녹색성장 연구 11-19-1
글로벌법제연구센터 법제와 정책 연구

Measurement, reporting and verification of greenhouse gas emissions in France

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Abstract

Ⅰ. Background

- To evaluate scientific, technical and socio-economic data in a comprehensive, objective and transparent way to understand risks posed by climate change caused by human activity, one established the Intergovernmental Panel on Climate Change (IPCC). Sponsored by the United Nations, the IPCC published its first report on climate change in 1990. At that time there was not enough scientific evidence to suggest that human activity affects the climate of the planet. Nevertheless, the Framework Convention on Climate Change was adopted in 1992 at Rio to stabilize greenhouse gas emissions to a level that would prevent the effects of human activities on climate. Subsequently, in 1995, the IPCC said in its second report that facts suggest that human activity influences visibly on the global climate. Two years later, in December 1997, more than 160 countries adopted the Kyoto Protocol to reduce emissions of greenhouse gas that could contribute to climate change. Since that date, many initiatives have been developed to reduce sources of air pollution.

- To ensure that mitigation of greenhouse gases succeeds, control means have been developed: measurement, reporting and verification (MRV) of greenhouse gas (GHG) emissions.

Nonetheless, these control means have posed another problem: how to efficiently and globally proceed to MRV of GHG?

○ An efficient and global answer has been primarily given by international treaties. Furthermore, it has been completed at the European level and finally implemented in France.

Ⅱ. Current Legal System and Its Problems

□ A systematic analysis of European laws and its French implementations has been tried.

○ This methodology appeared necessary because there is often a gap between European law and Member State' implementation (particularly concerning Directives) which has to be taken in account.

○ Moreover Member States are able to decide about How to implement European legislation in certain limit.

□ The study first revealed a very specific system based upon Emission Limit Values (ELV) of GHG emissions. Nevertheless, it appeared that the system has been then complicated with the creation of the European Union Emissions Trading System (EU ETS).

○ Indeed, MRV of GHG emissions are fairly different depending on their belonging to ELV system or EU Emission Trading System.

Ⅲ. Main contents

□ The French MRV Process

○ The research follows the MRV process, step by step. It starts with a general presentation of gases concerned and a general explanation of the legal European Framework. Then, the research distinguishes between measurement, reporting and verification in order to understand the specificity of each step. Finally, a brief description of National authorities involved in the process is given.

□ Interaction Between ELV System and EU Emission Trading System

○ The research tries to make the difference, when it appears necessary, between ELV system and EU ETS. Indeed, depending on the aformentioned systems, MRV can be fairly different.

Ⅳ. Expected effects

□ This is the first study to distinguish between the system of emissions limits value and the EU ETS in the French MRV process. Indeed, this process is usually only studied through the EU ETS although the ELV system is older and targets, moreover, 60% of GHG emissions.

□ The beginning of a reflection about a better integration of other GHG emitters in the whole MRV process (Local Authorities, corporations etc.).

□ Awareness of certain defaults in evaluation of GHG emissions (E.g. nuclear plants: evaluations of GHG emissions are usually based upon the only functioning of nuclear plants and do not include GHG emissions of building, maintenance, dismantlement, etc. of nuclear plants).

Key Words : Measurement, reporting, verification, MRV, emission limit value, ELV, emission trading scheme, EU ETS, greenhouse gases, GHG, climate change, France, European Union」

목 차

Introduction

The international community has realized the problems linked to global warming. A global policy has been developed in which a single State cannot accomplish anything. And although some States have decided not to enroll in this voluntary approach, our attention should focus on proactive policies. As such, the Kyoto protocol plays an important role. And European Union and its members have understood the importance of acting. Therefore, a system of measurement, reporting and verification (hereinafter MRV) of greenhouse gas (hereinafter GHG) emissions has been gradually introduced.

The Decision 280/2004/EC[1], recently completed by the Regulation 920/2010/EC[2], has established a mechanism designed to:

- Monitor, in the Member States, all anthropogenic greenhouse gas emissions (including their removal by sinks) not controlled by the Montreal Protocol on substances that deplete the ozone layer;
- Evaluate progress made in this field to ensure compliance with the Community's commitments concerning emissions and their removal;
- Implement the UNFCCC and the Kyoto Protocol;
- Ensure that information reported by the Community to the UNFCCC Secretariat is complete, accurate, consistent, transparent and comparable.

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1) Decision of the European Parliament and of the Council of February 11th 2004 concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol, Official Journal L 49 of February 19th 2004.

2) Commission Regulation of October 7th 2010 for a standardized and secured system of registries pursuant to Directive 2003/87/EC of the European Parliament and of the Council and Decision No 280/2004/EC of the European Parliament and of the Council.

Consequently, the Member States and the Community respectively must devise, publish and implement national programmes and a Community programme to limit or reduce anthropogenic emissions by sources and enhance the removal, by sinks, of all greenhouse gases not controlled by the Montreal Protocol in order to contribute to:

- Stabilizing CO2 emissions at 1990 levels by 2000 (this UNFCCC objective has been met by the Community and its Member States);
- Meeting the Community's commitments under the UNFCCC and the Kyoto Protocol to reduce all greenhouse gas emissions not controlled by the Montreal Protocol;
- Transparent and accurate monitoring of the actual and projected progress of Member States towards reducing these emissions, including the effect of Community measures.

To do that, the national programmes must include information on:

- The effect of national policies and measures on emissions and removals, broken down by gas and by sector;
- National projections for emissions and removal of CO2 and other greenhouse gases for 2005, 2010, 2015 and 2020;
- Measures being taken or planned to implement relevant Community policies and to comply with commitments under the Kyoto Protocol.

And each year, the Commission evaluates whether the progress made throughout the Community is sufficient to meet the commitments made at international level under the UNFCCC and the Kyoto Protocol. That is why the Commission must submit an annual progress evaluation report to the European Parliament and the Council. This report must include information on projected emissions and removals, and on policies and

measures taken to reduce emissions.

As a Member State of European Union, France has to comply with the European legal framework inspired itself by international agreements. And before to discover MRV of greenhouse gas emissions in France, we would like to quickly remind which gases are concerned and, above all, we would like to clarify the European legal framework by giving a general presentation.

1 - Measurable gases

Article 3.1 of the Kyoto Protocol, ratified in France in 2005[3)], provides that "Parties included in Annex A shall, individually or jointly, ensure that their aggregate anthropogenic carbon dioxide equivalent emissions of the greenhouse gases listed in Annex A do not exceed their assigned amounts". And, according to the annex A, implemented by the annex 1 of Directive 2003/87/EC, greenhouse gases are:

- Carbon dioxide (CO2);
- Methane (CH4);
- Nitrous oxide (N2O);
- Hydrofluorocarbons (HFCs);
- Perfluorocarbons (PFCs);
- Sulphur hexafluoride (SF6).

Nonetheless, these various gases, which are qualified of direct greenhouse gases, are not the only ones that must be measured, declared and verified. Indeed, indirect greenhouse gases such as nitrogen oxides (NOx), sulfur dioxide (SO2), carbon monoxide (CO) and Non Methane Volatile

3) Decree No. 2005-295, March 22nd 2005, JORF n°75, March 31st 2005, p. 5813.

Organic Compounds (NMVOC) are also concerned by MRV.

Furthermore, all greenhouse gases have what is called a Global Warming Potential (GWP). This value is used to compare the abilities of different greenhouse gases to trap heat in the atmosphere. GWPs are based on the heat-absorbing ability of each gas relative to that of carbon dioxide (CO2), as well as the decay rate of each gas (the amount removed from the atmosphere over a given number of years). GWPs can also be used to define the impact greenhouse gases will have on global warming over different time periods or time horizons. These are usually 20 years, 100 years and 500 years. For most greenhouse gases, the GWP declines as the time horizon increases. This is because the greenhouse gas is gradually removed from the atmosphere through natural removal mechanisms, and its influence on the greenhouse effect declines. Some of the CFCs however, have long atmospheric lifetimes, and the 100-year GWP may be greater than the 20 year GWP.

Global warming potential table[4)]

Greenhouse Gas	Formula	100-year GWP (SAR[5)])	100-year GWP (AR4[6)])
Carbon dioxide	CO2	1	1
Methane	CH4	21	25
Nitrous oxide	N2O	310	298
Sulphur hexafluoride	SF6	23,900	22,800
Hydrofluorocarbons (HFCs)			
HFC-23	CHF3	11,700	14,800

4) Intergovernmental Panel on Climate Change (IPCC), Fourth Assessment Report (AR4), Working Group 1 (WG1), Chapter 2, Changes in Atmospheric Constituents and in Radiative Forcing, Table 2.14, page 212.

Greenhouse Gas	Formula	100-year GWP (SAR[5])	100-year GWP (AR4[6])
HFC-32	CH2F2	650	675
Perfluorocarbons (PFCs)			
Perfluoromethane	CF4	6,500	7,390
Perfluoroethane	C2F6	9,200	12,200
Perfluoropropane	C3F8	7,000	8,830
Perfluorobutane	C4F10	7,000	8,860
Perfluorocyclobutane	c-C4F8	8,700	10,300
Perfluoropentane	C5F12	7,500	13,300
Perfluorohexane	C6F14	7,400	9,300

By assigning a GWP value it allows policy makers to compare the impacts of emissions and reductions of different gases. For instance, methane is a significant contributor to the greenhouse effect and has a GWP of 25 according to the AR4. This means methane is approximately 25 times more heat-absorptive than carbon dioxide per unit of weight.

2 - A general presentation of the European legal framework

Many various activities are measurable according to French law, of course inspired by European and international legal framework. Yet we need to make a distinction between activities included in the EU ETS and those which are not because pursued aims are different depending on this criterion:

5) Second Assessment Report, 1995.

6) Fourth Assessment Report, 2007. This report has refined previous values but values issued of the SAR are still used in much of the literature.

General objective at the European Union level -20% GHG compared with 1990 -14% GHG compared with 2005	
France: objective for 2020	
Sectors excluded of ETS -14% GHG compared with 2005	ETS sectors -21% GHG compared with 2005

This technical matter is legislated by many different laws. In order to simplify one presents the situation talking first about the system of Emission Limit Values (hereinafter ELV) and then about the Emissions Trading System (hereinafter EU ETS) because these two systems are fairly different about declaration, verification and also penalties.

(1) System of Emission Limit Values

According to the Directive 2008/1/EC, Emission Limit Values[7] "means the mass, expressed in terms of certain specific parameters, concentration and/or level of an emission, which may not be exceeded during one or more periods of time; emission limit values may also be laid down for certain groups, families or categories of substances, in particular for those listed in Annex III. The emission limit values for substances normally apply at the point where the emissions leave the installation, any dilution being disregarded when determining them; with regard to indirect releases into water, the effect of a water treatment plant may be taken into account when determining the emission limit values of the installation involved, provided that an equivalent level is guaranteed for the

7) Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control (Codified version) Text with EEA relevance, article 2. 6.

protection of the environment as a whole and provided this does not lead to higher levels of pollution in the environment". In concrete terms, activities included in the ELV system have to be measured, reported and verified. This ELV system has been extended to different types of pollutants activities.

a - IPPC Directive

Integrated Pollution Prevention and Control Directive (2008/1/EC) requires industrial and agricultural activities with a high pollution potential, as defined in Annex I to the Directive (energy industries, production and processing of metals, mineral industry, chemical industry, waste management, livestock farming, etc.), to have a permit. This permit can only be issued if certain environmental conditions are met, so that the companies themselves bear responsibility for preventing and reducing any pollution they may cause.

In order to receive a permit an industrial or agricultural installation must comply with certain basic obligations. In particular, it must:

- Use all appropriate pollution-prevention measures, namely the best available techniques (which produce the least waste, use less hazardous substances, enable the substances generated to be recovered and recycled, etc.);
- Prevent all large-scale pollution;
- Prevent, recycle or dispose of waste in the least polluting way possible;
- Use energy efficiently;
- Ensure accident prevention and damage limitation;
- Return sites to their original state when the activity is over.

In addition, the decision to issue a permit must contain a number of specific requirements, including:

- Emission limit values for polluting substances (with the exception of greenhouse gases if the emission trading scheme applies[8]);
- Any soil, water and air protection measures required;
- Waste management measures;
- Measures to be taken in exceptional circumstances (leaks, malfunctions, temporary or permanent stoppages, etc.);
- Minimization of long-distance or transboundary pollution;
- Release monitoring;
- All other appropriate measures.

b - LCP Directive

The overall aim of the Large Combustion Plants Directive (2001/80/EC) is to reduce emissions of acidifying pollutants, particles, and ozone precursors. Control of emissions from large combustion plants - those whose rated thermal input is equal to or greater than 50 MW - plays an important role in the Union's efforts to combat acidification, eutrophication[9] and ground-level ozone as part of the overall strategy to reduce air pollution.

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8) In order to coordinate the permit process required under the Directive and the greenhouse gas emission trading scheme, a permit issued in compliance with the Directive is not obliged to contain the emission limit values for greenhouse gases if these gases are subject to an emission trading scheme, provided there is no local pollution problem. The competent authorities can also decide not to impose energy efficiency measures targeted at combustion plants.

9) Eutrophication means the enrichment of water by nutrients, especially compounds of nitrogen and/or phosphorus, causing an accelerated growth of algae and higher forms of plant life to produce an undesirable disturbance to the balance of organisms present in the water and to the quality of the water concerned.

The LCP Directive encourages the combined generation of heat and power and sets specific emission limit values for the use of biomass as fuel. It also includes certain gas turbines in its scope in order to regulate NOx and SO2 emissions.

c - WI Directive

The aim of the Waste Incineration Directive (2000/76/EC) is to prevent or to reduce as far as possible negative effects on the environment caused by the incineration and co-incineration of waste. In particular, it should reduce pollution caused by emissions into the air, soil, surface water and groundwater, and thus lessen the risks which these pose to human health.

This is to be achieved through the application of operational conditions, technical requirements, and emission limit values for incineration and co-incineration plants within the EU.

The WI Directive sets emission limit values and monitoring requirements for pollutants to air such as dust, nitrogen oxides (NOx), sulphur dioxide (SO2), hydrogen chloride (HCl), hydrogen fluoride (HF), heavy metals and dioxins and furans. The Directive also sets controls on releases to water resulting from the treatment of the waste gases. Most types of waste incineration plants fall within the scope of the WI Directive, with some exceptions, such as those treating only biomass (e.g. vegetable waste from agriculture and forestry). Experimental plants with a limited capacity used for research and development of improved incineration processes are also excluded.

d - VOC Solvents Emissions Directive

The Volatile Organic Compounds Solvents Emissions Directive (1999/13/EC) is the main policy instrument for the reduction of industrial emissions of volatile organic compounds (VOCs) in the European Union. It covers a wide range of solvent using activities, e.g. printing, surface cleaning, vehicle coating, dry cleaning and manufacture of footwear and pharmaceutical products. The VOC Solvents Emissions Directive requires installations in which such activities are applied to comply either with the emission limit values set out in the Directive or with the requirements of the so-called reduction scheme. The Directive sets out emission limit values for VOCs in waste gases and maximum levels for fugitive emissions (expressed as percentage of solvent input) or total emission limit values. The purpose of the reduction scheme is to allow the operator the possibility to achieve by other means emission reductions, equivalent to those achieved if the emission limit values were to be applied. This could be typically achieved by substituting products with a high content of solvents for low-solvent or solvent-free products and changing to solvent free production processes.

e - GHG emitters

GHG emitters are also submitted to the ELV system, except when concerned activities are included in the EU ETS Directive.

(2) - EU ETS Directive

The EU ETS[10] is a cornerstone of the European Union's policy to

10) Legality of the EU ETS has recently been recognized by the Tribunal of the

combat climate change and its key tool for reducing industrial greenhouse gas emissions cost-effectively. The Directive 2003/87/EC, amended by the Directive 2009/29/EC, has created a special statutory regime for certain activities which are, ipso jure, excluded from the ELV system. And this major distinction has important consequences on the MRV system. Indeed, effectiveness of the EU ETS depends very heavily on the accurate measurement of GHG emissions, declaration from operators, and verifications of these declarations[11].

Brief explicative table

MRV of GHG emissions in France (according to European legislation)	
ELV system	**EU ETS Directive**
Several directives have extended the ELV system to different types of activities: - Classified facilities for the protection of the environment: IPPC directive, 2008/1/EC; - Large combustion plants: directive 2001/80/EC; - Wastes disposal installations: directive 2000/76/EC; - Volatile organic compounds emitters: directives 94/63/EC and 2009/126/EC; - GHG emitters, except when	The EU ETS provides that the emission permit shall not include an ELV for direct emissions of GHG (unless it is necessary to ensure that no significant local pollution is caused). This directive concerns: - Directive 2003/87/EC: Energy activities; Production and processing of ferrous metals; Mineral industry; Industrial plants for the production of, on the one hand, pulp from timber or other fibrous materials

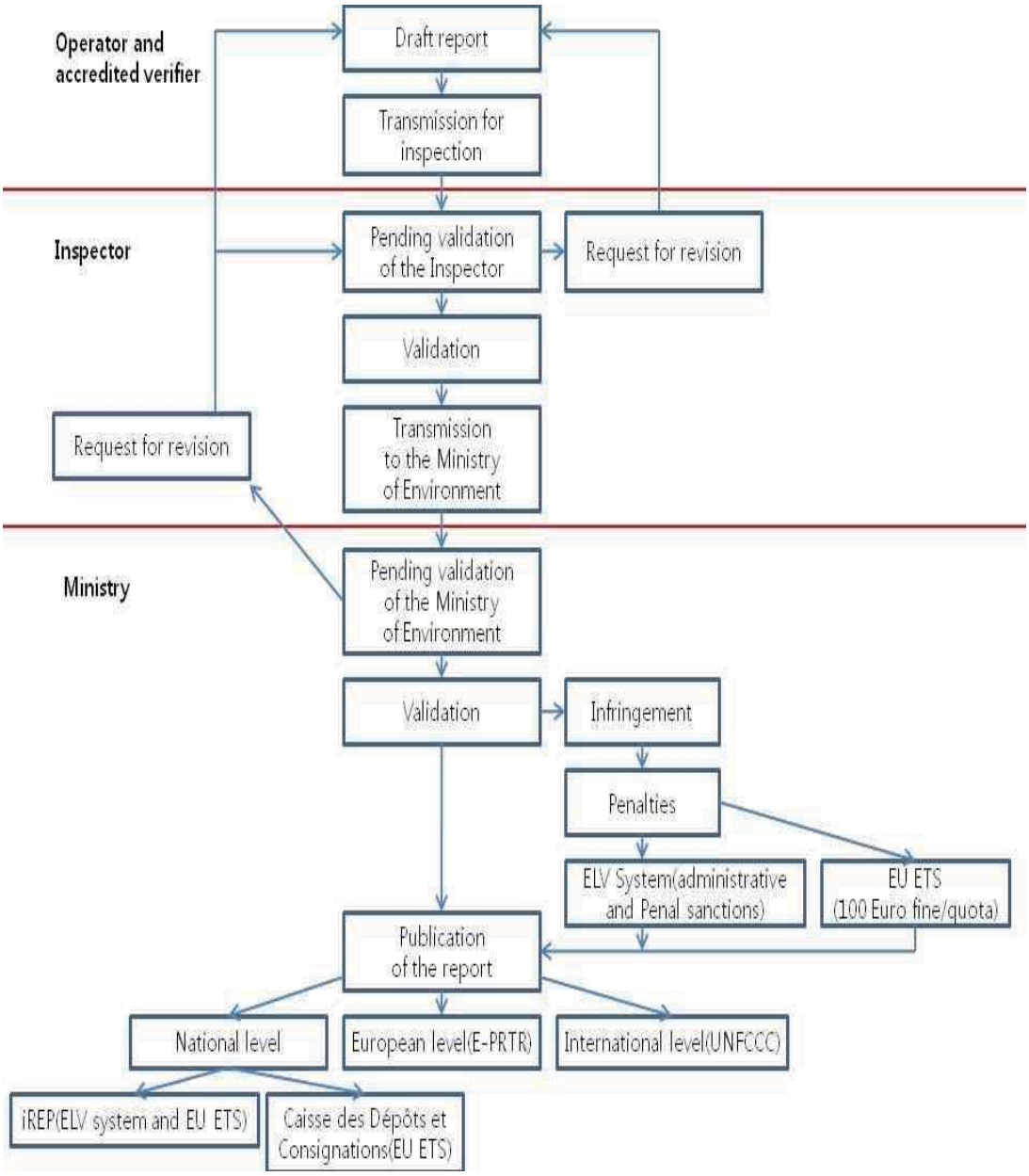
European Union (T. EU., 2 mars 2010, n° T-16/04). TREBULLE François Guy, Droit de l'environnement, Recueil Dalloz, 2010, p. 2468 et s.

11) HERBEL Peter et KROMAREK Pascale, Un exemple d'instrument économique de protection de l'environnement : la réduction des émissions de gaz à effet de serre, Recueil Dalloz, 2007, p. 963 et s.

concerned activities are included in the EU ETS directive.	and, on the other hand of paper and board with a production capacity exceeding 20 tonnes per day; - Directive 2008/101/EC: Aircraft operators - Directive 2009/29/EC: Production of aluminium; Chemistry.
Register: iREP	Register: iREP and "Caisse des dépôts et consignations"
Activities producing 60% of GHG emissions	Activities producing 40% of GHG emissions
Administrative and penal penalties	100 Euros per tonne CO2 when failure to respect quota allowance

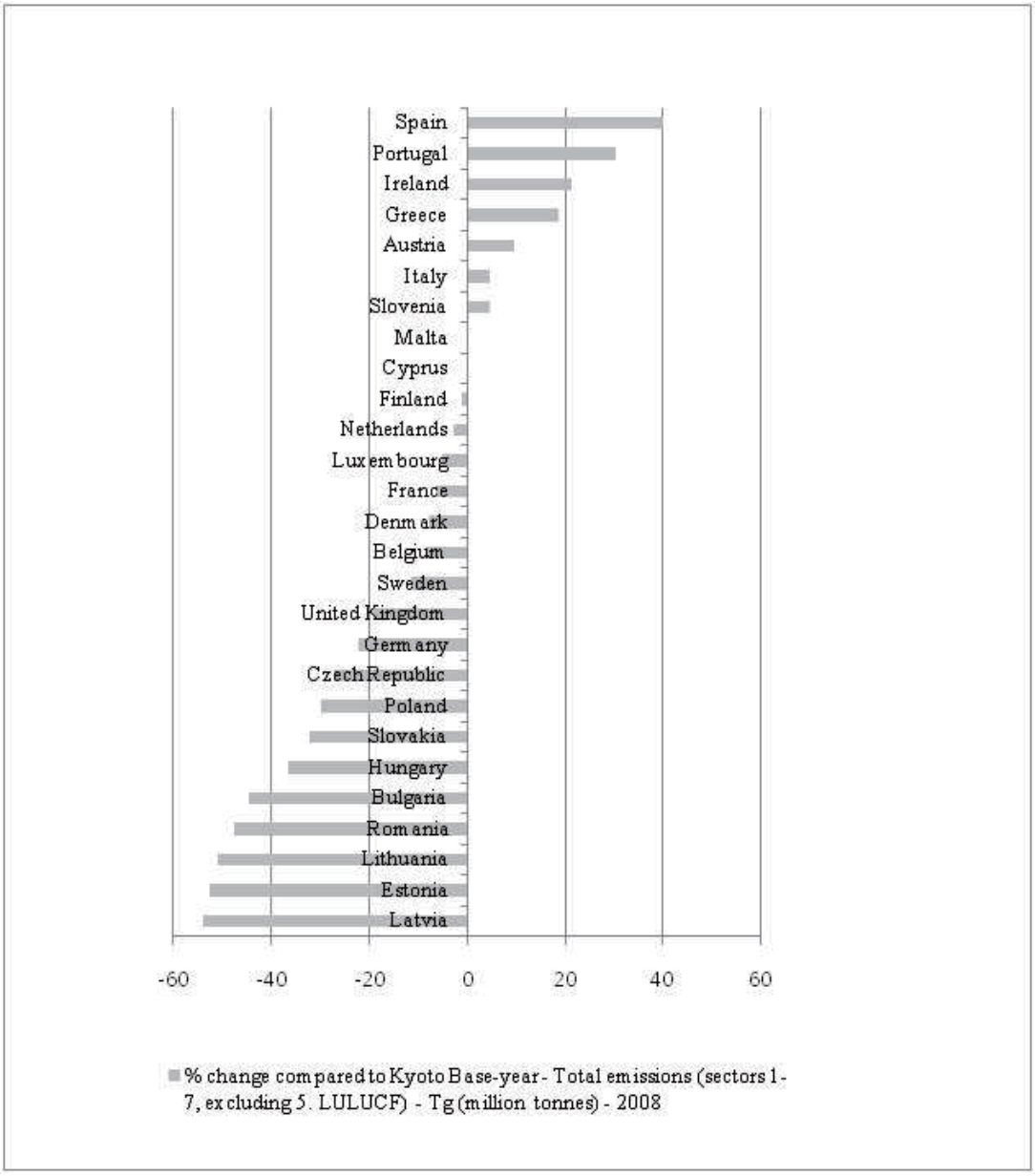
The attractive effect of EU ETS should be underlined. Indeed, some activities have been integrated into the MRV process only because of their integration into the EU Emission Trading Scheme. This is the reason why precisions about EU ETS will be given when necessary.

3 - General scheme of the MRV process



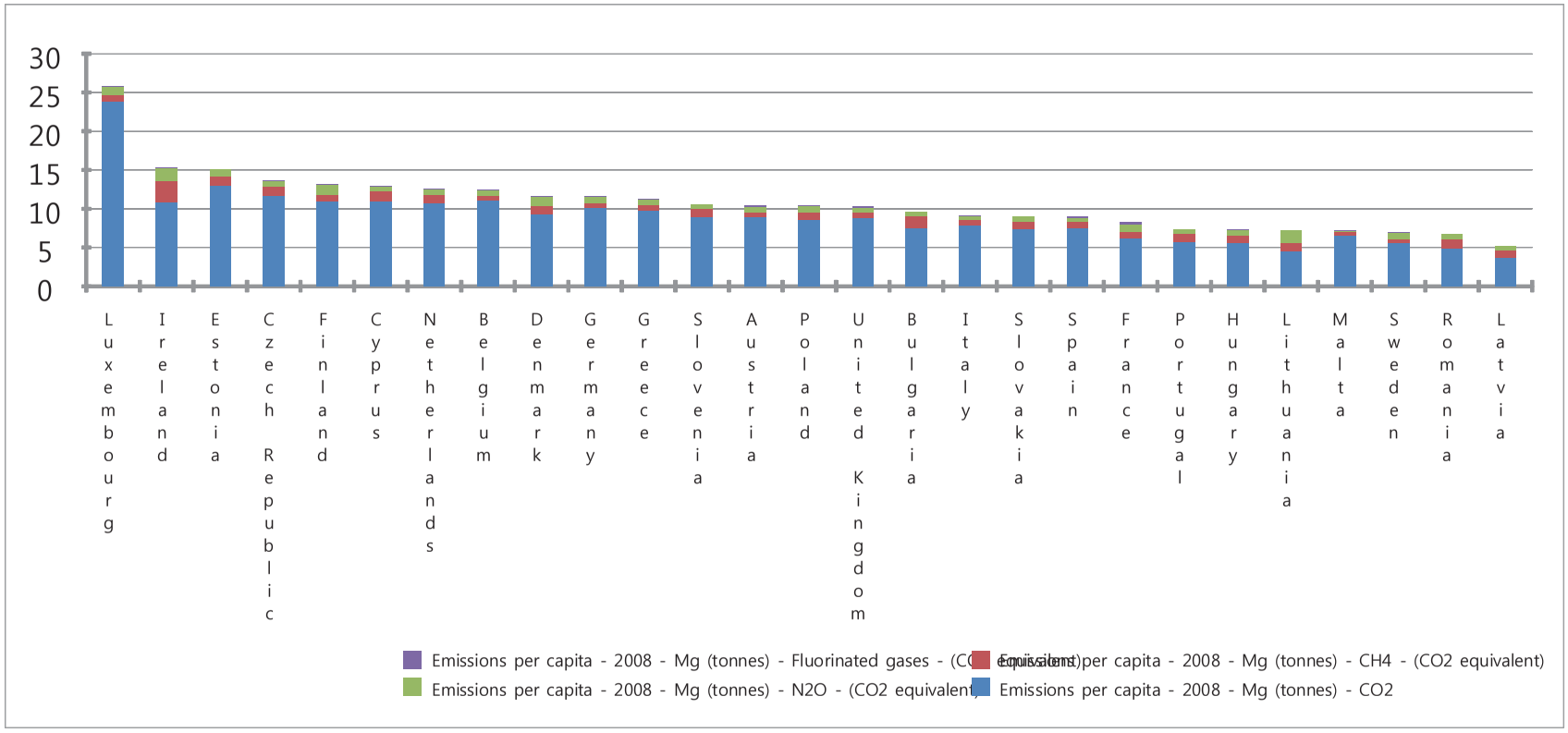
4 - General data relating to France

Comparison with European member States[12)]



12) Source: Pivot application, http://dataservice.eea.europa.eu/PivotApp/

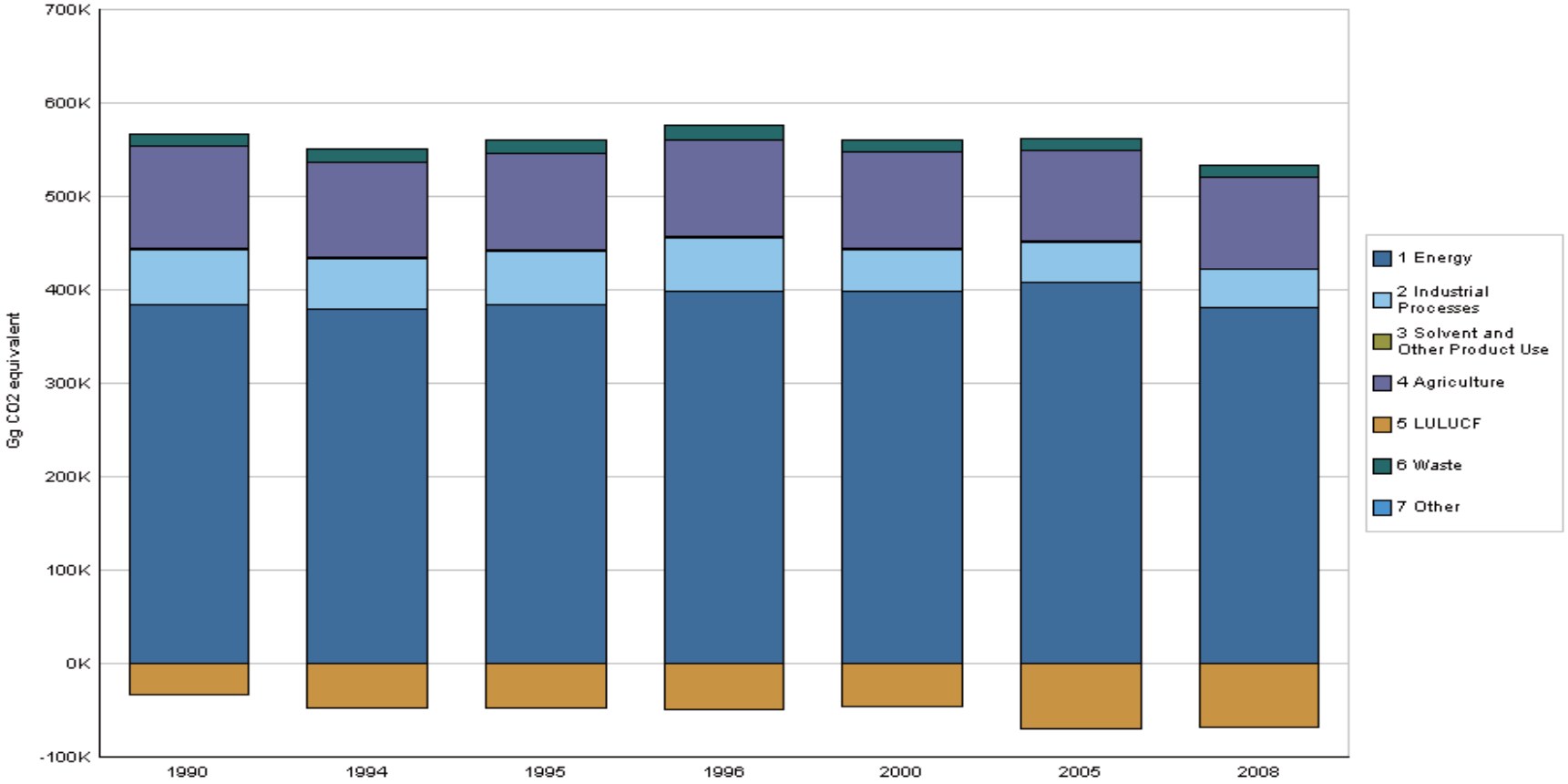
GHG Emissions per capita, EU 27[13)]



13) Source: Pivot application, http://dataservice.eea.europa.eu/PivotApp/

Annual greenhouse gas (GHG) emissions for France

Query results for Party: France - Years: 1990, 1994, 1995, 1996, 2000, 2005 and last year - Category: Total GHG emissions including LULUCF/LUCF - Gas: Aggregate GHGs



Source: UNFCCC Data Interface, Monday, 03 January 2011 10:23:24 CET

I - Measurement of greenhouse gases

Measurement, as the first step in the MRV process (1), is the basis of the fight against GHG emissions. For this reason, it must be realized under the best conditions possible. Consequently it is important to define precisely activities concerned and methodologies recommended.

But to be quite comprehensive, the particular case of activities subject only to the requirement of measurement must be evoked (2). Indeed, if these activities are not yet subject to reporting and verification requirements at the national level, it is likely that they will be someday.

1 - Activities concerned with the entire MRV process

Nowadays, two main activities are involved in the entire MRV process: classified facilities and aircraft operators.

At the beginning, the MRV process has been created exclusively for certain classified facilities. But it quickly appeared that this scheme needed to be reinforced in order to prepare post-Kyoto period[14]. Consequently it has been extended to other industrial activities (1) but also to aircraft operators (2) with the main preoccupation to increase the EU Emission Trading System.

(1) Classified facilities

Before evoking recommended methodology (b), it is necessary to define precisely which facilities are concerned (a) by this regulation. Then,

14) THIEFFRY Patrick, Renforcement du système d'échange de quotas d'émission de gaz à effet de serre : l'Union européenne prête pour l'après-Kyoto, Actualité Juridique du Droit Administratif, 2010, p. 259 et s.

because there are too many different situations, one will describe few examples of measurement (c).

a - Facilities concerned

Classified facilities are subject to the requirement of measurement whatever they are under rule of the EU ETS or the ELV system. Nonetheless, this distinction has to be done from the beginning because legal regime is different depending on this original distinction.

➢ EU ETS

The section R. 229-5 of the Environment Code details the industrial activities that must measure their greenhouse gases emissions in the framework of the EU Emission Trading System. It applies to classified facilities for the protection of the environment[15] producing or processing ferrous metals, energy, mineral products, paper or paper pulp. However, there is an exception with facilities or parts of facilities used for research, development and testing of new products and processes. According to the section aforementioned, facilities which meet criteria below are concerned[16]:

15) This is a juridical category. “Classified facilities for the protection of the environment” are facilities operated or owned by any person or entity, public or private, which may be dangerous or inconvenient for the neighborhood, health, safety, healthiness, agriculture, protection of nature, environment and landscape, for rational utilization of energy or conservation of sites and monuments and features of archaeological heritage (Environment Code, section L. 511-1).

16) We have mentioned supra that Directive 2009/29/EC has introduced production of aluminium and chemistry in the emission trading system. These activities are not in the following development because the Directive aforementioned has not yet been implemented in France. But it should be done shortly by an ordinance. Indeed, an enabling act is currently being studied by parliament in order to implement notably clauses of the Directive 2009/29/EC (see in annex I).

I. - Activities of energy production

I-A. - Combustion installations with a total rated thermal input exceeding 20 MW (Except in installations for the incineration of hazardous or municipal waste)

1. For combustion plants, one understands in particular the boilers, turbines and engines. Excluded are:
- Subject to II and 2 below, facilities using in a direct way a product of combustion in a manufacturing process, including industrial furnaces, reactors of chemical industry and heating or direct drying facilities;
- Boilers used solely for emergency power systems security or take over the main power failure during an operation or maintenance of this one;
- Generators used exclusively in emergency power supply.

2. Are included in this category of installations:
- Combustion plants used for the manufacture of ethylene or propylene;
- Combustion plants related to the manufacture of carbon black and related thereto;
- Flare stacks designed to exploit oil and gas stations at sea, for exploration, analysis, storage and treatment of these substances, and flare stacks in terrestrial terminals of reception of oil and gas exploited in these stations;
- Combustion plants used in the manufacture of rockwool;
- Direct drying facilities used on sites of manufacture of starch and dairy products.

I-B. - Oil Refineries
Coking plants

II. - Industrial activities outside the energy sector

II-A. - Production and processing of ferrous metals
Metal ore roasting or sintering plants, including sulphide ore.
Production of iron or steel plants (primary or secondary fusion), including

equipments for continuous casting with a capacity exceeding 2.5 tonnes per hour.
Facilities located on the same site as the facilities above and inserted into the cycle of production of iron or steel, including rolling mills, reheating furnaces, annealing furnaces and pickling equipments.

II-B. - Mineral industry
Facilities intended for the production of cement clinker in rotary kilns with a production capacity exceeding 500 tonnes per day, or lime in rotary kilns with a production capacity exceeding 50 tonnes per day, or in other types of furnaces with a production capacity exceeding 50 tonnes per day.
Facilities intended for the manufacture of glass, including those for the production of glass fibers and glass wool, with a melting capacity exceeding 20 tonnes per day.
Facilities for the manufacture of ceramic products by firing, in particular roof tiles, bricks, refractory bricks, floor tiles, stoneware or porcelain, with a production capacity exceeding 75 tonnes per day, a capacity oven higher than 4 m^3 and a density per kiln exceeding 300 kg/m^3.

II-C. - Other Activities
Industrial plants for the manufacture of:
a) Paper pulp from timber or other fibrous materials;
b) Paper and paperboard with a production capacity exceeding 20 tonnes per day.

- ELV system

The article 28 of Directive 2009/29/EC has modified the article 27 of Directive 2003/87/EC and has also confirmed the exclusion of small installations subject to equivalent measures. And activities which are not under rule of EU ETS enter into the ELV system. The Directive provides that “Following consultation with the operator, Member States

may exclude from the Community scheme installations which have reported to the competent authority emissions of less than 25,000 tonnes of carbon dioxide equivalent and, where they carry out combustion activities, have a rated thermal input below 35 MW, excluding emissions from biomass [···] and which are subject to measures that will achieve an equivalent contribution to emission reductions". However, the Member State concerned has to comply with few conditions.

First, the Member State has to notify the Commission of each such installation, specifying the equivalent measures applying to that installation that will achieve an equivalent contribution to emission reductions that are in place, before the list of installations pursuant to Article 11(1)[17] has to be submitted and at the latest when this list is submitted to the Commission.

Then, the Member State has to confirm that monitoring arrangements are in place to assess whether any installation emits 25,000 tonnes or more of carbon dioxide equivalent, excluding emissions from biomass, in any one calendar year. Member States may allow simplified monitoring, reporting and verification measures for installations with average annual verified emissions between 2008 and 2010 which are below 5,000 tonnes a year, in accordance with Article 14. This flexibility obviously allows reducing associated costs[18].

Furthermore, the Member State has to confirm that if any installation emits 25,000 tonnes or more of carbon dioxide equivalent, excluding

17) "Each Member State shall publish and submit to the Commission, by 30 September 2011, the list of installations covered by this Directive in its territory and any free allocation to each installation in its territory calculated in accordance with the rules referred to in Article 10a(1) and Article 10c".

18) BROHE Arnaud, Les marchés de quotas de CO2, Larcier, 2008, p. 85.

emissions from biomass, in any one calendar year or the measures applying to that installation that will achieve an equivalent contribution to emission reductions are no longer in place, the installation will be reintroduced into the Community scheme.

Finally, the Member State has to publish the information referred to in points aforementioned for public comment.

In addition, the Directive extends this exclusion of the Community scheme to hospitals if they undertake equivalent measures.

b - Methodology recommended

The article 4 of the ministerial order of March 31st 2008 allows a determination of emissions using either:

- A calculation-based methodology;
- A measurement-based methodology.

However, the operator may propose to measure emissions if he can demonstrate that:

- It reliably gives higher accuracy than the relevant calculation applying a combination of the highest tiers;
- The comparison between measurement and calculation is based on an identical list of sources and emissions.

➢ Calculation-based methodology

According to the Decision 2007/589/EC, the calculation of CO2 emissions shall be based either on the following general formula:

CO2 emissions = activity data[19] * emission factor[20] * oxidation factor

However, there is a difference between combustion emissions and

process emissions[21]:

Combustion emissions	Process emissions
Activity data shall be based on fuel consumption. The quantity of fuel used shall be expressed in terms of energy content as TJ, unless otherwise indicated in these guidelines. The emission factor shall	Activity data shall be based on material consumption, throughput or production output and expressed in t or Nm3. The emission factor shall be expressed in [tCO2/t or tCO2/Nm3]. Carbon contained in

19) According to the annex I of the ministerial order of March 31st 2008, activity data represent information on material flow, consumption of fuel, input material or production output expressed as energy [TJ] (in exceptional cases also as mass or volume [t or Nm3]) in the case of fuels and mass or volume in the case of raw materials or products [t or Nm3]. The determination of activity data by the operator can be based on the invoiced amount of fuel or material determined in compliance with Annex I and the approved tiers of Annexes II to XI of the Decision 2007/589/EC.

Where activity data for the calculation of emissions cannot be determined directly, the activity data shall be

determined via an assessment of stock changes:

Material T = Material A + (Material D - Material F) - Material E

Where:

Material T: Material processed during the reporting period;

Material A: Material purchased during the reporting period;

Material D: Material stock at the beginning of the reporting period;

Material F: Material stock at the end of the reporting period;

Material E: Material used for other purposes (transportation or re-sold).

20) Emission factors are based on the carbon content of fuels or input materials and expressed as tCO2/TJ (combustion emissions), or tCO2/t or tCO2/Nm3 (process emissions). For the conversion of carbon into the respective value for CO2 the factor of 3,664 [tCO2/t C] shall be used. A table of emission factors according to European legislation is available in Annex II and can be confronted with the French implementation in Annex III.

Biomass is considered as CO2 neutral. An emission factor of 0 [tCO2/TJ or t or Nm3] shall be applied to biomass. An exemplary list of different types of materials accepted as biomass is given in Section 12 of the Annex I of the Decision 2007/589/EC.

21) Nevertheless, an alternative approach could be used if defined in the activity-specific guidelines (see below in [c - Chosen examples of activity-specific guidelines]).

Combustion emissions	Process emissions
be expressed as tCO2/TJ, unless otherwise indicated in these guidelines. When a fuel is consumed not all of the carbon in the fuel is oxidized to CO2. Incomplete oxidation occurs due to inefficiencies in the combustion process that leave some of the carbon unburned or partly oxidized as soot or ash. Un-oxidized or partially oxidized carbon is taken into account in the oxidation factor which shall be expressed as a fraction. The oxidation factor shall be expressed as a fraction of one. The resulting calculation formula is: *CO2 emissions = fuel flow [t or Nm3] * net calorific value [TJ/t or TJ/Nm3] * emission factor [tCO2/TJ] * oxidation Factor*	input materials, which is not converted to CO2 during the process, is taken into account in the conversion factor which shall be expressed as a fraction. In the event that a conversion factor is taken into account in the emission factor, a separate conversion factor shall not be applied. The quantity of input material used shall be expressed in terms of mass or volume [t or Nm3]. The resulting calculation formula is: *CO2 emissions = activity data [t or Nm3] * emission factor [tCO2/t or Nm3] * conversion factor*

In order to implement this ministerial order, the "Agence de l'Environnement et de la Maîtrise de l'Energie"[22] (ADEME) has created the "Bilan Carbone"® method[23]. It is a method of accounting of greenhouse

22) The ADEME is an industrial and commercial public establishment under the joint supervision of three different Ministries: Ecology, Sustainable Development, Transportation and Housing; Higher Education and Research; Industry, Energy and Digital Economy.

23) It consists with:

- An Excel spreadsheet, said "Master spreadsheet", ready to perform the calculation of emissions, compare the emissions from one year to another and assess the potential of

gas emissions from readily available data to achieve a good assessment of direct emissions or induced by the activity measured. This assessment is the first step to making a "greenhouse effect" diagnosis of its business. By organizing emission sources according to their importance, it is easier to prioritize actions in order to reduce emissions most effectively. This method developed by the ADEME is compatible with ISO 14064, GHG Protocol Initiative and the EU ETS Directive (2003/87/EC) concerning the system for trading of CO2.

- Measurement-based methodology

The GHG emissions may be determined by a measurement-based methodology using Continuous Emission Measurement Systems (CEMS) from all or selected emission sources using standardized or accepted methods once the operator has received approval from the competent authority before the reporting period that using a CEMS achieves greater accuracy than the calculation of emissions using the most accurate tier approach. Specific approaches for measurement based methodologies are laid down in Annex XII of these guidelines. Installations applying CEMS as part of their monitoring system are to be notified by Member States to the EU Commission pursuant to Article 21 of Directive 2003/87/EC.

The procedures applied for the measurement of concentrations, as well

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various mitigation actions;
- A first utility specifically designed to assist the user in calculating tonnes/kilometers in road transport;
- A second utility dedicated to the calculation of leakage of refrigerant gases in refrigeration and air conditioning;
- A third utility intended to allow the user to exploit the main results of the spreadsheet by simulating “what is at stake economically” if the cost of fossil fuels increases, or if a tax on GHG emissions is imposed;
- Instruction manuals to use these spreadsheets.

as for mass or volume flows shall, where available, be according to a standardized method that limits sampling and measurement bias and has a known measurement uncertainty. CEN standards (i.e. those issued by the European Committee for Standardization) shall be used, if available. If CEN standards are not available, suitable ISO standards (i.e. those issued by the International Standardization Organization) or national standards shall apply. Where no applicable standards exist, procedures can be carried out where possible in accordance with suitable draft standards or industry best practice guidelines.

Relevant ISO standards include, inter alia:

- ISO 12039:2001 Stationary source emissions - Determination of carbon monoxide, carbon dioxide and oxygen - Performance characteristics and calibration of an automated measuring method,
- ISO 10396:2006 Stationary source emission - Sampling for the automated determination of gas concentrations,
- ISO 14164:1999 Stationary source emissions. Determination of the volume flow rate of gas streams in ducts - automated method.

The biomass fraction of measured CO2 emissions shall be subtracted based on the calculation approach and shall be reported as a memo item

Total emissions of a greenhouse gas from an emission source over the reporting period shall be determined by using the below formula (including GHG concentration[24] and flue gas flow[25]):

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24) The GHG concentration in the flue gas is determined by continuous measurement at a representative point.

25) The dry flue gas flow can be determined using one of the following methods:
Method A
The flue gas flow Qe is calculated by means of a mass-balance approach, taking into account all significant parameters such as input material loads, input air flow, process

$$GHG_{-tot\ ann}\ [t] = \sum_{i=1}^{operating\_hours\_p.a.} GHG\text{-}concentration_i * flue\ gas\ flow_i$$

In case several emission sources exist in one installation and cannot be measured as one, emissions from these emission sources shall be measured separately and summed up to the total emissions of the specific gas over the reporting period in the whole installation.

According to the Annex I of the ministerial order enacted on March 31st 2008, the CEMS implies frequent measures:

Fuel/Material	Frequency of analysis
Natural gas	At least weekly
Process gas (a mixture of refinery gas, coke oven gas, blast furnace gas and converter gas)	At least daily, following proper procedures at different times of day
Fuel oil	All 20 000 tonnes and at least six times a year
Coal, coking coal, petroleum coke	All 20 000 tonnes and at least six times a year
Solid waste (fossil pure or mixed waste biomass / waste fuels)	All 5 000 tonnes and at least four times a year
Liquid waste	All 10 000 tonnes and at least four times a year

efficiency, etc. and on the output side the product output, the O2 concentration, SO2 and NOx concentrations, etc. The specific calculation approach shall be approved by the competent authority as part of the evaluation of the monitoring plan and the monitoring methodology therein.

Method B

The flue gas flow Qe is determined by continuous flow measurement at a representative point.

Fuel/Material	Frequency of analysis
Carbonate minerals (limestone and dolomite, for example)	All 50 000 tonnes and at least four times a year
Clays and shales	Amounts of material corresponding to 50,000 tonnes of CO2, at least four times a year
Other inflows and outflows recorded in the mass balance (not applicable to fuels and reducing agents)	All 20 000 tonnes and at least once a month
Other materials	Depending on the type of material and the variation quantity of material corresponding to 50 000 tonnes of CO2, at least four times a year

c - Chosen examples of activity-specific guidelines

There are too many different activities that need to be calculated (the measurement-based methodology is not concerned here). That is why one can only give few concrete examples with steel works and manufacture of glass..

- Steel works: coke ovens, metal ore roasting and sintering installations, production of pig iron and steel

These three different activities are mentioned separately in the EU Decision 2007/589/EC but they are gathered in the French ministerial order of March 31st 2008. Indeed, they can be part of steel works with a direct technical connection between themselves.

If the installation's permit encompasses the entire steel works and not solely coke ovens, metal ore roasting and sintering installations, production of pig iron and steel, the CO2 emissions may also be monitored for the integrated steel works as a whole, using the mass-balance approach. If it does not, these three activities have to be measured separately.

The mass-balance approach shall consider all carbon in inputs[26], stocks[27], products[28] and other exports[29] from the installation to determine the level of emissions of greenhouse gases over the reporting period, using the following equation:

CO2 emissions [tCO2] = (input - products - export - stock changes) * conversion factor CO2/C

Finally, the calculation shall then be as follows:

CO2 emissions [tCO2] = (Σ (activity data $_{input}$ * carbon content $_{input}$) - Σ (activity data $_{products}$ * carbon content $_{products}$) - Σ (activity data $_{export}$ * carbon content $_{export}$) - Σ (activity data $_{stock\ changes}$ * carbon content $_{stock\ changes}$)) * 3,664

Nevertheless, when the three activities aforementioned are not considered as a whole, they have to be measured separately. Concerning combustion emissions, there is no particular difficulty because the previous

26) Input [tC]: all carbon entering the boundaries of the installation.

27) Stock changes [tC]: stock increases of carbon within the boundaries of the installation.

28) Products [tC]: all carbon in products and materials, including by-products, leaving the boundaries of the installation.

29) Export [tC]: carbon exported from the boundaries of the installation, e.g. discharged to sewer, deposited into landfill or through losses. Export does not include the release of greenhouse gases into the atmosphere.

general formula[30] applies. But concerning process emissions, there is a little difference depending on the activity:

Coke ovens; production of pig iron and steel	Metal ore roasting and sintering installations
CO2 emission [tCO2] = Σ (activity data $_{input}$ * emission factor $_{input}$) - Σ (activity data $_{output}$ * emission factor $_{input}$)	CO2 emissions = Σ (activity data $_{process\ input}$ * emission factor * conversion factor)

- Installations for the manufacture of glass

CO2 is released during melting in the furnace, from carbonates contained in the raw materials, and from the neutralization of HF, HCl and SO2 in the flue gases with limestone or other carbonates. Emissions from the decomposition of carbonates in the melting process and from scrubbing shall both be part of the installation's emissions. They shall be added to the emission total but be reported separately if possible. CO2 from carbonates in the raw materials released during melting in the furnace is directly linked with the glass production and shall be calculated based on the converted quantity of carbonates from raw material - mainly soda, lime/limestone, dolomite and other alkali and alkali earth carbonates supplemented by carbonate free recycled glass (cullet). Calculation shall be based on the amount of carbonates consumed. The following formula shall be used:

CO2 emissions [t CO2] = Σ (activity data * emission factor) + Σ (additive * emission factor)

30) CO2 emissions = fuel flow [t or Nm3] * net calorific value [TJ/t or TJ/Nm3] * emission factor [tCO2/TJ] * oxidation Factor

In this formula, “Activity data” is the amount [t] of carbonate raw materials or additives associated with CO2 emissions, as delivered (such as dolomite, limestone, soda, and other carbonates) and processed for the production of glass in the installation during the reporting period. The GHG emissions must be calculate with the following emission factors:

Carbonate	Emission factor [t CO2/t carbonate]
CaCO3	0,440
MgCO3	0,522
Na2CO3	0,415
BaCO3	0,223
Li2CO3	0,596
K2CO3	0,318
SrCO3	0,298
NaHCO3	0,524

Furthermore, the ministerial order of March 31st 2008 has enacted additional data. Indeed, CO2 emissions from glassworks are very different depending on the type of manufactured glass (flat glass, glass containers, glass bottles and domestic, fiber glass [building], glass wool, glass art and others). The default formula used to calculate emissions are:

- Flat glass: emissions (tCO2) = Production capacity of glassware (t/year) × 0, 75;
- Container glass (bottles and jars): emissions (tCO2) = Production capacity of glassware (t/year) × 0, 7;
- Domestic glass, bottle: emissions (tCO2) = Production capacity of glassware (t/year) × 1, 7;
- Glass wool: emissions (tCO2) = Production capacity of glassware

(t/year) × 0, 6;

- Fiber reinforcement: emissions (tCO2) = Production capacity of glassware (t/year) × 1;
- Glasses and other techniques: emissions (tCO2) = Production capacity of glassware (t/year) × 1, 3.

(2) - Aircraft operators

Aviation contributes to the overall climate change impact of human activities and the environmental impact of greenhouse gas emissions from aircraft can be mitigated through measures to tackle climate change in the EU and third countries, especially in developing countries, and to fund research and development for mitigation and adaptation including in particular in the fields of aeronautics and air transport. The integration of aircraft operators in the MRV process has been motivated by its integration in the Emission Trading Scheme and initiated by directive 2008/101/EC. The objective of the amendments made to directive 2003/87/EC by this directive is to reduce the climate change impact attributable to aviation by including emissions from aviation activities in the Community scheme[31].

31) Indeed, “Aviation has an impact of around 3% on global climate because it releases emissions of carbon dioxide, oxides of nitrogen, water vapor and particles of sulfate and soot. The Intergovernmental Panel on Climate Change has estimated that the long-term impact of aviation on climate change was mainly due to its emissions of carbon dioxide”. Rapport au Président de la République relatif à l’ordonnance No. 2010-1232 du 21 octobre 2010 portant diverses dispositions d’adaptation au droit de l’Union européenne en matière d’environnement, JORF, No. 246, 22 octobre 2010.

a - Flights concerned

This is a strong illustration of European Union's determination[32] because it is a fact that emissions from international aviation are not integrated into Member States' commitments under the Kyoto Protocol. Indeed, this Directive provides that "From 1st January 2012 all flights which arrive at or depart from an aerodrome situated in the territory of a Member State to which the Treaty applies shall be included" in the emission trading scheme, except several situations[33].

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32) This commitment reflects a willingness to exceed the letter of the text of Kyoto. Indeed, European Union has fulfilled more stringent reduction targets than those expected by the Kyoto Protocol. LE BAULT-FERRARESE Bernadette, La réception du Protocole de Kyoto en droit européen, Revue Trimestrielle de Droit Européen, 2010, p. 55 et s.

33) "(a) flights performed exclusively for the transport, on official mission, of a reigning Monarch and his immediate family, Heads of State, Heads of Government and Government Ministers, of a country other than a Member State, where this is substantiated by an appropriate status indicator in the flight plan;
(b) military flights performed by military aircraft and customs and police flights;
(c) flights related to search and rescue, fire-fighting flights, humanitarian flights and emergency medical service flights authorized by the appropriate competent authority;
(d) any flights performed exclusively under visual flight rules as defined in Annex 2 to the Chicago Convention;
(e) flights terminating at the aerodrome from which the aircraft has taken off and during which no intermediate landing has been made;
(f) training flights performed exclusively for the purpose of obtaining a licence, or a rating in the case of cockpit flight crew where this is substantiated by an appropriate remark in the flight plan provided that the flight does not serve for the transport of passengers and/or cargo or for the positioning or ferrying of the aircraft;
(g) flights performed exclusively for the purpose of scientific research or for the purpose of checking, testing or certifying aircraft or equipment whether airborne or ground-based;
(h) flights performed by aircraft with a certified maximum take-off mass of less than 5 700 kg;
(i) flights performed in the framework of public service obligations imposed in accordance with Regulation (EEC) No. 2408/92 on routes within outermost regions, as

b - Methodology recommended

Emissions shall be monitored by calculation, using the following formula:

Fuel consumption × emission factor

The Directive aforementioned refer to 2006 IPCC Inventory Guidelines or subsequent updates of these Guidelines concerning the emission factors[34].

Fuel consumption shall include fuel consumed by the auxiliary power unit. Actual fuel consumption for each flight shall be used wherever possible and shall be calculated using the following formula:

(Amount of fuel contained in aircraft tanks once fuel uplift for the flight is complete) - (amount of fuel contained in aircraft tanks once fuel uplift for subsequent flight is complete) + (fuel uplift for that subsequent flight).

If actual fuel consumption data are not available, a standardized tiered

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specified in Article 299(2) of the Treaty, or on routes where the capacity offered does not exceed 30 000 seats per year; and

(j) flights which, but for this point, would fall within this activity, performed by a commercial air transport operator operating either:

- Fewer than 243 flights per period for three consecutive four-month periods, or
- Flights with total annual emissions lower than 10 000 tonnes per year.

Flights performed exclusively for the transport, on official mission, of a reigning Monarch and his immediate family, Heads of State, Heads of Government and Government Ministers, of a Member State may not be excluded under this point".

34) Decision 2009/339/EC of April 16th 2009 amending Decision 2007/589/EC as regards the inclusion of monitoring and reporting guidelines for emissions and tonne-kilometer data from aviation activities:

Fuel	Emission factor (tCO2/tfuel)
Aviation gasoline (AvGas)	3,10
Jet gasoline (Jet B)	3,10
Jet kerosene (Jet A1 or Jet A)	3,15

method shall be used to estimate fuel consumption data based on best available information.

Default IPCC emission factors, taken from the 2006 IPCC Inventory Guidelines or subsequent updates of these Guidelines, shall be used unless activity-specific emission factors identified by independent accredited laboratories using accepted analytical methods are more accurate. The Directive also provides that the emission factor for biomass shall be zero and that, furthermore, a separate calculation shall be made for each flight and for each fuel.

2 - Activities concerned by the only obligation of measurement

Other legal entities are concerned with the requirement to measure greenhouse gas emissions excluding other obligations (without national reporting and verification). Such is the case of territorial authorities and also limited companies.

(1) - Legal entities of public law

Local authorities have been integrated into the national movement for reducing greenhouse gas emissions. Section L. 1111-2 of the General Code of Territorial Authorities specifies that they must help the State in the fight against greenhouse effect by the mastery and rational use of energy.

a - Creation of local strategic documents: Regional climate, air and energy plans

Articles L. 222-1, L. 222-2 and L. 222-3 of the Environment Code consider the issue in a more concrete way. Indeed, the Code requires the creation of "Schémas Régionaux Climat, Air, Energie"[35] (SRCAE[36]) which must be developed by the joint action of the "préfet de region"[37] and the president of the Regional Council[38] after consultation with territorial authorities of the considered region[39]. This plan is a strategic document which associates local and State actions in a long term perspective with two main dates: 2020 and 2050. Article L. 222-1 defines tree major objectives:

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35) Regional climate, air and energy plans.

36) This local strategic document replaces the regional plan for air quality (PRQA) introduced by the law on air and the rational use of energy of December 30th 1996 and amended by decree No. 98-362 of May 6th 1998, integrated into articles R. 222-1 to R. 222-12 of the Environment Code. It consisted of setting medium and long-term approaches to prevent or reduce air pollution in order to attain the objectives in terms of air quality defined in this plan.
The establishment and monitoring of the PRQA were transferred to the Regional Councils by virtue of the law relative to local democracy of 27 February 2002. This plan was based on the measurement of air quality and emissions inventory. It was used as a tool for scheduling, information and public dialogue at regional level.
To meet the objectives in terms of air quality, it set orientations to prevent or curb air pollution or reduce its effects. Revised every 5 years, this plan should be submitted for public consultation.

37) General administrator of a "Région". He represents State authority.

38) Locals elected.

39) In France, there is a three levels organization: first, "communes", then "départements" and finally "régions". And "régions" seem to be the best local level in order to adapt specifically the national climate plan and to unify all the existing expertise at the local level. BRAYE Dominique, NÈGRE Louis, SIDO Bruno et DUBOIS Daniel, Rapport fait au nom du Sénat, n° 552, 2009, Tome I, p. 193.

- Mitigate effects of climate change and adapt thereto. Local authorities must help State fulfills the goal of reducing greenhouse gas emissions: divide emissions by four before 2050[40];
- Prevent or reduce air pollution;
- Establish qualitative and quantitative targets to be achieved, on the one hand in developing the potential of terrestrial energy (notably renewable and recovery energy), and on the other hand for implementation of efficient techniques for energy efficiency such as cogeneration units, including power from biomass, accordance with objectives from the European legislation on energy and climate. In addition, a regional wind plan is appended to this document and defines, in line with objectives from the European legislation on energy and climate, parts of the territory propitious for developing wind energy.

The draft plan is based on several tools (taking into account economic and social aspects) developed in the "region". The II of the article L. 222-1 of environment code lists the different tools:

- An inventory of emissions of air pollutants and greenhouse gas emissions;
- Energy balance;
- An assessment of the potential energy, renewable and recovery;
- An assessment of possible improvements in energy efficiency;
- An assessment of air quality and its effects on public health and the environment.

The implementing decree for regional climate, air and energy plans has

40) BOISSIEU (de) Christian, Division par quatre des emissions de gaz à effet de serre de la France à l'horizon 2050, La Documentation française, Paris, 2006, 142 p.

not yet been enacted. However, the draft decree already provides relevant information's about greenhouse gas emissions. And the 5th of the future article R. 222-2 I enacts that Local authorities must realize an inventory of greenhouse gases emissions in the following sectors: residential, tertiary, transport, agriculture, industry and garbage.

The draft plan is made available to the public during a period of one month to allow participation. After, it is finally adopted by the Regional Council and ordered by the regional "préfet". After a period of five years, the regional plan is evaluated and may be revised as a joint initiative of the regional "préfet" and the president of the Regional Council in line with results obtained in achieving objectives and, in particular, according with the standards of air quality.

Each region needs to adopt this plan within a period of one year following the entry into force of Act No. 2010-788 of July 12th 2010 on national commitment to the environment that is before July 13, 2011. This very short period is already criticized even though the implementing decree has not yet been enacted. One thinks that this dead line is not realistic.

The ADEME has already adapted the "Bilan Carbone®" method for Local authorities. This program proposes two specific modules. The first one allows Local authorities defining their own greenhouse gas emissions in various matters (housing, garbage management, education, sports equipment etc. every matters belonging to their competencies). Thanks to this program, Local authorities can be exemplary actors of decentralization. The second one calculates greenhouse gas emissions including all activities within the territory of the community. The study allows integrating ten areas: energy industries, industrial processes, tertiary, residential, agriculture and fisheries, freight, passenger transport, road and constructions, end of

life waste, manufacturing of future waste.

However, we must clarify that this new obligation on local authorities has a cost: this service is capped at 15,000 € for a Company and to 30,000 € including VAT for a local authority and the cost is funded 50% by ADEME.

b - Balance of greenhouse gas emissions

All legal persons of public law are now required to produce a balance of greenhouse gas emissions[41] about both patrimony and competences. The article L. 229-25 No. 3 of environment Code includes following public persons:

- Local authorities: State; "Régions"; "Départements"; "Communes" or "Communautés de communes" exceeding 50.000 inhabitants;
- Public persons employing more than 250 people.

Nonetheless, "Communes" or "Communautés de communes" which population is under 50.000 inhabitants and public persons employing less than 250 people can also voluntary pass a balance of greenhouse gas emissions.

Balances of greenhouse gas emissions must be provided before December 31st 2012. In order to encourage public persons, the method of establishing balance will be freely available to local authorities and their groupings.

Balances, which have to be updated every three years, are collected both by "préfet" and president of Regional Council. These public

41) HAVARD Michel, Rapport sur l'obligation d'élaboration d'un bilan d'émissions des gaz a effet de serre prévue par l'article 26 du Projet de loi portant "Engagement National pour l'Environnement", in collaboration with GAZEAU Jean-Claude (IGPEF), December 2009, 45 p., La Documentation française, March 2010

authorities have to check balances of greenhouse gas emissions and local policies subsequently developed by legal entities of public law.

To conclude, French local authorities feel really involved in fight against GHG emissions: indeed, in France the greenhouse effect comes mainly (80%) from energy consumption and thus CO2 emissions from buildings, vehicles and industry. And local authorities, holders of power in urban planning, territorial planning and concessions on production or transportation of energy, can play an important role in the fight against global warming. And to prove their engagement, they made a common declaration before Copenhagen and Cancun according to which European Union have to amend the EU ETS system. It is therefore in the negotiations that will soon open at the European level, targeting for the next programming period, to define the European objectives and financial resources that will be made, of identify climate change and action by local and regional authorities as a priority in all common policies, particularly the cohesion policy. In this perspective the EU ETS will impose the auctioning from 2013 emission permits granted to businesses. Their sale will bring in money to member States. Of the total recoveries, at least 50% will be used in actions against climate change according to the Commission. Of the 50% dedicated to action against global warming, local authorities offer the following share: one third for companies that act against greenhouse gas emissions; one third to power the “green funds” set up in Copenhagen for fight against global warming; the remaining third would be allocated to local authorities. In order to obtain this financing, local authorities are aware that their actions must be “measurable, reportable and verifiable”. That is the reason why one thinks that local authorities should be integrated in the MRV system.

(2) - Legal entities of private law

These legal entities are concerned by the Commercial Code but also by the Environment Code.

a - Corporations under Commercial Code

Section L. 225-102 of the Commercial Code requires that Board of directors of corporations providing an annual report during general assembly. Obviously, this report concerns mainly the commercial, economic and tax situation of the company. Yet since a decree of January 14th 2009[42] it must also contain environmental information. And section A. 225-1 of the Commercial Code establishes obligations involving to corporations in matter of environment:

- Air emissions of greenhouse gases, of substances contributing to acidification, eutrophication and photochemical pollution, of persistent organic compounds;
- Emissions to water and soil of substances contributing to acidification or eutrophication, of toxic substances in the aquatic environment;
- Emissions to air and water of toxic metals, radioactive substances, and substances that are carcinogenic, mutagenic or toxic to reproduction.

b - Legal entities of private law under Environment Code

Certain entities of private law are also in obligation to provide a balance of greenhouse gas emissions. Article L. 229-25 of environment Code mentions two different cases:

42) JORF n°16, January 14th 2009, p. 1132.

- Legal entities of private law employing over 500 people;
- In the overseas territories, legal entities of private law employing over 250 people.

Here, one can point two remarks. The first one is that there is a difference between France and French overseas territories. Indeed, French overseas territories are very small territories and it is a fact that there are not a lot of big entities of private law. The second one is that the method of establishing the balance of greenhouse gas emissions is not free for legal entities of private law, contrary to Local authorities.

Balances, which have to be updated every three years, are collected both by “préfet” and president of Regional Council. These public authorities have to check balances of greenhouse gas emissions and environment policies subsequently developed by legal entities of private law.

Ⅱ - Reporting of greenhouse gases

Declaration of GHG emissions is a formality required for activities included in ELV system and in EU ETS system. So the distinction aforementioned does not need to be taking in account. In order to simplify, one presents first classified facilities and then aircraft operators.

Nonetheless, one has to emphasize a little difference concerning the dead line for reporting GHG emissions: activities depending on the ELV system have to be reported, each year, before March 31st while activities depending on the EU Emission Trading System have to be reported, each year, before February 15th. This difference is understandable with the necessity to organize, as soon as possible, the trading of allowances.

1 - Classified facilities

Every year, the Ministry for ecology, sustainable development and spatial planning collects data relative to pollutant emissions into the air, water, soil and waste of classified installations. This data must be entered onto a specifically dedicated website, the GEREP[43] (GEstion Électronique du Registre des Émissions Polluantes[44]).

Data are used to make information on emissions available to the general public, at national[45] and European[46] levels. Data on CO2 emissions are used to constitute the register created to implement the Directive of

43) https://www.declarationpollution.ecologie.gouv.fr/gerep/

44) Electronic management of pollutants emissions register.

45) Data are published on the website of the iREP (Registre français des Emissions Polluantes sur internet) http://www.irep.ecologie.gouv.fr/IREP/index.php

46) Data are published on the website of the E-PRTR (European Pollutant Release and Transfer Register) http://prtr.ec.europa.eu/

October 13th 2003 establishing a greenhouse gas emissions trading scheme within the Community. Air emissions data are also used by CITEPA when carrying out national emissions inventories, aimed at demonstrating French compliance with international commitments as well as with European directives.

The disclosure website contains two Excel files which are downloadable. The first one is for industrial activities while the second one is for farming activities. This website also provides several guides in order to help concerned people to estimate truly their data.

The declaration file contains many tables integrating the results of measurements of greenhouse gas emissions. Due to their high numbers, it is impossible to integrate them in the present report. Consequently we can only give a short description of the “Industry” disclosure file:

- “Properties”: identification of the operator and facility, administrative information;
- “Water”: disclosure of water emissions and sampling;
- “Air”: disclosure of air emissions and disclosure of greenhouse gas emissions for the facilities concerned;
- “Waste”: disclosure of hazardous waste production and treatment of hazardous and non-hazardous waste for the installations concerned;
- “Toxic”: disclosure of toxic or carcinogenic substance emissions into the air, water, soil and waste;
- “Assessment & Questions”: identification of the signatory and disclosure validation.

2 - Aircraft operators

There are two different types of aircraft operator: the ones are submitted to the ordinary law, the others are under small emitters' regulation.

(1) - Ordinary law

The Commission Decision 2009/339/EC on the inclusion of monitoring and reporting guidelines for emissions and tonne-kilometer data from aviation activities, published on April 16th 2009, has amended the Decision 2007/589/EC. It has defined August 31st 2009 as the deadline to submit an activity monitoring plans which is the only way for aircraft operators to ask for free allowances in 2011 when submitting their activity report.

It has also precised that each aircraft operator must submit an emission monitoring plan before year 2010 of 2011 and then must update it before each trading period (which means before 2012 and 2013)[47].

After each monitoring year, the aircraft operators will have to submit an emission report before March 31st of the following year to the DGAC. This report must be verified by an independent verifier (infra) before submission.

Aircraft operators have been included in the MRV cycle by the ordinance n° 2010-1232, enacted on October 21st 2010[48], according to

47) Monitoring plans must be submitted to the following email address (est.aviation@aviation-civile.gouv.fr) or, failing that, by postal mail to the following postal address (DTA-SDD-ETS, 50 rue Henry Farman, 75720 PARIS CEDEX 15, FRANCE).

48) JORF n°246, October 22nd 2010, p. 18885.

the following calendar:

- January 1st 2010: Beginning of the emissions data monitoring and activity data monitoring.
- August 31st 2010: Deadline to submit emissions monitoring plans for 2011 regarding airlines companies who did not.
- December 31st 2010: End of emissions and activity monitoring year 2010: realization of emissions and activity reports which must be verified before being sent to the "Direction générale de l'aviation civile"[49] (DGAC).
- January 1st 2011: Beginning of the emissions monitoring year 2011.
- March 31st 2011: Deadline to submit verified emissions report and verified activity report and to ask for free allowances for 2012 and for the second period 2013-2020 (associated to the activity report submission).
- August 31st 2011: Deadline to submit updates of emissions monitoring plans for the first period.
- 2012: First trading period of one year.
- August 31st 2012: Deadline to submit updates of emissions monitoring plans for the second period.
- 2013: First year of the second trading period.
- March 31st 2013: Deadline to submit verified emissions report of 2012.
- April 30th 2013: Deadline to return emission allowances of 2012.
- August 31st 2013: Deadline to submit activity monitoring plan for 2014 for new entrants and fast growing aircraft operators.
- 2014: Second year of the second period and beginning of the activity

49) General Directorate of civil aviation

data monitoring for new entrants and operators in high growth in order to access the special reserve of free allowances.

Aircraft operators have to follow a two steps proceeding in order to declare their greenhouse gas emissions. First they have to fill an excel file named “Déclaration d’activité (Tonnes kilomètres)”[50] which is downloadable on the website of the Ministry of environment. This document includes:

- Aircraft data;
- Tonne/kilometer data;

Then, they have to complete another excel file named “Déclaration d’émissions”[51]. This document includes:

- Emission data overview;
- Detailed emission data;
- Aircraft data;

We will focus on more important tables of the Excel file[52] in order to describe the system of declaration which is composed with various different tables classified by sections.

50) Activity report (Tons kilometers).
51) Emissions report.
52) This file is provided with macros: most part of time, calculations are automatics.

Section 5 (b): Total emissions of fuels used[53)]

Name of fuel	EF [t CO2 / t fuel]	NCV [Gj/t]	EF [t CO2 / TJ]	Biomass content [%]	Fuel consumption in reporting year [tones]	CO2 emissions [t CO2]
Jet kerosene (jet A1 or jet A)	3,15	44,10	71,50	0,00		0
Jet gasoline (jet B)	3,10	44,30	70,00	0,00		0
Aviation gasoline (AvGas)	3,10	44,30	70,00	0,00		0
Other fuels can be added						
Total emission in the reporting year						0

Section 8: Use of biomass

Name of alternative fuel	Amount biomass employed (choose input in t or m3)		CO2 emitted from biomass [t CO2] (optional information)
	[t]	[m3]	

53) For alternative fuels, enter the name as specified in the approved monitoring plan, the emission factor (either in the column “EF [t CO2 / t fuel]” or “EF [t CO2 / TJ]”), the Net Calorific Value (column “NCV”) and the biomass content in %, if applicable. Furthermore the CO2 emissions are not calculated automatically for alternative fuels. The value of CO2 emissions refers to the fossil carbon content of the fuel only.

Section 9(a): control table

		Emissions from each fuel [t CO2]					Total [t CO2]
		Jet kerosene (jet A1 or jet A)	Jet gasoline (jet B)	Aviation gasoline (AvGas)	Alternative fuel 1	*<add more fuels before this column>*	
A	Total aggregated CO2 emissions from all flights falling under Annex I of the EU-ETS Directive (=B+C)	0	0	0	0	0	0
B	of which departure MS is the same as arrival MS (domestic flights, = sum of section 9(b))	0	0	0	0	0	0
C	Of which all other flights (international flights both intra and extra EU, (= D+E)	0	0	0	0	0	0
D	emissions from all flights departing from a MS to another MS or a third country (sum of section 9(c))	0	0	0	0	0	0
E	emissions from all flights arriving at a MS from a third country (sum of section 9(d))	0	0	0	0	0	0
	Total emissions entered in section 5(b)	0 t CO2					
	Difference to data given in this sheet	0 t CO2					

Section 9(b): Aggregated CO2 emissions from all flights of which departure Member State is the same as arrival Member State (domestic flights)

Member State of departure and arrival	Emissions from each fuel [t CO2]					Total [t CO2]
	Jet kerosene (jet A1 or jet A)	Jet gasoline (jet B)	Aviation gasoline (AvGas)	Alternative fuel 1	*<add more fuels before this column>*	
Austria						0
Belgium						0
Bulgaria						0
Cyprus						0
Czech Republic						0
Denmark						0
Estonia						0
Finland						0
France						0
Germany						0
Greece						0
Hungary						0
Ireland						0
Italy						0
Latvia						0

Member State of departure and arrival	Emissions from each fuel [t CO2]					Total [t CO2]
	Jet kerosene (jet A1 or jet A)	Jet gasoline (jet B)	Aviation gasoline (AvGas)	Alternative fuel 1	*<add more fuels before this column>*	
Lithuania						0
Luxembourg						0
Malta						0
Netherlands						0
Poland						0
Portugal						0
Romania						0
Slovakia						0
Slovenia						0
Spain						0
Sweden						0
United Kingdom						0
Sum of domestic flights	0	0	0	0	0	0

Section 9(c): Aggregated CO2 emissions from all flights departing from each Member State to another Member State or third country

EU Member State of departure	State of arrival	Emissions from each fuel [t CO2]					Total [t CO2]
		Jet kerosene (jet A1 or jet A)	Jet gasoline (jet B)	Aviation gasoline (AvGas)	Alternative fuel 1	*<add more fuels before this column>*	
Please select[54)]	Please select						0
Please select	Please select						0
Please select	Please select						0
Please select	Please select						0
< Please add additional rows above this row, if needed >							0
Aggregated CO2 emissions from all flights	0	0	0	0	0	0	0

54) This table contains macro with pre-selected countries.

Section 9(d): Aggregated CO2 emissions from all flights arriving at each Member State from a third country

State of departure	EU Member State of arrival	Emissions from each fuel [t CO2]					Total [t CO2]
		Jet kerosene (jet A1 or jet A)	Jet gasoline (jet B)	Aviation gasoline (AvGas)	Alternative fuel 1	*<add more fuels before this column>*	
Please select[55]	Please select						0
Please select	Please select						0
Please select	Please select						0
Please select	Please select						0
< Please add additional rows above this row, if needed >							0
Aggregated CO2 emissions from all flights	0	0	0	0	0	0	0

55) This table contains macro with pre-selected countries.

(2) - Small emitter's regulation

For small emitters (which means emitting less than 10,000 tonnes of CO2 per year or performing less than 243 flight during three consecutive four-month periods) without aircraft operator certificate, there is a simplified method that can be used. This simplified method enables the use of a tool which is provided by Eurocontrol[56] and which allows emissions by flight to be estimated, freeing the aircraft operator of monitoring.

The European Commission has now approved Eurocontrol's simplified fuel consumption estimation tool which has been developed for this purpose. The tool meets the requirements of the guidelines established by Decision 2007/589/EC in respect of the approach based on individual flights, actual route length and statistically sound fuel consumption relationships.

The Small Emitters' Tool is freely available for use without charge[57]. It may also be used by aircraft operators who are not small emitters for determining estimates of fuel consumption for specific flights where actual fuel consumption data is missing[58].

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56) The article 18 b of the Directive 2008/101 of the European Parliament and of the Council, 2008 19th 2008 provides the Assistance from Eurocontrol.

57) It can be download: http://www.eurocontrol.int/environment/public/standard_page/small_emitters.html

58) Article 1, (2): "All aircraft operators pursuant to Part 5 of Annex XIV to Decision 2007/589/EC for the purposes of estimating the fuel consumption of particular flights covered by Annex I to Directive 2003/87/EC where the data necessary to monitor the emissions of carbon dioxide are missing as a result of the circumstances beyond the control of the aircraft operator and which cannot be determined by an alternative method defined in the operator's monitoring plan". Commission Regulation (EU) No 606/2010 of 9 July 2010 on the approval of a simplified tool developed by the

The Small Emitters' Tool is based on the method developed for the assessment of the historical aviation emissions which would have been covered by the EU ETS Scheme in 2004-2006. It uses statistically robust fuel consumption coefficients for the majority of common aircraft types as well as a more generic approach for other aircraft.

Small emitters' tool[59)]

ICAO Aircraft Type Designator	Distance (Nm)	Estimated Fuel (Kg)	Estimated CO2 (Kg)	Calculator Message
A212	150			AC type not found
A10	150	515	1,622	Ok
A109	150	128	403	Ok
A225	150	5,142	16,197	Ok
A300	150	3,158	9,948	Ok
A306	150	3,158	9,948	Ok
A320	1,569	9,862	31,065	Ok
B744	3,500	77,550	244,283	Ok

European organization for air safety navigation (Eurocontrol) to estimate the fuel consumption of certain small emitting aircraft operators.

59) The tool is programmed with a set of default figures for the LTO (Landing and Take-Off) cycle which can cause a value to be given even if the distance is zero.

Ⅲ - Verification of greenhouse gases

Greenhouse gases emissions are controlled in three different ways. First, proprietors have the responsibility of monitoring their facilities. Then, measure of greenhouse gas emissions are certified by accredited verifiers. Finally, States authorities check all the process.

1 - Self-monitoring

The principle of the monitoring of releases by the operator is not new. It was formally asked by the law of July 19th 1976 on classified installations for environmental protection (No. 76-663, July 19th 1976, Art. 6) and clarified by its Implementing Decree (No. 77-1133, September 21st 1977, Art. 17). The self-monitoring is now governed by Articles L. 512-3 and R. 512-28 of the Environment Code. The nature and severity of the self-monitoring are proportional to the size of the facility or its releases.

Thus, the more pollutants facilities are submitted to the decree of February 2nd 1998 or by specific ministerial order excluded from its scope. They plan to measure the pollutants, the nature and conditions of the measure and, where applicable, the method, especially for the measurement of dust.

For other installations, requirements for monitoring emissions are fully determined by the «préfet"ural authorization, except, as appropriate, regarding methods of sampling and testing if a ministerial order specifies methods standard references (A. July 7th 2009 concerning modalities of analysis in the air and water in "Classified facilities for the protection of

the environment").

The results of the self-monitoring must be regularly submitted to the inspection of classified installations accompanied, where appropriate, of comments on causes of exceeding (breakdown, starting, fuel change...) and on corrective actions implemented or planned.

2 - Verification by accredited verifiers

Accredited verifiers are important actors of the MRV system. Consequently, we have to question about the accreditation process (1) before to define the proceeding of verification (2). But the difference between accreditation and certification must be made first: "accreditation" is the process according to which an organism receives the ability to deliver "certification"; "certification" is the process according to which an accredited verifier testifies of conformity of products, proceedings, systems or people.

(1) Accreditation process

Accreditation process in France has been unified under the direction of the "COmité FRançais d'Accréditation" (COFRAC)[60] for both classified facilities and aircraft operators. As a matter of fact, the COFRAC is the only French organism able to deliver an accreditation according to Decree No. 2008-1401[61]. However, the accreditation may be given by any accreditation body other than COFRAC signatory of the multilateral

60) French comity for accreditation: http://www.cofrac.fr

61) Décret n° 2008-1401 du 19 décembre 2008 relatif à l'accréditation et à l'évaluation de conformité pris en application de l'article 137 de la loi n° 2008-776 du 4 août 2008 de modernisation de l'économie, JORF, 26 décembre 2008, p. 20014.

accord in the frame of the European co-operation for Accreditation (EA). But in this case, the verifier shall satisfy the additional conditions.

Overview of procedure

	Classified installations	Aircraft operators
Provisions	Ministerial order, March 31st 2008, articles 16-21	Ministerial order, August 9th 2010, articles 1-5
Accreditation	COFRAC/ Accreditation body signatory of the multilateral accord in the frame of the EA	COFRAC/ Accreditation body signatory of the multilateral accord in the frame of the EA
Authorization	Ministry of environment	General Directorate of civil aviation

Despite that general procedure is the same for both activities, some differences deserve to be underlined.

- Classified installations

There are two types of requesters who might be accredited in accordance with the ministerial order of March 31st 2008: those who are accredited by the COFRAC without additional conditions and those who are accredited by an accreditation body other than the COFRAC signatory of the multilateral accord in the frame of the European co-operation for Accreditation (EA). Those last one must send additional documents to the General Directorate of civil aviation:

- A copy of the document proving their accreditation and its technical annex;
- Elements demonstrating that the personnel involved in the verification of reports have a detailed knowledge of the French language;
- Elements demonstrating that the personnel involved in the verification

of reports have a detailed knowledge of the French applicable regulations;

- An acceptance to be subject, at least once during the 2008-2012 period, of an audit of its verification activity by the COFRAC in co-ordination with the body having accredited the verifier.

➢ Aircraft operators

As aforementioned about classified installations, there are also two types of requesters who might be accredited in accordance with the ministerial order of August 9th 2010: those who are accredited by the COFRAC without additional conditions and those who are accredited by an accreditation body other than the COFRAC signatory of the multilateral accord in the frame of the European co-operation for Accreditation (EA). Those last one must send additional documents to the General Directorate of civil aviation:

- A copy of the document proving their accreditation;
- Elements demonstrating that the personnel involved in the verification of reports have a detailed knowledge of the French applicable regulations;
- An acceptance to be subject, at least once during the 2011-2020 period, of an audit of its verification activity by the COFRAC in co-ordination with the body having accredited the verifier.

(2) Proceedings of verification by accredited verifiers

Proceedings are inspired by the Directive 2003/87/EC and based upon a specific methodology: a strategic analysis; a risk analysis; the verification;

an internal verification report. Methodology is globally the same for classified facilities and aircraft operators but few details are quite different.

a - Classified facilities

The ministerial order of March 31st 2008 provides that statements are checked at the expense of proprietor by an accredited verifier. Plants are classified into three categories depending on the level of the average annual CO2 emissions reported during the period 2005-2007:

- Class A: installations with average reported annual emissions over the previous trading period (or a conservative estimate or projection if reported emissions are not available or no longer applicable) equal to or less than 50 kilotonnes of fossil CO2 before subtraction of transferred CO2;
- Class B: installations with average reported annual emissions over the previous trading period (or a conservative estimate or projection if reported emissions are not available or no longer applicable) of greater 50 kilotonnes and equal to or less than 500 kilotonnes of fossil CO2 before subtraction of transferred CO2);
- Class C: installations with average reported annual emissions over the previous trading period (or a conservative estimate or projection if reported emissions are not available or no longer applicable) of greater than 500 kilotonnes of fossil CO2 before subtraction of transferred CO2.

To sum up, class C facilities are subject to an annual visit by an accredited verifier while facilities in categories A and B are visited at

least twice during the period 2008-2012 subject to the exemptions that may benefit to low-emitting facilities (less than 25 kilotonnes). Following the audit, the accredited verifier issues an opinion of reasonable assurance certifying that the declaration was made in accordance with the monitoring plan and the data contained in the declaration does not contain any material misstatement. The verified statement is then transmitted to the «préfet" and by delegation to the inspection of classified installations, conducting all necessary control to complement the control done by the accredited verifier. The Minister for the Environment approves the statements and transmits electronically to the register the only validated statements at the latest March 31.

A strategic analysis

The verifier shall verify whether the monitoring plan has been approved by the "préfet" and whether it is the right version (if this is not the case, the verifier should not continue the verification except for elements that are obviously not affected by the non-approval). Furthermore, the verifier has to:

- Understand each activity undertaken by the installation, the sources, source streams within the installation, the metering equipment used to monitor or measure activity data, the origin and application of emission factors and oxidation/conversion factors, any other data used to calculate or measure the emissions, and the environment in which the installation operates;
- Understand the operator's monitoring plan, data flow, as well as its control system, including the overall organization with respect to monitoring and reporting.

Finally, the verifier applies the materiality level[62] defined in the table below:

Category of installations	Materiality levels
A and B	5 %
C	2 %

A risk analysis

The verifier shall first analyze the inherent risks and control risks related to the scope and complexity of the operator's activities and emission sources and source streams, and which could lead to a material misstatements and non-conformities. Then, he has to draw up a verification plan which is commensurate with this risk analysis. The verification plan describes the way in which the verification activities are to be carried out. It contains a verification programme and a data sampling plan. The verification programme describes the nature of the activities, at what times they must be carried out and their scope in order for the verification plan to be completed. The data sampling plan sets out what data is to be tested in order to reach a verification opinion.

A verification

In carrying out the verification, the verifier shall conduct a site visit, when appropriate, to inspect the operation of meters and monitoring systems, conduct interviews, and collect sufficient information and

62) "Materiality level" is the threshold beyond which the difference between the declared values and the tested values is considered significant of a material misstatements and non-conformities.

evidence. Moreover, the verifier shall:

- Carry out the verification plan by gathering data in accordance with the defined sampling methods, walkthrough tests, document reviews, analytical procedures and data review procedures, including any relevant additional evidence, upon which the verifier's verification opinion will be based;
- Confirm the validity of the information used to calculate the uncertainty level[63] as set in the approved monitoring plan;
- Verify that the approved monitoring plan is implemented and seek understanding whether the monitoring plan is up to date;
- Request the operator to provide any missing data or complete missing sections of audit trails, explain variations in the emissions data, or revise calculations, or adjust reported data, before reaching a final verification opinion. The verifier should, in any form, report all non-conformities and misstatements identified to the operator.

The operator shall correct any reported misstatements. The entire population from which a sample was taken shall be corrected.

Throughout the verification process, the verifier shall determine misstatements and non-conformities by assessing whether the monitoring plan has been implemented to support the determination of non-conformities and if there is clear and objective evidence obtained through the gathering of data to support the determination of misstatements.

63) "Measurement uncertainty" is an estimate that indicates the range in which is the real value of what one measures. The level of uncertainty depends on each country's institutional and technical capabilities.

An internal verification report

At the end of the verification process, the verifier shall prepare an internal verification report. The verification report shall record evidence showing that the strategic analysis, the risk analysis and the verification plan has been performed in full, and provide sufficient information to support verification opinions. The internal verification report should as well facilitate a potential evaluation of the audit by the competent authority and accreditation body.

Based on the findings contained in the internal verification report, the verifier shall make a judgment with respect to whether the annual emissions report contains any material misstatement as compared to the materiality threshold, and whether there are material non-conformities or other issues relevant for the verification opinion.

b - Aircraft operators

A ministerial order enacted on August 9th 2010 and published on August 25th 2010 relative to the verification of emissions reports and tonne-kilometer reports in the frame of the EU-ETS allows the verifier to check that the monitoring and quantification of emissions of tonne-kilometer data have been performed in conformity with the monitoring plans submitted by the aircraft operator and with the provisions of Decision 2009/339/CE. Furthermore, it also requires the verifier to formulate a statement with reasonable assurance of whether the data in the emissions of tonne-kilometer report are free from material misstatement and whether no material non-conformities exist. This ministerial order complies with document “EA-6/03: 2010” written by the European co-operation for

Accreditation[64] and includes following steps:

A strategic analysis

The verifier shall verify that the monitoring plan has been approved and that the correct version has been used (if it is not the case, the verifier should not continue the verification, except for the elements not suffering from the absence of approval).

- In the case of an emissions report, the verifier shall be aware of the relevant aviation activities as interpreted through the criteria set forth in Decision 2009/450/EC, of the procedures for collecting data on fuel used, of the chosen methodologies of calculation, and of the quantities of alternative fuel used, if any, together with their emission factor;
- In the case of tonne-kilometer report, the verifier shall be aware of the relevant aviation activities as interpreted through the criteria set forth in Decision 2009/450/EC, of the source of information used to calculate the great circle distance between airports, of the methods, there being, used to measure the weight of baggage, freight and mail, and of the procedures used to determine the number of passengers on board;

In both cases the verifier shall understand the monitoring plan of the aircraft operator, the data flow and the control system.

A risk analysis

The verifier shall first analyze the inherent and control risks involved in the fuel burn data or the tonne-kilometer data, likely to lead to

64) http://www.european-accreditation.org

material misstatements or material non-conformities. Thus he shall establish a verification plan in coherence with the risk analysis aforementioned, comprising a verification program and a data sampling plan. The verification program indicates the nature and the scope of the verification activities and when they shall be carried out while the data sampling plan indicates the data to be tested in order to reach an assessment.

A verification

The verifier shall:

- apply the verification plan through the collection of data and all relevant information, in the frame of the data sampling plan, the testing of data flow, the analysis of documents, data analysis and data review procedures, which will form the basis of the assessment ;
- confirm that all information used are coherent with the level of uncertainty contained in the approved monitoring plan;
- verify that the approved monitoring plan is actually implemented;
- ask the operator, if necessary, to explain the variations appearing in the emissions data or the tonne-kilometer data, or to recalculate them, before formulating its final assessment.

The verifier shall also in a way or another indicate to the operator all the material misstatements and material non-conformities found. Consequently, the operator shall correct these in the set of data from which the data sample has been extracted.

Lastly the verifier shall, throughout the verification process, look for material misstatements and material non-conformities by means of reviewing, on the one hand, whether the verification plan has been implemented in such a way as to allow for the detection of material

non-conformities and, on the other hand, if the elements of evidence found during the data collection are sufficiently clear and objective to allow for the detection of misstatements.

An internal verification report

At the end of the verification process, the verifier has to prepare an internal report. This report contains elements proving that the strategy analysis, the risk analysis and the verification plan have been carried out in an exhaustive manner, and holds enough information to sustain the assessment.

The ministerial order took the situation of small emitters into account and in the case of an aircraft operator considered as a small emitter as per paragraph 4 of Annexe XIV of Decision 2007/589/EC modified by Decision 2009/339/EC. Thanks to this section, the verifier shall consider that the information on fuel burn provided through the simplified procedure for the monitoring of emissions, if it has been selected, is free from misstatements and non-conformities. Furthermore, a site visit is not mandatory, provided the operator makes available to the verifier, on his request and to his satisfaction, all relevant information, notably in relation to the source data which have been used for the reports.

(3) Current accredited verifiers

Companies able to verify are not necessarily the same depending on whether it is for classified facilities or aircraft operators.

a - Classified facilities

Current accredited verifiers have been authorized with a ministerial order of October 31st 2008[65] and amended by another ministerial order of October 28th 2009[66].

Company name	Registered office	Activities[67]				
		Ⅰ-A	Ⅰ-B	Ⅱ-A	Ⅱ-B	Ⅱ-C
APAVE alsacienne.	2, rue Thiers, BP 1347, 68056 Mulhouse Cedex.	*		*	*	*
APAVE parisienne.	13-17, rue Salneuve, 75854 Paris Cedex 17.	*			*	*
BUREAU VERITAS Certification France.	Le Guillaumet, 92046 Paris-La Défense Cedex.	*	*	*	*	*
CETE APAVE Nord-Ouest.	51, avenue de l'Architecte-Cordonnier, BP 247, 59019 Lille Cedex.	*		*	*	*
CETE APAVE Sud Europe.	8, rue Jean-Jacques-Vernazza, ZAC Saumaty-Seon, 13322 Marseille Cedex 16.	*		*		*
DELOITTE & Associés.	185, avenue Charles-de-Gaulle, 92524 Neuilly-sur-Seine.	*		*	*	*
DNV CERTIFICATION	16, impasse Pierre-Blancard, 13007 Marseille.	*	*	*	*	*

65) JORF n°65, March 18th 2009, p. 4849.
66) JORF n°274, November 26th 2009, p. 20311.

Company name	Registered office	Activities[67]				
		Ⅰ-A	Ⅰ-B	Ⅱ-A	Ⅱ-B	Ⅱ-C
France.						
ERNST & YOUNG & Associés.	11, allée de l'Arche, 92037 Paris-La Défense Cedex.	*	*	*	*	*
KPMG SA.	Immeuble Le Palatin, 3, cours du Triangle, 92939 La Défense Cedex.	*	*		*	
LRQA France SAS.	1, boulevard Vivier-Merle, tour Société Suisse, 69003 Lyon.	*	*	*	*	*
PRICEWATERHOUSECOOPERS AUDIT SA.	63, rue de Villiers, 92908 Neuilly-sur-Seine.	*	*	*	*	*
SGS MULTILAB.	7, rue Jean-Mermoz, ZI de Saint-Guénault, 91080 Courcouronnes.	*			*	*
SOCOTEC industries.	2, rue Marcel-Dassault, BP 70259, zone industrielle, 59472 Seclin.	*			*	*

b - Aircraft operators

The list of accredited verifiers is available on the website of the DGAC[68] and it is regularly updated (latest version of December 8th 2010).

67) See *supra.*

68) http://www.developpement-durable.gouv.fr

Accredited verifiers	Temporarily able verifiers[69)]
LLOYD'S REGISTER QUALITY ASSURANCE (The Netherlands) Aviation Centre Lloyd's Register Nederland, P.O. Box 701, 3000 AS Rotterdam Weena-Zuid 170, 3012 NC, Rotterdam – THE NETHERLANDS Adresse en France : LRQA France SA, Tour Swiss Life, 1, Boulevard Vivier Merle, 69003 Lyon - FRANCE	BUREAU VERITAS CERTIFICATION FRANCE Le Guillaumet 92046 PARIS LA DEFENSE CEDEX – France Email (commercial) : stephane.rideau@fr.bureauveritas.com Email (technique) : aurelie.gilotte@fr.bureauveritas.com
PRICEWATERHOUSECOOPERS CERTIFICATION B.V. Thomas R. Malthusstraat 5, 1066 JR, P.O. Box 90357, 1006 BJ, Amsterdam – THE NETHERLANDS E-mail : jeroen.kruijd@nl.pwc.com	DELOITTE & ASSOCIES 185 avenue Charles de Gaulle 92524 NEUILLY SUR SEINE – FRANCE Email : edugelay@deloitte.fr Tel : +33 (0)1 55 61 62 59
VERIFAVIA (UK) LTD. : Suite 13399, 2nd Floor, 145-157 St John Street, London EC1V 4PY UNITED KINGDOM E-mail : julien.dufour@verifavia.com Adresse en France : VerifAvia SARL 15 rue des boulangers	KPMG S.A. Immeuble Le Palatin - 3 cours du Triangle 92939 PARIS LA DEFENSE CEDEX - FRANCE Email : parnaud@kpmg.fr Tel : +33 (0)1 55 68 90 05

Accredited verifiers	Temporarily able verifiers[69)]
75005 PARIS – FRANCE	
COMPLETE INTEGRATED CERTIFICATION SERVICES LTD Queens Road, Penkhull, Stoke-on-Trent ST4 7LQ – UNITED KINGDOM E-mail : info@cicsglobal.com Tel: +44 (0)1782 411008	SGS MULTILAB 7 rue Jean Mermoz ZI Saint Guénault- Courcouronnes 91031 EVRY – FRANCE
BSI PO Box 9000 Milton Keynes MK14 6WT - UNITED KINGDOM E-mail: Andrew.Launn@bsigroup.com Tel: +44(0)845 080 9000	ERNST & YOUNG et ASSOCIES 41 rue Ybry 92200 NEUILLY SUR SEINE - FRANCE Email : christophe.schmeitzky@fr.ey.com Tel : +33 (0)1 4693 6000
	VERIFAVIA SARL 15 rue des boulangers 75005 PARIS – FRANCE Email : julien.dufour@verifavia.com

69) “In order to allow for a new verifier to obtain an accreditation for the verification of reports mentioned in article 1, either by COFRAC or by another accreditation body as mentioned in paragraph I of article 2, this verifier shall be considered as temporarily able to verify such reports as soon as he sends to the Director of air transport a copy of the convention, together with the technical annexes thereof, signed in view of the accreditation, or a copy of any document indicating a positive acceptance of the demand for accreditation by the accreditation body. This temporary ability shall not exceed eighteen months”. Article 4, ministerial order, August 9th 2010, relatif à la vérification des déclarations d’émissions et de données relatives aux tonnes-kilomètres des exploitants d’aéronef dont la France est responsable dans le cadre du système communautaire d’échange de quotas d’émission de gaz à effet de serre.

3 - Control by State authorities

Control and penalties are fairly different considering ELV system and EU ETS and sentences cannot be cumulated.

(1) ELV System

An operator who fails to comply with operating requirements can be subject to both administrative and penal sanctions, the principle of *non bis in idem* (double jeopardy) do not receiving application to cases of combination of administrative and penal sanctions (Conseil constitutionnel, July 28th 1989, No. 89-260 DC). However, the solution of combination could be modified under the influence of European jurisprudence. Indeed, the European Court of Human Rights has ruled that the principle of *non bis in idem* also applies to the case of two administrative and penal procedures involving facts that are substantially the same (ECHR February 10th 2009, No. 14939/03, *Zolotoukhine c/ Russie*).

a - Administrative sanction

These sanctions can be implemented when:

- The breach of conditions imposed on the operator was legally established. This implies in particular that the inspection report on the basis of which the penalty is enacted has been prepared by an inspector under oath;
- The operator has not complied with the formal notice to comply with the requirements infringed (art. L. 514-1, I, Environment Code).

The lack of formal notice vitiates the administrative sanction of a substantial procedural defect leading to its cancellation except in an emergency case. Indeed, the "préfet" is required to inform the operator, with a formal notice, that he must comply with the requirements infringed when the inspector of classified facilities found non-compliance. However, judges are led to consider legality of the formal notice when the operator contests the merits of the requirements imposed on him or argues that he has respected them, or even when it denies that he is truly the operator. The judge controls the following characteristics in the formal notice:

- The notice is a measure of police who, as such, must be motivated;
- It does not include new or more stringent requirements but only require compliance with the requirements of existing orders;
- It must also allow the operator a period appropriate to his situation.

If at the expiry of the period prescribed by the formal notice the operator does not comply with it, the "préfet" may:

- Proceed to the specific performance of the measures prescribed to the operator's expense;
- Deposit in hands of a public accountant a sum representing the amount of work required, which will be returned as and when carrying out the work. Money deposited can be used for expenses incurred in the execution of motion (art. L. 514-1 and II, Environment Code);
- Suspend provisionally the functioning of the facility until execution of the measures prescribed, after consultation with the "COnseil Départemental de l'Environnement, des Risques Sanitaires et Technologiques"[70)]

(CODERST). During the period of suspension, the operator must pay its staff, as if the facility was operating normally. Note that if the functioning continues in violation of a suspension, it is constitutive of a misdemeanor punishable by 2 years in prison and fined 150,000 Euros (art. L. 514-1-I, Environment Code).

The "préfet" is totally free in the choice of penalties however he has to respect the *audi alteram partem* principle (adversarial principle) according to which the operator should have an opportunity of presenting his case and be fully informed of the case (documents, evidence, arguments, etc.) relied upon by the "préfet". In this way, a court has ruled that a formal notice cannot be considered as a part of an adversarial proceeding.

b - Penal sanction

Non-compliance with ELV is punishable, like any exploitation operating outside the requirements, by penalties stipulated for the 5th class minor offenses (art. R. 514-4, Environment Code). The inspector transmits its observations to the public prosecutor who decides to pursue or not. If he does, a court can pronounce a maximal sentence of 6 month in prison and fined 75,000 Euros. In addition, the court can impose the prohibition to use the facility until the provisions it has been violated have been met.

70) Those councils are competent in matter of environment, health risks and technology at the administrative level of "départements".

(2) EU ETS Directive

If, by the end of April, the company has not returned enough quotas to cover its disclosed emissions, the “préfet” issues a statement of offence and gives the operator formal notice to comply within one month (limitation of CO2 emissions, purchase of quotas, transfer from one installation account to another installation account etc.). After this date, he will fine them € 100 per tonne of excess CO2, the payment of which does not free the operator from his obligations, i.e. he will still have to purchase the required quotas.

Ⅳ - National balance

At the national level, three main actors are responsible for the national balance. First, the **SNIEPA** ("Système National d'Inventaire des Émissions de Polluants Atmosphériques"[71]) which is responsible for compilation of all data. It has been created by the Ministry of environment[72] in 2006 and it allows France estimating emission of principal atmospheric pollutants by different sectors of activity. The National inventory is organized to ensure the consistency of the results vis-à-vis all applications that use these data, especially to meet the obligations of EU Directives and decisions as well as international Conventions and their Protocols.

Then, the technical preparation of emissions to air inventories is entrusted by the "Direction Générale de l'Énergie et du Climat"[73] (DGEC) to the **CITEPA** ("Centre Interprofessionnel Technique d'Études de la Pollution Atmosphérique"[74]). It is an accredited agency according to ISO-9001 for the task abovementioned. Established in 1961, it is a Technical Center with a status of association (law 1901). Today, it comprises about 200 members (manufacturers, professional associations and unions, energy producers, automakers, environmental industries, offices and laboratories of measures) thus forming an inter-professional network which provides relevant information and news on regulatory changes and technological developments in air pollution. This Center has two main tasks in the MRV process. On the one hand, he is responsible

71) National inventory system of pollutants emissions into the atmosphere.
72) Ministerial order, December 29th 2006, JORF, n°60, March 11th 2007.
73) General Directorate for Energy and Climate.
74) Interprofessional Technical Center for Studies on Air Pollution.

for establishing the methodology for inventories at the National level. To this end, he produced a guide[75] entitled "Organisation et Méthodes des Inventaires Nationaux des Emissions Atmosphériques"[76] (OMINEA) which is regularly updated. On the other hand, it is also responsible for providing the National inventory report under the treaty obligations of France (European Union and UNFCCC[77]).

Finally, the **GCIIE** ("Groupe de Concertation et d'Information sur les Inventaires d'Emission"[78]). It has been created in order to assist the

75) CITEPA/OMINEA, Organisation et méthodes des inventaires nationaux des émissions atmosphériques en France, 7ème édition, février 2010, 1092 p.

76) National inventories of air emissions in France: Organization and Methodology.

77) CITEPA/Rapport CCNUCC, Rapport national d'inventaire pour la France au titre de la Convention Cadre des Nations-Unies sur les Changements Climatiques et du Protocole de Kyoto, édition 2010, 1168 p.

78) According to the Ministerial order, December 29th 2006, annex III, the Cooperation and Information Group on Emissions Inventories is composed with following State authorities:

- Ministère chargé de l'agriculture (Ministry of agriculture):

*Service central des enquêtes et études statistiques (SCEES) (Central Service for inquiry and statistic studies);

*Direction générale de la forêt et des affaires rurales (DGFAR) (General Directorate for forest and rural affairs);

*Direction générale des politiques économique, européenne et internationale (DGPEEI) (General Directorate for economic, European and international policies).

- Ministère chargé de l'économie et de l'industrie (Ministry of economy and industry):

*Direction générale de l'énergie et des matières premières (DGEMP) (General Directorate for energy and raw materials);

*Direction générale des entreprises (DGE) (General Directorate for business);

*Direction générale du Trésor et de la politique économique (DGTPE) (General Directorate of Treasury and Economic Policy);

*Direction générale de l'INSEE (General Directorate of the National Institute for Statistics and Economic Studies).

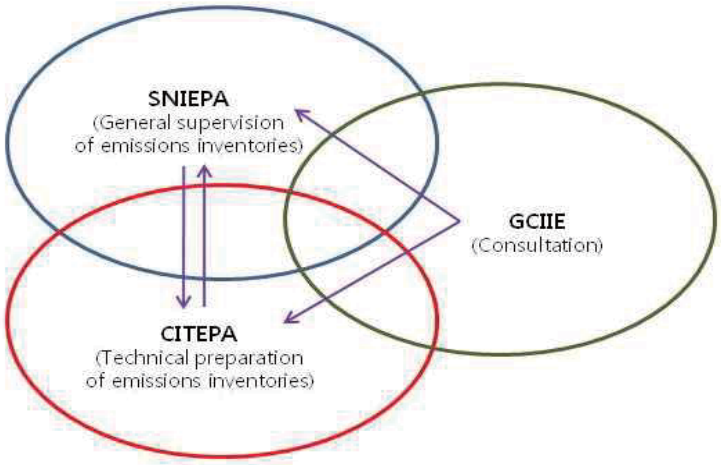
- Ministère chargé de l'équipement, de l'urbanisme et des transports (Ministry of Equipment, Planning and Transportation):

*Direction des affaires économiques et internationales (DAEI) (Directorate of Economic and International Affairs);

*Direction générale de l'aviation civile (DGAC) (General Directorate of civil aviation);

SNIEPA and the CITEPA. This Group is an inter-ministerial task force. The Group is first consulted about methodologies for inventories and their evolution, before introduction into the national system. It is also consulted on the draft inventory reports. After review of consulted Departments, the Ministry of Environment approves the surveys, particularly those submitted to the Community and International institutions, on time and format required, in accordance with France's obligations in this area.

General scheme of National Actors involved in the MRV process



*Direction générale de la mer et des transports (DGMT) (General Directorate of sea and transportation);

*Direction de la sécurité et de la circulation routières (DSCR) (Directorate for security and road traffic);

*Direction générale de l'urbanisme, de l'habitat et de la construction (DGUHC) (Generale Directorate of planning, housing and building);

*Centre d'études et de recherche des transports urbains (CERTU) (Center of studies and research for urban transportation).

- Ministère chargé de l'environnement (Ministry of environment):

Direction de la prévention des pollutions et des risques (DPPR) (Directorate for prevention of pollution and risks);

Direction des études économiques et de l'évaluation environnementale (D4E) (Directorate for economic studies and environmental assessment).

- Mission interministérielle de l'effet de serre (MIES) (Interministerial mission for greenhouse effect).

List of statistics and data from government agencies used for compilation of emissions inventories[79)]

Sector	Type of data	Data emitter organisms
Energy	Energy balance Energy consumption in France Consumption and distribution of petroleum products to non-energy use Energy consumption in residential and tertiary sectors Renewable energy consumption in industry, residential and tertiary sectors Petrochemical balance	Ministry in charge of industry
	Annual statements of pollutants emitted by certain classified facilities	Ministry in charge of environment
	Energy consumption in agriculture and food industries	Ministry in charge of agriculture and fishery
	Transports account of the Nation Shipping statistics Air transports statistics	Ministry in charge of transport
Industrial proceedings	Statements of pollutants emitted by certain classified facilities	Ministry in charge of environment
	Production of food and drink industries – Branch investigation	Ministry in charge of agriculture and fishery
	Industrial statistics	Ministry in charge of industry

79) Ministerial order, December 29th 2006, National inventory system of pollutants emissions into the atmosphere.

Sector	Type of data	Data emitter organisms
	Inventory of refrigerant fluids	ADEME
Solvents and other products utilization	Statements of pollutants emitted by certain classified facilities	Ministry in charge of environment
	Production, importation and exportation, consumption of paint/ink/glue	Ministry in charge of industry
Agriculture	Agriculture statistics characterization of methods of livestock (management of animals excrements)	Ministry in charge of agriculture and fishery
LULUCF (Land Use, Land-Use Change and Forestry)	Forest statistics Utilization of the territory Harvesting of timber and timber production	Ministry in charge of agriculture and fishery
	Forest growth (overseas territories excluded)	IFN[80]
	Temperature/global solar radiation	ECOFOR/ONF[81]
Garbage	Inventory of household waste treatment facilities Health care risk wastes statistics Industrial wastes statistics	ADEME
	Statements of pollutants emitted Watching of dioxins and heavy metals emitted by incineration facilities	Ministry in charge of environment

80) Inventaire National Forestier (National Forest Inventory).

81) ECOsysteme FORestier (Forest ecosystem) and Office National des Forêts (National Office of Forest).

Conclusion

In the International and European framework, France has implemented a strong MRV process which obviously contributes to the fight against global warming. Indeed, MRV of GHG emissions allows efficiency of mitigation to be checked. Then, it permits ensuring that International and European requirements are fulfilled. Furthermore, France has finally understood the economic need to be performing in green growth matter. Indeed, the experience gained today in this field of competence will soon allow low cost investments in strategic countries[82] (developing countries). However, MRV process in France can be criticize at least considering two different points. On the one hand, the specific place of nuclear energy in France should be taken in account. 78% of French electricity comes from nuclear plants. This fact partially explains the low rate of GHG emissions. But measurement of GHG emitted by nuclear plants does not include GHG emissions of all activities allowing building, functioning, dismantlement and nuclear waste management of these nuclear plants.

On the other hand, the local level should also be taken more in account. Indeed, in some situations, Local authorities can perform many skills and possess a variety of infrastructure and equipment. The Law n° 2009-967 of August 3rd 2009 (Grenelle 2) has created numerous obligations against Local authorities, in particular an obligation of measurment of GHG emissions. So the next step should be a total integration of Local authorities into the MRV process because of the high degree of decentralization in France.

82) BIRAUD Pierre-Noel et JESTIN FLEURY Nicole, Effet de serre : modélisation économique et décision publique, La Documentation française, 2002, p. 124.

Annex

Annex I: Clauses of the Directive 2009/29/EC which need to be shortly implemented by the french government

Activities	Greenhouse gases
-Combustion of fuels in installations with a total rated thermal input exceeding 20 MW (except in installations for the incineration of hazardous or municipal waste) -Refining of mineral oil -Production of coke	Carbon dioxide
-Metal ore (including sulphide ore) roasting or sintering, including pelletisation -Production of pig iron or steel (primary or secondary fusion) including continuous casting, with a capacity exceeding 2,5 tonnes per hour -Production or processing of ferrous metals (including ferro-alloys) where combustion units with a total rated thermal input exceeding 20 MW are operated. Processing includes, inter alia, rolling mills, re-heaters, annealing furnaces, smitheries, foundries, coating and pickling -Production of secondary aluminium where combustion units with a total rated thermal input exceeding 20 MW are operated -Production or processing of non-ferrous metals, including production of alloys, refining, foundry casting, etc., where combustion units with a total rated thermal input (including fuels used as reducing agents) exceeding 20 MW are operated	Carbon dioxide
-Production of primary aluminium	Carbon dioxide

Activities	Greenhouse gases
	and perfluorocarbons
-Production of cement clinker in rotary kilns with a production capacity exceeding 500 tonnes per day or in other furnaces with a production capacity exceeding 50 tonnes per day -Production of lime or calcination of dolomite or magnesite in rotary kilns or in other furnaces with a production capacity exceeding 50 tonnes per day -Manufacture of glass including glass fibre with a melting capacity exceeding 20 tonnes per day -Manufacture of ceramic products by firing, in particular roofing tiles, bricks, refractory bricks, tiles, stoneware or porcelain, with a production capacity exceeding 75 tonnes per day -Manufacture of mineral wool insulation material using glass, rock or slag with a melting capacity exceeding 20 tonnes per day -Drying or calcination of gypsum or production of plaster boards and other gypsum products, where combustion units with a total rated thermal input exceeding 20 MW are operated	Carbon dioxide
-Production of pulp from timber or other fibrous materials -Production of paper or cardboard with a production capacity exceeding 20 tonnes per day -Production of carbon black involving the carbonization of organic substances such as oils, tars, cracker and distillation residues, where combustion units with a total rated thermal input exceeding 20 MW are operated -Production of ammonia	Carbon dioxide

Activities	Greenhouse gases
-Production of bulk organic chemicals by cracking, reforming, partial or full oxidation or by similar processes, with a production capacity exceeding 100 tonnes per day -Production of hydrogen (H2) and synthesis gas by reforming or partial oxidation with a production capacity exceeding 25 tonnes per day -Production of soda ash (Na2CO3) and sodium bicarbonate (NaHCO3) -Capture of greenhouse gases from installations covered by this Directive for the purpose of transport and geological storage in a storage site permitted under Directive 2009/31/EC -Transport of greenhouse gases by pipelines for geological storage in a storage site permitted under Directive 2009/31/EC -Geological storage of greenhouse gases in a storage site permitted under Directive 2009/31/EC	
-Production of nitric acid -Production of adipic acid -Production of glyoxal and glyoxylic acid	Carbon dioxide and nitrous oxide

Annex II: Emission factors related to net calorific value (NCV) and net calorific values per mass of fuel, Decision 2007/589/EC, Annex I, part 11, table 4:

Fuel type description	Emission factor (tCO2/TJ)	Net calorific value (TJ/Gg)
	2006 IPCC guidelines (except biomass)	2006 IPCC guidelines

Crude oil	73,3	42,3
Orimulsion	76,9	27,5
Natural gas liquids	64,1	44,2
Motor gasoline	69,2	44,3
Kerosen	71,8	43,8
Shale oil	73,3	38,1
Gas/diesel oil	74,0	43,0
Residual fuel oil	77,3	40,4
Liquefied petroleum gases	63,0	47,3
Ethane	61,6	46,4
Naphtha	73,3	44,5
Bitumen	80,6	40,2
Lubricants	73,3	40,2
Petroleum coke	97,5	32,5
Refinery feedstocks	73,3	43,0
Refinery gas	51,3	49,5
Paraffin waxes	73,3	40,2
White spirit and SBP	73,3	40,2
Other petroleum products	73,3	40,2
Anthracite	98,2	26,7
Coking coal	94,5	28,2
Other bituminous coal	94,5	25,8
Sub-bituminous coal	96,0	18,9
Lignite	101,1	11,9
Oil shale and tar sands	106,6	8,9
Patent fuel	97,5	20,7
Coke oven, coke and lignite coke	107,0	28,2
Gas coke	107,0	28,2
Coal tar	80,6	28,0
Gas, works gas	44,7	38,7
Coke oven gas	44,7	38,7
Blast furnace gas	259,4	2,5
Oxygen steel furnace gas	171,8	7,1

Natural gas	56,1	48,0
Industrial wastes	142,9	n.a.
Waste oils	73,3	40,2
Peat	105,9	9,8
Wood/wood waste	0	15,6
Other primary solid biomass	0	11,6
Charcoal	0	29,5
Biogasoline	0	27,0
Biodiesels	0	27,0
Other liquid biofuels	0	27,4
Landfill gas	0	50,4
Sludge gas	0	50,4
Other biogas	0	50,4
	Other sources	Other sources
Waste tyres	85,0	n.a.
Carbon monoxide	155,2	10,1
Methane	54,9	50,0

Annex III: Emission factors related to net calorific value (NCV) and net calorific values per mass of fuel, Ministerial order, March 31st 2008, Annex I, part I-2.f., table 4[83]:

Code	Combustible	NCV	Emission factor	
		TJ/t	T CO2/TJ	T CO2/t
Combustible (except biomass)				
101	Coking coal	26.10^{-3}	95	2,47
102	Steaming coal	26.10^{-3}	95	2,47
103	Sub-bituminous coal	20.10^{-3}	96	1,92
104	Coal briquettes	32.10^{-3}	95	3,04

83) This table shows emission factors specified by France in the latest national inventory submitted to the secretariat of the United Nations Framework Convention on Climate Change.

Annex

Code	Combustible		NCV	Emission factor		
			TJ/t	T CO2/TJ	T CO2/t	
105	Lignite		17.10⁻³	100	1,70	
106	Lignite briquettes		17.10⁻³	98	1,67	
107	Coal tar		28.10⁻³	107	3,00	
108	Lignite coke		17.10⁻³	108	1,84	
110	Petroleum coke		32.10⁻³	96	3,07	
113	Peat		11,6.10⁻³	110	1,28	
114	Household waste		8,8.10⁻³	96	0,845	
121A	Tyres		26.10⁻³	85	2,21	
121B	Plastic waste		23.10⁻³	75	1,73	
Liquid combustibles (except biomass)						
201	Crude oil		42.10⁻³	73	3,07	
203	Commercial heavy fuel oil		40.10⁻³	78	3,12	
204	Domestic fuel		42.10⁻³	75	3,15	
210	Naphtha		45.10⁻³	73	3,07	
211	Shale oil		36.10⁻³	73	2,63	
219	Lubricants		40,2.10⁻³	73	2,93	
220	White spirit		41,9.10⁻³	Special	-	
222	Bitumen		40,2.10⁻³	81	3,26	
224A	High viscosity fuel oil		39,2.10⁻³	80	3,14	
2240	Other petroleum products		40,2.10⁻³	73	2,93	
Gaseous fuel (except biomass)						
301	Natural gas	H type	49,6.10⁻³	57[84)]	185 kg CO2 /MWh CVF[85)]	2,14.10⁻³ tCO2/m³
		B type	38,2.10⁻³			1,82.10⁻³ tCO2/m³
302	Liquefied natural gas		49,6.10⁻³	57	-	
303	Liquefied petroleum gases		46.10⁻³	64	-	

Code	Combustible	NCV	Emission factor	
		TJ/t	T CO2/TJ	T CO2/t
311	Gas works gas	Special	52	-
312	Steel works gas	$6{,}9.10^{-3}$	183	-

84) Same emission factor for both gases.

85) Calorific Value of Fuel.

Table of relevant provisions

Ⅰ- European regulations

- Commission Regulation (EU) No 920/2010 of 7 October 2010 for a standardised and secured system of registries pursuant to Directive 2003/87/EC of the European Parliament and of the Council and Decision No 280/2004/EC of the European Parliament and of the Council

Ⅱ- Directives

- Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community
- Directive 2008/101/EC of the European Parliament and of the Council of 19 November 2008 amending Directive 2003/87/EC so as to include aviation activities in the scheme for greenhouse gas emission allowance trading within the Community
- Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC

Ⅲ- Community Decisions

- Commission Decision 2009/450/EC of 8 June 2009 on the detailed interpretation of the aviation activities listed in Annex I to Directive

2003/87/EC of the European Parliament and of the Council

- Decision 406/2009/EC of the European Parliament and of the Council of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020

- Commission Decision of 18 July 2007 establishing guidelines for the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council

- Decision 280/2004/ EC of the European Parliament and of the Council of 11 February 2004 concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol

Ⅳ- Law

- Loi n° 2009-967 du 03/08/09 de programmation relative à la mise en œuvre du Grenelle de l'environnement

Ⅴ- Decrees

- Décret n° 2010-300 du 22/03/10 relatif à la préparation de l'extension du système d'échange de quotas d'émission de gaz à effet de serre

- Décret n° 2007-979 du 15/05/07 approuvant le plan national d'affectation des quotas d'émission de gaz à effet de serre établi pour la période 2008-2012

- Livre II : Milieux Physiques - Titre II : Air et Atmosphère

- Décret n° 2007-286 du 02/03/07 modifiant le décret n° 2004-832 du 19 août 2004 pris pour l'application des articles L. 229-5 à L. 229-19 du

code de l'environnement et relatif au système d'échange de quotas d'émission de gaz à effet de serre

- Décret n° 2005-190 du 25/02/05 approuvant le plan national d'affectation des quotas d'émission de gaz à effet de serre établi pour la période 2005-2007

- Décret n° 2004-832 du 19/08/04 pris pour l'application des articles L. 229-5 à L. 229-19 du code de l'environnement et relatif au système d'échange de quotas d'émission de gaz à effet de serre

VI- Ministerial orders

- Arrêté du 09/08/10 relatif à la vérification des déclarations d'émissions et de données relatives aux tonnes-kilomètres des exploitants d'aéronef dont la France est responsable dans le cadre du système communautaire d'échange de quotas d'émission de gaz à effet de serre

- Arrêté du 01/04/10 fixant les modalités de la déclaration et de la vérification des émissions des installations entrant à compter du 1er janvier 2013 dans le système d'échange de quotas d'émission de gaz à effet de serre

- Arrêté du 31/03/08 relatif à la vérification et à la quantification des émissions déclarées dans le cadre du système d'échange de quotas d'émission de gaz à effet de serre pour la période 2008-2012

- Arrêté du 31/01/08 relatif au registre et à la déclaration annuelle des émissions polluantes et des déchets

- Arrêté du 29/05/06 pris pour l'application des articles 3 et 4 du décret n° 2006-622 du 29 mai 2006 pris pour l'application des articles L. 229-20 à L. 229-24 du code de l'environnement et portant transposition

de la directive 2004/101/CE du Parlement européen et du Conseil du 27 octobre 2004 modifiant la directive 2003/87/CE établissant un système d'échange de quotas d'émission de gaz à effet de serre dans la Communauté au titre des mécanismes de projet du protocole de Kyoto

- Arrêté du 28/07/05 relatif à la vérification et à la quantification des émissions déclarées dans le cadre du système d'échange de quotas d'émission de gaz à effet de serre

Ⅶ- Circulars

- Circulaire du 13/03/08 relative à l'application de l'arrêté du 31 janvier 2008 relatif au registre et à la déclaration annuelle des émissions polluantes et des déchets

- Circulaire du 23/09/05 relative au système d'échange de quotas d'émission de gaz à effet de serre - Quantification, déclaration et vérification des émissions - Plan de surveillance

- Circulaire du 15/04/02 relative aux modalités de contrôle par l'inspection des installations classées des bilans annuels des émissions de gaz à effet de serre

Bibliography

BIRAUD Pierre-Noel et JESTIN FLEURY Nicole, Effet de serre : modélisation économique et décision publique, La Documentation française, 2002, 318 p.;

BOISSIEU (de) Christian, Division par quatre des emissions de gaz à effet de serre de la France à l'horizon 2050, La Documentation française, Paris, 2006, 142 p.;

BRAYE Dominique, NÈGRE Louis, SIDO Bruno et DUBOIS Daniel, Rapport fait au nom du Sénat, n° 552, 2009, Tome I, 579 p.;

BROHE Arnaud, Les marchés de quotas de CO2, Larcier, 2008, 160 p.;

CITEPA/OMINEA, Organisation et méthodes des inventaires nationaux des émissions atmosphériques en France, 7ème édition, février 2010, 1092 p.;

CITEPA/Rapport CCNUCC, Rapport national d'inventaire pour la France au titre de la Convention Cadre des Nations-Unies sur les Changements Climatiques et du Protocole de Kyoto, édition 2010, 1168 p.;

DE GERANDO Bertrand, Energies-climat : quotas d'émission de gaz à effet de serre. Système d'échange de quotas, entreprises et collectivités bénéficiaires, outils de gestion des quotas, Lamy, 2010, 300 p.;

HAVARD Michel, Rapport sur l'obligation d'élaboration d'un bilan d'émissions des gaz a effet de serre prévue par l'article 26 du Projet de loi portant "Engagement National pour l'Environnement", in collaboration with GAZEAU Jean-Claude (IGPEF), December 2009, 45 p., La Documentation française, March 2010;

HERBEL Peter et KROMAREK Pascale, Un exemple d'instrument économique de protection de l'environnement : la réduction des émissions de gaz à effet de serre, Recueil Dalloz, 2007, p. 963 et s.;

Ministère de l'aménagement du territoire et de l'environnement, Guide méthodologique relatif au contrôle des déclarations des émissions de gaz a effet de serre, Avril 2002, https://www.declarationpollution.ecologie.gouv.fr/gerep/download/guide_methodo_version_V8_15_04_2002pr.pdf

LE BAULT-FERRARESE Bernadette, La réception du Protocole de Kyoto en droit européen, Revue Trimestrielle de Droit Européen, 2010, p. 55 et s.;

MOLINER-DUBOST Marianne, Air. Actions sur les émissions. Instruments sectoriels et politiques intégrées, JurisClasseur Environnement et Développement durable, Fascicule 3550;

PAQUES Michel, La directive 2003/87/CE et le système d'échange de quotas d'émission de gaz à effet de serre dans la Communauté européenne, Revue Trimestrielle de Droit Européen, 2004, p. 249 et s.;

Rapport au Président de la République relatif à l'ordonnance No. 2010-1232 du 21 octobre 2010 portant diverses dispositions d'adaptation au droit de l'Union européenne en matière d'environnement, JORF, No. 246, 22 octobre 2010;

THIEFFRY Patrick, Renforcement du système d'échange de quotas d'émission de gaz à effet de serre : l'Union européenne prête pour l'après-Kyoto, Actualité Juridique du Droit Administratif, 2010, p. 259 et s.;

TREBULLE François Guy, Droit de l'environnement, Recueil Dalloz, 2010, p. 2468 et s.;

Website

AIDA: http://www.ineris.fr/aida/

ADEME: http://www2.ademe.fr

COFRAC: http://www.cofrac.fr

Eurocontrol: http://www.eurocontrol.int/

European co-operation for Accreditation: http://www.european-accreditation.org

European Union: http://ec.europa.eu

GEREP: https://www.declarationpollution.ecologie.gouv.fr/gerep/

iREP: http://www.pollutionsindustrielles.ecologie.gouv.fr/IREP/

Ministry of ecology, sustainable development, transport and housing: http://www.developpement-durable.gouv.fr/

UNFCCC: http://unfccc.int/