline	2-stroke	2021	576	0	35	2156	16	10745	42	0	0	65
Gasoline	2-stroke	2022	576	0	35	2156	16	10745	42	0	0	65
Gasoline	2-stroke	2023	576	0	35	2156	16	10745	42	0	0	65
Gasoline	2-stroke	2024	576	0	35	2156	16	10745	42	0	0	65
Gasoline	2-stroke	2025	576	0	35	2156	16	10745	42	0	0	65
Gasoline	2-stroke	2026	576	0	35	2156	16	10745	42	0	0	65
Gasoline	2-stroke	2027	576	0	35	2156	16	10745	42	0	0	65
Gasoline	2-stroke	2028	576	0	35	2156	16	10745	42	0	0	65
Gasoline	2-stroke	2029	576	0	35	2156	16	10745	42	0	0	65
Gasoline	2-stroke	2030	576	0	35	2156	16	10745	42	0	0	65
Gasoline	4-stroke	2005	3351	2	292	3599	249	103616	245	5	0	22
Gasoline	4-stroke	2006	3350	2	298	3615	251	105284	245	5	0	22

Gasoline 4-stroke	2007	3348	2	306	3636	254	107333	244	5	0	22
Gasoline 4-stroke	2008	3347	2	315	3638	254	109706	244	5	0	23
Gasoline 4-stroke	2009	3346	2	322	3628	253	112233	244	5	0	23
Gasoline 4-stroke	2010	3346	2	328	3617	252	112960	244	5	0	23
Gasoline 4-stroke	2011	3346	2	335	3604	250	113745	244	5	0	23
Gasoline 4-stroke	2012	3346	2	343	3604	250	114584	244	5	0	24
Gasoline 4-stroke	2013	3346	2	343	3580	247	115203	244	5	0	24
Gasoline 4-stroke	2014	3346	2	343	3555	245	115855	244	5	0	24
Gasoline 4-stroke	2015	3346	2	343	3528	242	116539	244	5	0	24
Gasoline 4-stroke	2016	3346	2	343	3528	242	117254	244	5	0	24
Gasoline 4-stroke	2017	3346	2	343	3528	242	117253	244	5	0	24
Gasoline 4-stroke	2018	3346	2	343	3528	242	117253	244	5	0	24
Gasoline 4-stroke	2019	3346	2	343	3528	242	117252	244	5	0	24
Gasoline 4-stroke	2020	3346	2	343	3528	242	117252	244	5	0	24
Gasoline 4-stroke	2021	3346	2	343	3528	242	117252	244	5	0	24
Gasoline 4-stroke	2022	3346	2	343	3528	242	117252	244	5	0	24
Gasoline 4-stroke	2023	3346	2	343	3528	242	117252	244	5	0	24
Gasoline 4-stroke	2024	3346	2	343	3528	242	117252	244	5	0	24
Gasoline 4-stroke	2025	3346	2	343	3528	242	117252	244	5	0	24
Gasoline 4-stroke	2026	3346	2	343	3528	242	117252	244	5	0	24
Gasoline 4-stroke	2027	3346	2	343	3528	242	117252	244	5	0	24
Gasoline 4-stroke	2028	3346	2	343	3528	242	117252	244	5	0	24
Gasoline 4-stroke	2029	3346	2	343	3528	242	117252	244	5	0	24
Gasoline 4-stroke	2030	3346	2	343	3528	242	117252	244	5	0	24

Emission factors (g/GJ) for household and gardening 2005-2030

FuelType	Engine	Year	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Gasoline	2-stroke	2005	0.5	50	7148	58	15932	73	0.4	0.1	91
Gasoline	2-stroke	2006	0.5	58	7233	59	15904	73	0.4	0.1	92
Gasoline	2-stroke	2007	0.5	66	7350	60	15902	73	0.4	0.1	93
Gasoline	2-stroke	2008	0.5	69	7088	58	16138	73	0.4	0.1	96
Gasoline	2-stroke	2009	0.5	66	6283	50	16761	73	0.4	0.1	99
Gasoline	2-stroke	2010	0.5	62	5332	42	17437	73	0.4	0.1	104
Gasoline	2-stroke	2011	0.5	57	4214	32	18173	73	0.4	0.1	108
Gasoline	2-stroke	2012	0.5	58	4142	31	18229	73	0.4	0.1	109
Gasoline	2-stroke	2013	0.5	59	4068	30	18285	73	0.4	0.1	110
Gasoline	2-stroke	2014	0.5	59	3991	30	18342	73	0.4	0.1	110
Gasoline	2-stroke	2015	0.5	59	3911	29	18441	73	0.5	0.1	111
Gasoline	2-stroke	2016	0.5	60	3827	28	18540	73	0.5	0.1	111
Gasoline	2-stroke	2017	0.5	60	3740	27	18641	73	0.5	0.1	112
Gasoline	2-stroke	2018	0.5	60	3740	27	18641	73	0.5	0.1	112
Gasoline	2-stroke	2019	0.5	60	3740	27	18641	73	0.5	0.1	112
Gasoline	2-stroke	2020	0.5	60	3740	27	18641	73	0.5	0.1	112
Gasoline	2-stroke	2021	0.5	60	3740	27	18641	73	0.5	0.1	112
Gasoline	2-stroke	2022	0.5	60	3740	27	18641	73	0.5	0.1	112
Gasoline	2-stroke	2023	0.5	60	3740	27	18641	73	0.5	0.1	112
Gasoline	2-stroke	2024	0.5	60	3740	27	18641	73	0.5	0.1	112
Gasoline	2-stroke	2025	0.5	60	3740	27	18641	73	0.5	0.1	112
Gasoline	2-stroke	2026	0.5	60	3740	27	18641	73	0.5	0.1	112
Gasoline	2-stroke	2027	0.5	60	3740	27	18641	73	0.5	0.1	112
Gasoline	2-stroke	2028	0.5	60	3740	27	18641	73	0.5	0.1	112
Gasoline	2-stroke	2029	0.5	60	3740	27	18641	73	0.5	0.1	112
Gasoline	2-stroke	2030	0.5	60	3740	27	18641	73	0.5	0.1	112
Gasoline	4-stroke	2005	0.5	87	1074	74	30919	73	1.3	0.1	7
Gasoline	4-stroke	2006	0.5	89	1079	75	31429	73	1.3	0.1	7

Gasoline	4-stroke	2007	0.5	91	1086	76	32054	73	1.3	0.1	7
Gasoline	4-stroke	2008	0.5	94	1087	76	32776	73	1.3	0.1	7
Gasoline	4-stroke	2009	0.5	96	1084	76	33545	73	1.3	0.1	7
Gasoline	4-stroke	2010	0.5	98	1081	75	33762	73	1.3	0.1	7
Gasoline	4-stroke	2011	0.5	100	1077	75	33997	73	1.3	0.1	7
Gasoline	4-stroke	2012	0.5	102	1077	75	34248	73	1.3	0.1	7
Gasoline	4-stroke	2013	0.5	102	1070	74	34433	73	1.3	0.1	7
Gasoline	4-stroke	2014	0.5	102	1062	73	34628	73	1.3	0.1	7
Gasoline	4-stroke	2015	0.5	102	1055	72	34833	73	1.3	0.1	7
Gasoline	4-stroke	2016	0.5	102	1054	72	35047	73	1.3	0.1	7
Gasoline	4-stroke	2017	0.5	102	1054	72	35047	73	1.3	0.1	7
Gasoline	4-stroke	2018	0.5	102	1055	72	35047	73	1.3	0.1	7
Gasoline	4-stroke	2019	0.5	102	1055	72	35047	73	1.3	0.1	7
Gasoline	4-stroke	2020	0.5	102	1055	72	35047	73	1.3	0.1	7
Gasoline	4-stroke	2021	0.5	102	1055	72	35047	73	1.3	0.1	7
Gasoline	4-stroke	2022	0.5	102	1055	72	35047	73	1.3	0.1	7
Gasoline	4-stroke	2023	0.5	102	1055	72	35047	73	1.3	0.1	7
Gasoline	4-stroke	2024	0.5	102	1055	72	35047	73	1.3	0.1	7
Gasoline	4-stroke	2025	0.5	102	1055	72	35047	73	1.3	0.1	7
Gasoline	4-stroke	2026	0.5	102	1055	72	35047	73	1.3	0.1	7
Gasoline	4-stroke	2027	0.5	102	1055	72	35047	73	1.3	0.1	7
Gasoline	4-stroke	2028	0.5	102	1055	72	35047	73	1.3	0.1	7
Gasoline	4-stroke	2029	0.5	102	1055	72	35047	73	1.3	0.1	7
Gasoline	4-stroke	2030	0.5	102	1055	72	35047	73	1.3	0.1	7

Fuel use and emissions (tons) for small boats and pleasure crafts 2005-2030

Engine	Fuel type	Year	Fuel (TJ)	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
	Diesel	2005	1002	94	879	170	3	454	74	3	0	105
	Diesel	2006	1002	94	870	168	3	452	74	3	0	104
	Diesel	2007	1002	94	862	167	3	450	74	3	0	102
	Diesel	2008	1002	94	853	165	3	448	74	3	0	101
	Diesel	2009	1002	94	845	163	3	446	74	3	0	100
	Diesel	2010	1002	94	836	161	3	444	74	3	0	98
	Diesel	2011	1002	94	827	159	3	442	74	3	0	97
	Diesel	2012	1002	94	819	157	3	440	74	3	0	96
	Diesel	2013	1002	94	810	155	3	438	74	3	0	94
	Diesel	2014	1002	94	802	153	2	436	74	3	0	93
	Diesel	2015	1002	94	793	151	2	435	74	3	0	92
	Diesel	2016	1002	94	784	149	2	433	74	3	0	90
	Diesel	2017	1002	94	776	147	2	431	74	3	0	89
	Diesel	2018	1002	94	767	145	2	429	74	3	0	88
	Diesel	2019	1002	94	759	143	2	427	74	3	0	86
	Diesel	2020	1002	94	750	141	2	425	74	3	0	85
	Diesel	2021	1002	94	750	141	2	425	74	3	0	85
	Diesel	2022	1002	94	750	141	2	425	74	3	0	85
	Diesel	2023	1002	94	750	141	2	425	74	3	0	85
	Diesel	2024	1002	94	750	141	2	425	74	3	0	85
	Diesel	2025	1002	94	750	141	2	425	74	3	0	85
	Diesel	2026	1002	94	750	141	2	425	74	3	0	85
	Diesel	2027	1002	94	750	141	2	425	74	3	0	85
	Diesel	2028	1002	94	750	141	2	425	74	3	0	85
	Diesel	2029	1002	94	750	141	2	425	74	3	0	85
	Diesel	2030	1002	94	750	141	2	425	74	3	0	85
2-stroke	Gasoline	2005	142	0	12	756	7	1561	10	0	0	41
2-stroke	Gasoline	2006	116	0	10	618	6	1277	8	0	0	34

2-stroke	Gasoline	2007	93	0	8	495	4	1022	7	0	0	27
2-stroke	Gasoline	2008	72	0	6	385	3	795	5	0	0	21
2-stroke	Gasoline	2009	54	0	4	289	3	596	4	0	0	16
2-stroke	Gasoline	2010	39	0	3	206	2	426	3	0	0	11
2-stroke	Gasoline	2011	26	0	2	137	1	284	2	0	0	7
2-stroke	Gasoline	2012	15	0	1	82	1	170	1	0	0	4
2-stroke	Gasoline	2013	8	0	1	41	0	85	1	0	0	2
2-stroke	Gasoline	2014	3	0	0	14	0	28	0	0	0	1
2-stroke	Gasoline	2015	0	0	0	0	0	0	0	0	0	0
2-stroke	Gasoline	2016	0	0	0	0	0	0	0	0	0	0
2-stroke	Gasoline	2017	0	0	0	0	0	0	0	0	0	0
2-stroke	Gasoline	2018	0	0	0	0	0	0	0	0	0	0
2-stroke	Gasoline	2019	0	0	0	0	0	0	0	0	0	0
2-stroke	Gasoline	2020	0	0	0	0	0	0	0	0	0	0
2-stroke	Gasoline	2021	0	0	0	0	0	0	0	0	0	0
2-stroke	Gasoline	2022	0	0	0	0	0	0	0	0	0	0
2-stroke	Gasoline	2023	0	0	0	0	0	0	0	0	0	0
2-stroke	Gasoline	2024	0	0	0	0	0	0	0	0	0	0
2-stroke	Gasoline	2025	0	0	0	0	0	0	0	0	0	0
2-stroke	Gasoline	2026	0	0	0	0	0	0	0	0	0	0
2-stroke	Gasoline	2027	0	0	0	0	0	0	0	0	0	0
2-stroke	Gasoline	2028	0	0	0	0	0	0	0	0	0	0
2-stroke	Gasoline	2029	0	0	0	0	0	0	0	0	0	0
2-stroke	Gasoline	2030	0	0	0	0	0	0	0	0	0	0
4-stroke	Gasoline	2005	251	0	154	152	15	4868	18	0	0	1
4-stroke	Gasoline	2006	265	0	161	164	16	4778	19	0	0	1
4-stroke	Gasoline	2007	278	0	167	175	17	4658	20	0	0	1
4-stroke	Gasoline	2008	289	0	173	185	18	4507	21	0	0	1
4-stroke	Gasoline	2009	299	0	178	193	19	4326	22	0	0	1
4-stroke	Gasoline	2010	307	0	182	201	20	4115	22	0	0	1
4-stroke	Gasoline	2011	314	0	186	207	20	3874	23	1	0	1

4-stroke	Gasoline	2012	320	0	189	212	21	3602	23	1	0	1
4-stroke	Gasoline	2013	324	0	191	215	21	3300	24	1	0	1
4-stroke	Gasoline	2014	327	0	192	218	21	2968	24	1	0	1
4-stroke	Gasoline	2015	328	0	193	219	22	2605	24	1	0	1
4-stroke	Gasoline	2016	328	0	193	219	22	2605	24	1	0	1
4-stroke	Gasoline	2017	328	0	193	219	22	2605	24	1	0	1
4-stroke	Gasoline	2018	328	0	193	219	22	2605	24	1	0	1
4-stroke	Gasoline	2019	328	0	193	219	22	2605	24	1	0	1
4-stroke	Gasoline	2020	328	0	193	219	22	2605	24	1	0	1
4-stroke	Gasoline	2021	328	0	193	219	22	2605	24	1	0	1
4-stroke	Gasoline	2022	328	0	193	219	22	2605	24	1	0	1
4-stroke	Gasoline	2023	328	0	193	219	22	2605	24	1	0	1
4-stroke	Gasoline	2024	328	0	193	219	22	2605	24	1	0	1
4-stroke	Gasoline	2025	328	0	193	219	22	2605	24	1	0	1
4-stroke	Gasoline	2026	328	0	193	219	22	2605	24	1	0	1
4-stroke	Gasoline	2027	328	0	193	219	22	2605	24	1	0	1
4-stroke	Gasoline	2028	328	0	193	219	22	2605	24	1	0	1
4-stroke	Gasoline	2029	328	0	193	219	22	2605	24	1	0	1
4-stroke	Gasoline	2030	328	0	193	219	22	2605	24	1	0	1

Emission factors (g/GJ) for small boats and pleasure crafts 2005-2030

Engine	Fuel type	Year	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
	Diesel	2005	94	877	170	2.8	453	74	3.0	0.2	105
	Diesel	2006	94	869	168	2.7	451	74	3.0	0.2	104
	Diesel	2007	94	860	166	2.7	449	74	3.0	0.2	102
	Diesel	2008	94	851	164	2.7	447	74	3.0	0.2	101
	Diesel	2009	94	843	162	2.6	445	74	3.0	0.2	100
	Diesel	2010	94	834	160	2.6	443	74	3.0	0.2	98
	Diesel	2011	94	826	158	2.6	441	74	3.0	0.2	97
	Diesel	2012	94	817	157	2.5	439	74	3.0	0.2	96
	Diesel	2013	94	808	155	2.5	437	74	3.0	0.2	94
	Diesel	2014	94	800	153	2.5	436	74	3.0	0.2	93
	Diesel	2015	94	791	151	2.5	434	74	3.0	0.2	92
	Diesel	2016	94	783	149	2.4	432	74	3.0	0.2	90
	Diesel	2017	94	774	147	2.4	430	74	3.0	0.2	89
	Diesel	2018	94	765	145	2.4	428	74	3.0	0.2	87
	Diesel	2019	94	757	143	2.3	426	74	3.0	0.2	86
	Diesel	2020	94	748	141	2.3	424	74	3.0	0.2	85
	Diesel	2021	94	748	141	2.3	424	74	3.0	0.2	85
	Diesel	2022	94	748	141	2.3	424	74	3.0	0.2	85
	Diesel	2023	94	748	141	2.3	424	74	3.0	0.2	85
	Diesel	2024	94	748	141	2.3	424	74	3.0	0.2	85
	Diesel	2025	94	748	141	2.3	424	74	3.0	0.2	85
	Diesel	2026	94	748	141	2.3	424	74	3.0	0.2	85
	Diesel	2027	94	748	141	2.3	424	74	3.0	0.2	85
	Diesel	2028	94	748	141	2.3	424	74	3.0	0.2	85
	Diesel	2029	94	748	141	2.3	424	74	3.0	0.2	85
	Diesel	2030	94	748	141	2.3	424	74	3.0	0.2	85
2-stroke	Gasoline	2005	0.5	83	5323	48	10995	73	0.3	0.1	289

2-stroke	Gasoline	2006	0.5	83	5323	48	10995	73	0.3	0.1	289
2-stroke	Gasoline	2007	0.5	83	5323	48	10995	73	0.3	0.1	289
2-stroke	Gasoline	2008	0.5	83	5323	48	10995	73	0.3	0.1	289
2-stroke	Gasoline	2009	0.5	83	5323	48	10995	73	0.3	0.1	289
2-stroke	Gasoline	2010	0.5	83	5323	48	10995	73	0.3	0.1	289
2-stroke	Gasoline	2011	0.5	83	5323	48	10995	73	0.3	0.1	289
2-stroke	Gasoline	2012	0.5	83	5323	48	10995	73	0.3	0.1	289
2-stroke	Gasoline	2013	0.5	83	5323	48	10995	73	0.3	0.1	289
2-stroke	Gasoline	2014	0.5	83	5323	48	10995	73	0.3	0.1	289
2-stroke	Gasoline	2015	-	-	-	-	-	-	-	-	-
2-stroke	Gasoline	2016	-	-	-	-	-	-	-	-	-
2-stroke	Gasoline	2017	-	-	-	-	-	-	-	-	-
2-stroke	Gasoline	2018	-	-	-	-	-	-	-	-	-
2-stroke	Gasoline	2019	-	-	-	-	-	-	-	-	-
2-stroke	Gasoline	2020	-	-	-	-	-	-	-	-	-
2-stroke	Gasoline	2021	-	-	-	-	-	-	-	-	-
2-stroke	Gasoline	2022	-	-	-	-	-	-	-	-	-
2-stroke	Gasoline	2023	-	-	-	-	-	-	-	-	-
2-stroke	Gasoline	2024	-	-	-	-	-	-	-	-	-
2-stroke	Gasoline	2025	-	-	-	-	-	-	-	-	-
2-stroke	Gasoline	2026	-	-	-	-	-	-	-	-	-
2-stroke	Gasoline	2027	-	-	-	-	-	-	-	-	-
2-stroke	Gasoline	2028	-	-	-	-	-	-	-	-	-
2-stroke	Gasoline	2029	-	-	-	-	-	-	-	-	-
2-stroke	Gasoline	2030	-	-	-	-	-	-	-	-	-
4-stroke	Gasoline	2005	0.5	611	604	61	19357	73	1.6	0.1	4.3
4-stroke	Gasoline	2006	0.5	606	618	62	18004	73	1.6	0.1	4.3
4-stroke	Gasoline	2007	0.5	602	630	63	16761	73	1.6	0.1	4.3
4-stroke	Gasoline	2008	0.5	599	639	63	15596	73	1.6	0.1	4.3
4-stroke	Gasoline	2009	0.5	596	647	64	14483	73	1.6	0.1	4.3
4-stroke	Gasoline	2010	0.5	594	653	65	13402	73	1.6	0.1	4.3

4-stroke	Gasoline	2011	0.5	592	658	65	12336	73	1.6	0.1	4.3
4-stroke	Gasoline	2012	0.5	591	662	65	11271	73	1.6	0.1	4.3
4-stroke	Gasoline	2013	0.5	590	665	65	10193	73	1.6	0.1	4.3
4-stroke	Gasoline	2014	0.5	589	667	66	9088	73	1.6	0.1	4.3
4-stroke	Gasoline	2015	0.5	589	667	66	7943	73	1.6	0.1	4.3
4-stroke	Gasoline	2016	0.5	589	667	66	7943	73	1.6	0.1	4.3
4-stroke	Gasoline	2017	0.5	589	667	66	7943	73	1.6	0.1	4.3
4-stroke	Gasoline	2018	0.5	589	667	66	7943	73	1.6	0.1	4.3
4-stroke	Gasoline	2019	0.5	589	667	66	7943	73	1.6	0.1	4.3
4-stroke	Gasoline	2020	0.5	589	667	66	7943	73	1.6	0.1	4.3
4-stroke	Gasoline	2021	0.5	589	667	66	7943	73	1.6	0.1	4.3
4-stroke	Gasoline	2022	0.5	589	667	66	7943	73	1.6	0.1	4.3
4-stroke	Gasoline	2023	0.5	589	667	66	7943	73	1.6	0.1	4.3
4-stroke	Gasoline	2024	0.5	589	667	66	7943	73	1.6	0.1	4.3
4-stroke	Gasoline	2025	0.5	589	667	66	7943	73	1.6	0.1	4.3
4-stroke	Gasoline	2026	0.5	589	667	66	7943	73	1.6	0.1	4.3
4-stroke	Gasoline	2027	0.5	589	667	66	7943	73	1.6	0.1	4.3
4-stroke	Gasoline	2028	0.5	589	667	66	7943	73	1.6	0.1	4.3
4-stroke	Gasoline	2029	0.5	589	667	66	7943	73	1.6	0.1	4.3
4-stroke	Gasoline	2030	0.5	589	667	66	7943	73	1.6	0.1	4.3

Fuel use and emissions (tons) in CollectER format 2005-2030

Sector	Fuel type	Year	Fuel (TJ)	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Agriculture	Diesel	2005	13379	6	11259	1249	20	6052	990	42	2	921
Agriculture	Diesel	2006	13343	6	10651	1157	19	5740	987	42	2	863
Agriculture	Diesel	2007	13293	6	9967	1060	17	5422	984	42	2	803
Agriculture	Diesel	2008	13207	6	9266	961	16	5093	977	42	2	743
Agriculture	Diesel	2009	13090	6	8628	875	14	4822	969	41	2	687
Agriculture	Diesel	2010	12961	6	8060	795	13	4562	959	41	2	633
Agriculture	Diesel	2011	12817	6	7442	720	12	4287	948	41	2	582
Agriculture	Diesel	2012	12717	6	6896	655	11	4020	941	40	2	528
Agriculture	Diesel	2013	12622	6	6401	594	10	3768	934	40	2	473
Agriculture	Diesel	2014	12513	6	5903	539	9	3522	926	40	2	418
Agriculture	Diesel	2015	12351	6	5283	481	8	3259	914	40	2	356
Agriculture	Diesel	2016	12242	6	4751	437	7	3051	906	39	2	305
Agriculture	Diesel	2017	12207	6	4330	407	7	2905	903	39	2	267
Agriculture	Diesel	2018	12210	6	3968	384	6	2784	904	39	2	233
Agriculture	Diesel	2019	12195	6	3611	360	6	2669	902	39	2	202
Agriculture	Diesel	2020	12182	6	3274	338	6	2562	901	39	2	173
Agriculture	Diesel	2021	12182	6	2939	324	5	2480	901	39	2	158
Agriculture	Diesel	2022	12211	6	2704	313	5	2420	904	39	2	145
Agriculture	Diesel	2023	12254	6	2504	306	5	2374	907	40	2	134
Agriculture	Diesel	2024	12269	6	2290	295	5	2317	908	40	2	123
Agriculture	Diesel	2025	12248	6	2054	280	5	2243	906	40	2	110
Agriculture	Diesel	2026	12200	6	1806	263	4	2160	903	39	2	97
Agriculture	Diesel	2027	12140	6	1580	247	4	2083	898	39	2	86
Agriculture	Diesel	2028	12141	6	1426	236	4	2037	898	39	2	79
Agriculture	Diesel	2029	12139	6	1277	225	4	1988	898	39	2	71
Agriculture	Diesel	2030	12120	6	1125	213	3	1933	897	39	2	63
Agriculture	Gasoline	2005	279	0	26	288	37	6987	20	0	0	7
Agriculture	Gasoline	2006	256	0	26	264	35	5778	19	0	0	6
Agriculture	Gasoline	2007	256	0	26	264	35	5813	19	0	0	6

Agriculture	Gasoline	2008	256	0	26	264	35	5853	19	0	0	6
Agriculture	Gasoline	2009	256	0	26	264	35	5898	19	0	0	6
Agriculture	Gasoline	2010	256	0	26	264	35	5947	19	0	0	6
Agriculture	Gasoline	2011	256	0	26	264	35	6000	19	0	0	6
Agriculture	Gasoline	2012	256	0	26	264	35	6057	19	0	0	6
Agriculture	Gasoline	2013	256	0	26	264	35	6117	19	0	0	6
Agriculture	Gasoline	2014	256	0	26	264	35	6180	19	0	0	6
Agriculture	Gasoline	2015	256	0	26	264	35	6180	19	0	0	6
Agriculture	Gasoline	2016	256	0	26	264	35	6180	19	0	0	6
Agriculture	Gasoline	2017	256	0	26	264	35	6180	19	0	0	6
Agriculture	Gasoline	2018	256	0	26	264	35	6180	19	0	0	6
Agriculture	Gasoline	2019	256	0	26	264	35	6180	19	0	0	6
Agriculture	Gasoline	2020	256	0	26	264	35	6180	19	0	0	6
Agriculture	Gasoline	2021	256	0	26	264	35	6180	19	0	0	6
Agriculture	Gasoline	2022	256	0	26	264	35	6180	19	0	0	6
Agriculture	Gasoline	2023	256	0	26	264	35	6180	19	0	0	6
Agriculture	Gasoline	2024	256	0	26	264	35	6180	19	0	0	6
Agriculture	Gasoline	2025	256	0	26	264	35	6180	19	0	0	6
Agriculture	Gasoline	2026	256	0	26	264	35	6180	19	0	0	6
Agriculture	Gasoline	2027	256	0	26	264	35	6180	19	0	0	6
Agriculture	Gasoline	2028	256	0	26	264	35	6180	19	0	0	6
Agriculture	Gasoline	2029	256	0	26	264	35	6180	19	0	0	6
Agriculture	Gasoline	2030	256	0	26	264	35	6180	19	0	0	6
Forestry	Diesel	2005	159	0	118	9	0	52	12	1	0	6
Forestry	Diesel	2006	159	0	104	8	0	47	12	1	0	6
Forestry	Diesel	2007	159	0	90	7	0	44	12	1	0	5
Forestry	Diesel	2008	159	0	81	6	0	42	12	1	0	5
Forestry	Diesel	2009	159	0	72	5	0	39	12	1	0	4
Forestry	Diesel	2010	159	0	65	5	0	39	12	1	0	4
Forestry	Diesel	2011	159	0	60	4	0	38	12	1	0	4
Forestry	Diesel	2012	159	0	55	4	0	36	12	1	0	4

Forestry	Diesel	2013	159	0	51	4	0	34	12	1	0	3
Forestry	Diesel	2014	158	0	45	3	0	32	12	1	0	3
Forestry	Diesel	2015	158	0	38	3	0	30	12	1	0	2
Forestry	Diesel	2016	158	0	32	3	0	27	12	1	0	2
Forestry	Diesel	2017	158	0	27	3	0	26	12	1	0	1
Forestry	Diesel	2018	158	0	23	3	0	26	12	1	0	1
Forestry	Diesel	2019	158	0	18	3	0	25	12	1	0	1
Forestry	Diesel	2020	158	0	15	3	0	25	12	1	0	1
Forestry	Diesel	2021	158	0	13	3	0	25	12	1	0	1
Forestry	Diesel	2022	158	0	10	3	0	24	12	1	0	1
Forestry	Diesel	2023	158	0	10	3	0	24	12	1	0	1
Forestry	Diesel	2024	158	0	9	3	0	24	12	1	0	1
Forestry	Diesel	2025	158	0	9	3	0	24	12	1	0	1
Forestry	Diesel	2026	158	0	9	3	0	24	12	1	0	1
Forestry	Diesel	2027	158	0	8	3	0	24	12	1	0	1
Forestry	Diesel	2028	158	0	8	3	0	24	12	1	0	1
Forestry	Diesel	2029	158	0	8	3	0	24	12	1	0	1
Forestry	Diesel	2030	158	0	8	3	0	24	12	1	0	1
Forestry	Gasoline	2005	76	0	5	498	4	1237	6	0	0	6
Forestry	Gasoline	2006	75	0	6	503	4	1244	5	0	0	6
Forestry	Gasoline	2007	74	0	6	512	4	1256	5	0	0	6
Forestry	Gasoline	2008	74	0	6	512	4	1256	5	0	0	6
Forestry	Gasoline	2009	73	0	6	439	4	1256	5	0	0	6
Forestry	Gasoline	2010	71	0	5	362	3	1256	5	0	0	6
Forestry	Gasoline	2011	70	0	4	278	2	1256	5	0	0	6
Forestry	Gasoline	2012	70	0	4	278	2	1256	5	0	0	6
Forestry	Gasoline	2013	70	0	4	278	2	1256	5	0	0	6
Forestry	Gasoline	2014	70	0	4	278	2	1256	5	0	0	6
Forestry	Gasoline	2015	70	0	4	278	2	1256	5	0	0	6
Forestry	Gasoline	2016	70	0	4	278	2	1256	5	0	0	6
Forestry	Gasoline	2017	70	0	4	278	2	1256	5	0	0	6

Forestry	Gasoline	2018	70	0	4	278	2	1256	5	0	0	6
Forestry	Gasoline	2019	70	0	4	278	2	1256	5	0	0	6
Forestry	Gasoline	2020	70	0	4	278	2	1256	5	0	0	6
Forestry	Gasoline	2021	70	0	4	278	2	1256	5	0	0	6
Forestry	Gasoline	2022	70	0	4	278	2	1256	5	0	0	6
Forestry	Gasoline	2023	70	0	4	278	2	1256	5	0	0	6
Forestry	Gasoline	2024	70	0	4	278	2	1256	5	0	0	6
Forestry	Gasoline	2025	70	0	4	278	2	1256	5	0	0	6
Forestry	Gasoline	2026	70	0	4	278	2	1256	5	0	0	6
Forestry	Gasoline	2027	70	0	4	278	2	1256	5	0	0	6
Forestry	Gasoline	2028	70	0	4	278	2	1256	5	0	0	6
Forestry	Gasoline	2029	70	0	4	278	2	1256	5	0	0	6
Forestry	Gasoline	2030	70	0	4	278	2	1256	5	0	0	6
Industry	Diesel	2005	11249	5	8864	1190	19	5090	832	35	2	970
Industry	Diesel	2006	11239	5	8394	1093	18	4767	832	35	2	901
Industry	Diesel	2007	11222	5	7793	981	16	4415	830	35	2	825
Industry	Diesel	2008	11206	5	7167	867	14	4058	829	35	2	747
Industry	Diesel	2009	11201	5	6782	803	13	3912	829	35	2	691
Industry	Diesel	2010	11200	5	6399	741	12	3770	829	35	2	635
Industry	Diesel	2011	11210	5	6050	699	11	3696	830	35	2	607
Industry	Diesel	2012	11213	5	5698	657	11	3594	830	35	2	571
Industry	Diesel	2013	11220	5	5466	619	10	3480	830	35	2	533
Industry	Diesel	2014	11212	5	5239	580	9	3349	830	35	2	493
Industry	Diesel	2015	11189	5	4911	545	9	3233	828	35	2	463
Industry	Diesel	2016	11168	5	4590	512	8	3117	826	35	2	432
Industry	Diesel	2017	11128	5	4327	478	8	2978	824	35	2	397
Industry	Diesel	2018	11092	5	4082	448	7	2840	821	35	2	363
Industry	Diesel	2019	11058	5	3863	428	7	2740	818	35	2	334
Industry	Diesel	2020	11021	5	3669	412	7	2650	816	35	2	307
Industry	Diesel	2021	10998	5	3496	402	7	2574	814	35	2	285
Industry	Diesel	2022	10980	5	3343	395	6	2539	812	35	2	277

Industry	Diesel	2023	10965	5	3193	388	6	2519	811	34	2	272
Industry	Diesel	2024	10958	5	3060	384	6	2502	811	34	2	269
Industry	Diesel	2025	10950	5	3037	380	6	2485	810	34	2	266
Industry	Diesel	2026	10942	5	3015	377	6	2468	810	34	2	262
Industry	Diesel	2027	10934	5	2998	373	6	2450	809	34	2	259
Industry	Diesel	2028	10927	5	2985	371	6	2431	809	34	2	256
Industry	Diesel	2029	10919	5	2972	368	6	2412	808	34	2	252
Industry	Diesel	2030	10911	5	2959	365	6	2393	807	34	2	249
Industry	Gasoline	2005	165	0	32	244	17	2122	12	0	0	2
Industry	Gasoline	2006	163	0	32	243	17	2129	12	0	0	2
Industry	Gasoline	2007	161	0	32	243	17	2138	12	0	0	2
Industry	Gasoline	2008	159	0	32	242	17	2149	12	0	0	2
Industry	Gasoline	2009	157	0	33	241	17	2161	11	0	0	3
Industry	Gasoline	2010	157	0	33	241	17	2174	11	0	0	3
Industry	Gasoline	2011	156	0	33	240	17	2189	11	0	0	3
Industry	Gasoline	2012	156	0	33	239	17	2205	11	0	0	3
Industry	Gasoline	2013	156	0	33	238	17	2221	11	0	0	3
Industry	Gasoline	2014	156	0	34	237	17	2239	11	0	0	4
Industry	Gasoline	2015	156	0	34	236	17	2239	11	0	0	4
Industry	Gasoline	2016	156	0	34	235	17	2239	11	0	0	4
Industry	Gasoline	2017	156	0	34	234	17	2239	11	0	0	4
Industry	Gasoline	2018	156	0	34	234	17	2239	11	0	0	4
Industry	Gasoline	2019	156	0	34	234	17	2239	11	0	0	4
Industry	Gasoline	2020	156	0	34	234	17	2239	11	0	0	4
Industry	Gasoline	2021	156	0	34	234	17	2239	11	0	0	4
Industry	Gasoline	2022	156	0	34	234	17	2239	11	0	0	4
Industry	Gasoline	2023	156	0	34	234	17	2239	11	0	0	4
Industry	Gasoline	2024	156	0	34	234	17	2239	11	0	0	4
Industry	Gasoline	2025	156	0	34	234	17	2239	11	0	0	4
Industry	Gasoline	2026	156	0	34	234	17	2239	11	0	0	4
Industry	Gasoline	2027	156	0	34	234	17	2239	11	0	0	4

Industry	Gasoline	2028	156	0	34	234	17	2239	11	0	0	4
Industry	Gasoline	2029	156	0	34	234	17	2239	11	0	0	4
Industry	Gasoline	2030	156	0	34	234	17	2239	11	0	0	4
Industry	LPG	2005	1040	0	1381	152	8	109	68	4	0	5
Industry	LPG	2006	1017	0	1350	149	8	107	66	4	0	5
Industry	LPG	2007	1004	0	1333	147	8	105	65	4	0	5
Industry	LPG	2008	998	0	1325	146	8	105	65	3	0	5
Industry	LPG	2009	990	0	1314	145	8	104	64	3	0	5
Industry	LPG	2010	980	0	1301	143	8	103	64	3	0	5
Industry	LPG	2011	972	0	1290	142	7	102	63	3	0	5
Industry	LPG	2012	970	0	1289	142	7	102	63	3	0	5
Industry	LPG	2013	977	0	1297	143	8	102	63	3	0	5
Industry	LPG	2014	974	0	1294	142	7	102	63	3	0	5
Industry	LPG	2015	959	0	1274	140	7	101	62	3	0	5
Industry	LPG	2016	948	0	1259	138	7	99	62	3	0	5
Industry	LPG	2017	924	0	1227	135	7	97	60	3	0	5
Industry	LPG	2018	898	0	1193	131	7	94	58	3	0	4
Industry	LPG	2019	876	0	1163	128	7	92	57	3	0	4
Industry	LPG	2020	860	0	1142	126	7	90	56	3	0	4
Industry	LPG	2021	844	0	1120	123	6	88	55	3	0	4
Industry	LPG	2022	829	0	1100	121	6	87	54	3	0	4
Industry	LPG	2023	817	0	1085	119	6	86	53	3	0	4
Industry	LPG	2024	817	0	1085	119	6	86	53	3	0	4
Industry	LPG	2025	817	0	1085	119	6	86	53	3	0	4
Industry	LPG	2026	817	0	1085	119	6	86	53	3	0	4
Industry	LPG	2027	817	0	1085	119	6	86	53	3	0	4
Industry	LPG	2028	817	0	1085	119	6	86	53	3	0	4
Industry	LPG	2029	817	0	1085	119	6	86	53	3	0	4
Industry	LPG	2030	817	0	1085	119	6	86	53	3	0	4
Household/gardening	Gasoline	2005	4069	2	327	8727	291	115088	297	5	0	87
Household/gardening	Gasoline	2006	4060	2	339	8751	293	116621	296	5	0	88

Household/gardening	Gasoline	2007	4052	2	352	8801	296	118554	296	5	0	88
Household/gardening	Gasoline	2008	4029	2	362	8471	293	120752	294	5	0	88
Household/gardening	Gasoline	2009	4001	2	364	7749	286	123251	292	5	0	88
Household/gardening	Gasoline	2010	3974	2	367	6976	278	123951	290	5	0	89
Household/gardening	Gasoline	2011	3948	2	369	6155	269	124709	288	5	0	89
Household/gardening	Gasoline	2012	3944	2	377	6098	269	125521	288	5	0	89
Household/gardening	Gasoline	2013	3941	2	377	6015	266	126112	288	5	0	89
Household/gardening	Gasoline	2014	3938	2	377	5931	262	126737	287	5	0	90
Household/gardening	Gasoline	2015	3934	2	377	5845	259	127421	287	5	0	90
Household/gardening	Gasoline	2016	3931	2	377	5784	258	128136	287	5	0	90
Household/gardening	Gasoline	2017	3928	2	377	5721	258	128135	287	5	0	90
Household/gardening	Gasoline	2018	3928	2	377	5721	258	128135	287	5	0	90
Household/gardening	Gasoline	2019	3928	2	377	5721	258	128134	287	5	0	90
Household/gardening	Gasoline	2020	3928	2	377	5721	258	128134	287	5	0	90
Household/gardening	Gasoline	2021	3928	2	377	5721	258	128134	287	5	0	90
Household/gardening	Gasoline	2022	3928	2	377	5721	258	128134	287	5	0	90
Household/gardening	Gasoline	2023	3928	2	377	5721	258	128134	287	5	0	90
Household/gardening	Gasoline	2024	3928	2	377	5721	258	128134	287	5	0	90
Household/gardening	Gasoline	2025	3928	2	377	5721	258	128134	287	5	0	90
Household/gardening	Gasoline	2026	3928	2	377	5721	258	128134	287	5	0	90
Household/gardening	Gasoline	2027	3928	2	377	5721	258	128134	287	5	0	90
Household/gardening	Gasoline	2028	3928	2	377	5721	258	128134	287	5	0	90
Household/gardening	Gasoline	2029	3928	2	377	5721	258	128134	287	5	0	90
Household/gardening	Gasoline	2030	3928	2	377	5721	258	128134	287	5	0	90
Inland waterways	Diesel	2005	1002	94	879	170	3	454	74	3	0	105
Inland waterways	Diesel	2006	1002	94	870	168	3	452	74	3	0	104
Inland waterways	Diesel	2007	1002	94	862	167	3	450	74	3	0	102
Inland waterways	Diesel	2008	1002	94	853	165	3	448	74	3	0	101
Inland waterways	Diesel	2009	1002	94	845	163	3	446	74	3	0	100
Inland waterways	Diesel	2010	1002	94	836	161	3	444	74	3	0	98
Inland waterways	Diesel	2011	1002	94	827	159	3	442	74	3	0	97

Inland waterways	Diesel	2012	1002	94	819	157	3	440	74	3	0	96
Inland waterways	Diesel	2013	1002	94	810	155	3	438	74	3	0	94
Inland waterways	Diesel	2014	1002	94	802	153	2	436	74	3	0	93
Inland waterways	Diesel	2015	1002	94	793	151	2	435	74	3	0	92
Inland waterways	Diesel	2016	1002	94	784	149	2	433	74	3	0	90
Inland waterways	Diesel	2017	1002	94	776	147	2	431	74	3	0	89
Inland waterways	Diesel	2018	1002	94	767	145	2	429	74	3	0	88
Inland waterways	Diesel	2019	1002	94	759	143	2	427	74	3	0	86
Inland waterways	Diesel	2020	1002	94	750	141	2	425	74	3	0	85
Inland waterways	Diesel	2021	1002	94	750	141	2	425	74	3	0	85
Inland waterways	Diesel	2022	1002	94	750	141	2	425	74	3	0	85
Inland waterways	Diesel	2023	1002	94	750	141	2	425	74	3	0	85
Inland waterways	Diesel	2024	1002	94	750	141	2	425	74	3	0	85
Inland waterways	Diesel	2025	1002	94	750	141	2	425	74	3	0	85
Inland waterways	Diesel	2026	1002	94	750	141	2	425	74	3	0	85
Inland waterways	Diesel	2027	1002	94	750	141	2	425	74	3	0	85
Inland waterways	Diesel	2028	1002	94	750	141	2	425	74	3	0	85
Inland waterways	Diesel	2029	1002	94	750	141	2	425	74	3	0	85
Inland waterways	Diesel	2030	1002	94	750	141	2	425	74	3	0	85
Inland waterways	Gasoline	2005	393	0	165	907	22	6429	29	0	0	42
Inland waterways	Gasoline	2006	382	0	170	782	22	6055	28	0	0	35
Inland waterways	Gasoline	2007	371	0	175	670	22	5679	27	0	0	28
Inland waterways	Gasoline	2008	361	0	179	569	22	5302	26	0	0	22
Inland waterways	Gasoline	2009	353	0	183	482	22	4922	26	0	0	17
Inland waterways	Gasoline	2010	346	0	186	407	22	4541	25	1	0	12
Inland waterways	Gasoline	2011	340	0	188	344	22	4158	25	1	0	9
Inland waterways	Gasoline	2012	335	0	190	294	22	3772	24	1	0	6
Inland waterways	Gasoline	2013	332	0	192	256	22	3385	24	1	0	4
Inland waterways	Gasoline	2014	329	0	193	231	22	2996	24	1	0	2
Inland waterways	Gasoline	2015	328	0	193	219	22	2605	24	1	0	1
Inland waterways	Gasoline	2016	328	0	193	219	22	2605	24	1	0	1

Inland waterways	Gasoline	2017	328	0	193	219	22	2605	24	1	0	1
Inland waterways	Gasoline	2018	328	0	193	219	22	2605	24	1	0	1
Inland waterways	Gasoline	2019	328	0	193	219	22	2605	24	1	0	1
Inland waterways	Gasoline	2020	328	0	193	219	22	2605	24	1	0	1
Inland waterways	Gasoline	2021	328	0	193	219	22	2605	24	1	0	1
Inland waterways	Gasoline	2022	328	0	193	219	22	2605	24	1	0	1
Inland waterways	Gasoline	2023	328	0	193	219	22	2605	24	1	0	1
Inland waterways	Gasoline	2024	328	0	193	219	22	2605	24	1	0	1
Inland waterways	Gasoline	2025	328	0	193	219	22	2605	24	1	0	1
Inland waterways	Gasoline	2026	328	0	193	219	22	2605	24	1	0	1
Inland waterways	Gasoline	2027	328	0	193	219	22	2605	24	1	0	1
Inland waterways	Gasoline	2028	328	0	193	219	22	2605	24	1	0	1
Inland waterways	Gasoline	2029	328	0	193	219	22	2605	24	1	0	1
Inland waterways	Gasoline	2030	328	0	193	219	22	2605	24	1	0	1

Emission factors (g/GJ) in CollectER format 1985-2004

Sector	Fuel type	Year	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3	TSP
Agriculture	Diesel	2005	0.5	842	93	1.5	452	74	3.1	0.2	69
Agriculture	Diesel	2006	0.5	798	87	1.4	430	74	3.1	0.2	65
Agriculture	Diesel	2007	0.5	750	80	1.3	408	74	3.1	0.2	60
Agriculture	Diesel	2008	0.5	702	73	1.2	386	74	3.2	0.2	56
Agriculture	Diesel	2009	0.5	659	67	1.1	368	74	3.2	0.2	53
Agriculture	Diesel	2010	0.5	622	61	1.0	352	74	3.2	0.2	49
Agriculture	Diesel	2011	0.5	581	56	0.9	335	74	3.2	0.2	45
Agriculture	Diesel	2012	0.5	542	51	0.8	316	74	3.2	0.2	42
Agriculture	Diesel	2013	0.5	507	47	0.8	299	74	3.2	0.2	37
Agriculture	Diesel	2014	0.5	472	43	0.7	281	74	3.2	0.2	33
Agriculture	Diesel	2015	0.5	428	39	0.6	264	74	3.2	0.2	29
Agriculture	Diesel	2016	0.5	388	36	0.6	249	74	3.2	0.2	25
Agriculture	Diesel	2017	0.5	355	33	0.5	238	74	3.2	0.2	22

Agriculture	Diesel	2018	0.5	325	31	0.5	228	74	3.2	0.2	19
Agriculture	Diesel	2019	0.5	296	30	0.5	219	74	3.2	0.2	17
Agriculture	Diesel	2020	0.5	269	28	0.5	210	74	3.2	0.2	14
Agriculture	Diesel	2021	0.5	241	27	0.4	204	74	3.2	0.2	13
Agriculture	Diesel	2022	0.5	221	26	0.4	198	74	3.2	0.2	12
Agriculture	Diesel	2023	0.5	204	25	0.4	194	74	3.2	0.2	11
Agriculture	Diesel	2024	0.5	187	24	0.4	189	74	3.2	0.2	10
Agriculture	Diesel	2025	0.5	168	23	0.4	183	74	3.2	0.2	9
Agriculture	Diesel	2026	0.5	148	22	0.4	177	74	3.2	0.2	8
Agriculture	Diesel	2027	0.5	130	20	0.3	172	74	3.2	0.2	7
Agriculture	Diesel	2028	0.5	117	19	0.3	168	74	3.2	0.2	6
Agriculture	Diesel	2029	0.5	105	19	0.3	164	74	3.2	0.2	6
Agriculture	Diesel	2030	0.5	93	18	0.3	159	74	3.2	0.2	5
Agriculture	Gasoline	2005	0.5	94	1032	132.7	25003	73	1.6	1.1	24
Agriculture	Gasoline	2006	0.5	100	1031	135.9	22565	73	1.6	1.2	25
Agriculture	Gasoline	2007	0.5	100	1031	135.9	22701	73	1.6	1.2	25
Agriculture	Gasoline	2008	0.5	100	1031	135.9	22857	73	1.6	1.2	25
Agriculture	Gasoline	2009	0.5	100	1031	135.9	23032	73	1.6	1.2	25
Agriculture	Gasoline	2010	0.5	101	1031	135.8	23224	73	1.6	1.2	25
Agriculture	Gasoline	2011	0.5	101	1031	135.8	23431	73	1.6	1.2	25
Agriculture	Gasoline	2012	0.5	101	1031	135.8	23653	73	1.6	1.2	25
Agriculture	Gasoline	2013	0.5	101	1031	135.8	23888	73	1.6	1.2	25
Agriculture	Gasoline	2014	0.5	101	1031	135.8	24135	73	1.6	1.2	25
Agriculture	Gasoline	2015	0.5	101	1031	135.8	24135	73	1.6	1.2	25
Agriculture	Gasoline	2016	0.5	101	1030	135.8	24135	73	1.6	1.2	25
Agriculture	Gasoline	2017	0.5	101	1030	135.7	24135	73	1.6	1.2	25
Agriculture	Gasoline	2018	0.5	101	1030	135.7	24135	73	1.6	1.2	25
Agriculture	Gasoline	2019	0.5	101	1030	135.7	24135	73	1.6	1.2	25
Agriculture	Gasoline	2020	0.5	101	1030	135.7	24135	73	1.6	1.2	25
Agriculture	Gasoline	2021	0.5	101	1030	135.7	24135	73	1.6	1.2	25
Agriculture	Gasoline	2022	0.5	101	1030	135.7	24135	73	1.6	1.2	25

Agriculture	Gasoline	2023	0.5	101	1030	135.7	24135	73	1.6	1.2	25
Agriculture	Gasoline	2024	0.5	101	1030	135.7	24135	73	1.6	1.2	25
Agriculture	Gasoline	2025	0.5	101	1030	135.7	24135	73	1.6	1.2	25
Agriculture	Gasoline	2026	0.5	101	1030	135.7	24135	73	1.6	1.2	25
Agriculture	Gasoline	2027	0.5	101	1030	135.7	24135	73	1.6	1.2	25
Agriculture	Gasoline	2028	0.5	101	1030	135.7	24135	73	1.6	1.2	25
Agriculture	Gasoline	2029	0.5	101	1030	135.7	24135	73	1.6	1.2	25
Agriculture	Gasoline	2030	0.5	101	1030	135.7	24135	73	1.6	1.2	25
Forestry	Diesel	2005	0.5	743	58	0.9	329	74	3.2	0.2	40
Forestry	Diesel	2006	0.5	651	50	0.8	296	74	3.2	0.2	35
Forestry	Diesel	2007	0.5	567	44	0.7	275	74	3.2	0.2	31
Forestry	Diesel	2008	0.5	510	39	0.6	262	74	3.2	0.2	29
Forestry	Diesel	2009	0.5	453	33	0.5	248	74	3.2	0.2	28
Forestry	Diesel	2010	0.5	411	31	0.5	246	74	3.2	0.2	27
Forestry	Diesel	2011	0.5	375	28	0.5	239	74	3.2	0.2	26
Forestry	Diesel	2012	0.5	348	26	0.4	226	74	3.2	0.2	23
Forestry	Diesel	2013	0.5	321	24	0.4	214	74	3.2	0.2	21
Forestry	Diesel	2014	0.5	285	22	0.4	201	74	3.2	0.2	18
Forestry	Diesel	2015	0.5	243	20	0.3	187	74	3.2	0.2	14
Forestry	Diesel	2016	0.5	200	18	0.3	173	74	3.2	0.2	11
Forestry	Diesel	2017	0.5	170	18	0.3	168	74	3.2	0.2	9
Forestry	Diesel	2018	0.5	143	18	0.3	162	74	3.2	0.2	8
Forestry	Diesel	2019	0.5	115	17	0.3	157	74	3.2	0.2	6
Forestry	Diesel	2020	0.5	98	17	0.3	157	74	3.2	0.2	5
Forestry	Diesel	2021	0.5	81	17	0.3	156	74	3.2	0.2	5
Forestry	Diesel	2022	0.5	64	17	0.3	155	74	3.2	0.2	5
Forestry	Diesel	2023	0.5	62	17	0.3	155	74	3.2	0.2	5
Forestry	Diesel	2024	0.5	60	17	0.3	154	74	3.2	0.2	4
Forestry	Diesel	2025	0.5	58	17	0.3	153	74	3.2	0.2	4
Forestry	Diesel	2026	0.5	56	17	0.3	153	74	3.2	0.2	4
Forestry	Diesel	2027	0.5	54	17	0.3	153	74	3.2	0.2	4

Forestry	Diesel	2028	0.5	52	17	0.3	153	74	3.2	0.2	4
Forestry	Diesel	2029	0.5	50	17	0.3	153	74	3.2	0.2	4
Forestry	Diesel	2030	0.5	50	17	0.3	153	74	3.2	0.2	4
Forestry	Gasoline	2005	0.5	61	6514	54.1	16172	73	0.4	0.1	75
Forestry	Gasoline	2006	0.5	73	6684	55.7	16522	73	0.4	0.1	76
Forestry	Gasoline	2007	0.5	86	6899	57.6	16934	73	0.4	0.1	78
Forestry	Gasoline	2008	0.5	86	6899	57.6	16934	73	0.4	0.1	78
Forestry	Gasoline	2009	0.5	76	6037	49.8	17249	73	0.4	0.1	79
Forestry	Gasoline	2010	0.5	66	5061	40.9	17576	73	0.4	0.1	81
Forestry	Gasoline	2011	0.5	55	3964	31.0	17916	73	0.5	0.1	82
Forestry	Gasoline	2012	0.5	55	3964	31.0	17916	73	0.5	0.1	82
Forestry	Gasoline	2013	0.5	55	3964	31.0	17916	73	0.5	0.1	82
Forestry	Gasoline	2014	0.5	55	3964	31.0	17916	73	0.5	0.1	82
Forestry	Gasoline	2015	0.5	55	3964	31.0	17916	73	0.5	0.1	82
Forestry	Gasoline	2016	0.5	55	3964	31.0	17916	73	0.5	0.1	82
Forestry	Gasoline	2017	0.5	55	3964	31.0	17916	73	0.5	0.1	82
Forestry	Gasoline	2018	0.5	55	3964	31.0	17916	73	0.5	0.1	82
Forestry	Gasoline	2019	0.5	55	3964	31.0	17916	73	0.5	0.1	82
Forestry	Gasoline	2020	0.5	55	3964	31.0	17916	73	0.5	0.1	82
Forestry	Gasoline	2021	0.5	55	3964	31.0	17916	73	0.5	0.1	82
Forestry	Gasoline	2022	0.5	55	3964	31.0	17916	73	0.5	0.1	82
Forestry	Gasoline	2023	0.5	55	3964	31.0	17916	73	0.5	0.1	82
Forestry	Gasoline	2024	0.5	55	3964	31.0	17916	73	0.5	0.1	82
Forestry	Gasoline	2025	0.5	55	3964	31.0	17916	73	0.5	0.1	82
Forestry	Gasoline	2026	0.5	55	3964	31.0	17916	73	0.5	0.1	82
Forestry	Gasoline	2027	0.5	55	3964	31.0	17916	73	0.5	0.1	82
Forestry	Gasoline	2028	0.5	55	3964	31.0	17916	73	0.5	0.1	82
Forestry	Gasoline	2029	0.5	55	3964	31.0	17916	73	0.5	0.1	82
Forestry	Gasoline	2030	0.5	55	3964	31.0	17916	73	0.5	0.1	82
Industry	Diesel	2005	0.5	788	106	1.7	452	74	3.1	0.2	86
Industry	Diesel	2006	0.5	747	97	1.6	424	74	3.1	0.2	80

Industry	Diesel	2007	0.5	694	87	1.4	393	74	3.1	0.2	73
Industry	Diesel	2008	0.5	640	77	1.3	362	74	3.1	0.2	67
Industry	Diesel	2009	0.5	606	72	1.2	349	74	3.1	0.2	62
Industry	Diesel	2010	0.5	571	66	1.1	337	74	3.1	0.2	57
Industry	Diesel	2011	0.5	540	62	1.0	330	74	3.1	0.2	54
Industry	Diesel	2012	0.5	508	59	1.0	321	74	3.1	0.2	51
Industry	Diesel	2013	0.5	487	55	0.9	310	74	3.1	0.2	47
Industry	Diesel	2014	0.5	467	52	0.8	299	74	3.1	0.2	44
Industry	Diesel	2015	0.5	439	49	0.8	289	74	3.1	0.2	41
Industry	Diesel	2016	0.5	411	46	0.7	279	74	3.1	0.2	39
Industry	Diesel	2017	0.5	389	43	0.7	268	74	3.1	0.2	36
Industry	Diesel	2018	0.5	368	40	0.7	256	74	3.1	0.2	33
Industry	Diesel	2019	0.5	349	39	0.6	248	74	3.1	0.2	30
Industry	Diesel	2020	0.5	333	37	0.6	240	74	3.1	0.2	28
Industry	Diesel	2021	0.5	318	37	0.6	234	74	3.1	0.2	26
Industry	Diesel	2022	0.5	304	36	0.6	231	74	3.1	0.2	25
Industry	Diesel	2023	0.5	291	35	0.6	230	74	3.1	0.2	25
Industry	Diesel	2024	0.5	279	35	0.6	228	74	3.1	0.2	25
Industry	Diesel	2025	0.5	277	35	0.6	227	74	3.1	0.2	24
Industry	Diesel	2026	0.5	276	34	0.6	226	74	3.2	0.2	24
Industry	Diesel	2027	0.5	274	34	0.6	224	74	3.2	0.2	24
Industry	Diesel	2028	0.5	273	34	0.6	222	74	3.2	0.2	23
Industry	Diesel	2029	0.5	272	34	0.5	221	74	3.2	0.2	23
Industry	Diesel	2030	0.5	271	33	0.5	219	74	3.2	0.2	23
Industry	Gasoline	2005	0.5	194	1475	103.0	12843	73	1.4	0.1	13
Industry	Gasoline	2006	0.5	197	1492	104.5	13052	73	1.4	0.1	14
Industry	Gasoline	2007	0.5	201	1509	106.0	13278	73	1.4	0.1	15
Industry	Gasoline	2008	0.5	204	1524	107.3	13520	73	1.5	0.1	15
Industry	Gasoline	2009	0.5	208	1538	108.7	13776	73	1.5	0.1	17
Industry	Gasoline	2010	0.5	209	1536	108.7	13878	73	1.5	0.1	18
Industry	Gasoline	2011	0.5	210	1532	108.8	13988	73	1.5	0.1	19

Industry	Gasoline	2012	0.5	212	1528	108.8	14105	73	1.5	0.1	20
Industry	Gasoline	2013	0.5	214	1523	108.9	14229	73	1.5	0.1	22
Industry	Gasoline	2014	0.5	215	1518	108.9	14359	73	1.5	0.1	24
Industry	Gasoline	2015	0.5	215	1513	108.4	14359	73	1.5	0.1	24
Industry	Gasoline	2016	0.5	215	1509	107.9	14359	73	1.5	0.1	24
Industry	Gasoline	2017	0.5	215	1504	107.3	14359	73	1.5	0.1	24
Industry	Gasoline	2018	0.5	215	1504	107.3	14359	73	1.5	0.1	24
Industry	Gasoline	2019	0.5	215	1504	107.3	14359	73	1.5	0.1	24
Industry	Gasoline	2020	0.5	215	1504	107.3	14359	73	1.5	0.1	24
Industry	Gasoline	2021	0.5	215	1504	107.3	14359	73	1.5	0.1	24
Industry	Gasoline	2022	0.5	215	1504	107.3	14359	73	1.5	0.1	24
Industry	Gasoline	2023	0.5	215	1504	107.3	14359	73	1.5	0.1	24
Industry	Gasoline	2024	0.5	215	1504	107.3	14359	73	1.5	0.1	24
Industry	Gasoline	2025	0.5	215	1504	107.3	14359	73	1.5	0.1	24
Industry	Gasoline	2026	0.5	215	1504	107.3	14359	73	1.5	0.1	24
Industry	Gasoline	2027	0.5	215	1504	107.3	14359	73	1.5	0.1	24
Industry	Gasoline	2028	0.5	215	1504	107.3	14359	73	1.5	0.1	24
Industry	Gasoline	2029	0.5	215	1504	107.3	14359	73	1.5	0.1	24
Industry	Gasoline	2030	0.5	215	1504	107.3	14359	73	1.5	0.1	24
Industry	LPG	2005	0.0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	2006	0.0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	2007	0.0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	2008	0.0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	2009	0.0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	2010	0.0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	2011	0.0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	2012	0.0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	2013	0.0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	2014	0.0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	2015	0.0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	2016	0.0	1328	146	7.7	105	65	3.5	0.2	5

Industry	LPG	2017	0.0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	2018	0.0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	2019	0.0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	2020	0.0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	2021	0.0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	2022	0.0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	2023	0.0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	2024	0.0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	2025	0.0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	2026	0.0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	2027	0.0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	2028	0.0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	2029	0.0	1328	146	7.7	105	65	3.5	0.2	5
Industry	LPG	2030	0.0	1328	146	7.7	105	65	3.5	0.2	5
Household/gardening	Gasoline	2005	0.5	80	2145	71.6	28284	73	1.2	0.1	21
Household/gardening	Gasoline	2006	0.5	83	2155	72.2	28721	73	1.2	0.1	22
Household/gardening	Gasoline	2007	0.5	87	2172	73.0	29260	73	1.2	0.1	22
Household/gardening	Gasoline	2008	0.5	90	2102	72.8	29968	73	1.2	0.1	22
Household/gardening	Gasoline	2009	0.5	91	1937	71.4	30803	73	1.2	0.1	22
Household/gardening	Gasoline	2010	0.5	92	1755	69.9	31187	73	1.2	0.1	22
Household/gardening	Gasoline	2011	0.5	94	1559	68.2	31590	73	1.2	0.1	23
Household/gardening	Gasoline	2012	0.5	96	1546	68.1	31823	73	1.2	0.1	23
Household/gardening	Gasoline	2013	0.5	96	1526	67.4	32000	73	1.2	0.1	23
Household/gardening	Gasoline	2014	0.5	96	1506	66.6	32186	73	1.2	0.1	23
Household/gardening	Gasoline	2015	0.5	96	1486	65.8	32386	73	1.2	0.1	23
Household/gardening	Gasoline	2016	0.5	96	1471	65.7	32593	73	1.2	0.1	23
Household/gardening	Gasoline	2017	0.5	96	1456	65.6	32619	73	1.2	0.1	23
Household/gardening	Gasoline	2018	0.5	96	1456	65.6	32619	73	1.2	0.1	23
Household/gardening	Gasoline	2019	0.5	96	1456	65.6	32619	73	1.2	0.1	23
Household/gardening	Gasoline	2020	0.5	96	1456	65.6	32619	73	1.2	0.1	23
Household/gardening	Gasoline	2021	0.5	96	1456	65.6	32619	73	1.2	0.1	23

Household/gardening	Gasoline	2022	0.5	96	1456	65.6	32619	73	1.2	0.1	23
Household/gardening	Gasoline	2023	0.5	96	1456	65.6	32619	73	1.2	0.1	23
Household/gardening	Gasoline	2024	0.5	96	1456	65.6	32619	73	1.2	0.1	23
Household/gardening	Gasoline	2025	0.5	96	1456	65.6	32619	73	1.2	0.1	23
Household/gardening	Gasoline	2026	0.5	96	1456	65.6	32619	73	1.2	0.1	23
Household/gardening	Gasoline	2027	0.5	96	1456	65.6	32619	73	1.2	0.1	23
Household/gardening	Gasoline	2028	0.5	96	1456	65.6	32619	73	1.2	0.1	23
Household/gardening	Gasoline	2029	0.5	96	1456	65.6	32619	73	1.2	0.1	23
Household/gardening	Gasoline	2030	0.5	96	1456	65.6	32619	73	1.2	0.1	23
Inland waterways	Diesel	2005	93.7	877	170	2.8	453	74	3.0	0.2	105
Inland waterways	Diesel	2006	93.7	869	168	2.7	451	74	3.0	0.2	104
Inland waterways	Diesel	2007	93.7	860	166	2.7	449	74	3.0	0.2	102
Inland waterways	Diesel	2008	93.7	851	164	2.7	447	74	3.0	0.2	101
Inland waterways	Diesel	2009	93.7	843	162	2.6	445	74	3.0	0.2	100
Inland waterways	Diesel	2010	93.7	834	160	2.6	443	74	3.0	0.2	98
Inland waterways	Diesel	2011	93.7	826	158	2.6	441	74	3.0	0.2	97
Inland waterways	Diesel	2012	93.7	817	157	2.5	439	74	3.0	0.2	96
Inland waterways	Diesel	2013	93.7	808	155	2.5	437	74	3.0	0.2	94
Inland waterways	Diesel	2014	93.7	800	153	2.5	436	74	3.0	0.2	93
Inland waterways	Diesel	2015	93.7	791	151	2.5	434	74	3.0	0.2	92
Inland waterways	Diesel	2016	93.7	783	149	2.4	432	74	3.0	0.2	90
Inland waterways	Diesel	2017	93.7	774	147	2.4	430	74	3.0	0.2	89
Inland waterways	Diesel	2018	93.7	765	145	2.4	428	74	3.0	0.2	87
Inland waterways	Diesel	2019	93.7	757	143	2.3	426	74	3.0	0.2	86
Inland waterways	Diesel	2020	93.7	748	141	2.3	424	74	3.0	0.2	85
Inland waterways	Diesel	2021	93.7	748	141	2.3	424	74	3.0	0.2	85
Inland waterways	Diesel	2022	93.7	748	141	2.3	424	74	3.0	0.2	85
Inland waterways	Diesel	2023	93.7	748	141	2.3	424	74	3.0	0.2	85
Inland waterways	Diesel	2024	93.7	748	141	2.3	424	74	3.0	0.2	85
Inland waterways	Diesel	2025	93.7	748	141	2.3	424	74	3.0	0.2	85
Inland waterways	Diesel	2026	93.7	748	141	2.3	424	74	3.0	0.2	85

Inland waterways	Diesel	2027	93.7	748	141	2.3	424	74	3.0	0.2	85
Inland waterways	Diesel	2028	93.7	748	141	2.3	424	74	3.0	0.2	85
Inland waterways	Diesel	2029	93.7	748	141	2.3	424	74	3.0	0.2	85
Inland waterways	Diesel	2030	93.7	748	141	2.3	424	74	3.0	0.2	85
Inland waterways	Gasoline	2005	0.5	421	2307	55.9	16340	73	1.1	0.1	107
Inland waterways	Gasoline	2006	0.5	447	2050	57.5	15871	73	1.2	0.1	91
Inland waterways	Gasoline	2007	0.5	472	1806	58.9	15316	73	1.3	0.1	76
Inland waterways	Gasoline	2008	0.5	496	1576	60.3	14675	73	1.3	0.1	61
Inland waterways	Gasoline	2009	0.5	517	1365	61.5	13947	73	1.4	0.1	48
Inland waterways	Gasoline	2010	0.5	537	1176	62.6	13132	73	1.5	0.1	36
Inland waterways	Gasoline	2011	0.5	553	1012	63.6	12234	73	1.5	0.1	26
Inland waterways	Gasoline	2012	0.5	567	877	64.4	11258	73	1.5	0.1	17
Inland waterways	Gasoline	2013	0.5	578	774	65.0	10212	73	1.6	0.1	11
Inland waterways	Gasoline	2014	0.5	585	703	65.4	9103	73	1.6	0.1	7
Inland waterways	Gasoline	2015	0.5	589	667	65.7	7943	73	1.6	0.1	4
Inland waterways	Gasoline	2016	0.5	589	667	65.7	7943	73	1.6	0.1	4
Inland waterways	Gasoline	2017	0.5	589	667	65.7	7943	73	1.6	0.1	4
Inland waterways	Gasoline	2018	0.5	589	667	65.7	7943	73	1.6	0.1	4
Inland waterways	Gasoline	2019	0.5	589	667	65.7	7943	73	1.6	0.1	4
Inland waterways	Gasoline	2020	0.5	589	667	65.7	7943	73	1.6	0.1	4
Inland waterways	Gasoline	2021	0.5	589	667	65.7	7943	73	1.6	0.1	4
Inland waterways	Gasoline	2022	0.5	589	667	65.7	7943	73	1.6	0.1	4
Inland waterways	Gasoline	2023	0.5	589	667	65.7	7943	73	1.6	0.1	4
Inland waterways	Gasoline	2024	0.5	589	667	65.7	7943	73	1.6	0.1	4
Inland waterways	Gasoline	2025	0.5	589	667	65.7	7943	73	1.6	0.1	4
Inland waterways	Gasoline	2026	0.5	589	667	65.7	7943	73	1.6	0.1	4
Inland waterways	Gasoline	2027	0.5	589	667	65.7	7943	73	1.6	0.1	4
Inland waterways	Gasoline	2028	0.5	589	667	65.7	7943	73	1.6	0.1	4
Inland waterways	Gasoline	2029	0.5	589	667	65.7	7943	73	1.6	0.1	4
Inland waterways	Gasoline	2030	0.5	589	667	65.7	7943	73	1.6	0.1	4

Annex 5 Evaporation factors for fuelling and tank evaporation

Machinery type	Fueling (g/g fuel)	Tank evaporation (g/year
Aerial lifts (gasoline)	0.0064	124
ATV private	0.0064	124
ATV professional	0.0064	124
Bedding machines	0.0064	124
Chain saws (forestry)	0.0242	73
Chain saws (private)	0.0242	73
Chain saws (professional)	0.0242	73
Chippers	0.0336	124
Cultivators (private-large)	0.0064	124
Cultivators (private-small)	0.0064	124
Cultivators (professional)	0.0064	124
Cutters	0.0064	124
Drills	0.0336	124
Fodder trucks	0.0064	124
Garden shredders	0.0336	124
Generators (gasoline)	0.0064	124
Hedge cutters (private)	0.0336	124
Hedge cutters (professional)	0.0336	124
High pressure cleaners (gasoline)	0.0064	124
Kompressors (gasoline)	0.0064	124
Lawn movers (private)	0.0195	916
Lawn movers (professional)	0.0195	916
Other (gasoline)	0.0064	124
Other (gasoline)	0.0336	124
Pumps (gasoline)	0.0064	124
Rammers	0.0336	550
Riders (private)	0.0025	847
Riders (professional)	0.0025	847
Scrapers	0.0064	124
Shrub clearers (private)	0.0336	124
Shrub clearers (professional)	0.0336	124
Slicers	0.0336	124
Suction machines	0.0336	124
Sweepers	0.0064	124
Sweepers (gasoline)	0.0064	124
Tractors (gasoline-certified)	0.0064	124

Tractors (gasoline-non certified)	0.0064	124
Trimmers (private)	0.0336	124
Trimmers (professional)	0.0336	124
Vibratory plates (gasoline)	0.0064	550
Wood cutters	0.0064	124

Annex 6 Uncertainty calculation sheets for fuel use and emissions in 2004

	Gas	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t
		Input data Fuel TJ	Input data %	Input data %	%	%
Agriculture	Fuel	13750	12	5	13	5.696
Forestry	Fuel	237	15	5	16	0.117
Industry (constr. machinery. fork lifts)	Fuel	11339	17	5	18	6.401
Industry (other)	Fuel	1123	21	5	21	0.746
Household and gardening	Fuel	4078	17	5	18	2.302
Boats	Fuel	1406	21	5	21	0.934
Total	Fuel	31932				80.169
		Overall uncertainty in the year (%):			**8.954**	

	Gas	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t
		Input data tons SO2	Input data %	Input data %	%	%
Agriculture	SO_2	315	12	25	27.839	12.786
Forestry	SO_2	4	15	25	29.155	0.166
Industry (construction machinery. fork lifts)	SO_2	241	17	25	30.414	10.654
Industry (other)	SO_2	23	21	25	32.404	1.074
Household and gardening	SO_2	9	17	25	30.414	0.412
Boats	SO_2	95	21	25	32.404	4.473
Total	SO_2	687				298.350
		Overall uncertainty in the year (%):			**17.273**	

	Gas	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t
		Input data tons NOx	Input data %	Input data %	%	%
Agriculture	NO_x	11837	12	25	27.839	13.689
Forestry	NO_x	135	15	25	29.155	0.163
Industry (construction machinery. fork lifts)	NO_x	9899	17	25	30.414	12.506
Industry (other)	NO_x	845	21	25	32.404	1.138
Household and gardening	NO_x	317	17	25	30.414	0.401
Boats	NO_x	1040	21	25	32.404	1.400
Total	NO_x	24073				347.227
	Overall uncertainty in the year (%):					**18.634**

	Gas	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t
		Input data tons NMVOC	Input data %	Input data %	%	%
Agriculture	NMVOC	1667	12	25	27.839	3.370
Forestry	NMVOC	506	15	25	29.155	1.072
Industry (construction ma4chinery. fork lifts)	NMVOC	1295	17	25	30.414	2.860
Industry (other)	NMVOC	381	21	25	32.404	0.895
Household and gardening	NMVOC	8731	17	25	30.414	19.283
Boats	NMVOC	1191	21	25	32.404	2.801
Total	NMVOC	13771				401.191
	Overall uncertainty in the year (%):					**20.030**

	Gas	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t
		Input data tons CH4	Input data %	Input data %	%	%
Agriculture	CH_4	62	12	25	27.839	4.045
Forestry	CH_4	4	15	25	29.155	0.292
Industry (construction machinery. fork lifts)	CH_4	27	17	25	30.414	1.901
Industry (other)	CH_4	19	21	25	32.404	1.457
Household and gardening	CH_4	290	17	25	30.414	20.652
Boats	CH_4	25	21	25	32.404	1.884
Total	CH_4	427				452.258
	Overall uncertainty in the year (%):				**21.266**	

	Gas	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t
		Input data tons CO	Input data %	Input data %	%	%
Agriculture	CO	15042	12	25	27.839	2.890
Forestry	CO	1291	15	25	29.155	0.260
Industry (construction machinery. fork lifts)	CO	4991	17	25	30.414	1.048
Industry (other)	CO	2609	21	25	32.404	0.584
Household and gardening	CO	114073	17	25	30.414	23.948
Boats	CO	6865	21	25	32.404	1.535
Total	CO	144870				585.737
		Overall uncertainty in the year (%):			**24.202**	

	Gas	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t
		Input data ktons CO2	Input data %	Input data %	%	%
Agriculture	CO_2	1017	12	5	13.229	5.730
Forestry	CO_2	17	15	5	15.811	0.117
Industry (construction machinery. fork lifts)	CO_2	829	17	5	18.028	6.368
Industry (other)	CO_2	83	21	5	21.213	0.749
Household and gardening	CO_2	298	17	5	18.028	2.285
Boats	CO_2	104	21	5	21.213	0.936
Total	CO_2	2348				80.055
	Overall uncertainty in the year (%):				**8.947**	

	Gas	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t
		Input data tons N2O	Input data %	Input data %	%	%
Agriculture	N_2O	42	12	500	500.150	236.678
Forestry	N_2O	1	15	500	500.225	3.020
Industry (construction machinery. fork lifts)	N_2O	35	17	500	500.300	197.197
Industry (other)	N_2O	3	21	500	500.425	17.692
Household and gardening	N_2O	5	17	500	500.300	26.651
Boats	N_2O	3	21	500	500.425	18.999
Total	N_2O	90				96296.739
	Overall uncertainty in the year (%):				**310.317**	

	Gas	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t
		Input data tons NH3	Input data %	Input data %	%	%
Agriculture	NH_3	3	12	500	500.150	245.513
Forestry	NH_3	0	15	500	500.225	3.220
Industry (construction machinery. fork lifts)	NH_3	2	17	500	500.300	184.140
Industry (other)	NH_3	0	21	500	500.425	16.677
Household and gardening	NH_3	0	17	500	500.300	32.088
Boats	NH_3	0	21	500	500.425	18.597
Total	NH_3	6				95848.229
	Overall uncertainty in the year (%):				**309.594**	

	Gas	Year t emission	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t
		Input data tons TSP	Input data %	Input data %	%	%
Agriculture	TSP	998	12	25	27.839	12.137
Forestry	TSP	13	15	25	29.155	0.166
Industry (construction machinery. fork lifts)	TSP	918	17	25	30.414	12.194
Industry (other)	TSP	119	21	25	32.404	1.687
Household and gardening	TSP	87	17	25	30.414	1.158
Boats	TSP	154	21	25	32.404	2.179
Total	TSP	2288				304.981
	Overall uncertainty in the year (%):				**17.464**	