
AIR EMISSIONS IN FRANCE

Mainland France

Greenhouse gases (GHG)

(Emissions_FRmt_GESEN)

Note : the data presented in this document are revised annually in order to take into account the continuous improvements in knowledge, methodologies and reporting rules. Users are advised to ensure they are working from the most recent updates which may be published without prior notice.

Figures and data tables are not translated.

These results come from work carried out with the financial support of Ministry of Ecology, Energy, Sustainable Development and Spatial Planning (MEEDDAT)

(last updated May 2009)

Substances and index currently monitored

Greenhouse effect : CO₂, CH₄, N₂O, HFCs (total and speciation for 8 compounds), PFCs (total and speciation for 5 compounds), SF₆, global warming potential index over a period of 100 years (GWP).

Emissions in relation to key indicators such as population, area, gross domestic product (GDP), primary energy consumption, etc.

Emissions are presented in the form of charts for each substance and the main source categories in five-year intervals until 2000 and, thereafter, annually. The years corresponding to the maximum and minimum values are also included. Results are provisional for 2008. More detailed data highlighting various parameters such as sectors, fuels, etc. are available (by downloading the complete report : www.citepa.org/emissions/nationale/index_en.htm). Data are also available on CD-ROM at CITEPA.

1 Carbon Dioxide - CO₂

Source : CITEPA / CORALIE / SECTEN format - last updated 18 February 2009

Emissions (LULUCF* included)		Variations	
Survey period :	since 1960	Variation 2007 / 1980 :	-30 %
Emissions in 2007 :	309 Mt	Variation 2007 / 1990 :	-10 %
Maximum observed :	485 Mt in 1973	Variation 2007 / maximum :	-36 %
Minimum observed :	270 Mt in 1960	Variation 2007 / minimum :	+14 %

Main emitters

Main emitters in 2007 (sub-sectors ≥ 95 % of total emissions, LULUCF* excluded) :

1 - Residential	15 %
2 - Diesel-engined heavy duty vehicles	8.9 %
3 - Catalysed diesel-engined passenger cars	8.4 %
4 - Electricity production	8.1 %
5 - Tertiary, commercial and institutional	7.1 %
6 - Non-metallic mineral and construction materials	7.0 %
7 - Catalysed gasoline-engined passenger cars	5.8 %
8 - Iron and steel industry	5.0 %
9 - Chemical industry	4.8 %
10 - Petroleum refining	4.7 %
11 - Catalysed diesel-engined light duty cars	3.6 %
12 - Food and drink industry	3.0 %
13 - Non-catalysed diesel-engined passenger cars	2.3 %
14 - Other agriculture	1.9 %
15 - District heating	1.8 %
16 - Non-catalysed diesel-engined light duty cars	1.4 %
17 - Other energy conversion sectors	1.3 %
18 - Construction	1.2 %
19 - Paper, cardboard	1.2 %
20 - Capital goods and mobile machinery	1.0 %
21 - French civil aviation (**)	0.9 %
22 - Other manufacturing industry	0.9 %

* LULUCF : Land Use, Land Use Change and Forestry

** As defined by UNFCCC – domestic aviation emissions

Comments

In 2007, CO₂ emissions represented 388 Mt (LULUCF* and biomass excluded). Including LULUCF*, CO₂ emissions attained, 309 Mt (LULUCF* corresponded to -79 Mt). LULUCF* are limited in the Kyoto protocol.

All sectors contribute to the emissions in variable proportions according to the years. In 2007, the sectors were as followed by importance order for mainland France (LULUCF* excluded) :

- road transport : 32% emissions,
- manufacturing industry : 25% including nearly a third from non-metallic mineral and construction materials,
- residential/tertiary : 22% including two thirds from the residential sub-sector,
- energy conversion : 17%, nearly half of it is a result of electricity production,
- agriculture/forestry : 2%,
- the other transport sector : 2%.

In 1990, the distribution was different than that in 2007 :

- manufacturing industry : 29%,
- road transport : 28%,
- residential/tertiary : 21%,
- energy conversion : 18%,
- agriculture/forestry : 2%,
- the other transport sector : 2%.

Since 1960, emissions increase (+93 Mt, an increase of 32% during the period 1960-2007). Compared to 1990, the level of emissions is lower of 3 Mt, approximately -0.8% only whereas primary energy consumption has increased of 20%.

In 1991, 1998 and 2005, emissions were much higher than in the other years because of particular events.

The use of fossil fuels and biomass are the main sources of CO₂ emissions (95% of total emissions, LULUCF* excluded) which are partly reduced by sinks due to photosynthesis and the possible fixation of carbon in soils (included in LULUCF* sector) in the absence of other withholdings as the geological sequestration of CO₂ which could be considered in the future.

As emissions can be sensitive to weather variations, the fluctuation observed can be partly explained for that reason.

Possible measures to limit CO₂ emissions are presented in the Climate Plan 2004-2012 updated in 2006.

* LULUCF : Land Use, Land Use Change and Forestry



EMISSIONS DANS L'AIR EN FRANCE METROPOLITAINE (unité Tg = Mt)

Source CITEPA / CORALIE / format SECTEN

mise à jour : 18 février 2009

Secten_niv_1_SERRE-d/CO2.xls

Année	Transfor- mation énergie	Industrie manufac- turière	Rési- dentiel / tertiaire	Agricul- ture/syl- viculture hors UTCf (**)	Transport routier	Autres transports (*)	TOTAL hors UTCF (**)	UTCf (**)	TOTAL avec UTCf (**)	Hors total (*)	
1960	bilan secteur (a)	81	127	49	3,9	21	13,3	295	-26	270	6
	<i>biomasse hors bilan (b)</i>	<i>0,3</i>	<i>2,7</i>	<i>28</i>	<i>0,2</i>	<i>0,0</i>	<i>0,0</i>	<i>31</i>			
1965	bilan secteur (a)	97	153	63	5,4	34	11,0	363	-34	329	8
	<i>biomasse hors bilan (b)</i>	<i>0,5</i>	<i>3,8</i>	<i>28</i>	<i>0,2</i>	<i>0,0</i>	<i>0,0</i>	<i>32</i>			
1970	bilan secteur (a)	113	164	113	7,6	52	8,4	458	-52	405	15
	<i>biomasse hors bilan (b)</i>	<i>0,8</i>	<i>4,9</i>	<i>28</i>	<i>0,2</i>	<i>0,0</i>	<i>0,0</i>	<i>34</i>			
1973	bilan secteur (a)	139	174	137	9,0	69	8,7	537	-52	485	21
	<i>biomasse hors bilan (b)</i>	<i>1,1</i>	<i>5,6</i>	<i>29</i>	<i>0,2</i>	<i>0,0</i>	<i>0,0</i>	<i>35</i>			
1975	bilan secteur (a)	124	153	114	8,5	70	8,8	479	-60	420	18
	<i>biomasse hors bilan (b)</i>	<i>1,3</i>	<i>5,3</i>	<i>30</i>	<i>0,2</i>	<i>0,0</i>	<i>0,0</i>	<i>37</i>			
1980	bilan secteur (a)	147	144	112	9,4	85	8,1	506	-66	440	17
	<i>biomasse hors bilan (b)</i>	<i>1,8</i>	<i>5,4</i>	<i>28</i>	<i>0,2</i>	<i>0,0</i>	<i>0,0</i>	<i>35</i>			
1985	bilan secteur (a)	83	112	100	8,8	90	7,0	400	-51	350	13
	<i>biomasse hors bilan (b)</i>	<i>1,9</i>	<i>6,1</i>	<i>34</i>	<i>0,2</i>	<i>0,0</i>	<i>0,0</i>	<i>43</i>			
1990	bilan secteur (a)	69	113	83	9,4	109	7,6	391	-47	344	16
	<i>biomasse hors bilan (b)</i>	<i>3,4</i>	<i>6,8</i>	<i>34</i>	<i>0,2</i>	<i>0,0</i>	<i>0,0</i>	<i>44</i>			
1995	bilan secteur (a)	60	106	87	8,9	117	7,9	387	-59	327	18
	<i>biomasse hors bilan (b)</i>	<i>4,4</i>	<i>7,4</i>	<i>33</i>	<i>0,1</i>	<i>0,4</i>	<i>0,0</i>	<i>45</i>			
2000	bilan secteur (a)	65	104	88	8,6	125	8,4	398	-53	346	24
	<i>biomasse hors bilan (b)</i>	<i>5,3</i>	<i>7,2</i>	<i>31</i>	<i>0,2</i>	<i>0,9</i>	<i>0,0</i>	<i>45</i>			
2001	bilan secteur (a)	57	105	97	8,7	128	8,4	404	-62	342	22
	<i>biomasse hors bilan (b)</i>	<i>5,7</i>	<i>5,5</i>	<i>30</i>	<i>0,2</i>	<i>0,9</i>	<i>0,0</i>	<i>42</i>			
2002	bilan secteur (a)	62	101	87	8,6	128	8,5	396	-69	327	22
	<i>biomasse hors bilan (b)</i>	<i>6,1</i>	<i>7,0</i>	<i>27</i>	<i>0,2</i>	<i>0,9</i>	<i>0,0</i>	<i>42</i>			
2003	bilan secteur (a)	64	102	91	8,1	128	8,4	401	-73	328	23
	<i>biomasse hors bilan (b)</i>	<i>6,4</i>	<i>7,2</i>	<i>30</i>	<i>0,2</i>	<i>0,9</i>	<i>0,0</i>	<i>44</i>			
2004	bilan secteur (a)	64	100	96	8,5	128	8,3	405	-75	330	25
	<i>biomasse hors bilan (b)</i>	<i>6,7</i>	<i>7,4</i>	<i>30</i>	<i>0,2</i>	<i>1,0</i>	<i>0,0</i>	<i>45</i>			
2005	bilan secteur (a)	68	101	95	8,1	127	8,2	408	-78	330	24
	<i>biomasse hors bilan (b)</i>	<i>6,5</i>	<i>7,6</i>	<i>30</i>	<i>0,2</i>	<i>1,1</i>	<i>0,0</i>	<i>46</i>			
2006	bilan secteur (a)	65	99	92	8,0	126	8,1	398	-78	320	25
	<i>biomasse hors bilan (b)</i>	<i>6,5</i>	<i>7,7</i>	<i>29</i>	<i>0,2</i>	<i>2,0</i>	<i>0,0</i>	<i>45</i>			
2007	bilan secteur (a)	66	97	84	7,8	124	8,1	388	-79	309	26
	<i>biomasse hors bilan (b)</i>	<i>6,8</i>	<i>8,0</i>	<i>28</i>	<i>0,2</i>	<i>4,1</i>	<i>0,0</i>	<i>47</i>			
2008 (e)	bilan secteur (a)	61	95	89	8,4	118	8,0	380	-79	301	25
	<i>biomasse hors bilan (b)</i>	<i>7,2</i>	<i>8,0</i>	<i>28</i>	<i>0,1</i>	<i>6,4</i>	<i>0,0</i>	<i>50</i>			

(a) Bilan secteur net hors émissions CO₂ des énergies renouvelables, en particulier issues de la biomasse.(b) CO₂ issu de la combustion de la biomasse, hors bilan CO₂ du secteur.

(*) selon définitions de la CCNUCC - les émissions répertoriées hors total ne sont pas incluses, à savoir les émissions maritimes et aériennes internationales, ainsi que les émissions des sources non-anthropiques.

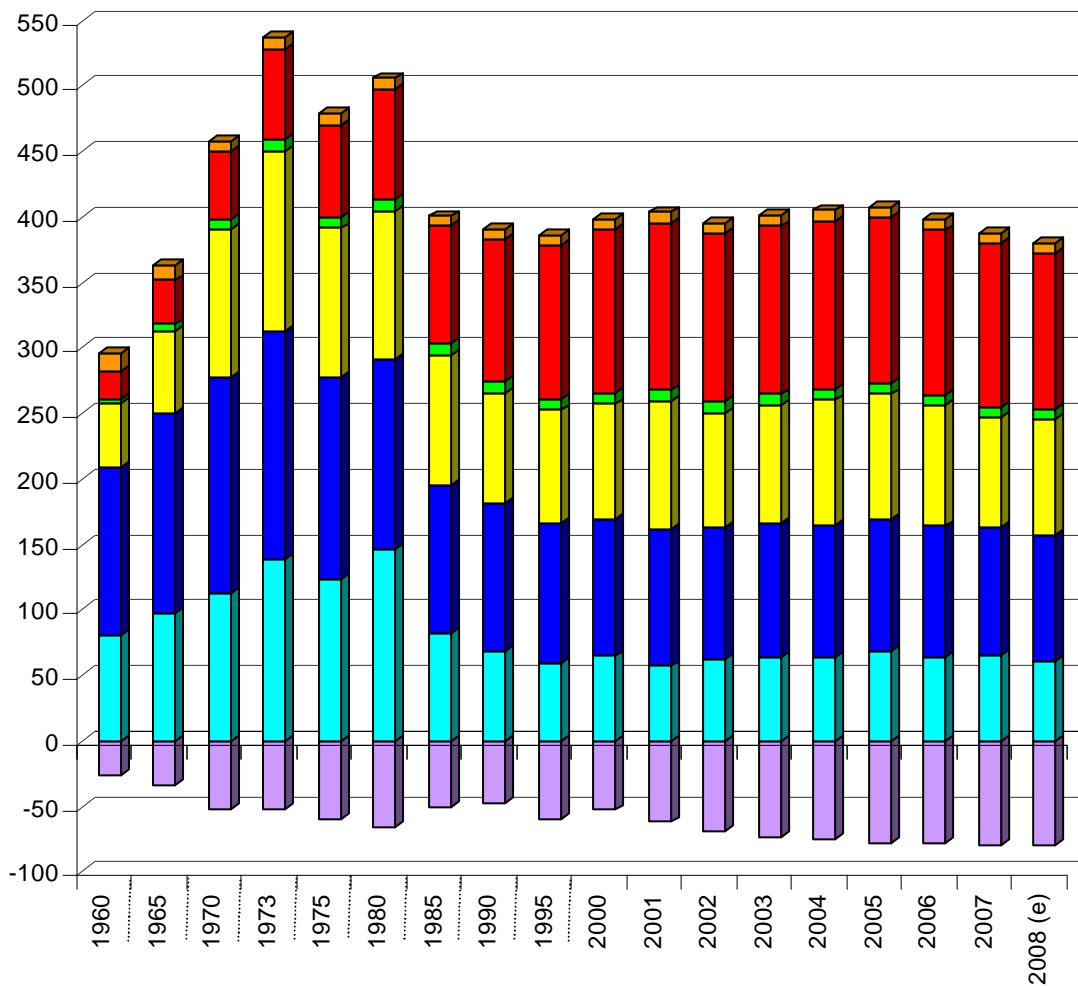
(**) Utilisation des Terres, leur Changement et la Forêt

(e) estimation préliminaire

Avertissement : ces valeurs sont régulièrement révisées et complétées afin de tenir compte de l'amélioration permanente des connaissances, des méthodes d'estimation et des règles de restitution. Les utilisateurs sont invités à s'assurer de l'existence de mises à jour plus récentes.

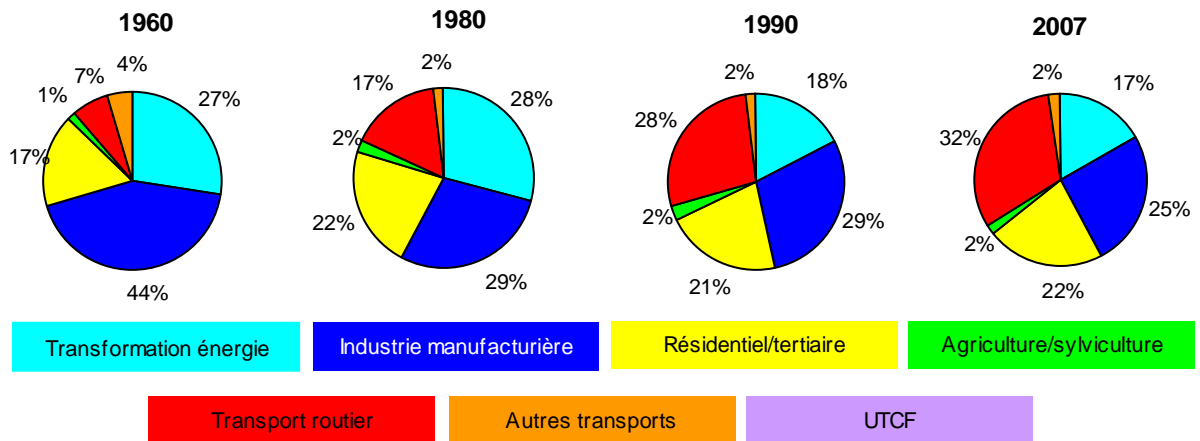
CO₂

Emissions atmosphériques par secteur en France métropolitaine en Mt



(e) estimation préliminaire

RÉPARTITION HORS UTCF



2 Methane – CH₄

Source : CITEPA / CORALIE / SECTEN format - last updated 18 February 2009

Emissions (LULUCF* included)		Variations	
Survey period :	since 1990		
Emissions in 2007 :	2 562 kt	Variation 2007 / 1990 :	-18 %
Maximum observed :	3 125 kt in 1991	Variation 2007 / maximum :	-18 %
Minimum observed :	2 562 kt in 2007	Variation 2007 / minimum :	0 %

Main emitters

Main emitters in 2007 (sub-sectors ≥ 95 % of total emissions, LULUCF* excluded) :

1 - Livestock	79 %
2 - Waste treatment	13 %
3 - Extraction and distribution of gaseous fuels	3.5 %

* LULUCF : Land Use, Land Use Change and Forestry

Comments

Emissions of CH₄ (LULUCF* excluded) reached 2 518 kt in 2007 in mainland France. CH₄ emissions from LULUCF* are due to absorption by forest soils and represent about 44 kt (2% of the sum of the sectors).

The sectors contributing to the CH₄ emissions, LULUCF* excluded, are in 2007 :

- agriculture/forestry (80%),
- manufacturing industry (13%),
- energy conversion (4%),
- residential/tertiary (3%),
- road transport (less than 1%),
- other transports (less than 1%).

During the 1990-2007 period, total emissions LULUCF excluded reduced of 18%, i.e. -538 kt.

The major sources of methane in agriculture/forestry were enteric fermentation of ruminants and manure management. Although agriculture/forestry emissions have decreased (-5.5%, i.e. -118 kt) between 1990 and 2007, the intensification of milk production (less cows with more efficiency) contributed to a higher level of the emissions in 2007 than in 1990 for this sector.

In the manufacturing industry sector, land filling is the first source for emissions (97% of this sector emissions, LULUCF* excluded, in 2007), but emissions from this sector increased until 1996, as a result of an increase in the quantities of waste generated. Thereafter, emissions tendency was to fell, following the development and improvement of biogas recovery.

In the sector of energy conversion, it should be noted that coal mining and natural gas transport and distribution are significant sources. Emissions from these two last activities are also decreasing (-73% i.e. -249 kt during the 1990-2007 period) because of the progressive phasing-out of coal mining in France and the upgrading programme of the gas network.

Although emission level from road transport was very low, they fell of 75% (-12 kt) between 1990 and 2007.

Without any new measures, a significant reduction in emissions is expected in the coming years (in agriculture and wastelands), potentially estimated to be 4 % of total emissions, LULUCF* excluded. This CH₄ emission decrease should significantly contribute to that induced by the Climate Plan.

* LULUCF : Land Use, Land Use Change and Forestry

CH₄

EMISSIONS DANS L'AIR EN FRANCE METROPOLITAINE (unité Gg = kt)

Source CITEPA / CORALIE / format SECTEN		mise à jour : 18 février 2009					Secten_niv_1_SERRE-d/CH4.xls			
Année	Transformation énergie	Industrie manufacturière	Résidentiel / tertiaire	Agriculture/sylviculture hors UTCF (**)	Transport routier	Autres transports (*)	TOTAL hors UTCF (**)	UTCF (**)	TOTAL avec UTCF (**)	Hors total (*)
1990	342	386	186	2 125	16,3	0,6	3 056	56,9	3 113	116
1991	323	405	227	2 096	16,1	0,5	3 068	57,5	3 125	116
1995	321	471	185	2 077	12,8	0,7	3 067	51,3	3 119	119
2000	220	414	149	2 075	8,9	0,7	2 867	49,9	2 917	122
2001	176	395	137	2 085	8,2	0,7	2 802	46,8	2 849	123
2002	167	380	119	2 065	7,4	0,8	2 740	48,4	2 788	124
2003	147	372	123	2 021	6,6	0,8	2 669	50,2	2 719	124
2004	102	365	117	1 998	6,1	0,8	2 589	46,5	2 635	125
2005	94,3	354	108	2 000	5,3	0,8	2 562	47,7	2 610	125
2006	93,0	336	97,7	1 997	4,7	0,8	2 530	44,8	2 574	130
2007	93,4	326	86,0	2 007	4,2	0,8	2 518	44,0	2 562	131
2008 (e)	93,4	316	79,9	2 007	3,6	0,8	2 501	44,0	2 545	131

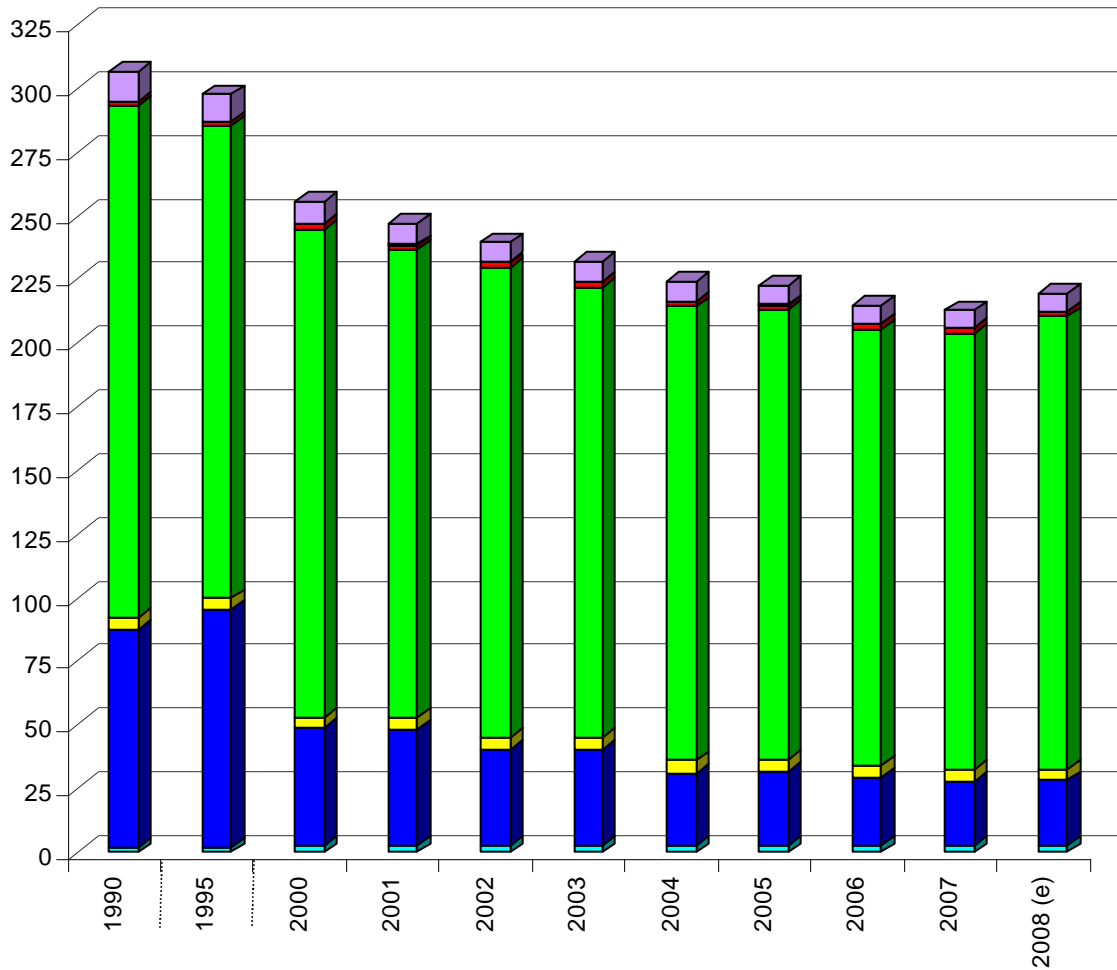
(*) selon définitions de la CCNUCC - les émissions répertoriées hors total ne sont pas incluses, à savoir les émissions maritimes et aériennes internationales, ainsi que les émissions des sources non-anthropiques.

(**) Utilisation des Terres, leur Changement et la Forêt

(e) estimation préliminaire

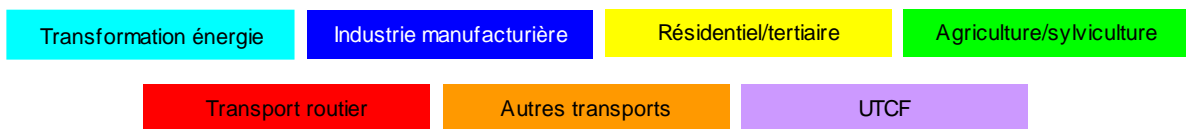
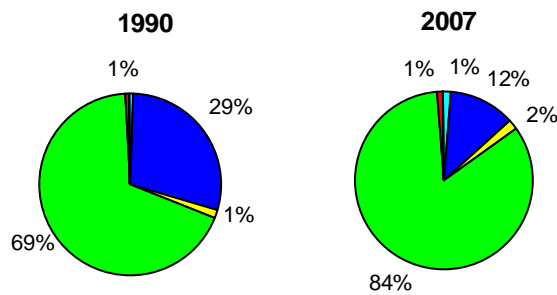
CH₄

Emissions atmosphériques par secteur en France métropolitaine en kt



(e) estimation préliminaire

RÉPARTITION HORS UTCF



3 Nitrous oxide – N₂O

Source : CITEPA / CORALIE / SECTEN format - last updated 18 February 2009

Emissions (LULUCF* included)

Variations

Survey period :	since 1990		
Emissions in 2007 :	213 kt	Variation 2007 / 1990 :	-31 %
Maximum observed :	306 kt in 1990	Variation 2007 / maximum :	-31 %
Minimum observed :	213 kt in 2007	Variation 2007 / minimum :	0 %

Main emitters

Main emitters in 2007 (sub-sectors ≥ 95 % of total emissions, LULUCF* excluded) :

1 - Crops	74 %
2 - Livestock	9.3 %
3 - Chemical industry	9.1 %
4 - Waste treatment	2.1 %
5 - Residential	1.5 %

* LULUCF : Land Use, Land Use Change and Forestry

Comments

206 kt of N₂O emissions LULUCF* excluded were observed in 2007. Emissions from LULUCF* amounted to 7 kt that year, they represented around 3% of total emissions.

Every sector contributes to the emissions, but in different proportions. However, whichever the year, the main source of N₂O emissions is the agriculture/forestry sector with 83% of total emissions in 2007. The emissions of this sector come from the nitrification/denitrification processes in cultivated soils, especially with the use of mineral nitrogen fertilizers, and manure management.

Manufacturing industry represented 12% of total emissions LULUCF* excluded in 2007. 74% of the emissions of this sector come from chemical industry in 2007.

The other but much less emitting sources were : residential/tertiary (2%), energy conversion (1%), road transport (1%) and the other transports than road (contribution negligible).

During the 1990-2007 period, emissions resulted a reduction of 28% (-84 kt). This reduction was observed in most of the sectors.

The emissions of agriculture/forestry sector have reduced since 1990 (-15%, i.e. -30 kt) in a result of less mineral quantities and less manure management (better milk production efficiency). However, agriculture emissions have increased sharply between 1990 and 2007 : 68% of total emissions LULUCF* excluded in mainland France in 1990 besides 83% in 2007.

The decrease observed in the manufacturing industry sector (-71%, i.e. -61 kt) was the result of the reduction of emissions in industrial processes, and particularly adipic, glyoxylic and nitric acid production.

Road transport emissions have increased constantly since 1990 (+0.6 kt, i.e. an increase of 43%) in a result of cars being progressively fitted with catalytic converters. It represented only 1% of total emissions mainland France in 2007.

* LULUCF : Land Use, Land Use Change and Forestry



EMISSIONS DANS L'AIR EN FRANCE METROPOLITAINE (unité Gg = kt)

Source CITEPA / CORALIE / format SECTEN

mise à jour : 18 février 2009

Secten_niv_1_SERRE-d/N2O.xls

Année	Transformation énergie	Industrie manufacturière	Résidentiel / tertiaire	Agriculture/sylviculture hors UTCF (**)	Transport routier	Autres transports (*)	TOTAL hors UTCF (**)	UTCF (**)	TOTAL avec UTCF (**)	Hors total (*)
1990	2,0	86	4,2	201	1,4	0,2	295	11	306	0,5
1995	2,3	93	4,4	186	1,5	0,2	287	11	298	0,5
2000	2,8	46	4,5	192	1,8	0,2	247	9,0	256	0,7
2001	2,4	46	4,7	183	1,9	0,2	239	8,3	247	0,6
2002	2,6	38	4,3	185	1,9	0,2	232	7,6	239	0,6
2003	2,7	38	4,5	177	1,9	0,2	224	7,9	232	0,7
2004	2,7	29	4,8	178	1,9	0,2	216	7,6	224	0,7
2005	2,9	29	4,7	176	1,9	0,2	215	7,5	223	0,7
2006	2,7	27	4,6	171	2,0	0,2	208	7,1	215	0,8
2007	2,7	25	4,3	171	2,0	0,2	206	6,8	213	0,8
2008 (e)	2,6	26	4,4	178	2,0	0,2	213	6,8	219	0,8

(*) selon définitions de la CCNUCC - les émissions répertoriées hors total ne sont pas incluses, à savoir les émissions maritimes et aériennes internationales, ainsi que les émissions des sources non-anthropiques.

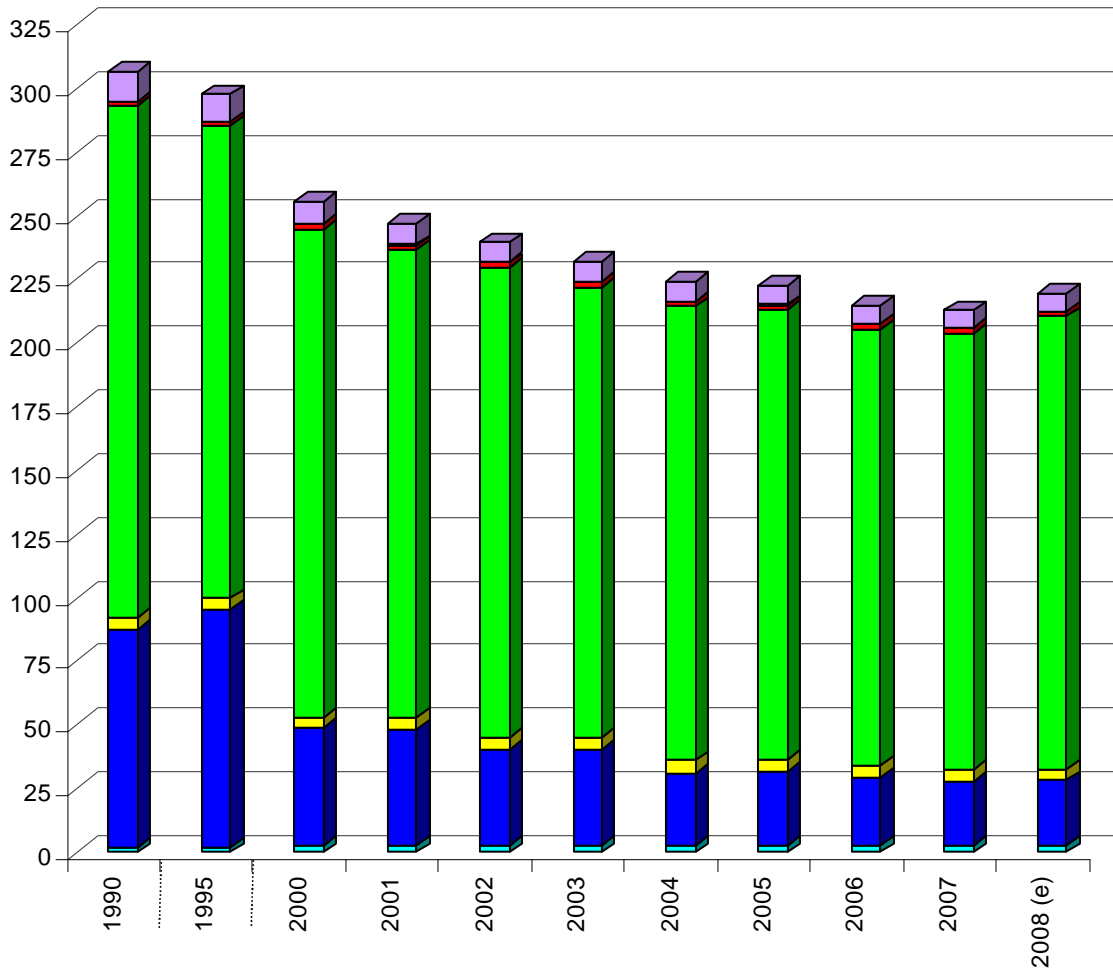
(**) Utilisation des Terres, leur Changement et la Forêt

(e) estimation préliminaire

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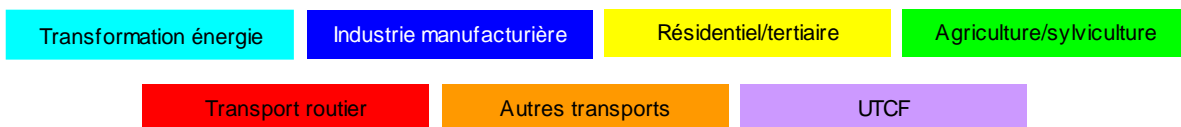
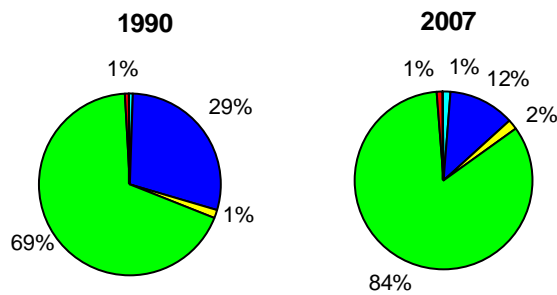
N₂O

Emissions atmosphériques par secteur en France métropolitaine en kt



(e) estimation préliminaire

RÉPARTITION HORS UTCF



4 Hydrofluorocarbons – HFCs

Source : CITEPA / CORALIE / SECTEN format - last updated 18 February 2009

Emissions		Variations	
Survey period :	since 1990		
Emissions in 2007 :	13 990 kt CO ₂ e	Variation 2007 / 1990 :	+283 %
Maximum observed :	13 990 kt CO ₂ e in 2007	Variation 2007 / maximum :	0 %
Minimum observed :	1 877 kt CO ₂ e in 1994	Variation 2007 / minimum :	+645 %

Main emitters

Main emitters in 2007 (sub-sectors ≥ 95 % of total emissions) :

1 - Tertiary, commercial and institutional	35 %
2 - Residential	11 %
3 - Capital goods and mobile machinery	8.0%
4 - Chemical industry	7.9%
5 - French civil aviation (**)	7.2%
6 - Catalysed diesel-engined passenger cars	6.9%
7 - Diesel-engined heavy duty vehicles	5.4%
8 - Catalysed gasoline-engined passenger cars	4.8%
9 - Food and drink industry	4.2%
10 - Catalysed diesel-engined light duty vehicles	3.0%
11 - Non-catalysed diesel-engined passenger cars	1.9%

** As defined by UNFCCC – domestic aviation emissions

Comments

In 2007, HFC emissions reached 13 990 kt CO₂ equivalent (CO₂e). They have sharply increased since 1990 (+283%, i.e. +10 333 kt CO₂e).

All the sectors contributed to the emissions in 2007 except LULUCF* (47% of total emissions from residential/tertiary, 24% from road transport, 21% from manufacturing industry, 7% from other transports than road, less than 1% from energy conversion and agriculture/forestry) whereas in 1990, only one sector contributed (manufacturing industry).

In the manufacturing industry sector, from 1990 to 1993, chemical industry was the main source of emissions caused by the synthesis of HFCs, HCFC-22 producing HFC-23, Trifluoroacetic acid (TFA).

The reductions operated since 1992 by the installation of treatments allowed a first fall of the total emissions of HFCs in France until 1995.

There has been an upward trend in emissions since then. The main reasons are the substitution of CFCs by HFCs which impacts less on the destruction of the stratospheric ozone.

Refrigeration/air conditioning from road transport responsible for 3 411 kt CO₂e of total emissions in 2007, rised sharply since 1993 (+3 380 kt CO₂e) after domestic and commercial refrigeration (around 3 387 kt CO₂e in 2007) which, associated with aerosol use (around 3 164 kt CO₂e in 2007) standed the residential/tertiary sector in first place with 47% of total emissions in 2007. At the same time, solvent use and evaporation process during the products filling have caused an increase of manufacturing industry emissions, in spite of emission reduction techniques introduced by chemical industry during the HFC synthesis.

From 2002, a new source of HFC emissions was identified : the use of HFCs in manufacturing industries as propulsing agents for polystyrene foam replacing HCFCs which are banned since they damage the ozone layer. HFC-365mfc are used since HCFC were banned in 2003, for polyurethane foam (PUR foam). It is emitting HFCs during the foam's manufacture and its life time.

It is important to stress that the chemical nature of the emitted HFCs has a significant impact on emissions in CO₂ equivalent.

Note :

For more information about refrigeration and air conditioning, refer to the report produced by the "Ecole des Mines de Paris", center for energy and processes, (<http://www.cenerg.ensmp.fr/english/index.html>)

HFC

EMISSIONS DANS L'AIR EN FRANCE METROPOLITAINE (unité Gg CO₂e = kt CO₂e)

Source CITEPA / CORALIE / format SECTEN			mise à jour : 18 février 2009				Secten_niv_1_SERRE-d/HFC.xls			
Année	Transformation énergie	Industrie manufacturière	Résidentiel / tertiaire	Agriculture/sylviculture hors UTCF (**)	Transport routier	Autres transports (*)	TOTAL hors UTCF (**)	UTCf (**)	TOTAL avec UTCF (**)	Hors total (*)
1990	0,0	3 657	0	0	0	0	3 657	0	3 657	0
1994	0,0	1 417	263	0	111	86	1 877	0	1 877	0
1995	0,2	925	1 682	0	276	558	3 440	0	3 440	0
2000	3,7	2 053	3 631	10	1 314	1 039	8 051	0	8 051	0
2001	4,7	2 036	4 032	17	1 564	1 041	8 695	0	8 695	0
2002	5,7	2 313	4 500	20	1 819	1 044	9 702	0	9 702	0
2003	6,5	2 535	5 218	23	2 226	1 047	11 055	0	11 055	0
2004	7,1	2 762	5 332	27	2 622	917	11 667	0	11 667	0
2005	7,4	2 933	5 874	31	2 874	919	12 640	0	12 640	0
2006	7,9	3 088	6 262	38	3 058	1 102	13 556	0	13 556	0
2007	8,2	2 940	6 551	40	3 411	1 039	13 990	0	13 990	0
2008 (e)	8,5	2 965	6 556	40	3 411	1 039	14 021	0	14 021	0

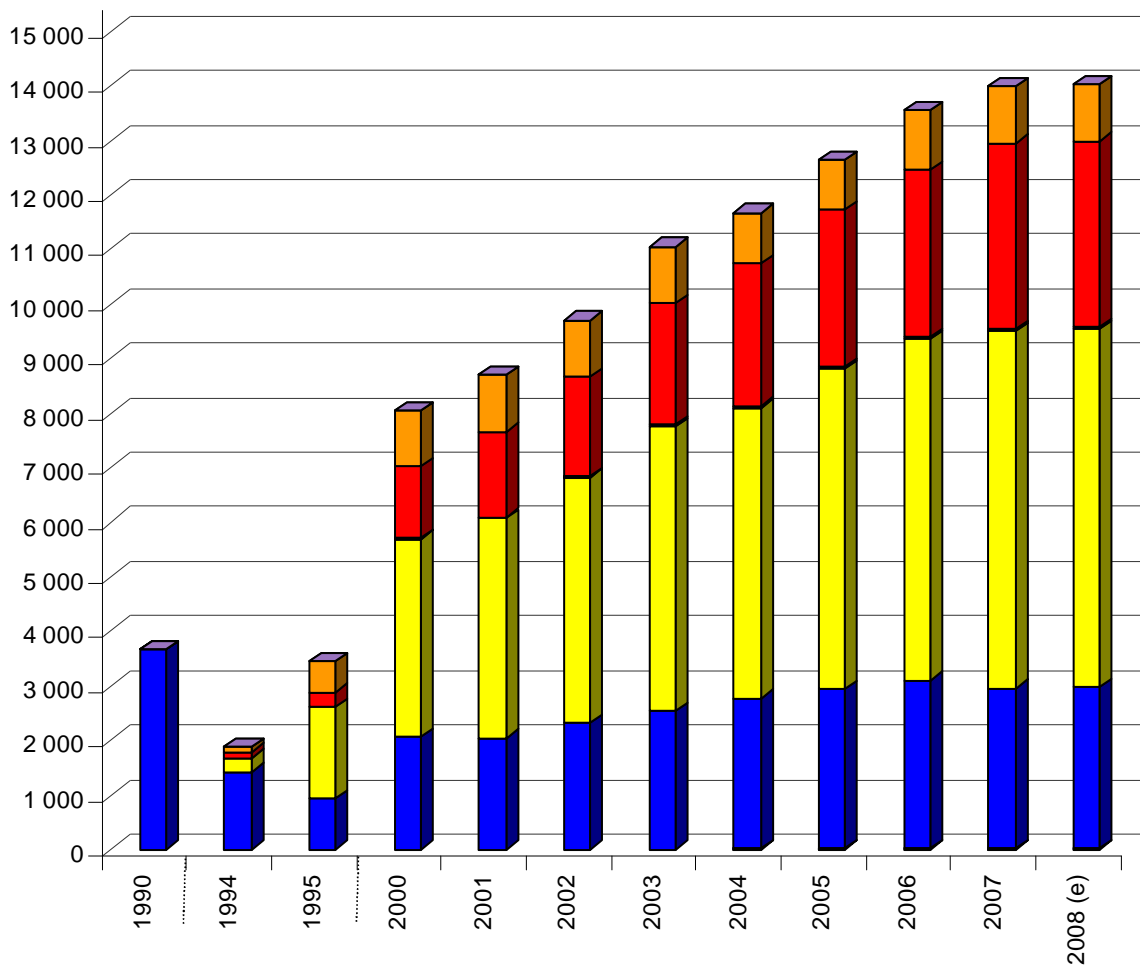
(*) selon définitions de la CCNUCC - les émissions répertoriées hors total ne sont pas incluses, à savoir les émissions maritimes et aériennes internationales, ainsi que les émissions des sources non-anthropiques.

(**) Utilisation des Terres, leur Changement et la Forêt

(e) estimation préliminaire

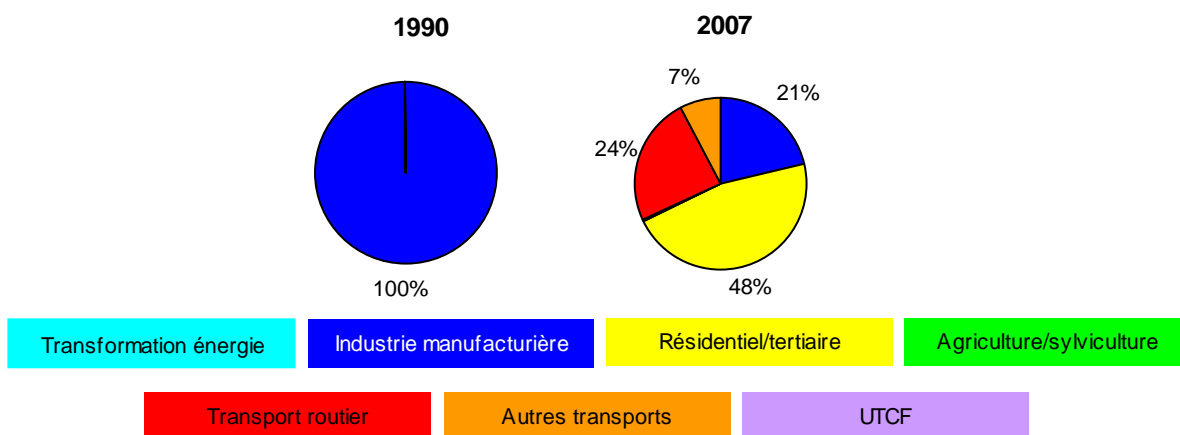
Avertissement : ces valeurs sont régulièrement révisées et complétées afin de tenir compte de l'amélioration permanente des connaissances, des méthodes d'estimation et des règles de restitution. Les utilisateurs sont invités à s'assurer de l'existence de mises à jour plus récentes.

HFC Emissions atmosphériques par secteur en France métropolitaine en kt CO₂e



(e) estimation préliminaire

RÉPARTITION HORS UTCF



5 Perfluorocarbons – PFCs

Source : CITEPA / CORALIE / SECTEN format - last updated 18 February 2009

Emissions		Variations	
Survey period :	since 1990		
Emissions in 2007 :	920 kt CO ₂ e	Variation 2007 / 1990 :	-79 %
Maximum observed :	4 293 kt CO ₂ e in 1990	Variation 2007 / maximum :	-79 %
Minimum observed :	920 kt CO ₂ e in 2007	Variation 2007 / minimum :	0 %

Main emitters

Main emitters in 2007 (sub-sectors \geq 95 % of total emissions) :

- | | |
|--|------|
| 1 - Non-ferrous metal smelting | 46 % |
| <i>included : aluminium</i> | 46 % |
| 2 - Capital goods and mobile machinery | 43 % |
| 3 - Chemical industry | 10 % |

Comments

In 2007, PFC emissions represented 920 kt CO₂e (CO₂e). Emissions dropped since 1990 as they fell by almost 78%.

The manufacturing industry sector accounts for the entire PFC emissions.

The sectors contributing to PFC emissions are :

- production of first fusion aluminium (PFC production),
- production of trifluoroacetic (CF₄ producing PFCs),
- production of semiconductors (use of PFCs).

After having fallen sharply, between 1990 and 1996, as a result of improvements in the aluminium electrolysis process, PFC emissions have much fluctuated these last years due to the rise in production of aluminium coupled with a non-optimum control and with the development of the semiconductor industry. In 2000 and 2001 emission control in the aluminium industry has improved, resulting in a further reduction in emissions thus residual difficulties in 2002 and 2003.

The closing down of one industry of aluminium production resulted in a diminution of the emissions in 2004 with however a steady production. An improvement in efficiency at another aluminium industry has allowed to reduce moreover the emissions in 2005.

Compared to HFCs, the GWP of the PFCs emitted are in a narrower fork, from 6 500 to 9 200, whereas for HFCs, it is spread out from 140 to 11 700. The evolution in mass of the emissions is thus very similar to that in equivalent CO₂, more especially as the structure of the emissions in terms of chemical species does not evolve much. PFC emissions in mainland France in mass have evolved from 587 t in 1990 to 127 t in 2007, a fall of 78% approximately over this period.

More reduction of emissions could appear. In the coming years, the semiconductor industry has undertaken to reduce its emissions (-10% between 1995 and 2010) in spite of growth in this sector. In addition, the aluminium industry will also continue its efforts to optimise processes.

PFC

EMISSIONS DANS L'AIR EN FRANCE METROPOLITAINE (unité Gg CO₂e = kt CO₂e)

Source CITEPA / CORALIE / format SECTEN

mise à jour : 18 février 2009

Secten_niv_1_SERRE-d/PFC.xls

Année	Transfor- mation énergie	Industrie manufac- turière	Rési- dentiel / tertiaire	Agricul- ture/syl- viculture hors UTCF (**)	Transport routier	Autres transports (*)	TOTAL hors UTCF (**)	UTCf (**)	TOTAL avec UTCf (**)	Hors total (*)
1990	0	4 293	0	0	0	0	4 293	0	4 293	0
1995	0	2 562	0	0	0	0	2 562	0	2 562	0
2000	0	2 487	0	0	0	0	2 487	0	2 487	0
2001	0	2 191	0	0	0	0	2 191	0	2 191	0
2002	0	3 477	0	0	0	0	3 477	0	3 477	0
2003	0	3 218	0	0	0	0	3 218	0	3 218	0
2004	0	2 180	0	0	0	0	2 180	0	2 180	0
2005	0	1 430	0	0	0	0	1 430	0	1 430	0
2006	0	1 167	0	0	0	0	1 167	0	1 167	0
2007	0	920	0	0	0	0	920	0	920	0
2008 (e)	0	871	0	0	0	0	871	0	871	0

(*) selon définitions de la CCNUCC - les émissions répertoriées hors total ne sont pas incluses, à savoir les émissions maritimes et aériennes internationales, ainsi que les émissions des sources non-anthropiques.

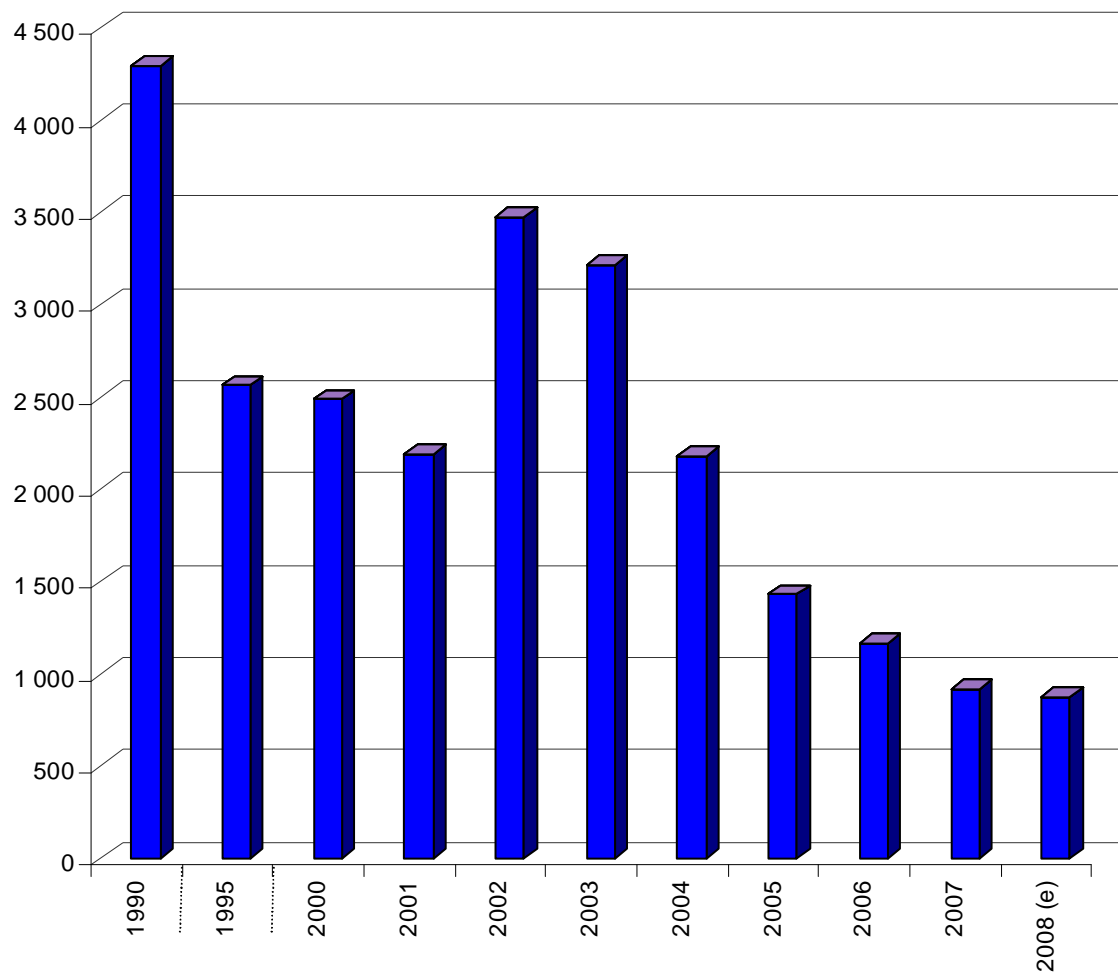
(**) Utilisation des Terres, leur Changement et la Forêt

(e) estimation préliminaire

Avertissement : ces valeurs sont régulièrement révisées et complétées afin de tenir compte de l'amélioration permanente des connaissances, des méthodes d'estimation et des règles de restitution. Les utilisateurs sont invités à s'assurer de l'existence de mises à jour plus récentes.

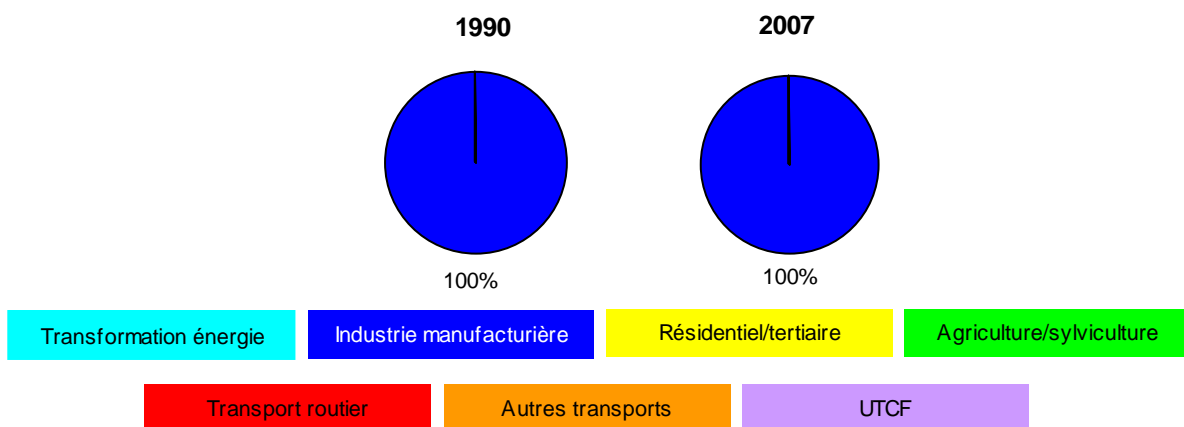
PFC

Emissions atmosphériques par secteur en France métropolitaine
en kt CO₂e



(e) estimation préliminaire

RÉPARTITION HORS UTCF



6 Sulphur fluoride – SF₆

Source : CITEPA / CORALIE / SECTEN format - last updated 18 February 2009

Emissions		Variations	
Survey period :	since 1990		
Emissions in 2007 :	1 064 kt CO ₂ e	Variation 2007 / 1990 :	-47 %
Maximum observed :	2 315 kt CO ₂ e in 1998	Variation 2007 / maximum :	-54 %
Minimum observed :	1 064 kt CO ₂ e in 2007	Variation 2007 / minimum :	0 %

Main emitters

Main emitters in 2007 (sub-sectors ≥ 95 % of total emissions) :

- 1 - Electricity production 47 %
- 2 - Non-ferrous metal smelting 30 %
- 3 - Capital goods and mobile machinery 18 %

Comments

In 2007, SF₆ emissions were estimated at 1 064 kt CO₂ equivalent (CO₂e) or 45 t in mass.

Just three sectors contributed to SF₆ emissions in mainland France, which are by order of importance in 2007 :

- manufacturing industry : 52% of total emissions,
- energy conversion : 47%,
- residential/tertiary : 1%.

These emissions have fallen since 1990 : -941 kt CO₂e (or -39 t in mass), a decrease of 47% between 1990 and 2007.

The evolution observed came from :

- in one hand, the SF₆ consumption reduction in the magnesium production, as well in foundries than to the only factory of first fusion which closed-down in 2002. It is important to stress that this factory has been converted in recycling magnesium and is consuming SF₆ at the same level than in 2000 since the year 2003. Since 2006, SF₆ were not used anymore as the new owner used another product (NaCl).
- in the other hand, from the variations of the electric equipment activity (a great fall of 151 kt CO₂e has been observed since 1990 due to real improvements).

Emissions have slightly reduced in energy conversion between 1995 and 1998 mainly in a result of a better air-tight of the electric equipments and maintenance procedures until 2002. Improvements do not balance the increase of the fleet anymore since then.

From 1999, emissions began to fall in the tertiary sector, mainly as a result of this substance no longer being used for the production of some sports shoes.

SF₆

EMISSIONS DANS L'AIR EN FRANCE METROPOLITAINE (unité Gg CO₂e = kt CO₂e)

Source CITEPA / CORALIE / format SECTEN

mise à jour : 18 février 2009

Secten_niv_1_SERRE-d/SF6.xls

Année	Transformation énergie	Industrie manufacturière	Résidentiel / tertiaire	Agriculture/sylviculture hors UTCF (**)	Transport routier	Autres transports (*)	TOTAL hors UTCF (**)	UTCF (**)	TOTAL avec UTCF (**)	Hors total (*)
1990	497	1 382	126	0	0	0	2 005	0	2 005	0
1995	511	1 589	126	0	0	0	2 226	0	2 226	0
1998	452	1 757	106	0	0	0	2 315	0	2 315	0
2000	452	1 353	29,2	0	0	0	1 834	0	1 834	0
2001	452	1 011	10,0	0	0	0	1 473	0	1 473	0
2002	461	843	10,2	0	0	0	1 315	0	1 315	0
2003	470	831	10,4	0	0	0	1 312	0	1 312	0
2004	479	987	10,6	0	0	0	1 476	0	1 476	0
2005	487	807	10,8	0	0	0	1 305	0	1 305	0
2006	495	672	11,0	0	0	0	1 178	0	1 178	0
2007	503	550	11,2	0	0	0	1 064	0	1 064	0
2008 (e)	511	527	11,3	0	0	0	1 049	0	1 049	0

(*) selon définitions de la CCNUCC - les émissions répertoriées hors total ne sont pas incluses, à savoir les émissions maritimes et aériennes internationales, ainsi que les émissions des sources non-anthropiques.

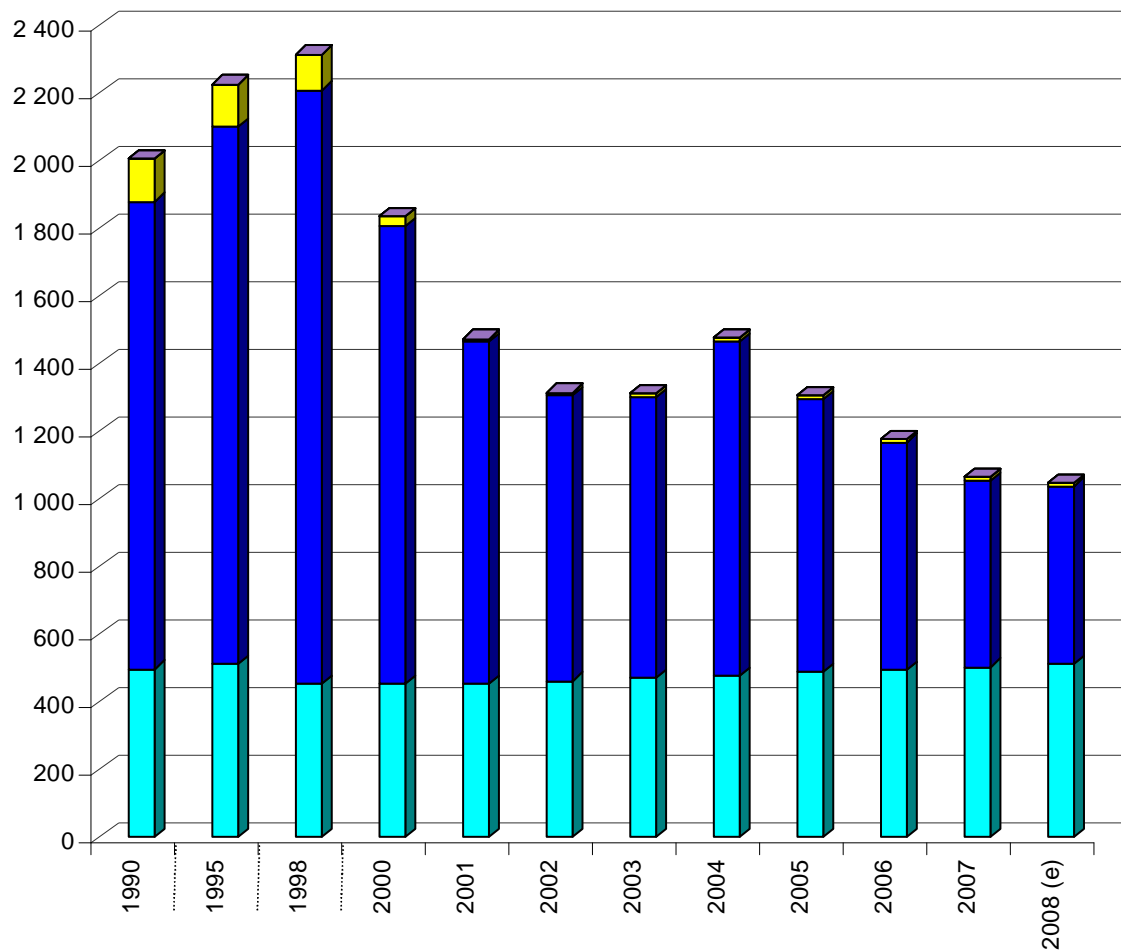
(**) Utilisation des Terres, leur Changement et la Forêt

(e) estimation préliminaire

Avertissement : ces valeurs sont régulièrement révisées et complétées afin de tenir compte de l'amélioration permanente des connaissances, des méthodes d'estimation et des règles de restitution. Les utilisateurs sont invités à s'assurer de l'existence de mises à jour plus récentes.

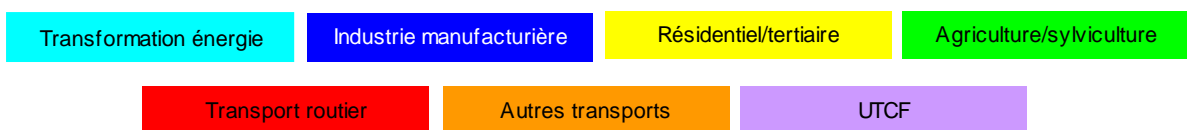
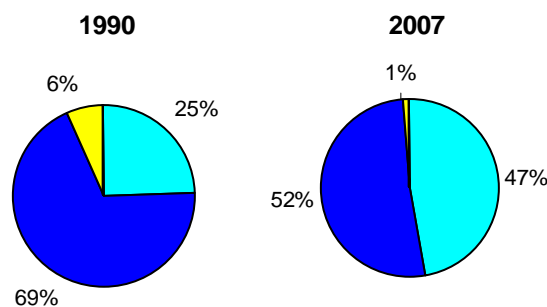
SF₆

Emissions atmosphériques par secteur en France métropolitaine
en kt CO₂e



(e) estimation préliminaire

RÉPARTITION HORS UTCF



7 Global Warming Potential – GWP

Source : CITEPA / CORALIE / SECTEN format - last updated 18 February 2009

This index provides an aggregated figure covering greenhouse gases. Usually, gases included are limited to the six direct greenhouse gases covered by the Kyoto Protocol : CO₂, CH₄, N₂O, HFCs, PFCs and SF₆.

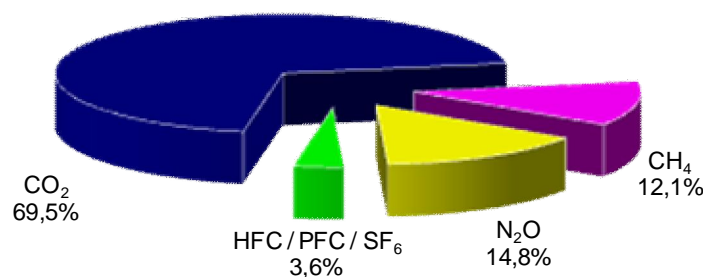
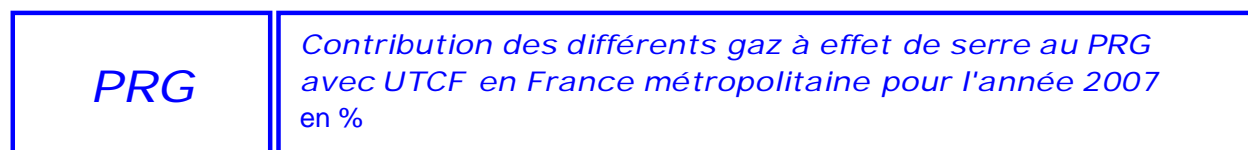
It is expressed as "CO₂ equivalent" because of the GWP of other substances expressed in relation to CO₂ (the value for CO₂ is 1 by definition). Confusion may occur between GWP and real CO₂ figures when such data is used by non-specialists.

The index is calculated on the basis of a time period of 100 years and takes into account the atmospheric life time of the substances.

Individual gas GWP values defined by IPCC are those of 1995 in accordance with the decisions taken by the Conference of the Parties :

- CO₂ = 1
- CH₄ = 21
- N₂O = 310
- HFCs = in the range of 140 – 11 700 depending on molecules (weighted values are 5 341 in 1990, 7 748 in 1993 and 1 629 in 2007).
- PFCs = in the range of 6 500 – 9 200 depending on molecules (weighted values are 7 287 in 1990, 7 469 in 1994 and 7 178 in 2007).
- SF₆ = 23 900

As illustrated in the next figure, the individual contribution of each gas to GWP varies considerably, with carbon dioxide being the dominant GHG (GreenHouse Gases), accounting for approximately two thirds of the total.



Emissions (LULUCF* included)**Variations**

Survey period :	since 1990		
Emissions in 2007 :	444	Mt CO ₂ e	Variation 2007 / 1990 : -14 %
Maximum observed :	542	Mt CO ₂ e in 1991	Variation 2007 / maximum : -18 %
Minimum observed :	444	Mt CO ₂ e in 2007	Variation 2007 / minimum : 0 %

Main emitters

Main emitters in 2007 (sub-sectors ≥ 95 % of total emissions, LULUCF* excluded) :

1 - Residential	12 %
2 - Livestock	9.2 %
3 - Crops	9.1 %
4 - Diesel-engined heavy duty vehicles	6.8 %
5 - Catalysed diesel-engined passenger cars	6.5 %
6 - Tertiary, commercial and institutional	6.3 %
7 - Electricity production	6.2 %
8 - Non-metallic mineral and construction materials	5.3 %
9 - Chemical industry	5.0 %
10 - Catalysed gasoline-engined passenger cars	4.5 %
11 - Iron and steel industry	3.8 %
12 - Petroleum refining	3.6 %
13 - Catalysed diesel-engined light duty vehicles	2.8 %
14 - Food and drink industry	2.4 %
15 - Non-catalysed diesel-engined passenger cars	1.8 %
16 - Waste treatment	1.7 %
17 - Other agriculture sources	1.5 %
18 - District heating	1.3 %
19 - Non-catalysed diesel-engined light duty vehicles	1.1 %
20 - Capital goods and mobile machinery	1.1 %
21 - Other energy conversion sectors	1.0 %
22 - Paper, cardboard	0.9 %
23 - Construction	0.9 %
24 - French civil aviation (**)	0.9 %

* LULUCF : Land Use, Land Use Change and Forestry

** As defined by UNFCCC – domestic aviation emissions

Comments

GWP (Global Warming Potential) for mainland France was estimated at 444 Mt CO₂ equivalent (CO₂e) in 2007 (LULUCF* included), and 520 Mt CO₂e, LULUCF* excluded.

All the sectors participated to greenhouse gas emissions, as followed in importance order (LULUCF* excluded) :

- road transport with 25% essentially due to CO₂,
- manufacturing industry with 22%, due to all of the 6 direct greenhouse gases,
- agriculture/forestry with 20% of total emissions, due to two pollutants : N₂O and CH₄,
- residential/tertiary with 18% of total emissions, due to all of the 6 direct greenhouse gases,
- Energy conversion with 13% essentially due to CO₂,
- Other transports (other than road) with 2% essentially due to CO₂.

GWP emissions have decreased by around 6.5% between 1990 and 2007 (LULUCF* excluded), that is to say -36 Mt CO₂e and -70 Mt CO₂e (-14%) LULUCF included.

CO₂ emissions contributed to 70% of GWP emissions. Then came N₂O emissions with 15%, CH₄ 12% and HFCs/PFCs/SF₆ 4%.

The biggest increase evolution since 1990 (in GWP) came from HFC emissions : +283%.

Note

The total in this format is different compared to the UNFCCC format (DOM and COM included) and to the KYOTO format (DOM included) due to the geographical perimeter (mainland France only).

* LULUCF : Land Use, Land Use Change and Forestry

PRG		EMISSIONS DANS L'AIR EN FRANCE METROPOLITAINE (unité Tg CO ₂ e = Mt CO ₂ e)									
Source CITEPA / CORALIE / format SECTEN		mise à jour : 18 février 2009						Secten_niv_1_SERRE-d/PRG.xls			
Année		Transfor- mation énergie	Industrie manufac- turière	Rési- dentiel / tertiaire	Agricul- ture/syl- viculture hors UTCF (**)	Transport routier	Autres transports (*)	TOTAL hors UTCF (**)	UTCF (**)	TOTAL avec UTCF (**)	Hors total (*)
1990	bilan secteur (a)	77	157	89	116	110	7,6	556	-42	514	19
	CO ₂ biomasse hors bilan (b)	3,4	6,8	34	0,2	0,0	0,0	44			
1991	bilan secteur (a)	89	158	99	114	112	7,5	580	-38	542	19
	CO ₂ biomasse hors bilan (b)	3,7	6,9	41	0,2	0,0	0,0	52			
1995	bilan secteur (a)	68	150	94	110	118	8,5	548	-55	493	20
	CO ₂ biomasse hors bilan (b)	4,4	7,4	33	0,1	0,4	0,0	45			
2000	bilan secteur (a)	71	133	96	112	127	9,5	548	-49	499	26
	CO ₂ biomasse hors bilan (b)	5,3	7,2	31	0,2	0,9	0,0	45			
2001	bilan secteur (a)	62	132	106	109	130	9,6	549	-58	491	25
	CO ₂ biomasse hors bilan (b)	5,7	5,5	30	0,2	0,9	0,0	42			
2002	bilan secteur (a)	67	127	96	109	131	9,7	540	-66	474	25
	CO ₂ biomasse hors bilan (b)	6,1	7,0	27	0,2	0,9	0,0	42			
2003	bilan secteur (a)	68	128	100	105	131	9,5	542	-70	473	25
	CO ₂ biomasse hors bilan (b)	6,4	7,2	30	0,2	0,9	0,0	44			
2004	bilan secteur (a)	67	123	105	106	132	9,3	542	-72	470	28
	CO ₂ biomasse hors bilan (b)	6,7	7,4	30	0,2	1,0	0,0	45			
2005	bilan secteur (a)	72	123	105	105	130	9,2	544	-75	469	27
	CO ₂ biomasse hors bilan (b)	6,5	7,6	30	0,2	1,1	0,0	46			
2006	bilan secteur (a)	68	120	102	103	130	9,3	531	-75	457	28
	CO ₂ biomasse hors bilan (b)	6,5	7,7	29	0,2	2,0	0,0	45			
2007	bilan secteur (a)	69	116	94	103	129	9,3	520	-76	444	29
	CO ₂ biomasse hors bilan (b)	6,8	8,0	28	0,2	4,1	0,0	47			
2008 (e)	bilan secteur (a)	65	114	98	106	122	9,1	514	-76	438	28
	CO ₂ biomasse hors bilan (b)	7,2	8,0	28	0,1	6,4	0,0	50			

(a) Bilan secteur net hors émissions CO₂ des énergies renouvelables, en particulier issues de la biomasse.

(b) CO₂ issu de la combustion de la biomasse, hors bilan CO₂ du secteur.

(*) selon définitions de la CCNUCC - les émissions répertoriées hors total ne sont pas incluses, à savoir les émissions maritimes et aériennes internationales, ainsi que les émissions des sources non-anthropiques.

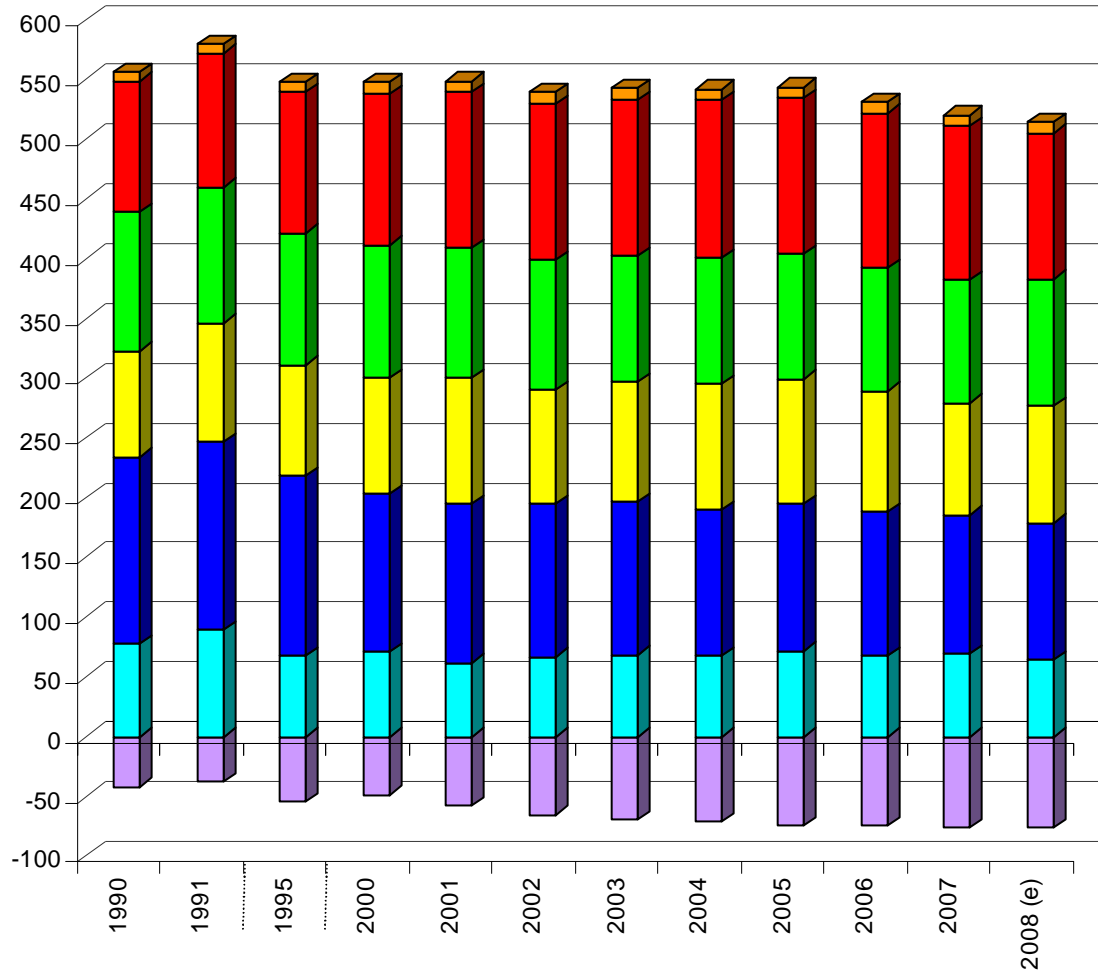
(**) Utilisation des Terres, leur Changement et la Forêt

(e) estimation préliminaire

Avvertissement : ces valeurs sont régulièrement révisées et complétées afin de tenir compte de l'amélioration permanente des connaissances, des méthodes d'estimation et des règles de restitution. Les utilisateurs sont invités à s'assurer de l'existence de mises à jour plus récentes.

PRG

Emissions atmosphériques par secteur en France métropolitaine
en Mt CO₂e



RÉPARTITION HORS UTCF

(e) estimation préliminaire

