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Abstract

This report documents the EDGAR INGOS emission inventory for CH4 and N2O, as publicly made available on: http://edgar.jrc.ec.europa.eu/ingos/index.php?SECURE=123.
The EDGAR INGOS CH4 and N2O emission inventory provides bottom-up estimates of global anthropogenic CH4 and N2O emissions for the period 2000-2010. The EDGAR InGOS product is an update of the EDGARv4.2FT2010 inventory, taking into account emissions reported as point sources by facilities under the European Pollutant Release and Transfer Register (E-PRTR) for (1) power plants (N2O), (2) oil refineries (CH4 and N2O), (3) coal mining (CH4), (4) production of oil and gas (CH4), (5) chemicals production (inorganic, nitro-fertilizers and other bulk chemicals) (N2O), industrial process and product use (N2O), (6) solid waste - landfills (CH4), (7) industrial wastewater treatment (CH4 and N2O). In a first step gridmaps have been improved for the European region taking into account the geospatial data of the E-PRTR database. In addition, for the last 4 years an option is given to select inventories solely based on officially reported emission data (for the categories covered by E-PRTR), gapfilled with EDGARv4.2FT2010 for non-reporting countries.

Table of Contents

1. Introduction

The 2000-2010 global time series for CH4 and N2O emissions are mainly based on the EDGAR emission inventory, version v4.2FT2010 (Olivier & Janssens-Maenhout, 2012). The default emission factors from the 2006 IPCC Guidelines (IPCC, 2006) were used (instead of the Revised 1996 IPCC Guidelines), except for road transport where technology-specific factors were used from the EMEP-EEA emission inventory guidebook (EEA, 2009). The EDGAR v4.2 FT2010 provides an extended time series for all sources by adding emissions for 2009 and 2010 to the EDGAR v4.2 version available at http://edgar.jrc.ec.europa.eu/overview.php?v=42 (EC-JRC/PBL, 2011).

The emissions of EDGARv4.2FT2010 are gridded with improved EDGAR proxy data, documented in the EDGAR gridding manual (Janssens-Maenhout et al., 2013).

For the INGOS project, an upgrade of the CH4 and N2O gridmaps with data of EPRTR, available at http://prtr.ec.europa.eu/FacilityLevels.aspx is undertaken. The upgrade consisted mainly in better spatial distribution with the facility location of EPRTR database, version v4.2. There are three different methods to upgrade with the info of EPRTR:

- method 1: use only EPRTR point source data (as reported, i.e. without any scaling) for the EPRTR countries;

- method 2: use EPRTR point source data, but scale them to match the EDGARv4.2FT2010 total for that sector and country;

- method 3: use EPRTR point source data (as reported, i.e. without any scaling) but add a diffusive source for the difference between EDGARv4.2FT2010 and the EPRTR point source with the EDGAR proxy distribution so that the country and sector-specific total matches the EDGARv4.2FT2010 total for that sector in that country.

2. CH4 emission gridmaps

Two sets of CH4 emission data are provided:

1. **Baseline 2000-2010 for CH4**: this is the complete anthropogenic emissions dataset with EDGARv4.2FT2010 time series, gridded with upgraded EDGAR proxy data, except for coal mining, oil and gas production, solid waste disposal and wastewater in which EPRTR point source data were applied.
2. **Option: CH4 official emission data of EPRTR 2007-2010**: this is a subset providing anthropogenic emissions for some sectors (coal mining, solid waste, wastewater, oil production and gas production) as reported to EPRTR. The sectors are only gapfilled with EDGARv4.2FT2010 for those countries where no data are reported, or for those (diffusive) subsectors that are not subject to EPRTR reporting.

2.1. Baseline 2000-2010 for CH4

2.1.1 The CH4 inventory compilation under EDGARv4.2FT2010

For the baseline emission gridmaps the 2000-2010 emissions are equal in sector- and country-specific totals to the CH4 estimates of the EDGARv4.2FT2010 time series. The compilation of the EDGARv4.2FT2010 emission inventory applied a bottom up approach with the following data information sources:

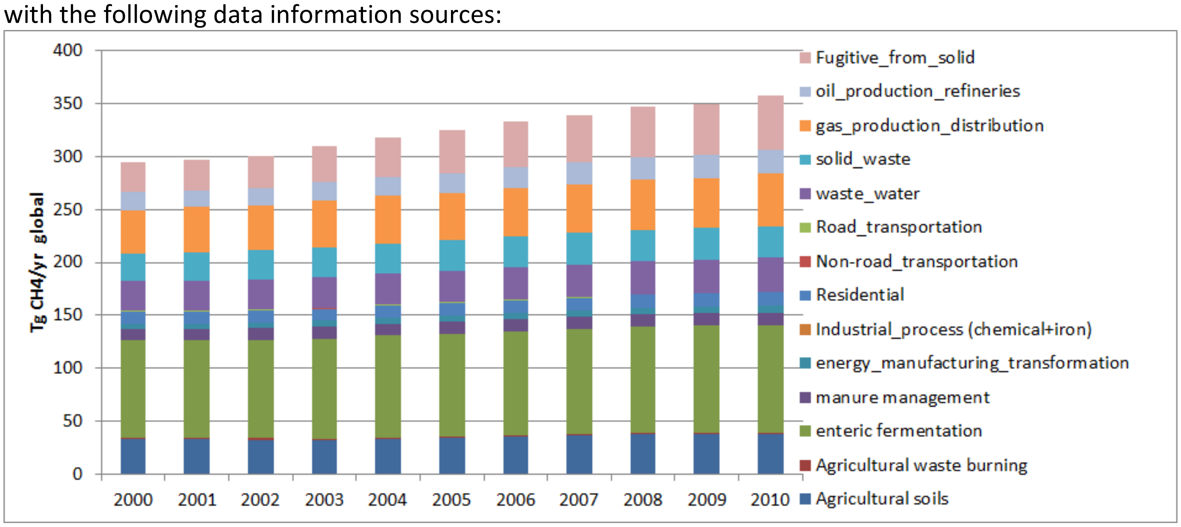

Fig. 0: Sector-specific global total CH4 per year of the EDGARv4.2FT2010, which is the INGOS baseline dataset (the exact numbers are provided in the Annex, table A.1).

- For the agricultural soils (AGS): The total area harvested for rice cultivation was obtained from FAO (2007d, 2010), which was split over different ecology types (rainfed, irrigated, deep water and upland) using IRRI (2007). The total harvested area of rice production in China was increased by 40%, due to recognition that official harvested rice area statistics of China are largely underestimating the actual area (Denier van der Gon, 1999; 2000). However, methane emission factors were not from IPCC (2006) but from a review of Neue (1997), and country-specific studies by Mitra et al. (2004), Gupta et al. (2002) and IIASA (2007).

- For the agricultural waste burning (AWB): The fractions of crop residues removed from and burned in the field were estimated using data of Yevich and Logan (2003) and UNFCCC (2008) for fractions burned in the field by Annex I countries.
- For the energy, manufacturing and transformation (EMT): IEA energy statistics for OECD and Non-OECD countries (completed with EIA energy data to disaggregate some IEA regions into countries) were applied to calculate the emissions from energy production, energy consumption (small scale and industrial scale) and from energy transformation, each subsector per country and per fuel type of coal, gas and oil. For charcoal production the emissions factors are from Andreae (2011).
- For the enteric fermentation (ENF): Livestock numbers were taken from FAO (2007b,c, 2010). For enteric fermentation for cattle, country-specific methane emission factors were calculated following the IPCC methodology (IPCC, 2006) using country-specific milk yield (dairy cattle) and carcass weight (other cattle) trends from FAO (2007c) to estimate the trends in the emission factors. For other animal types, regional emission factors from IPCC (2006) were used.
- For the fossil fuel fires: Data for long-lasting underground coal fires have been compiled for China, India, USA and Australia based on van Dijk et al (2010). Oil fires are the Kuwait oil fires in 1991 due to the first Gulf War.
- For the fugitive emissions form solid fossil fuel mining (FFS): hard coal and brown coal production data have been split into surface and underground mining based on various national reports. Emission factors for coal mining are based on average depths of coal production based on CIAB (1994), EURACOAL (2008), Kirchgessner et al. (1993) and include post mining emissions. Methane recovery from coal mining was included for twelve countries amounting to about 1.3 Tg in 1990 (of which about one-third was allocated to the United States and Germany). Recovery in 2005 was estimated at 2.8 Tg (of which 50% in China and 25% in the United States (UNFCCC, 2010; Thakur et al., 1994, 1996; EPA, 2008; Cheng et al., 2011).
- For the gas production and distribution (PRO_GAS): For gas transport and distribution, pipeline length was used as activity data. Pipeline length and material statistics are taken from reports on Europe by Eurogas and Marcogaz, national reports (e.g. the United States and Canada), UNFCCC (2008) and supplemental data from CIA (2008). The CO2 emission factor excludes the indirect emissions through gas venting.
- For the oil production and distribution (PRO_OIL): For oil production, transport and distribution GHG emissions factors are from IPCC (2006), supplemented with data from UNFCCC (2008), except for the emission factor for CH4 from oil tanker transport which is from Rudd and Hill (2001). The CH4 emission factor for venting and flaring has been derived from country-specific data reported to UNFCCC (2010), with the average value used as global default, applied to all other countries. Total amounts of natural gas flared (sometimes including gas vented) for most countries for 1994 onwards are primarily based on amounts of gas flared determined from the satellite observations of the intensity of flaring lights (Elvidge et al., 2009), reported by NOAA (2011).
- For the industrial processes and product use (IPPU): Process emissions from iron& steel and from chemicals are based on UN Industrial Commodity Statistics (UN, 2006a), often supplemented for recent years by data from the US Geological Survey (USGS, 2007).
- For the manure management (MNM): The shares of different animal waste management systems were based on regional defaults provided in IPCC (2006) and regional trend estimates for diary and non-dairy cattle for the fractions stall-fed, extensive grazing and mixed systems from Bouwman et al. (2005). Methane

emissions from manure management were estimated by applying default IPCC emission factors for each country and temperature zone. For the latter, the 1x1 degree grid map for non-dairy cattle from Lerner et al. (1988) was used and the annual average temperature per grid cell from New et al. (1999) to calculate the livestock fractions of the countries in 19 annual mean temperature zones for cattle, swine and buffalo and three climates zones for other animals (cold, temperate, warm).

- For the non-road transportation (TNR): IEA energy statistics and IPCC 2006 EFs.
- For the residential sector (RES): IEA energy statistics and IPCC 2006 EFs.
- For the road transportation (TRO): IEA energy statistics and IPCC 2006 EFs.
- For the solid waste disposal (SWD): For estimating the amount of organic solid waste in landfills three key parameters have to be determined: (a) Municipal Solid Waste (MSW) generated per year (kg/cap), (b) fraction of total solid waste that is landfilled, and (c) fraction of Degradable Organic Carbon (DOC) in the MSW (%). Total and urban population figures were taken from UN (2006b).The amounts of Municipal Solid Waste (MSW) generated are the primary statistics for emissions from landfills. The 2006 IPCC Guidelines provide country-specific data for 2000 of the amount of MSW generated per year per capita (urban capita in case of non-Annex I countries) and the fraction landfilled and incinerated. Based on regional defaults for the composition of MSW, IPCC (2006) provides regional defaults for the fraction Degradable Organic Carbon (DOC), which was adjusted with UNFCCC (2008) data for Annex I countries. For calculation of methane emissions from landfills using the First Order Decay (FOD) model of IPCC (2006), the Methane Conversion Factor (MCF), the k value and the Oxidation Factor (OX) are required. The MCF represents the type of landfill, managed aerobic or anaerobic, unmanaged deep or shallow. Apart from country-specific time series for 11 Annex I countries, two sets of MCF time series for Annex I and non-Annex I countries were determined based on assumptions for the fractions of the four landfill types over time. For the k-value, which is the methane generation rate (that is inversely proportional to the half-life value of the DOC), default regional MSW composition weighted k-values for four climate zones (tropical dry/wet and non-tropical dry/wet) are provided by IPCC (2006). For EDGAR 4.2 FT2010, country-specific values were calculated using the country-specific fractions of population (urban population for non-Annex I countries) in each climate zone. For the Oxidation Factor the IPCC default values were used (0.1 for Annex I and 0 for non-Annex I countries). Finally, the amounts of methane recovered (and used or flared), that is to be subtracted from the gross methane emissions, were used as reported by Annex I countries in UNFCCC (2010) and for 23 non-Annex I countries from CDM projects reported by the UNEP Risø Centre (2011). Total recovery in 2010 is estimated at 12.9 Tg CH_4, half of which by the United States and almost one fifth by the United Kingdom; about 13% is recovered by non-Annex I countries.
- For the waste water treatment (WWT): For domestic wastewater, total organics in wastewater (BOD5) was estimated using regional default or country-specific default values for BOD5 generation per capita per day provided by IPCC (2006). For industrial wastewater, total organically degradable material in wastewater from industry was calculated per type of industry from WW generation per ton of product and COD values (chemical oxygen demand) industrial degradable organic component in wastewater) in kg/m3 WW, using defaults from IPCC (2006). Production statistics for industry types that produce most organics in wastewater are available from UN (2006a). Examples are meat and poultry, raw sugar, alcohol, pulp and organic chemicals. To estimate methane emissions from domestic

wastewater, additional information is required on the WW treatment systems, such as sewer (to wastewater treatment plants (WWTP) or to raw discharge), latrines by type, open pits and septic tanks. Regional or country-specific default fractions for 2000 were from IPCC (2006). In addition, country-specific fractions of improved sanitation over time from Van Drecht et al. (2009) were used, based on the UN Water Supply and Sanitation (WSS) dataset and other national reports, and fractions reported by Doorn and Liles (1999). For industrial methane emissions, fractions on-site treatment in WWTP, sewer with and without city-WWTP, and raw discharge were based on regional values reported by Doorn et al. (1997). To calculate methane emissions from wastewater, default factors provided by IPCC (2006) per type of WW treatment were used, with default methane correction factors (MCF) per type of treatment. For Annex I countries, OECD or EIT average fractions of methane recovered in WWTPs (and either used as biogas or flared) were used, except for five countries for which country-specific values reported in UNFCCC (2008) were used.

2.1.2 The gridding of the CH4 emissions with EDGAR and EPRTR proxy data

Table 1: For the CH4 main sectors: overview of the different gridmaps used for each of the human activities (with IPCC identification code). Special proxy data developed with the geospatial coordinates of the facilities in the EPRTR data start with "ingos_" to differentiate from the standard EDGAR proxy data.

main sectors grouping the human activities	IPCC-code for activity	description	CH4_gridmap_baseline
energy_manufacturing_transformation	1.A1a.	power plants (not combusting biomass)	PP_CARMA_2007
energy_manufacturing_transformation	1.A1c.1	transformation coal - BKB	Urban_population
energy_manufacturing_transformation	1.A1c.2	other transformation of solid fuel and energy carriers	Urban_population
oil_production_refineries	1.A1r. (eprtr facilities)	refinery facilities of EPRTR	ingos_CH4_refineries
oil_production_refineries	1.A1r.	petroleum refining (other than EPRTR)	oil_refineries
energy_manufacturing_transformation	1.A2a.x	industrial combustion of biomass for iron&steel	steel
energy_manufacturing_transformation	1.A2a.	industrial combustion of fossil fuel for iron&steel	steel
energy_manufacturing_transformation	1.A2b.x	industrial combustion of biomass for nonferrous	nonferrous
energy_manufacturing_transformation	1.A2b.	industrial combustion of fossil fuel for nonferrous	nonferrous
energy_manufacturing_transformation	1.A2c.x	industrial combustion of biomass for chemical industry	chemical
energy_manufacturing_transformation	1.A2c.	industrial combustion of fossil fuel for chemical industry	chemical
energy_manufacturing_transformation	1.A2d.x	combustion of biomass for paper industry	Urban_population
energy_manufacturing_transformation	1.A2d.	combustion for paper industry	Urban_population
energy_manufacturing_transformation	1.A2e.x	combustion of biomass for food	Urban_population
energy_manufacturing_transformation	1.A2e.	combustion for food	Urban_population
energy_manufacturing_transformation	1.A2f.	combustion for other (incl. cement)	Urban_population
TNR_non-road_transportation	1.A3a.	domestic aviation	air_domestic
TRO_road_transportation	1.A3b.	road transport	Roads
TNR_non-road_transportation	1.A3c.	railway	railways
TNR_non-road_transportation	1.A3d.	inland waterway	fishing
TNR_non-road_transportation	1.A3e.	non-road other transport	Rural_population
RCO_residential	1.A4a.x	combustion of biomass for buildings of commercial and public services	Urban_population
RCO_residential	1.A4a.	combustion of fossil for buildings of commercial and public services	Urban_population
RCO_residential	1.A4b.x	combustion of biomass for buildings of residential sector	pop_01x01_LO
RCO_residential	1.A4b.	combustion of fossil for buildings of residential sector	pop_01x01_LO
RCO_residential	1.A4c.1x	combustion of biomass for buildings of agriculture or forestry sector	Rural_population
RCO_residential	1.A4c.1	combustion of fossil for buildings of agriculture or forestry sector	Rural_population
RCO_residential	1.A4c.2	combustion of fossil for off-road machinery in agri or forestry sector	Rural_population
RCO_residential	1.A4c.3	combustion for equipment & buildings in fisheries sector	Rural_population
RCO_residential	1.A4d.x	non-specified use of biomass for buildings, equipment, machinery	pop_01x01_LO
RCO_residential	1.A4d.	non-specified use of fossil for buildings, equipment, machinery	pop_01x01_LO
RCO_residential	1.A5b.1	Off-road machinery: mining (diesel)	Rural_population
energy_manufacturing_transformation	1.B1b.1	solid fuel transformation	Urban_population
energy_manufacturing_transformation	1.B1b.3x	charcoal production	pop_01x01_LO
fugitive_from_solid	1.B1r. (eprtr facilities)	coal mining sites of EPRTR	ingos_CH4_coal_mines
fugitive_from_solid	1.B1r.	coal mines (other than EPRTR)	ingos_CH4_coal_mines
gas_production_distribution	1.B2b.3	transmission of gas (pipelines from production to distributor)	pop_01x01_LO
gas_production_distribution	1.B2b.4	distribution of gas (to the citizen)	Urban_population
gas_production_distribution	1.B2b.	gas production	gas_production
oil_production_refineries	1.B2c.	venting and flaring at oil & gas production sites	oil_production
TNR_non-road_transportation	1.C1 .	international aviation	air_international
TNR_non-road_transportation	1.C2 .	international shipping	Ships_2007
IPPU_industrial_process_&_product_use	2.B .	process emissions of chemical industry	chemical
IPPU_industrial_process_&_product_use	2.C .	process emissions of iron & steel industry	steel
ENF_enteric_fermentation	4.A .	enteric fermentation of cattle	cattle_01x01_LO
MNM_manure_management	4.B .	manure management of cattle	cattle_01x01_LO
AGS_agricultural_soils	4.C .	rice cultivation	rice
AWB_agricultural_waste_burning	4.F .	field burning of agricultural residues	crop_01x01_LO
SWD_solid_waste_disposal	6.A . (eprtr facilities)	solid waste disposal in landfill facilities of EPRTR	ingos_ch4_swd_ldf
SWD_solid_waste_disposal	6.A .	solid waste disposal in landfill facilities (other than EPRTR)	ingos_ch4_swd_ldf
WWT_Waste_water	6.B1 . (eprtr facilities)	industrial waste water treatment facilities of EPRTR	waste_wwt
WWT_Waste_water	6.B1 .	industrial waste water treatmet facilities (other than EPRTR)	Urban_population
WWT_Waste_water	6.B2 .	domestic waste water treatment	pop_01x01_LO
SWD_solid_waste_disposal	6.C . (eprtr facilities)	waste incineration facilities of EPRTR	ingos_ch4_swd_inc
SWD_solid_waste_disposal	6.C .	waste incineration facilities (other than EPRTR)	waste_swd_inc
SWD_solid_waste_disposal	6.D .	other solid waste disposal (hazardous, compost)	waste_swd_inc
FFF_fossil_fuel_fires	7.A .	fossil fuel fires: coal (underground) and oil (Kuwait)	fossil_fuel_fires

Baseline emissions 2000-2010 of EDGARv4.2FT2010 are gridded with upgraded EDGAR proxy data, except for coal mining, oil and gas production (refineries, the oil extraction and gas extraction), solid waste disposal (landfills and incineration) and wastewater (industrial). An overview of the gridmaps used for each of the sectors is given in Table 1. For more info on the EDGAR proxy data we refer to EDGAR gridding manual of Janssens-Maenhout et al. (2013).

The EPRTR data, version v4.2, was used applying method 2 for the coal mines emitting CH4 (5 EU countries[1]), waste incineration (5 EU countries), refineries (10 EU countries + 1 nonEU), oil extraction (3 EU countries+ 1nonEU), gas extraction (4 EU countries + 1 nonEU) and applying method 3 for the landfills (24 EU countries + Iceland) and the industrial wastewater emissions (13 EU countries).

The proxy datasets based on EPRTR are yearly datasets, 2007, 2008, 2009 and 2010 (with for coal mining considerable variation in number of facilities over the 4 years). For the years 2000-2006 the same proxy data as for 2007 are used. The scaling - a relative weighting within the country- of the emissions was based on the CH4 emitted by the facilities, with exception for the waste incineration. For the incineration the CO2 emissions are less uncertain and more representative for the level of the activity and therefore selected for the scaling instead of the CH4 emissions.

2.2. Option: CH4 official emission data of EPRTR 2007-2010

The CH4 dataset reported for the facilities under EPRTR has been compared to the EDGAR estimates. The EPRTR data for coal mining show lower estimates for the 9 countries than the EDGARv4.2FT2010, as shown in Table 2 and Fig. 1. The EPRTR are in the same range as reported for UNFCCC and can indicate that the uncertain emission factor estimate following the general IPCC guidelines lead to overestimation.

Table2: Comparison of the coal mining data (Gg CH4/yr) reported in EPRTR (v4.2) and the EDGAR (v4.2FT2010) data.

	EPRTR					EDGAR				
Country	Gg CH4 in 2007	Gg CH4 in 2008	Gg CH4 in 2009	Gg CH4 in 2010	number of points	Gg CH4 in 2007	Gg CH4 in 2008	Gg CH4 in 2009	Gg CH4 in 2010	number of sites
Germany	174	177	111	122	17	355	313	289	277	10u + 9s
spain	2	2	0	0	4	68	56	52	47	8u + 4s
Poland	467	405	466	456	18	1616	1546	1564	1537	14u + 3s
Roumania	16	15	12	13	4	49	49	46	42	1u
UK	31	70	69	57	7	72	85	74	80	31u
							with u=underground, s=surface			

[1]The underground coal gasification reported for some countries, do not emit CH4 and are not taken up here.

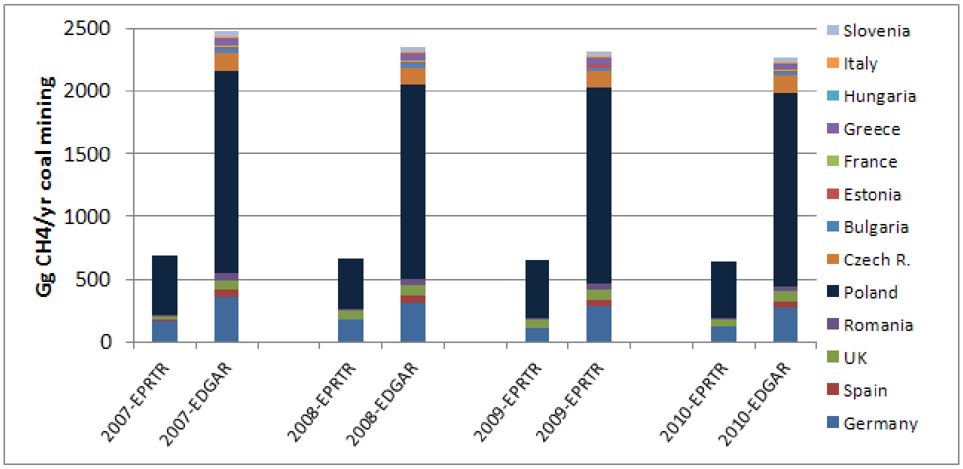

Fig.1: coal mining in EDGAR for EU-27 (13 countries) and in EPRTR reported for the 5 countries for the four years from 2007 to 2010.

For the landfill emissions the total sum of reported CH4 from the 1359 landfill facilities in EPRTR mounts at much lower estimates for the 25 European countries than the estimates of EDGAR, as shown in Fig. 2. Given the threshold for reporting, set by the EPRTR directive for landfills with either a capacity of more than 10 tons/day or a total capacity of more than 25000 tons in total have to report pollutant releases. They report those pollutants that are above the given threshold, which is for CH4 100ton/yr. Many small landfills which do not release 100 tons/yr might be missing out. For the solid waste incineration, the reported amount of CH4 incinerated is in the same order as estimated by EDGAR, as shown in Fig. 3, but the number of countries reporting in EPRTR is very small.

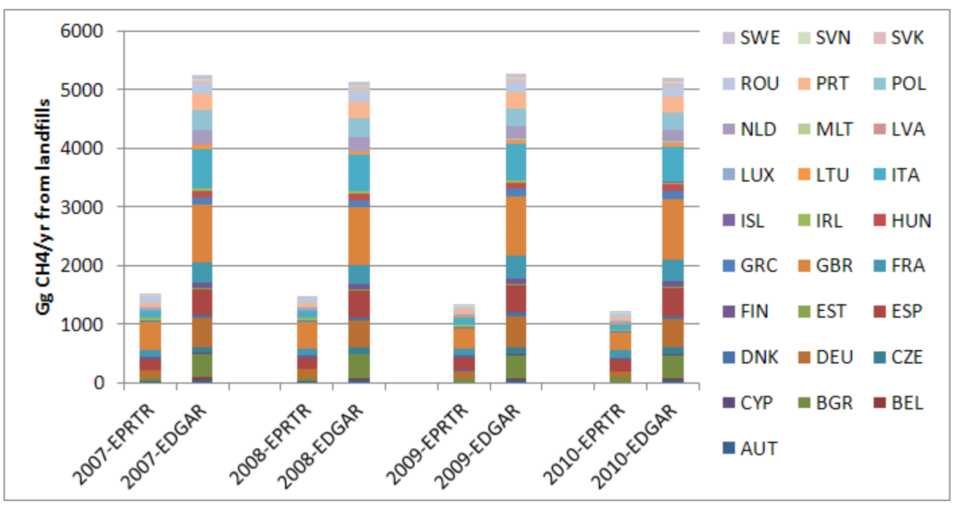

Fig.2: landfill emissions in EDGAR for EU-27 + Iceland and in EPRTR reported for the 25 countries.

Table3: Comparing waste incineration emissions of reporting countries in EPRTR with EDGARv4.2FT2010 in Gg CH4 /yr.

Country	Gg CH4 in 2007-EPRTR	Gg CH4 in 2007-EDGAR		Gg CH4 in 2008-EPRTR	Gg CH4 in 2008-EDGAR		Gg CH4 in 2009-EPRTR	Gg CH4 in 2009-EDGAR		Gg CH4 in 2010-EPRTR	Gg CH4 in 2010-EDGAR
DEU	0.62	0.00		0.00	0.00		0.00	0.00		0.00	0.00
FRA	0.35	2.48		0.24	2.46		0.34	2.44		0.00	2.46
ITA	6.35	1.28		1.72	1.30		1.62	1.32		2.43	1.34
NLD	4.17	0.00		2.43	0.00		4.63	0.00		4.06	0.00
PRT	0.41	0.33		0.48	0.35		0.52	0.37		0.55	0.39

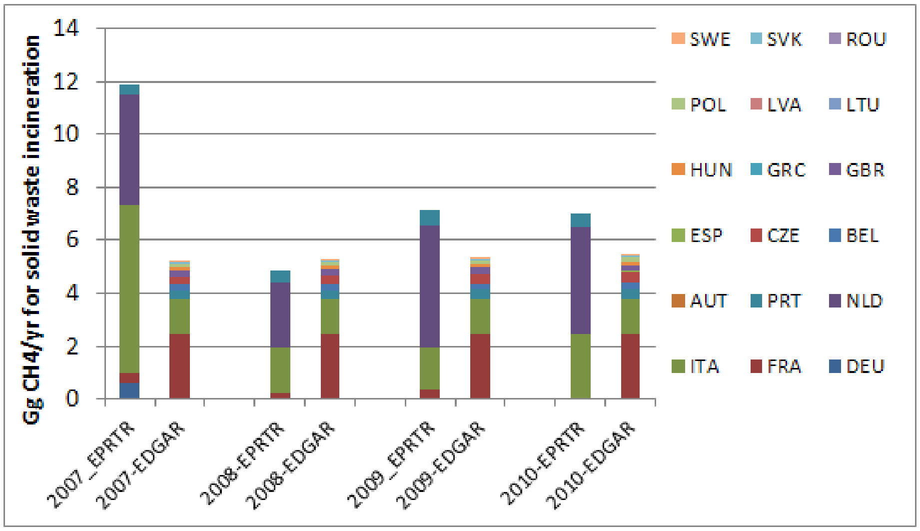

Fig.3: Solid waste incineration emissions of CH4 in EDGAR (18 out of 27 EU countries) and in EPRTR (5 out of 27 EU countries).

For the industrial wastewater even lower emissions are reported. Fig. 4 compares the industrial facilities estimated in EDGAR with those reported in EPRTR. The domestic wastewater is left out in this comparison because it is not subject to EPRTR-reporting.

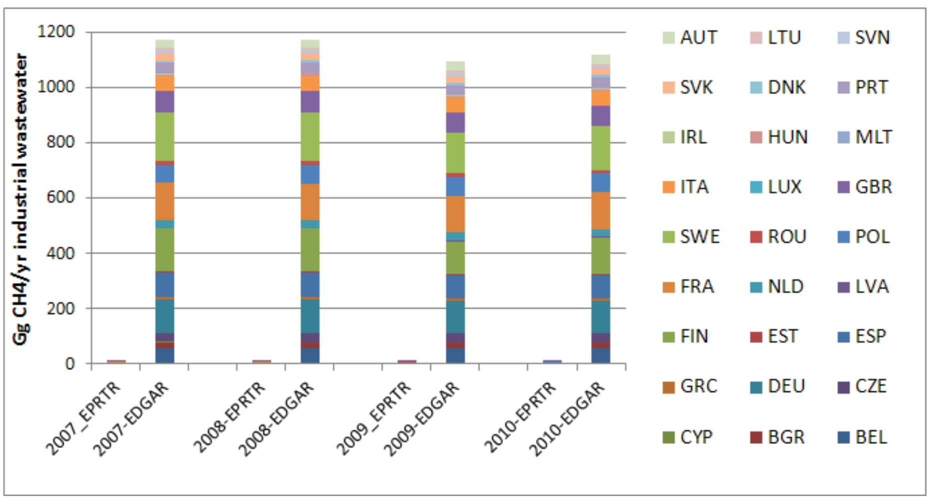

Fig.4: Industrial wastewater emissions in EDGAR for EU-27 and in EPRTR reported for the 13 countries.

For the oil and gas production, the EPRTR v4.2 database reports the CH4 emissions from oil refineries, which are higher than in EDGARv4.2FT2010, as shown in Fig. 5 as well as the CH4 emissions from oil extraction sites in Table5 and gas extraction sites in Fig.6. The number of reporting countries remains smaller than estimated in EDGAR with the energy statistics of IEA, but the reported values are expected to have a lower uncertainty. Fig. 6 for the total gas production and distribution sector shows that EDGARv4.2FT2010 provides the dominant transmission and distribution leakages.

Table4: Comparing emissions of oil refineries in Gg CH4 /yrfor reporting countries in EPRTR (v4.2) and the EDGAR(v4.2FT2010).

country	Gg CH4 in 2007-EPRTR	Gg CH4 in 2007-EDGAR	Gg CH4 in 2008-EPRTR	Gg CH4 in 2008-EDGAR	Gg CH4 in 2009-EPRTR	Gg CH4 in 2009-EDGAR	Gg CH4 in 2010-EPRTR	Gg CH4 in 2010-EDGAR
GBR	4.89	0.98	5.94	0.97	6.99	0.88	6.74	0.90
DNK	3.87	0.10	1.65	0.10		0.10		0.09
ESP	2.03	0.53	2.34	0.50	1.75	0.47	1.65	0.48
FRA	0.58	0.30	0.50	0.36	0.43	0.33	0.21	0.31
SWE	0.33	0.04	0.33	0.05	0.33	0.05	0.33	0.05
NLD	0.31	0.29	0.20	0.29	0.72	0.28	2.09	0.27
DEU	0.11	0.44		0.42		0.41		0.43
BEL		0.10		0.10	0.10	0.09	0.11	0.10
ITA		0.36	0.21	0.35	0.14	0.32		0.36
PRT		0.09		0.07	0.32	0.08	0.51	0.08

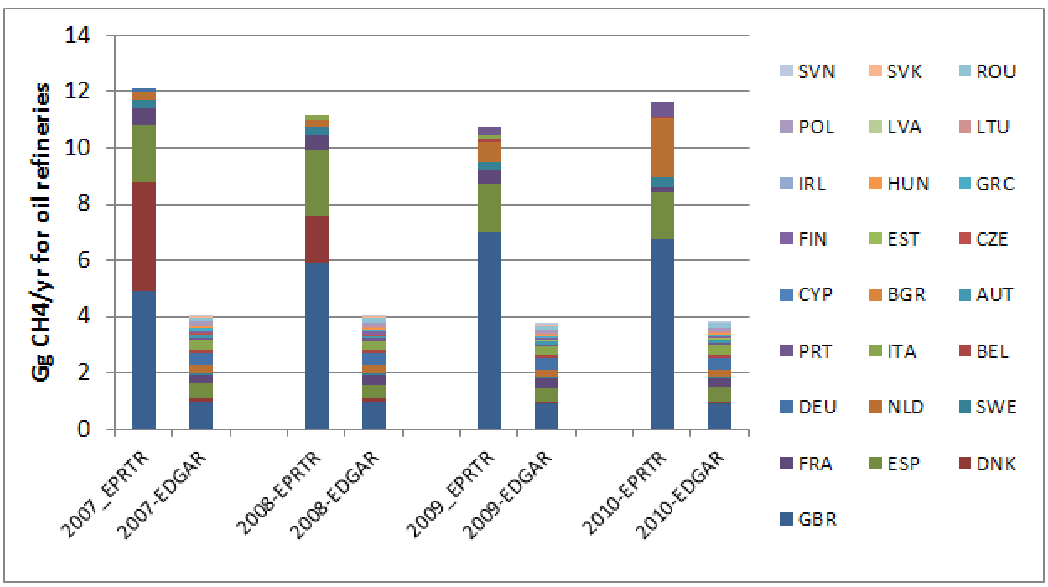

Fig.5: CH4 emissions from oil refineries in EDGAR (25 country-specific emissions estimated) and in EPRTR (10 reporting countries) for EU-27.

Table 5: oil extraction in Gg CH4 /yr from EPRTR and EDGAR in comparison.

country	Gg CH4 in 2007-EPRTR	Gg CH4 in 2007-EDGAR	Gg CH4 in 2008-EPRTR	Gg CH4 in 2008-EDGAR	Gg CH4 in 2009-EPRTR	Gg CH4 in 2009-EDGAR	Gg CH4 in 2010-EPRTR	Gg CH4 in 2010-EDGAR
Norway	245.70	20.12	253.55	21.84	254.12	21.37	254.09	18.94
Poland	0.00	8.40	13.00	8.60	6.94	8.70	6.87	8.90
Roumania	0.00	1.20	1.19	1.20	0.88	1.20	0.85	1.20
UK	0.48	1.60	0.00	1.60	0.00	1.60	0.00	1.60

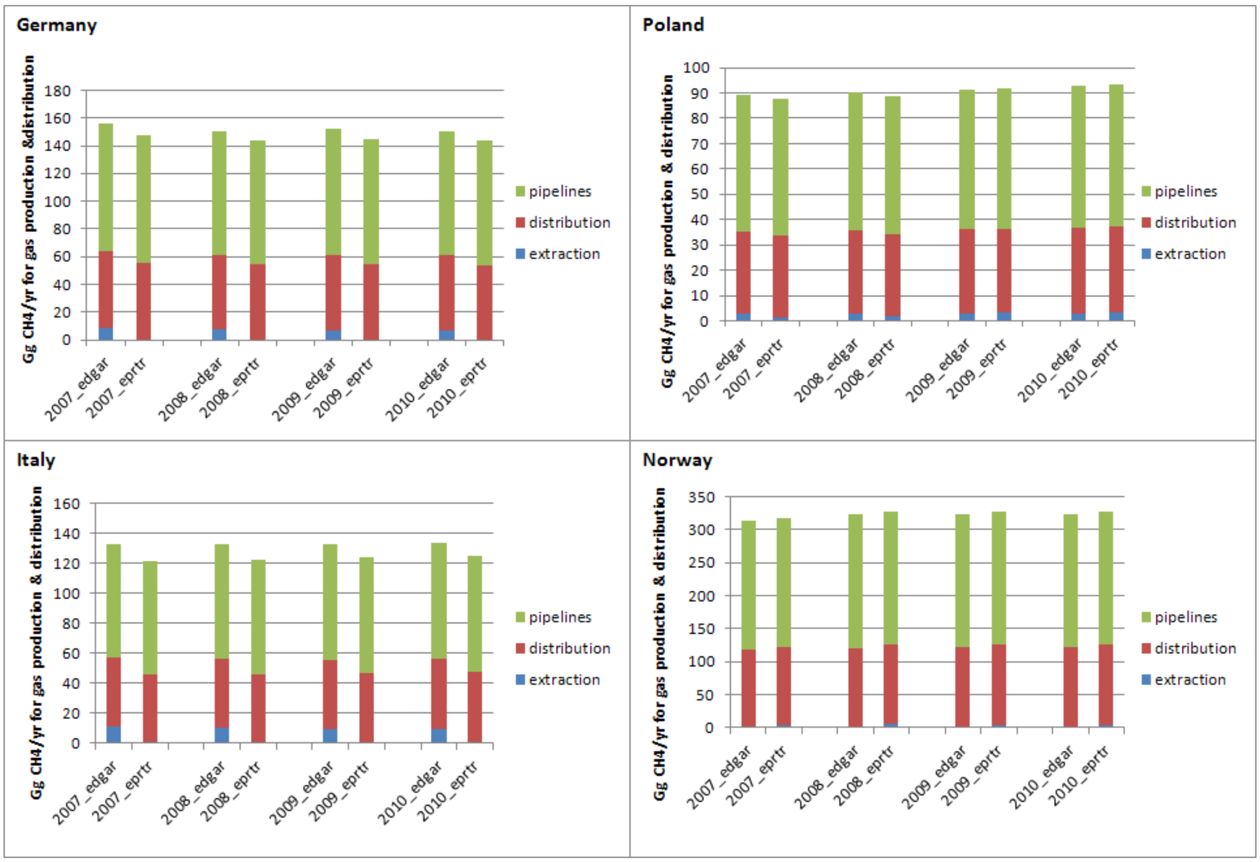

Fig.6: comparison of the complete gas production and distribution sector, under the reference case (EDGAR) and for the option case using EPRTR (in which EPRTR data are only reported for the extraction) and gapfilled with EDGAR.

A variant for each of the sectors where EPRTR data are reported have been calculated applying method 1 and using solely the EPRTR official emissions for the years reported (2007-2010) for those countries where reporting is done. All missing countries were gapfilled with EDGAR data. These subsets of data are made available under the “Option” CH4 emission gridmaps for 2007-2010.

For the coal mining the emission gridmap contains only EPRTRv4.2 CH_4 emissions for the reporting countries. For the solid waste disposal, the emission gridmap contains only EPRTRv4.2 CH_4 emissions for the landfills and the incinerators in the reporting countries. For the oil production and refineries sector, both the refineries data and the oil production data are from EPRTRv4.2 for the reporting countries. For the waste water sector, the emission gridmaps are containing EPRTRv4.2 emissions for the industrial waste but in addition are including also the domestic wastewater from EDGAR to represent the sector complete. Idem for the gas production and distribution sector, the gas extraction data are from EPRTRv4.2 for the reporting countries but the CH_4 leakages of the transmission by pipelines and of the distribution network in cities are taken from EDGAR for all countries and included to complete the sector.

3. N2O emission gridmaps

Two sets of N2O emission data are provided:

1. **Baseline 2000-2010 for N2O**: this is the complete anthropogenic emissions dataset with EDGARv4.2FT2010 time series, gridded with upgraded EDGAR proxy data, except for oil production refineries and chemical industry in Europe. The latter two industries were gridded with the EPRTR point source data locations.
2. **Option: N2O official emission data of EPRTR 2007-2010**: this is a subset providing anthropogenic emissions for some sectors (oil production refineries, chemical industry and power plants) as reported to EPRTR. The emission data are only gapfilled with EDGARv4.2FT2010 within these sectors for those countries where no data are reported, or for those (diffusive) subsectors that are not subject to EPRTR reporting.

3.1. Baseline 2000-2010 for N2O

3.1.1 The N2O inventory compilation under EDGARv4.2FT2010

For the baseline emission gridmaps the 2000-2010 emissions are equal in sector- and country-specific total to the N2O emission estimates of the EDGARv4.2FT2010 time series. The compilation of the EDGARv4.2FT2010 emission inventory applied a bottom up approach with the following data information sources:

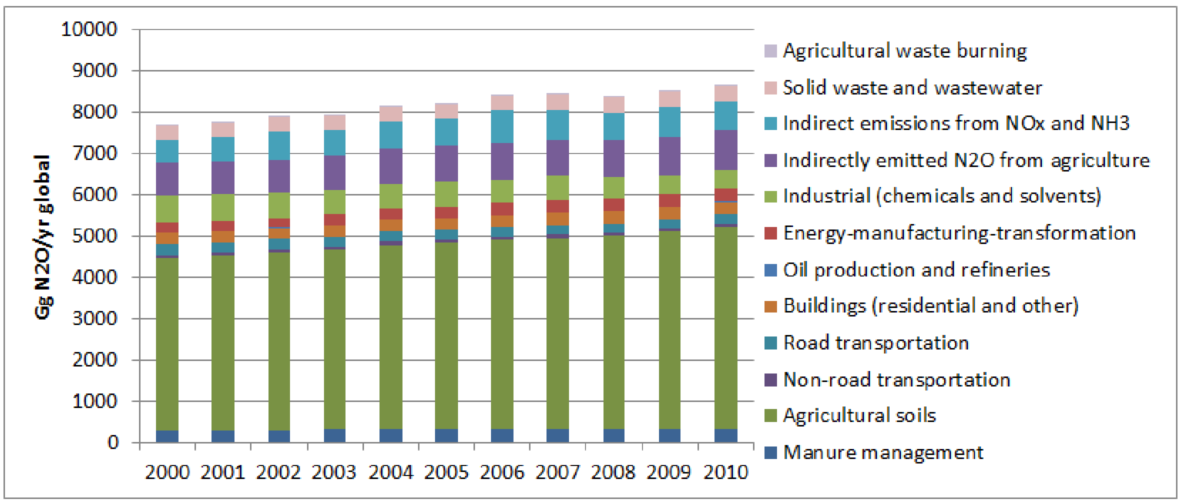

Fig. 7 : Sector-specific global total N2O per year of the EDGARv4.2FT2010 and the INGOS baseline dataset (the exact numbers are provided in Annex, table A.2).

- Energy and fossil fuel production and transformation (EMT): Data for fossil fuel production and use for 138 countries were taken from the IEA energy statistics for OECD and Non-OECD countries 1970-2008 (extended energy balances, in energy units) (IEA, 2007, 2010). This dataset comprises 94 sectors and 64 fuel types. For the countries of the Former Soviet Union and Former Yugoslavia a modified dataset was used to achieve a complete time series for the new countries for 1970 to 2008 of which the sum converges to the older dataset for the total Former Soviet Union and Yugoslavia. For another 62 countries, the aggregated IEA data for the regions 'Other

America', 'Other Africa' and 'Other Asia' have been split using the sectoral IEA data per region and total production and consumption figures per country of coal, gas and oil from energy statistics reported by the US Energy Information Administration (EIA, 2007, 2010).

- For oil production and refining (OPR): For oil production and refining the N2O emissions factors are from IPCC (2006), supplemented with data from UNFCCC (2008). The flaring emissions are for most countries from 1994 onwards determined from the satellite observations of the intensity of flaring lights (Elvidge et al., 2009), reported by NOAA (2011). For other years before 1994 and for other countries emissions or emissions trends were supplemented by CO2 trends from CDIAC (Marland et al., 2006), EIA (2011) and UNFCCC (2010).
- For road transport (TRO): For N2O from gasoline cars in road transport, the fraction of cars equipped with different types of catalytic converters was taken into account (based on various references). The factors for biofuel combustion were taken from the 2006 IPCC Guidelines. For charcoal production the emissions factors are from Andreae (2011).
- Industrial processes (chemicals and solvents) (IPPU): For the N2O sources nitric acid, adipic acid and caprolactam, production data are based on UNFCCC (2010) and on (smoothed and averaged data) SRIC (2005). For other industrial production for which no international statistics were available, such as silicon carbide and glyoxal, UNFCCC (2010) was used, which is limited to Annex I countries. However, for many countries interpolations and extrapolations were necessary to arrive at complete time series per country for 1970-2005/2008. Special attention had to be given to new EIT countries, in particular to Former Soviet Union and Former Yugoslavia countries, to match the older totals for the former countries. The N2O emission factors for the production of adipic acid, nitric acid, caprolactam and glyoxal are based on IPCC (2006). For adipic acid, abatement is only assumed from 1990 onwards if indicated in UNFCCC (2010) combined with activity data from SRIC (2005). For nitric acid in 1970, all old technology is assumed, changing their technology towards 1990 into high pressure plants in non-Annex I countries and a mix of low and medium pressure plants in Annex I countries that matches reported emissions in UNFCCC (2010). In addition, about 20% of global total production is equipped with Non-Selective Catalytic Reduction (NSCR) technology all in Annex II countries (Choe et al., 1993). For N2O from the use of anaesthesia an amount of 24 g N2O and 34 g N2O per capita in 2000 was used for EIT and Annex II countries, respectively, based on the average values in UNFCCC (2010) and tentatively set at 5 g/cap/year for non-Annex I countries, based on Kroeze (1994). Globally a declining rate from 1990 to 2005 of 20% was assumed as observed for total Annex I countries. For N2O from aerosol spray cans an amount of 10 g N2O per capita in 2000 was used for Annex I countries based on the average values in UNFCCC (2010) and none for non-Annex I countries. A uniform inclining rate from 1990 to 2005 of 50% was assumed as observed for total Annex I countries. In addition, for non-CO_2 emission reductions in developing countries up to 2010 we used the information on so-called CDM projects that have been implemented according to the "CDM pipeline" database maintained by the UNEP-Risø Centre (2011).
- Agricultural soils (AGS): In general, the IPCC (2006) methodology and new default emission factors for N2O were used to estimate agricultural emissions, except for the instances mentioned below. Please note that N2O emissions from agriculture as reported in EDGAR 4.2 FT2010 are substantially lower than those presently reported by most Annex I countries due to two markedly lower emission factors: the default IPCC emission factor ("EF1") for direct soil emissions of N2O from the use of synthetic fertilisers, manure used as fertiliser and from crop residues left in the field has been reduced by 20% and the default emission factor ("EF5") for indirect N2O emissions from nitrogen leaching and run-off has been reduced by 70% compared to

the values recommended in the 1996 IPCC Guidelines and the IPCC Good Practice Guidance (IPCC, 1997, 2000).

- Manure management (MNM): Livestock numbers were taken from FAO (2007b,c, 2010). Livestock numbers were combined with estimates for animal waste generated per head to estimate the total amount of animal waste generated. Nitrogen excretion rates for cattle, pigs and chicken in Europe were based on the CAPRI model (Pérez, 2005; Britz, 2005; Leip et al., 2007) and for all other countries and animal types in IPCC (2006). The trend in carcass weight was used to determine the development in nitrogen excretion over time. The shares of different animal waste management systems were based on regional defaults provided in IPCC (2006) and regional trend estimates for diary and non-dairy cattle for the fractions stall-fed, extensive grazing and mixed systems from Bouwman et al. (2005). N2O emissions from manure management were based on distribution of manure management systems from Annex I countries reporting to the UNFCCC (2008), Zhou et al. (2007) for China and IPCC (2006) for the rest of the countries. N2O emissions from the use of animal waste as fertilizer was estimated by taking into account loss of nitrogen that occurs from manure management systems before manure is applied to soils and additional nitrogen introduced by bedding material. N2O emissions from fertilizer use were estimated based on IFA (2007) and FAO (2007e) statistics and emission factors from IPCC (2006). Separate N2O emission factors were applied for tropical and non-tropical regions (IPCC, 2006).
- Agricultural waste burning (AWB): Nitrogen and dry-matter content of agricultural residues were estimated based on cultivation area and yield for 24 crop types from FAO (2007d) and IPCC (2006) factors. The fractions of crop residues removed from and burned in the field were estimated using data of Yevich and Logan (2003) and UNFCCC (2008) for fractions burned in the field by Annex I countries. Subsequently, N2O emissions from crop residues left in the field and non-CO2 emissions from field burning of the residues were calculated using IPCC (2006) emission factors.
- Indirect N2O emissions from leaching and runoff (N2O): were estimated based on nitrogen input to agricultural soils as described above. Leaching and run-off was assumed to occur in other areas than non-irrigated dryland regions, which were identified based on FAO (1999; 2000; 2005) and Murray et al. (1999). The fraction of nitrogen lost through leaching and runoff was based on a study of Van Drecht et al. (2003). IPCC (2006) emission factors were used for indirect N2O from leaching and runoff, as well as from deposition of agricultural NH3 and NOx emissions.
- Waste handling (SWT): For estimating the amount of organic solid waste in landfills three key parameters have to be determined: (a) Municipal Solid Waste (MSW) generated per year (kg/cap), (b) fraction of total solid waste that is landfilled, and (c) fraction of Degradable Organic Carbon (DOC) in the MSW (%). Total and urban population figures were taken from UN (2006b).The amounts of Municipal Solid Waste (MSW) generated are the primary statistics for emissions from landfills. For 70 countries, the 2006 IPCC Guidelines provide country-specific data for 2000 of the amount of MSW generated per year per capita (urban capita in case of non-Annex I countries) and the fraction landfilled and incinerated. For 58 more countries, country-specific values for the MSW generation per capita were found in the literature. For the remaining 91 countries, the waste generation per capita in 2000 was estimated using an exponential fit of the IPCC (2006) country-specific data for 70 countries of MSW/cap for 2000 to GDP/cap. For Annex I countries trend data for MSW generation/cap are available for the period 1990-2005 (UNFCCC, 2008). For other years and for other countries for which these data are not available, extrapolation from 2000 back and forward was done using the exponential fit mentioned above. When the country-specific fraction of MSW landfilled was missing, regional defaults provided in IPCC (2006) were used. In addition, UN statistics on MSW treatment may provide country-specific data for some other years than 2000. Based on regional defaults for the composition of MSW, IPCC (2006)

provides regional defaults for the fraction Degradable Organic Carbon (DOC). However, for Annex I countries, country-specific data from UNFCCC (2008) were used (sometimes including a change over time) and for 94 Non-Annex I countries, country-specific MSW composition data were found, from which the average DOC value was calculated. In version 4.2, for a number of Annex I countries the DOC fraction was adjusted to better reflect the overall emission trends for landfills as reported to UNFCCC (2008). For domestic wastewater, total organics in wastewater (BOD5) was estimated using regional default or country-specific default values for BOD5 generation per capita per day provided by IPCC (2006). For industrial wastewater, total organically degradable material in wastewater from industry was calculated per type of industry from WW generation per ton of product and COD values (chemical oxygen demand) in kg/m3 WW, using defaults from IPCC (2006). Production statistics for industry types that produce most organics in wastewater are available from UN (2006a). Examples are meat and poultry, raw sugar, alcohol, pulp and organic chemicals. For estimating N2O emissions from wastewater, the activity data is total annual amount of nitrogen in the wastewater, which was calculated from annual protein consumption per capita reported by FAO (2007f), using correction factors for non-consumed protein and for the fraction of industrial and commercial protein that is co-discharged. For the correction factors and the N2O emission factor, defaults provided in IPCC (2006) were used. Other waste sources are incineration, with activity data from UNFCCC (2008) and IPCC (2006) and extrapolations assuming a fixed ratio to landfilling, and composting (UNFCCC, 2008; ECN, 2008; CCC, 2008).

- Other indirect emissions (IDE): from atmospheric deposition of nitrogen of NOx and NH3 emissions from non-agricultural sources, mainly fossil fuel combustion and large scale biomass burning, were estimated using nitrogen in NOx and NH3 emissions from these sources as activity data, based on preliminary EDGAR 4.2 FT2010 data for these gases. The same IPCC (2006) emission factor was used for indirect N2O from atmospheric deposition of nitrogen from NH3 and NOx emissions as was used for agricultural emissions.

3.1.2 The gridding of the N2O emissions with EDGAR and EPRTR proxy data

Baseline emissions 2000-2010 of EDGARv4.2FT2010 are gridded with upgraded EDGAR proxy data, except for oil and gas production (refineries, the oil extraction and gas extraction), for chemicals production, power plants and waste water treatment (industrial). An overview of the gridmaps used for each of the sectors is given in Table 6. For more info on the EDGAR proxy data we refer to EDGAR gridding manual of Janssens-Maenhout et al (2013).

The EPRTR data, version v4.2, was used applying method 2 for the power plants (18 EU countries), refineries (10 EU countries + 1 nonEU), oil extraction (3 EU countries+ 1nonEU), gas extraction (4 EU countries + 1 nonEU), chemical plants (20 EU countries + 1 nonEU) and applying method 3 for the industrial wastewater emissions (13 EU countries).

The proxy datasets based on EPRTR are yearly datasets, 2007, 2008, 2009 and 2010. For the years 2000-2006 the same proxy data as for 2007 are used. The scaling - a relative weighting within the country- of the emissions was based on the N2O emitted by the facilities, with exception for the power plants and the waste incineration. For the incineration, the CO2 emissions are less uncertain and more representative for the level of the-this activity and therefore selected for the scaling instead of the N2O emissions.

Table 6: For the N2O main sectors: overview of the different gridmaps used for each of the human activities (with IPCC identification code). Special proxy data developed with the geospatial coordinates of the facilities in the EPRTR data start with "ingos_" to differentiate from the standard EDGAR proxy data.

main sectors grouping the human activities	IPCC-code for activity	description	N2O_gridmap_baseline
energy_manufacturing_transformation	1.A1a	power plants (not combusting biomass)	PP_CARMA_2007
energy_manufacturing_transformation	1.A1c.1	transformation coal - BKB	Urban_population
energy_manufacturing_transformation	1.A1c.2	other transformation of solid fuel and energy carriers	Urban_population
production_oil_and_gas	1.A1r.z	petroleum refining (other than EPRTR)	oil_refineries
energy_manufacturing_transformation	1.A2a.x	industrial combustion of biomass for iron&steel	steel
energy_manufacturing_transformation	1.A2a	industrial combustion of fossil fuel for iron&steel	steel
energy_manufacturing_transformation	1.A2b.x	industrial combustion of biomass for nonferrous	nonferrous
energy_manufacturing_transformation	1.A2b.z	industrial combustion of fossil fuel for nonferrous	nonferrous
energy_manufacturing_transformation	1.A2c.x	industrial combustion of biomass for chemical industry	chemical
energy_manufacturing_transformation	1.A2c	industrial combustion of fossil fuel for chemical industry	chemical
energy_manufacturing_transformation	1.A2d.x	combustion of biomass for paper industry	Urban_population
energy_manufacturing_transformation	1.A2d	combustion for paper industry	Urban_population
energy_manufacturing_transformation	1.A2e.x	combustion of biomass for food	Urban_population
energy_manufacturing_transformation	1.A2e	combustion for food	Urban_population
energy_manufacturing_transformation	1.A2f.c	industrial combustion for cement & lime industry	cement_DIE
energy_manufacturing_transformation	1.A2f	combustion for other (incl. cement)	Urban_population
TNR_non-road_transportation	1.A3a	domestic aviation	air_domestic
TRO_road_transportation	1.A3b	road transport	Roads
TNR_non-road_transportation	1.A3c	railway	railways
TNR_non-road_transportation	1.A3d	inland waterway	fishing
TNR_non-road_transportation	1.A3e	non-road other transport	Rural_population
RCO_residential	1.A4a.x	combustion of biomass for buildings of commercial and public services	Urban_population
RCO_residential	1.A4a	combustion of fossil for buildings of commercial and public services	Urban_population
RCO_residential	1.A4b.x	combustion of biomass for buildings of residential sector	pop_01x01_LO
RCO_residential	1.A4b	combustion of fossil for buildings of residential sector	pop_01x01_LO
RCO_residential	1.A4c.1	combustion of biomass for buildings of agriculture or forestry sector	Rural_population
RCO_residential	1.A4c.1	combustion of fossil for buildings of agriculture or forestry sector	Rural_population
RCO_residential	1.A4c.2	combustion of fossil for off-road machinery in agri or forestry sector	Rural_population
RCO_residential	1.A4c.3	combustion of biomass for equipment & buildings in fisheries sector	Rural_population
RCO_residential	1.A4c.3	combustion for equipment & buildings in fisheries sector	Rural_population
RCO_residential	1.A4d.x	non-specified use of biomass for buildings, equipment, machinery	pop_01x01_LO
RCO_residential	1.A4d	non-specified use of fossil for buildings, equipment, machinery	pop_01x01_LO
RCO_residential	1.A5b.1	Off-road machinery: mining (diesel)	Rural_population
production_oil_and_gas	1.B1r	coal mines (other than EPRTR)	ingos_CH4_coal_mines
production_oil_and_gas	1.B2	oil production (incl. venting flaring)	oil_production
TNR_non-road_transportation	1.C1	international aviation	air_international
TNR_non-road_transportation	1.C2	international shipping	Ships_2007
IPPU_industrial_process_&_product_use	2.B	process emissions of chemical industry (other than EPRTR)	chemical
IPPU_industrial_process_&_product_use	2.B2	process emissions of chemical industry (other than EPRTR)	chemical
IPPU_industrial_process_&_product_use	2.B2	process emissions of inorganic chemical industry	ingos_n2o_chemicals_inorganic
IPPU_industrial_process_&_product_use	2.B3	process emissions of adipic acid chemical industry	ingos_n2o_chemicals_organic
IPPU_industrial_process_&_product_use	2.B35	process emissions of organic chemical industry	ingos_n2o_chemicals_organic
IPPU_industrial_process_&_product_use	2.B5h	process emissions of glycoxal chemical industry	ingos_n2o_chemicals_organic
IPPU_industrial_process_&_product_use	2.B5f	process emissions of caprolactam chemical industry	ingos_n2o_chemicals_fert_nitro
IPPU_industrial_process_&_product_use	2.B5o	process emissions of chemical industry (others)	ingos_n2o_chemicals_other
IPPU_industrial_process_&_product_use	3.D	solvent and product use (non-specified)	Urban_population
MNM_manure_management	4.B	manure management of cattle	cattle_01x01_LO
N2O_agriculture	4.D3	indirect emissions from agriculture (leaching and run-off)	crop_01x01_LO
AGS_agricultural soils	4.D	direct agricultural soil emissions (fertilizers, manure, crop residues)	crop_01x01_LO
AWB_agricultural_waste_burning	4.F	field burning of agricultural residues	crop_01x01_LO
SWT_Waste_solid_wastewater	6.B	waste water treatment	waste_wwt
SWT_Waste_solid_wastewater	6.C	waste incineration facilities (other than EPRTR)	waste_swd_inc
SWT_Waste_solid_wastewater	6.D	other solid waste disposal (hazardous, compost)	waste_swd_inc
FFF_fossil_fuel_fires	7.A	fossil fuel fires: coal (underground) and oil (Kuwait)	fossil_fuel_fires
IDE_indirect_emissions	7.B1	Indirect N2O from non-agricultural NOx (emitted in cat. 1A1 -PP)	nitro_dep
IDE_indirect_emissions	7.B2	Indirect N2O from non-agricultural NOx (emitted in cat. 1A2 -ind. comb.)	nitro_dep
IDE_indirect_emissions	7.B3	Indirect N2O from non-agricultural NOx (emitted in cat. 1A3 - transport)	nitro_dep
IDE_indirect_emissions	7.B4	Indirect N2O from non-agricultural NOx (emitted in cat. 1A4 - res.)	nitro_dep
IDE_indirect_emissions	7.B5	Indirect N2O from non-agricultural NOx (emitted in cat. 5 - forest fires)	nitro_dep
IDE_indirect_emissions	7.C1	Indirect N2O from non-agricultural NH3 (emitted in cat. 1A1 - PP)	nitro_dep
IDE_indirect_emissions	7.C2	Indirect N2O from non-agricultural NH3 (emitted in cat. 1A2 - ind.comb.)	nitro_dep
IDE_indirect_emissions	7.C3	Indirect N2O from non-agricultural NH3 (emitted in cat. 1A3 - transport)	nitro_dep
IDE_indirect_emissions	7.C4	Indirect N2O from non-agricultural NH3 (emitted in cat. 1A4 - res.)	nitro_dep
IDE_indirect_emissions	7.C5	Indirect N2O from non-agricultural NH3 (emitted in cat. 5 - forest fires)	nitro_dep

3.2. Option: N2O official emission data of EPRTR 2007-2010

The N2O dataset reported for the facilities under EPRTR has been compared to the EDGAR estimates. The EPRTR data for power plants show lower estimates for the 18 (out of 27) countries than the EDGARv4.2FT2010, as shown in Table 7 and Fig. 8. A lower estimate by EPRTR might be due to the fact that there are small facilities which fall under the limit for reporting. Few countries show very good agreement (Romania, Portugal, Ireland and Slovenia) and for one country, Cyprus, we might find a typo with 1 order of magnitude for 2007.

Table 7: Comparing power plant N2O emissions calculated in EDGAR (v4.2FT2010) and reported in EPRTR (v4.2). Green colour indicates good agreement, orange indicate disagreement in reported data, red indicates missing data in EPRTR (v4.2).

kton N2O	2007_edgar	2007_EPRTR	2008_edgar	2008_EPRTR	2009_edgar	2009_EPRTR	2010_edgar	2010_EPRTR
DEU	7.36E+00	2.78E+00	7.20E+00	2.94E+00	6.99E+00	2.69E+00	7.15E+00	2.67E+00
FRA	1.07E+00	2.08E+00	9.27E-01	6.61E-01	9.92E-01	5.11E-01	1.11E+00	7.05E-01
GBR	2.37E+00	1.68E+00	2.17E+00	2.53E+00	1.96E+00	1.47E+00	2.07E+00	1.61E+00
ITA	2.38E+00	1.63E+00	2.43E+00	1.54E+00	2.07E+00	6.64E-01	2.13E+00	6.95E-01
ESP	1.52E+00	9.96E-01	1.10E+00	2.17E+00	9.50E-01	8.85E-01	7.70E-01	8.87E-01
ROU	4.26E-01	5.02E-01	3.99E-01	5.76E-01	3.49E-01	4.33E-01	3.27E-01	4.62E-01
CYP	1.69E-02	4.12E-01	1.72E-02	2.63E-02	1.74E-02	2.74E-02	1.68E-02	2.76E-02
GRC	5.45E-01	3.03E-01	5.39E-01	3.63E-01	5.07E-01	2.65E-01	4.69E-01	9.20E-02
NLD	6.49E-01	2.87E-01	6.35E-01	2.71E-01	6.79E-01	2.67E-01	7.22E-01	3.99E-01
PRT	2.59E-01	2.51E-01	2.41E-01	1.49E-01	2.66E-01	1.72E-01	2.24E-01	1.15E-01
DNK	5.36E-01	1.91E-01	5.10E-01	1.80E-01	5.24E-01	1.85E-01	5.96E-01	1.76E-01
POL	7.37E+00	1.52E-01	7.42E+00	9.61E-01	7.19E+00	4.27E-01	7.45E+00	6.14E-01
IRL	1.10E-01	1.33E-01	1.11E-01	1.59E-01	9.95E-02	1.53E-01	1.04E-01	1.39E-01
BEL	3.38E-01	9.52E-02	3.93E-01	7.22E-02	4.16E-01	1.01E-01	4.55E-01	9.37E-02
SVN	9.24E-02	8.42E-02	9.24E-02	1.18E-01	8.74E-02	9.68E-02	8.90E-02	7.99E-02
FIN	5.58E+00	6.92E-02	4.51E+00	8.08E-02	4.68E+00	1.09E-01	5.81E+00	1.29E-01
AUT	3.49E-01	3.64E-02	3.58E-01	3.50E-02	3.60E-01	1.80E-02	4.04E-01	1.89E-02
SWE	1.40E+00	3.02E-02	1.45E+00	3.04E-02	1.55E+00	3.57E-02	1.90E+00	4.63E-02
BGR	3.86E-01	0.00E+00	3.99E-01	0.00E+00	3.68E-01	0.00E+00	3.92E-01	0.00E+00
CZE	3.69E+00	0.00E+00	3.19E+00	0.00E+00	3.00E+00	0.00E+00	3.23E+00	0.00E+00
EST	1.93E-01	0.00E+00	1.73E-01	0.00E+00	1.57E-01	0.00E+00	2.15E-01	0.00E+00
HUN	2.20E-01	0.00E+00	2.17E-01	0.00E+00	2.02E-01	0.00E+00	2.09E-01	0.00E+00
LTU	2.62E-02	0.00E+00	2.61E-02	0.00E+00	2.96E-02	0.00E+00	3.10E-02	0.00E+00
LUX	8.62E-03	0.00E+00	8.61E-03	0.00E+00	9.47E-03	0.00E+00	1.15E-02	0.00E+00
LVA	2.33E-02	0.00E+00	2.38E-02	0.00E+00	2.30E-02	0.00E+00	2.58E-02	0.00E+00
MLT	1.12E-02	0.00E+00	6.10E-03	0.00E+00	5.73E-03	0.00E+00	5.73E-03	0.00E+00
SVK	7.84E-01	0.00E+00	8.35E-01	0.00E+00	8.59E-01	0.00E+00	9.26E-01	0.00E+00
Totals	3.77E+01	1.17E+01	3.54E+01	1.29E+01	3.44E+01	8.51E+00	3.68E+01	8.97E+00

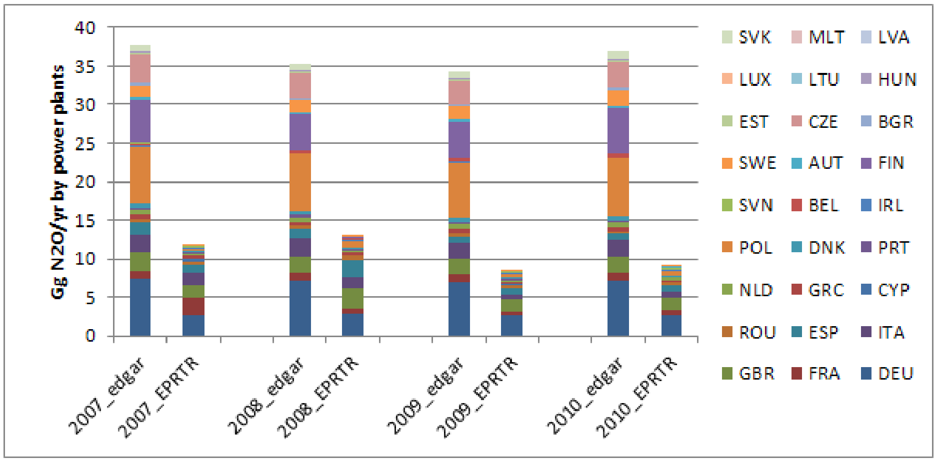

Fig. 8: Comparison for EU-27 of the N2O emissions from power plants calculated in EDGAR (v4.2FT2010) and reported for the 18 countries in EPRTR (v4.2).

The emissions of oil refineries have been also reported under EPRTR and compared with EDGAR (only sector of oil refining – IPCC 1A1r). It was noted that while only 10 countries reported CH4 emissions from oil refineries, 12 countries are reporting N2O emissions. Similar as for CH4, EDGAR systematically underestimates the oil refineries' N2O emissions, with about one order of magnitude. However EDGAR covers the double of countries (for which IEA reports oil refining activity data). Both effects are presented in Table 8 and Fig. 9.

Table 8: Comparing oil refineries N2O emissions of EDGAR (v4.2) and of EPRTR (v4.2).

kton N2O	2007_edgar	2007_EPRTR	2008_edgar	2008_EPRTR	2009_edgar	2009_EPRTR	2010_edgar	2010_EPRTR
ESP	1.18E-02	9.72E-01	8.32E-03	1.17E+00	7.90E-03	1.05E+00	8.07E-03	9.72E-01
FRA	1.51E-02	5.42E-01	1.46E-02	5.66E-01	1.44E-02	5.25E-01	1.56E-02	3.44E-01
DEU	1.77E-02	2.75E-01	1.60E-02	2.49E-01	1.56E-02	1.43E+00	1.62E-02	2.82E-01
GBR	2.47E-02	2.73E-01	2.34E-02	3.15E-01	2.13E-02	2.78E-01	2.16E-02	2.26E-01
BEL	3.30E-04	1.39E-01	4.60E-05	9.89E-02	4.28E-05	2.20E-01	4.86E-05	1.59E-01
ITA	1.92E-03	1.31E-01	2.09E-03	2.35E-01	1.94E-03	1.82E-01	2.16E-03	2.96E-01
ROU	1.07E-02	9.88E-02	1.07E-02	1.14E-01	8.41E-03	4.88E-02	9.54E-03	1.42E-02
NLD	1.62E-02	7.25E-02	1.62E-02	6.91E-02	1.88E-02	5.99E-02	2.06E-02	5.18E-02
GRC	1.21E-04	5.57E-02	1.34E-04	5.06E-02	1.25E-04	4.70E-02	1.29E-04	4.62E-02
FIN	2.01E-03	3.80E-02	2.18E-03	4.70E-02	1.94E-03	4.90E-02	2.47E-03	4.60E-02
CZE	5.44E-03	1.61E-02	5.77E-03	1.54E-02	6.21E-03	1.20E-02	6.68E-03	1.54E-02
SWE	1.67E-05	1.20E-02	1.26E-05	1.53E-02	1.31E-05	1.57E-02	1.20E-05	1.75E-02
AUT	1.36E-02	0.00E+00	1.70E-02	0.00E+00	1.27E-02	0.00E+00	1.46E-02	0.00E+00
BGR	7.06E-04	0.00E+00	3.53E-04	0.00E+00	3.91E-04	0.00E+00	5.30E-04	0.00E+00
DNK	1.42E-02	0.00E+00	1.45E-02	0.00E+00	1.51E-02	0.00E+00	1.86E-02	0.00E+00
EST	4.01E-03	0.00E+00	3.83E-03	0.00E+00	5.38E-03	0.00E+00	7.13E-03	0.00E+00
HUN	1.79E-04	0.00E+00	2.16E-04	0.00E+00	2.20E-04	0.00E+00	2.32E-04	0.00E+00
IRL	1.97E-03	0.00E+00	1.57E-03	0.00E+00	1.49E-03	0.00E+00	1.32E-03	0.00E+00
LTU	4.10E-03	0.00E+00	3.94E-03	0.00E+00	4.58E-03	0.00E+00	4.59E-03	0.00E+00
LVA	8.21E-03	0.00E+00	7.54E-03	0.00E+00	7.26E-03	0.00E+00	8.04E-03	0.00E+00
POL	1.34E-02	0.00E+00	2.16E-02	0.00E+00	1.86E-02	0.00E+00	2.01E-02	0.00E+00
PRT	5.68E-04	0.00E+00	2.97E-04	1.45E-02	3.49E-04	3.12E-02	3.41E-04	4.04E-01
SVK	3.48E-03	0.00E+00	3.35E-03	0.00E+00	3.62E-03	0.00E+00	4.59E-03	0.00E+00
SVN	1.25E-05	0.00E+00	1.67E-05	0.00E+00	1.67E-05	0.00E+00	3.89E-05	0.00E+00
Totals	1.70E-01	2.63E+00	1.74E-01	2.96E+00	1.67E-01	3.94E+00	1.83E-01	2.87E+00

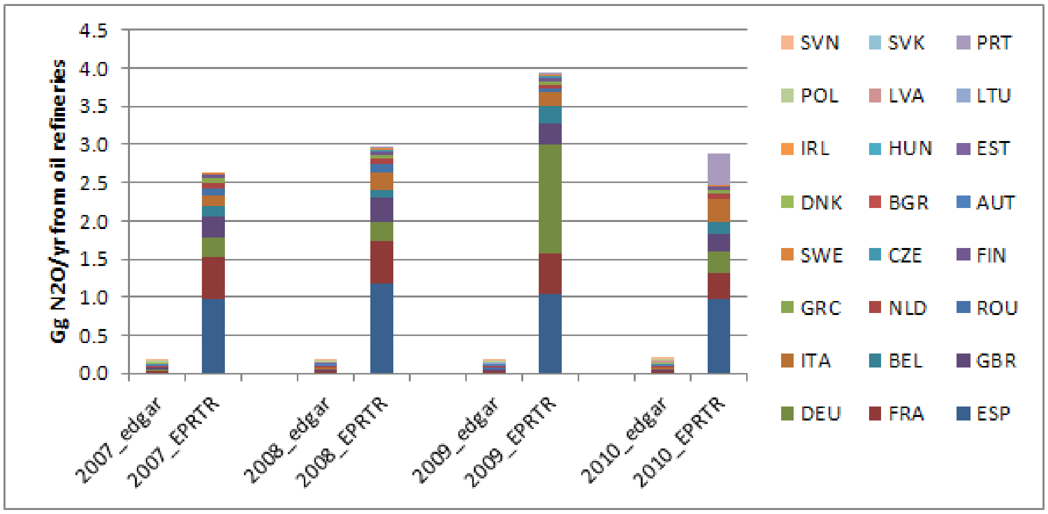

Fig. 9: Comparison for EU-27 of the N2O emissions from oil refineries calculated in EDGAR (v4.2FT2010) and reported for the 12 countries in EPRTR (v4.2).

Important point-sources of the N2O emissions originate also from the chemical industry. The sometimes energy-intensive chemical industry causes combustion emissions that are accounted under sector (4) energy manufacturing and transformation (EMT) and process emissions that are assigned to the special sector of process emissions from (3) industrial process and product use (IPPU). The chemical industry energy needs contribute only to 13% of the total industrial non-power combustion emissions. Moreover the most energy-intensive Haber-Bosch process is not in the basket for the N2O emitting chemical production facilities of EPRTR. Therefore only the process emissions of EDGAR (sector (3) IPPU)) are considered and confronted to the N2O emissions from chemical plants in the EPRTR database. The reported chemical production in EPRTR has been compared to EDGAR for inorganic chemicals production, nitro-fertilizer production and other (bulk) chemicals production. For the first type of chemicals, EPRTR reports relatively low emissions for only 4 out of the 21 EU-27 countries, which have IFA activity data for inorganic chemicals production in EDGAR, as shown in Table 9 and Fig. 10.

Table 9: Comparing N2O emissions from inorganic chemicals production calculated by EDGAR (v4.2FT2010) and reported under EPRTR (v4.2). Only 4 countries did report whereas EDGAR calculates for 21 countries N2O emissions from inorganic chemicals based on IFA data.

kton N2O	2007_edgar	2007_EPRTR		2008_edgar	2008_EPRTR		2009_edgar	2009_EPRTR		2010_edgar	2010_EPRTR
FIN	4.68E+00	1.30E+00		4.78E+00	1.10E+00		2.40E+00	5.24E-01		5.05E-01	8.76E-02
ITA	3.49E+00	1.67E-01		1.16E+00	3.10E-01		1.23E+00	0.00E+00		7.28E-01	0.00E+00
FRA	9.55E+00	8.77E-02		8.85E+00	2.35E-02		7.43E+00	4.80E+00		3.09E+00	1.45E+00
GBR	6.26E+00	5.00E-02		5.05E+00	5.10E-02		1.87E+00	4.60E-02		1.97E+00	5.10E-02

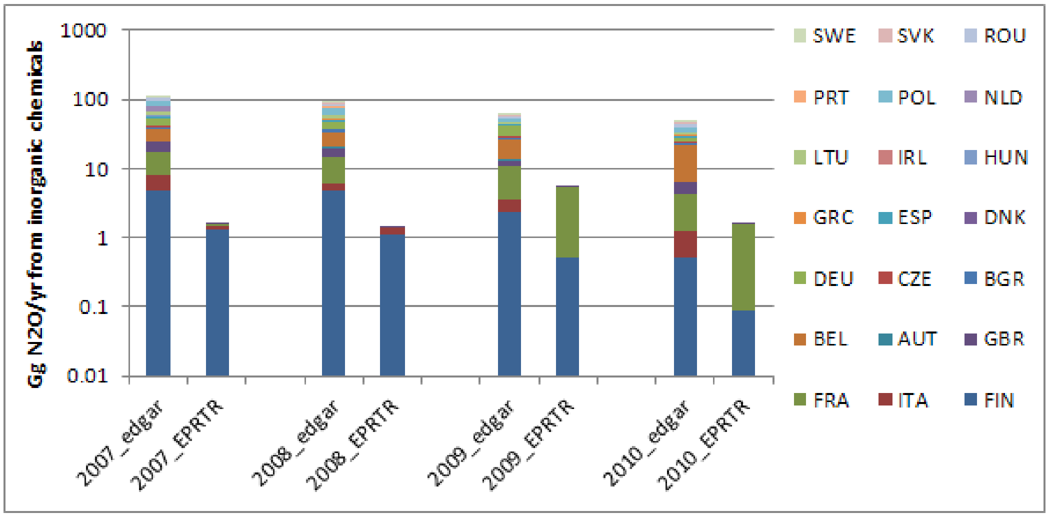

Fig. 10: Comparison of the N2O emitted by inorganic chemicals production in EDGAR & EPRTR.

For the nitro-fertiliser production, there is more data reported by EPRTR than calculated by EDGAR, as can be seen in Fig. 11. The data in EDGAR (only for 6 EU-27 countries) is in the same range as reported by EPRTR, shows Table 10. The sometimes very strong gradient over two successive years in the EPRTR data, lets suggest that there is a relative high uncertainty on the reported emissions. For EDGAR it is needed to update the missing countries, as probably the activity data that is reported to UNFCCC is more subject to confidentiality and withheld than the data to be reported under EPRTR.

Table 10: Comparing N2O emissions from nitro-fertilizer production calculated by EDGAR (v4.2FT2010) and reported under EPRTR (v4.2). Only 6 countries have emission estimates in EDGAR, whereas 16 did report under EPRTR. The green colour indicates reasonable agreement, the orange indicates that EDGAR might underestimate the emissions, whereas the grey colour indicates that a potential check is needed on the very strong EPRTR gradients.

kton N2O	2007_edgar	2007_EPRTR	2008_edgar	2008_EPRTR	2009_edgar	2009_EPRTR	2010_edgar	2010_EPRTR
AUT	0.00E+00	0.00E+00	0.00E+00	1.05E+00	0.00E+00	0.00E+00	0.00E+00	2.05E-01
BEL	1.71E+00	2.50E+00	1.75E+00	3.08E+00	1.81E+00	3.43E+00	2.24E+00	4.17E+00
BGR	0.00E+00	6.82E-01	0.00E+00	1.87E+00	0.00E+00	3.32E-01	0.00E+00	5.24E-01
CZE	3.60E-01	1.85E+00	3.60E-01	1.26E+00	2.88E-01	7.99E-01	2.26E-01	2.42E-01
DEU	2.38E+00	9.74E+00	2.38E+00	9.37E+00	3.07E+00	2.38E+00	8.77E-01	9.73E-01
ESP	7.20E-01	3.16E+00	7.20E-01	2.58E+00	6.65E-01	2.90E+00	4.32E-01	1.55E+00
FIN	0.00E+00	3.47E+00	0.00E+00	3.77E+00	0.00E+00	2.03E+00	0.00E+00	4.50E-01
FRA	0.00E+00	1.08E+01	0.00E+00	8.55E+00	0.00E+00	6.03E+00	0.00E+00	3.47E+00
GBR	0.00E+00	5.23E+00	0.00E+00	4.70E+00	0.00E+00	3.64E+00	0.00E+00	4.25E+00
GRC	0.00E+00	1.42E+00	0.00E+00	1.36E+00	0.00E+00	1.18E+00	0.00E+00	1.38E+00
HUN	0.00E+00	2.92E+00	0.00E+00	1.56E-02	0.00E+00	4.27E-02	0.00E+00	3.50E-02
ITA	0.00E+00	3.40E+00	0.00E+00	8.36E-01	0.00E+00	8.09E-01	0.00E+00	2.65E-01
LTU	0.00E+00	1.04E+01	0.00E+00	5.59E+00	0.00E+00	1.65E+00	0.00E+00	1.80E+00
NLD	4.23E+00	9.98E+00	4.23E+00	1.66E+00	4.10E+00	1.44E+00	3.74E+00	7.87E-01
POL	1.42E+00	9.24E+00	1.30E+00	8.60E+00	3.78E-01	1.12E+00	3.92E-01	1.14E+00
PRT	0.00E+00	1.57E+00	0.00E+00	9.88E-01	0.00E+00	5.41E-01	0.00E+00	6.99E-01
ROU	0.00E+00	5.93E-01	0.00E+00	2.33E+00	0.00E+00	3.93E+00	0.00E+00	2.54E+00
SVK	0.00E+00	3.40E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SWE	0.00E+00	7.88E-01	0.00E+00	8.66E-01	0.00E+00	9.83E-01	0.00E+00	1.01E+00
Totals	1.08E+01	7.77E+01	1.07E+01	5.85E+01	1.03E+01	3.32E+01	7.90E+00	2.55E+01

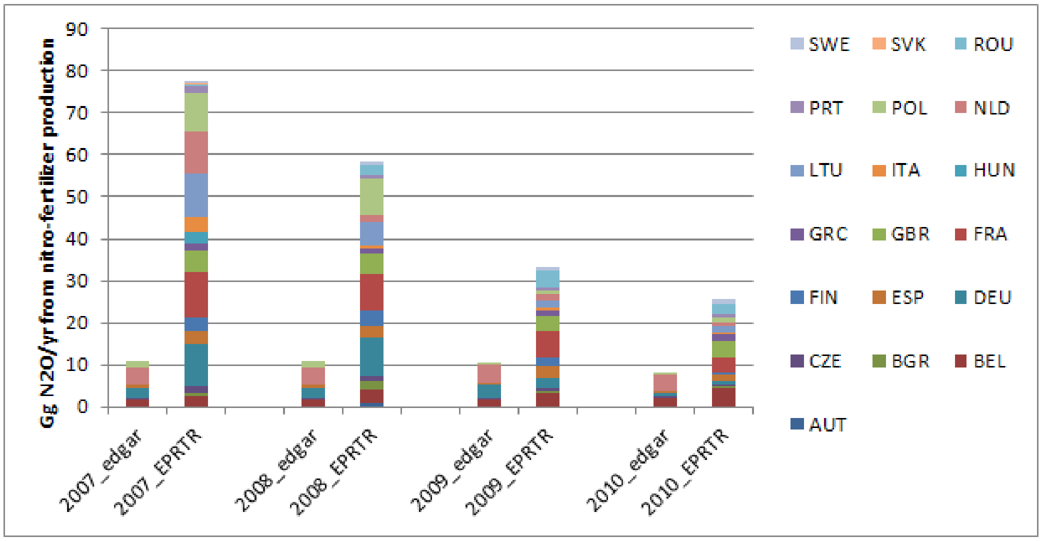

Fig. 11: Comparison of the N2O for nitro-fertilizer production in EDGAR & EPRTR.

For the remaining other bulk chemicals (mainly of organic type), Fig. 12 shows a relative good agreement between EDGAR (v4.2) and EPRTR (v4.2), indicating that the major contributors of EU-27 are taken up by both inventories. However, EDGAR's inventory on nitro-fertiliser production for only 4 countries could be extended with the estimates for additionally 6 countries, which are reporting also to EPRTR, as indicated in Table 11.

Table 11: Comparing N2O emissions from other (bulk) chemicals production calculated by EDGAR (v4.2FT2010) and reported under EPRTR (v4.2). Only 4 countries have emission estimates in EDGAR, whereas 10 did report under EPRTR. The green colour indicates reasonable agreement, the orange indicates that EDGAR might underestimate the emissions,and the red indicates that EDGAR is missing estimates.

kton N2O	2007_edgar	2007_EPRTR		2008_edgar	2008_EPRTR		2009_edgar	2009_EPRTR		2010_edgar	2010_EPRTR
BEL	0.00E+00	3.64E+00		0.00E+00	3.10E+00		0.00E+00	3.11E+00		0.00E+00	4.21E+00
CZE	0.00E+00	0.00E+00		0.00E+00	6.36E-02		0.00E+00	5.55E-01		0.00E+00	6.94E-01
DEU	1.98E+01	2.24E+01		1.98E+01	2.10E+01		2.56E+01	2.94E+01		7.31E+00	4.03E+00
FRA	8.10E+00	9.77E-01		8.10E+00	1.09E+00		6.80E+00	1.76E+00		2.83E+00	1.51E+00
GBR	6.58E+00	4.53E+00		6.58E+00	4.45E+00		2.44E+00	9.63E-01		2.57E+00	7.04E-01
ITA	3.66E+00	2.60E+00		3.31E+00	2.33E+00		3.50E+00	2.89E+00		2.07E+00	1.87E+00
NLD	0.00E+00	5.54E+00		0.00E+00	1.72E+00		0.00E+00	1.97E+00		0.00E+00	2.40E+00
POL	0.00E+00	6.51E+00		0.00E+00	4.57E+00		0.00E+00	2.48E+00		0.00E+00	2.69E+00
PRT	0.00E+00	8.50E-01		0.00E+00	8.28E-01		0.00E+00	1.09E-01		0.00E+00	4.24E-01
SWE	0.00E+00	2.40E-02		0.00E+00	2.13E-02		0.00E+00	2.20E-02		0.00E+00	1.90E-02
Totals	3.81E+01	4.72E+01		3.78E+01	3.94E+01		3.83E+01	4.34E+01		1.48E+01	1.87E+01

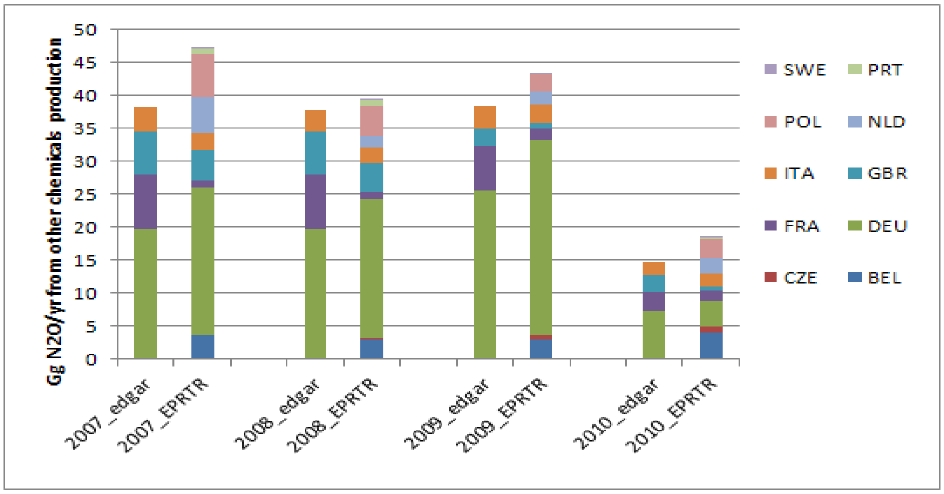

Fig. 12: Comparison of the N2O from other (bulk) (mainly organic) chemicals production in EPRTR (v4.2) and EDGAR (v4.2FT2010). The major emitter (Germany – green) is in agreement between the two inventories. Edgar misses 6 non-negligibly emitting countries in EU-27.

Finally the industrial wastewater, which is also an important emission source of N2O has been reported to EPRTR (v4.2) and as such, compared to EDGAR (v4.2FT2010). As can be seen in Table 12, only 9 countries reported emissions of these facilities, with relative high emissions (up to two orders of magnitude higher than in EDGAR), as shown in Fig.13 . It should be noted that the industrial wastewater is only 25% of the total wastewater. The domestic wastewater emissions of N2O have been taken up from EDGAR solely.

Table 12: Comparing N2O emissions from industrial wastewater treatment calculated by EDGAR (v4.2FT2010) and reported under EPRTR (v4.2). Only 9 countries report industrial wastewater emissions of N2O, whereas, all 27 EU countries are according to EDGAR calculations emitting N2O. The values reported are much higher (at least one order of magnitude) than calculated and therefore indicated in orange. The reported value of Belgium seems out of range and is indicated grey asking for a unit check by the EPRTR responsibles.

kton N2O	2007_edgar	2007_EPRTR		2008_edgar	2008_EPRTR		2009_edgar	2009_EPRTR		2010_edgar	2010_EPRTR
DEU	5.91E-02	2.16E+00		1.01E-02	2.21E+00		2.16E-01	2.00E+00		3.37E-01	1.88E+00
ROU	2.00E-01	8.28E-01		2.84E-03	1.02E+00		1.54E-01	8.68E-01		1.13E-01	9.08E-01
FIN	4.63E-02	9.78E-02		4.24E-02	1.02E-01		4.69E-03	1.30E-01		1.00E-02	1.27E-01
SWE	1.01E-01	5.66E-02		7.50E-02	8.37E-02		7.15E-02	8.53E-02		1.02E-01	5.50E-02
ESP	7.44E-01	5.37E-02		8.06E-01	0.00E+00		8.13E-01	0.00E+00		8.18E-01	0.00E+00
GRC	1.72E-01	3.79E-02		1.72E-01	3.80E-02		2.07E-01	0.00E+00		2.09E-01	0.00E+00
GBR	9.96E-01	1.70E-02		9.99E-01	1.70E-02		1.00E+00	3.98E-02		9.92E-01	4.51E-02
AUT	1.33E-01	1.28E-02		1.32E-01	1.36E-02		1.34E-01	1.33E-02		1.35E-01	1.35E-02
BEL	1.51E-01	0.00E+00		1.52E-01	0.00E+00		1.11E-01	4.12E+01		1.42E-01	1.19E-02

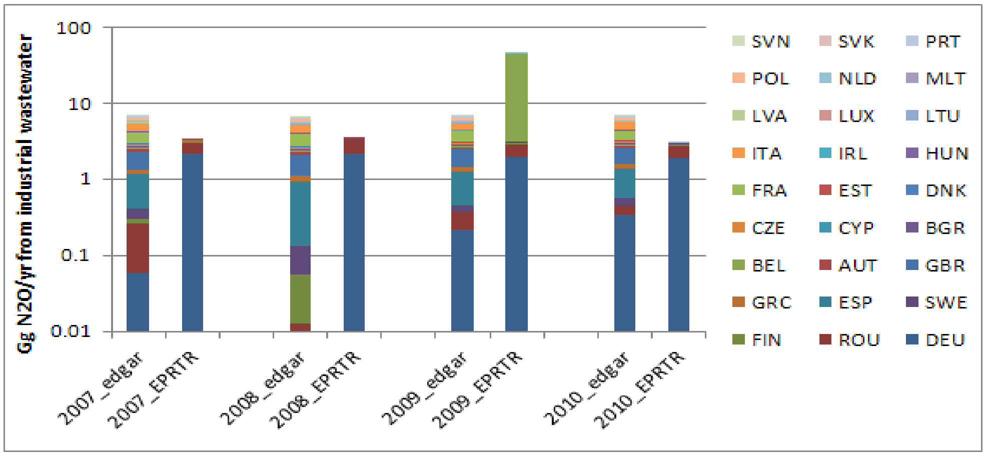

Fig. 13: Comparison of the N2O from other (bulk) (mainly organic) chemicals production in EPRTR (v4.2) and EDGAR (v4.2FT2010). The major emitter (Germany – green) is in agreement between the two inventories. Edgar misses 6 non-negligibly emitting countries in EU-27.

A variant for each of the above mentioned sectors where EPRTR data are reported have been calculated applying method 1 and using solely the EPRTR official emissions for the years reported (2007-2010) for those countries where reporting is done. All missing countries were gapfilled with EDGAR data. These subsets of data are made available under the "Option" N2O emission gridmaps for 2007-2010.

For the industrial process and product use the N2O emission gridmap contains only EPRTRv4.2 emissions for chemical industry reported by the countries to EPRTR. For the waste, only the industrial wastewater estimates are used from EPRTR. But for oil refineries and power plants the reported emissions are the "Option" case representing the complete sector for the respective 10 and 18 reporting EU-27 countries.

4. Conclusion

For the FP7 EU project InGOS ("Integrated non-CO2 Greenhouse gas Observing System") a new bottom-up inventory for CH4 and N2O anthropogenic emissions has been developed based on the EDGARv4.2 FT2010 country and sector-specific time series 2000-2010 and using the point source data from the European Pollutant Release and Transfer Register (E-PRTR) data base.

A combination of global consistent and complete coverage of the N2O and CH4 emissions have been sought with the EDGAR data, the new E-PRTR data brought for the European region very specific point source data. The latter was in a first step used to improve significantly the geospatial distribution of the emissions. Using point source data in the geospatial distribution of the country-totals obviously introduces large variations in emissions over the country. This distribution has also an impact on the spatial uncertainty and is subject to errors in coordinates of the facility locations. In addition it was noticed that EPRTR suffers from potentially incomplete reporting. Not all countries are reporting the CH4 and N2O emissions from the different types of facilities in EPRTR. Some facilities might potentially stay just below the capacity exempting them from the obligatory reporting.

In a second step, a comparison of the reported emissions in EPRTR and calculated ones in EDGAR indicated that a variant of an inventory with solely reported data for some sectors in some European countries is interesting. This has been delivered as an “Option” for 2007-2010 for the concerned sectors. For CH4 these are: coal mining, oil & gas production, solid waste and wastewater (industrial). For N2O these are: power plants, oil refineries, chemicals production and wastewater (industrial).

These EDGAR-INGOS inventory for CH4 and N2O has been delivered for each year (2000-2010) with sector-specific breakdown. These global gridmaps of 0.1degx0.1deg resolution with improvements at European level aim at serving in the first place the inverse modeling community of the INGOS project with a standard dataset for anthropogenic non-CO2 greenhouse gases. Further improvements can be envisaged with the feedback of the modeling results.

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Annex: Sector-specific global totals for CH4 in the INGOS dataset.

Table A.1.: Global total of Tg CH4 per year, as in the EDGARv4.2FT2010 dataset.

Dataset: v4.2_FT2010_CH4_N2O_Ingos(edgar)	- Substance : CH4	Unit: Tg									
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Agricultural soils	3.36E+01	3.31E+01	3.28E+01	3.24E+01	3.36E+01	3.44E+01	3.55E+01	3.65E+01	3.75E+01	3.79E+01	3.76E+01
Agricultural waste burning	1.35E+00	1.39E+00	1.36E+00	1.44E+00	1.47E+00	1.48E+00	1.50E+00	1.58E+00	1.58E+00	1.56E+00	1.60E+00
enteric fermentation	9.13E+01	9.19E+01	9.30E+01	9.44E+01	9.57E+01	9.69E+01	9.80E+01	9.91E+01	1.00E+02	1.01E+02	1.01E+02
manure management	1.08E+01	1.09E+01	1.10E+01	1.11E+01	1.12E+01	1.13E+01	1.14E+01	1.14E+01	1.15E+01	1.16E+01	1.17E+01
energy_manufacturing_transformation	4.80E+00	4.87E+00	5.11E+00	5.35E+00	5.51E+00	5.69E+00	5.83E+00	6.11E+00	6.19E+00	6.15E+00	6.74E+00
Industrial_process (chemical+iron)	1.93E-01	1.92E-01	1.97E-01	2.04E-01	2.18E-01	2.22E-01	2.28E-01	2.41E-01	2.52E-01	2.62E-01	2.74E-01
Residential	1.14E+01	1.14E+01	1.12E+01	1.14E+01	1.15E+01	1.16E+01	1.17E+01	1.18E+01	1.23E+01	1.24E+01	1.28E+01
Non-road_transportation	6.64E-02	6.42E-02	6.71E-02	6.85E-02	7.33E-02	7.45E-02	7.85E-02	8.23E-02	8.02E-02	7.83E-02	8.28E-02
Road_transportation	6.76E-01	6.62E-01	6.55E-01	6.43E-01	6.37E-01	6.20E-01	6.23E-01	6.30E-01	5.89E-01	5.97E-01	6.13E-01
waste_water	2.77E+01	2.83E+01	2.88E+01	2.93E+01	2.98E+01	3.00E+01	3.04E+01	3.08E+01	3.11E+01	3.13E+01	3.18E+01
solid_waste	2.68E+01	2.67E+01	2.71E+01	2.77E+01	2.79E+01	2.83E+01	2.90E+01	2.92E+01	2.95E+01	2.96E+01	2.99E+01
gas_production_distribution	4.08E+01	4.28E+01	4.28E+01	4.44E+01	4.51E+01	4.51E+01	4.57E+01	4.61E+01	4.74E+01	4.76E+01	4.92E+01
oil_production_refineries	1.68E+01	1.54E+01	1.62E+01	1.70E+01	1.76E+01	1.85E+01	1.97E+01	2.05E+01	2.12E+01	2.13E+01	2.24E+01
Fugitive_from_solid	2.85E+01	2.93E+01	3.04E+01	3.38E+01	3.74E+01	4.06E+01	4.27E+01	4.44E+01	4.75E+01	4.86E+01	5.13E+01
Large scale biomass burning	1.43E+04	1.74E+04	2.31E+04	1.68E+04	2.04E+04	2.23E+04	3.10E+04	2.88E+04	1.76E+04	2.11E+04	1.61E+04
Totals	*3.09E+02*	*3.14E+02*	*3.23E+02*	*3.25E+02*	*3.38E+02*	*3.46E+02*	*3.63E+02*	*3.67E+02*	*3.64E+02*	*3.70E+02*	*3.72E+02*
Totals - large scale biomass burning	*2.94E+02*	*2.96E+02*	*3.00E+02*	*3.09E+02*	*3.17E+02*	*3.24E+02*	*3.32E+02*	*3.38E+02*	*3.46E+02*	*3.49E+02*	*3.56E+02*

Annex: Sector-specific global totals for N2O in the INGOS dataset.

Table A.1.2: Global total of Tg N2O per year, as in the EDGARv4.2FT2010 dataset.

Dataset: INGOS-v4.2FT2010(JRC_INGOS)	**- Substance: N2O**	**- Units: Ktons - (first 500 lines)**									
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Agricultural soils	4.16E+03	4.21E+03	4.29E+03	4.35E+03	4.47E+03	4.51E+03	4.57E+03	4.62E+03	4.67E+03	4.77E+03	4.89E+03
Manure management	3.10E+02	3.11E+02	3.13E+02	3.16E+02	3.19E+02	3.24E+02	3.28E+02	3.32E+02	3.36E+02	3.39E+02	3.43E+02
Agricultural waste burning	3.49E+01	3.61E+01	3.53E+01	3.73E+01	3.82E+01	3.84E+01	3.89E+01	4.09E+01	4.09E+01	4.07E+01	4.10E+01
Industrial (chemicals and solvents)	6.66E+02	6.39E+02	5.91E+02	5.98E+02	5.98E+02	5.99E+02	5.65E+02	5.72E+02	5.20E+02	4.61E+02	4.45E+02
Energy-manufacturing-transformation	2.23E+02	2.27E+02	2.36E+02	2.52E+02	2.66E+02	2.76E+02	2.93E+02	3.08E+02	3.20E+02	3.18E+02	3.38E+02
Indirect emissions from NOx and NH3	5.67E+02	5.98E+02	6.88E+02	6.18E+02	6.36E+02	6.58E+02	7.88E+02	7.26E+02	6.33E+02	7.04E+02	6.99E+02
Indirectly emitted N2O from agriculture	7.92E+02	8.01E+02	8.19E+02	8.30E+02	8.53E+02	8.58E+02	8.73E+02	8.82E+02	8.94E+02	9.24E+02	9.48E+02
Oil production and refineries	7.52E+00	7.34E+00	7.11E+00	7.69E+00	7.51E+00	7.79E+00	7.50E+00	7.34E+00	7.10E+00	7.02E+00	7.18E+00
Buildings (residential and other)	2.70E+02	2.72E+02	2.70E+02	2.71E+02	2.82E+02	2.86E+02	2.89E+02	2.90E+02	2.89E+02	2.89E+02	2.94E+02
Solid waste and wastewater	3.35E+02	3.41E+02	3.46E+02	3.53E+02	3.57E+02	3.62E+02	3.66E+02	3.71E+02	3.75E+02	3.79E+02	3.84E+02
Road transportation	2.68E+02	2.61E+02	2.57E+02	2.50E+02	2.46E+02	2.38E+02	2.37E+02	2.36E+02	2.23E+02	2.19E+02	2.22E+02
Non-road transportation	7.24E+01	7.07E+01	7.47E+01	7.65E+01	7.71E+01	8.12E+01	8.52E+01	8.73E+01	7.80E+01	7.61E+01	7.96E+01
large scale biomass burning	1.13E+03	1.21E+03	1.27E+03	1.19E+03	1.22E+03	1.33E+03	1.56E+03	2.04E+03	1.39E+03	1.27E+03	1.84E+03
Total	***8.84E+03***	***8.98E+03***	***9.19E+03***	***9.15E+03***	***9.38E+03***	***9.57E+03***	***1.00E+04***	***1.05E+04***	***9.78E+03***	***9.79E+03***	***1.05E+04***
Total -large scale biomass burning	**7.71E+03**	**7.78E+03**	**7.93E+03**	**7.96E+03**	**8.15E+03**	**8.24E+03**	**8.44E+03**	**8.47E+03**	**8.39E+03**	**8.53E+03**	**8.69E+03**

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Title: CH_4 and N_2O Emission inventory compiled by EDGAR using also EPRTR data for the INGOS project

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Abstract
This report documents the EDGAR INGOS emission inventory for CH4 and N2O, as publicly made available on: http://edgar.jrc.ec.europa.eu/ingos/index.php?SECURE=123.
The EDGAR INGOS CH4 and N2O emission inventory provides bottom-up estimates of global anthropogenic CH4 and N2O emissions for the period 2000-2010. The EDGAR InGOS product is an update of the EDGARv4.2FT2010 inventory, taking into account emissions reported as point sources by facilities under the European Pollutant Release and Transfer Register (E-PRTR) for (1) power plants (N2O), (2) oil refineries (CH4 and N2O), (3) coal mining (CH4), (4) production of oil and gas (CH4), (5) chemicals production (inorganic, nitro-fertilizers and other bulk chemicals) (N2O), industrial process and product use (N2O), (6) solid waste - landfills (CH4), (7) industrial wastewater treatment (CH4 and N2O). In a first step gridmaps have been improved for the European region taking into account the geospatial data of the E-PRTR database. In addition, for the last 4 years an option is given to select inventories solely based on officially reported emission data (for the categories covered by E-PRTR), gapfilled with EDGARv4.2FT2010 for non-reporting countries.

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