# Understanding the issues around quantifying GHG emissions in the financial sector

## Volume 3

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Observatoire
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# Volume 3 - Case study of a 'top-down' methodology for quantifying financed emissions

In Volume 3, the reader will be presented with a 'top-down'1 methodology for counting emissions financed by financial players, based on the definition provided in Volume 1. Volume 3 sets out:
- The rules and conventions governing this methodology broken into two approaches: by 'scope' and by 'issue'.
- The conditions for implementing the method (assets taken into account, business lines for which the methodology is relevant and so on);
- Recommendations on how financial players might implement this methodology;
- Methodological recommendations allowing results to be interpreted through time, whilst taking into account the advantages and limitations of the method.

This work is based on an existing methodology (see below).

## 1. Methodological rules and conventions

The basic principles of the methodology in question were developed by the Finance and Sustainable Development Chair of the Université Paris Dauphine at the request of Crédit Agricole CIB, with the creation of the P9XCA method (see Thesis, 'La comptabilité des émissions de gaz à effet de serre par enjeu: un outil d'analyse des impacts du changement climatique sur les activités d'une banque de financement et d'investissement', Antoine Rose, 2014). For this guide, the working group used the P9XCA methodology as a starting point to produce methodological recommendations on using this macro-economic approach. This methodology offers an approach to quantifying the emissions related to financial players' financing and proprietary investment activities.

### 1.1. Objectives and basic principles

The objective of the methodology is to provide:
- an order of magnitude estimation of the emissions financed by a large scale, diversified financial player
- mapping out these emissions by sector and by geographical zone. This mapping exercise allows players to gain a complete picture of emissions whilst taking into account a wide range of asset types, in order to improve their understanding of emissions generated by their finance and investment activities. It is a snapshot of emissions financed by financial players at a specific moment in time.

This 'top-down' methodology for quantifying emissions financed by financial players involves allocating all GHG emissions to sources of finance (through bank debts, bond debt and equity - which are the three usual forms of financing the economy) based on their market share by economic sector and geographical zone. It is designed differently to 'bottom-up' methodologies which allow the emissions associated with the activity of each financed entity (companies, local government, households) to be allocated asset-by-asset, based on data published by these entities or extrapolations from such data.

The methodology is based on four basic principles:
- An easy-to-use methodology based on a limited set of data adapted to the internal management systems of the reporting financial institution.
- Emission factors calculated using public open-source data so as to ensure full
- transparency and availability of sources (see methodological annex)
- Quantification of emissions associated with a significant proportion of the balance sheet of financial players for which the method is recommended (see below) whilst taking into account total finance in the form of debt or equity
- No double-counting of financed emissions.

## 1.2. Feedback from financial players having tested the methodology

Methodology presented in this volume of the guide has been tested by 5 players from the financial sector through ORSE's Club Finance. The players have met regularly with the following objectives:
- To exchange views on the methodological rules proposed, discuss their relevance and clarify the businesses and assets for which the methodology may be considered
- To work on the concepts of emissions by 'scope' and by 'issue' (presented below), and how they may support objectives
- To work on the appropriate calculation rules to propose, in particular based on the data (classification available internally)
- To test the methodology (both versions: by 'scope' and by 'issue'), and share any practical difficulties associated with its implementation
- To share feedback on results and how they support the objectives initially identified.

The work carried out within this group has helped to improve this guide, allowing the principles proposed to be tested on the ground.

Feedback from this work has been wide-ranging. Firstly, it is interesting to note that the objectives of the players who agreed to test the methodology vary: a desire to help to develop methodologies in some cases, an interest in mapping financed emissions in others. One of the players has already been using the 'top-down' methodology for a number of years to produce a public report of the order of magnitude of financed emissions and set its priorities.

On the whole, players considered that the collection of data required for the calculations and the practical implementation of the calculations were relatively straightforward, although the time spent on implementing the method cannot be neglected. Indeed, implementing the method requires a good understanding of the classifications of the various systems of asset management and monitoring used internally by the various businesses and access to levels of detail on the consolidated data. Some of the players having tested the methodology considered this analysis to be worthwhile insofar as it allowed them to initiate discussions with their businesses internally and gain a better understanding of the classifications used for monitoring.

Some players reported a degree of difficulty in interpreting the results.  Indeed, the results do combine several effects: the distribution of assets by sector and by country (or geographical zone), the characteristics of each country in terms of GHG emissions and the financial structure of companies in different countries. This complexity makes the results difficult to analyse and creates a barrier to presenting, interpreting and basing arguments on the results.

For most players, the exercise was an opportunity for an interesting exchange of views with their Risk Department and SD/CSR Department. Indeed the objectives of the exercise (having a global perspective, quantifying an order of magnitude of emissions, breaking analysis down by geographical zone and sector) probably reflects the objectives and working methods used by those departments.  Presenting the results to other interlocutors internally would appear more difficult.

In conclusion, the methodology presented in this guide may be a tool for instigating discussion on the issues associated with financed emissions. Indeed, this methodology is a means of mapping emissions by sector and by geographical zone and may be used as an awareness-raising tool. The benefits highlighted by the players include:
- The possibility of obtaining an order of magnitude quantification of emissions by sector and geographical area
- Relatively straightforward data collection
- Internal discussion instigated on the issue of financed emissions.

Nevertheless, uncertainties associated with the analysis and the difficulty of interpreting the results limit the ability of some players to bring the results to all departments. The methodology presented in this guide is a 'work in progress' and liable to change in the future.

Although the objectives of producing an order of magnitude quantification of emissions and mapping emissions have been met, the methodology is not as such a tool for monitoring changes in emissions, for taking action to reduce those emissions or for measuring the risk brought about by financed emissions. Instead, it has been used as a 'diagnostic' tool to set priorities. Finally, in its current version, the methodology was considered to apply to corporate and investment banking (CIB), applies in part to retail and is not recommended for asset management (paragraph 1.4 of this volume).

**It is important to note that the players who have tested the methodology became involved in the work as a joint exercise. These players are not committing to using this methodology in the future or to publishing the results.**

### 1.3. Two perspectives: by 'scope' and by 'issue'

Annual GHG emissions by sector and by country may be seen from two perspectives: one by 'scope' allowing direct and indirect emissions associated with the financing of macro-sectors to be quantified, and the other a 'issue'-based perspective offering analysis of the emissions of macro-sectors according to their capacity for reduction.

According to the two perspectives, (scope-based and issue-based), GHG emissions from households (residential heating, fuel for transport) and the use of soil and deforestation are allocated to sectors, according to the conventions set out in the methodological annexes.

The graph below summarises the various possible parameters for accounting for emissions associated with a sector of activity
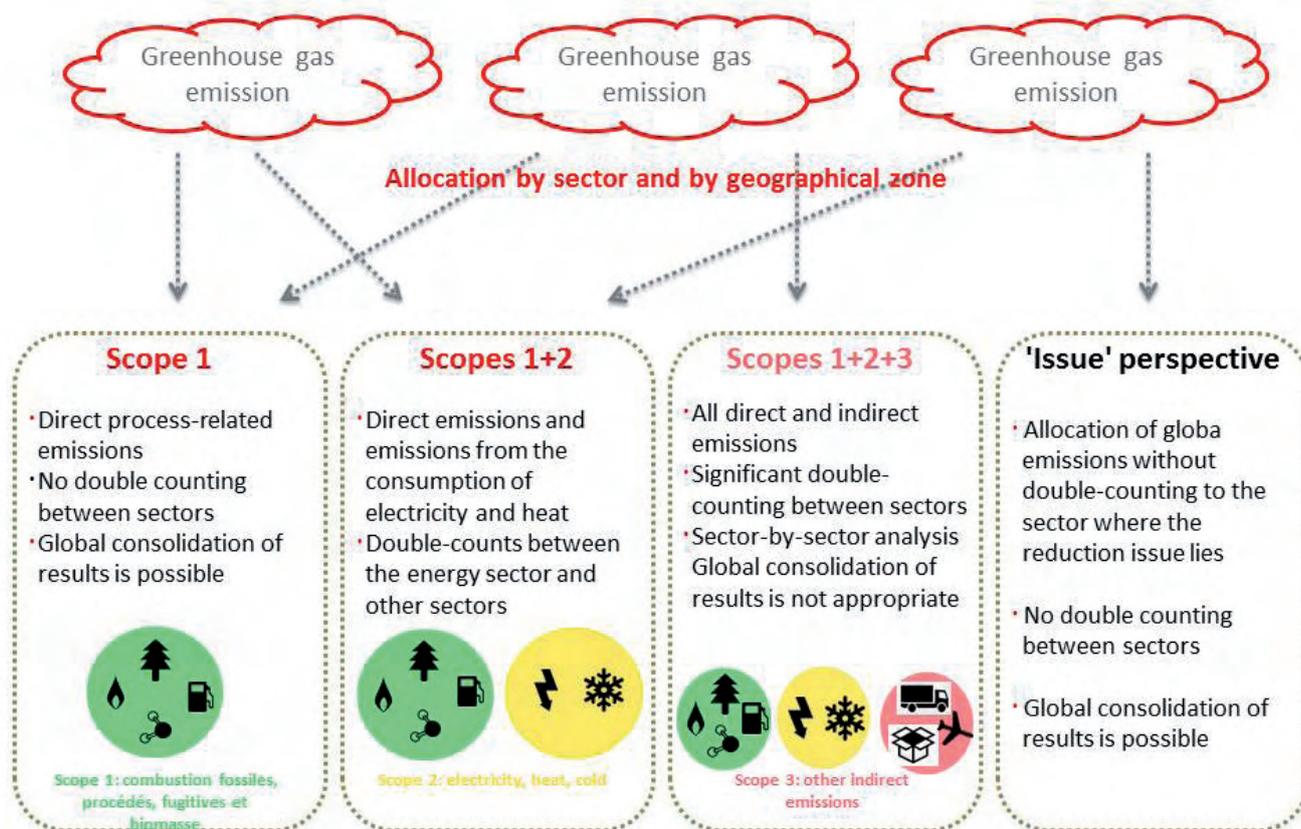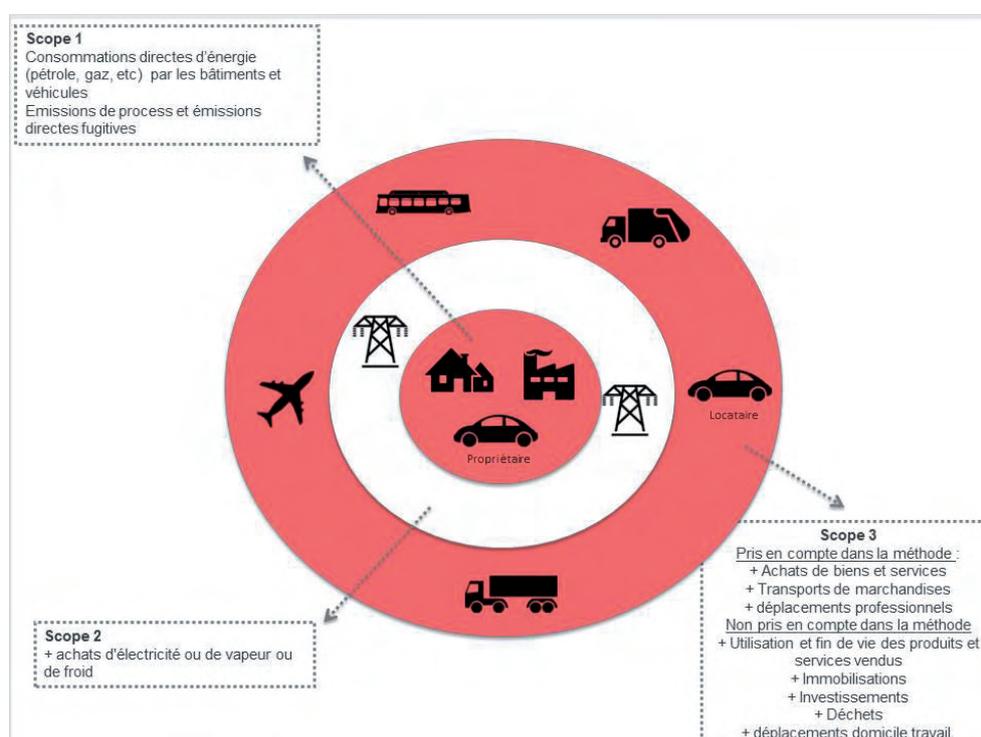


*Figure 1: Illustration of different accounting boundaries, by 'scope' and by 'issue'*

In accordance with the principles and objectives of the methodology, **it is possible to map out the emissions generated by finance and investment using these two approaches (by 'scope' and by 'issue' ), drawing on a single set of data.**

### 1.3.1. 'Scope'-based perspective

In accordance with the usual conventions for calculating GHG emissions, the scope-based approach allows emissions to be quantified according to three scopes:

- **Scope 1 emissions:** direct GHG emissions from sectors resulting from the burning of fossil fuels (petrol, natural gas and coal), process-related emissions, fugitive emissions and biomass emissions. Scope 1 emissions from the various sectors can be aggregated without producing double-counts.

- **Scope 2 emissions:** indirect GHG emissions from the consumption of electricity, steam and heat by sectors. According to this method, Scope 2 emissions are estimated by allocating emissions from the 'Electricity, Gas and Water Supply' (E) sector to each sector based on purchases from that sector. As such, accounting for Scope 2 emissions result in double-counting between, for example, the sector producing the electricity and the sectors consuming it, but allows an estimation of emissions arising from the energy consumption of each sector.

- **Scope 3 emissions:** Indirect emissions associated with the activity of the sector. Accounting for Scope 3 emissions is a means of estimating an order of magnitude of the emissions of a sector across its value chain and can provide useful insight when identifying priorities for action according to sector. Accounting for Scope 3 emissions results in many double-counts between sectors: for example emissions related to the manufacture of concrete may be accounted for both in the 'heavy industry' sector and in the 'construction' sector. Accounting for emissions resulting from the manufacture of concrete in the 'construction' sector is a means of estimating emissions from the embedded energy of construction materials (not produced directly by the construction sector but essential for the activity of this sector). Where Scope 3 emissions are accounted for, the overall consolidation of results of different sectors is not insightful. Indeed, such a consolidation would involve aggregating emissions generated across the value chain of each financed company and thus running the risk of counting certain emissions more than once. To take the example above, consolidating the results associated with financing two companies in the sectors 'construction' and 'heavy industry' would lead to the emissions associated with the production of concrete being counted twice. As such any results would represent 'actual' emissions associated with the economic system more than once. However, sector-by-sector analysis of Scope 3 emissions may be used to gain a better understanding of the issues and orders of magnitude.

**Scope 1**
Consommations directes d'énergie (pétrole, gaz, etc) par les bâtiments et véhicules
Emissions de process et émissions directes fugitives

Locataire

Propriétaire

**Scope 2**
+ achats d'électricité ou de vapeur ou de froid

**Scope 3**
Pris en compte dans la méthode :
+ Achats de biens et services
+ Transports de marchandises
+ déplacements professionnels
Non pris en compte dans la méthode
+ Utilisation et fin de vie des produits et services vendus
+ Immobilisations
+ Investissements
+ Déchets
+ déplacements domicile travail,

## 1.3.2. 'Issue'-based perspective

The 'issue'-based perspective complements the 'scope'-based perspective by providing a different overview of emissions generated by finance and investment activities without double counts.

### Principle of 'issue'-based accounting:

'Issue'-based accounting is an original2 model of carbon accounting which centres on the criteria based on which GHG emissions are allocated to different economic activities. In 'issue'-based accounting, an allocation is proposed based on the ability of agents to reduce them. The 'issue' of an economic agent is the quantity of GHG emissions that this agent could reduce in an economy where heavy restrictions on GHG emissions are introduced (high carbon prices, tax, standards). In this context, where GHG emissions would carry a cost, the internalisation of these additional costs would lead to a reduced demand for high-carbon goods, in favour of lower-carbon equivalents. The agent producing high-carbon goods must then respond to the change in demand through 'process innovation' (efficiency savings in design and manufacture) and 'product innovation' (efficiency savings throughout the product life). The GHG emissions targeted by these innovative approaches are the 'issue' for the agent.

An example can be given to illustrate this concept. The car manufacturing industry consumes intermediate products and possesses plants where it assembles vehicles powered by internal combustion engines which emit GHGs when in use. What is the 'issue' associated with the car manufacturing industry? Is it about knowing whether the assembly plant has solar panels or if it was built according to environmental quality standards? Rather, according to the 'issue'-based perspective
the 'issue' for this economic activity is the technology which will be chosen to design the engine and thus provide the end consumer with transportation. An assumption is made that, in an economy with high restrictions on GHG emissions, consumer tend to opt for low-emission vehicles.  So, the main challenge for the car industry is to offer such vehicles. This 'issue' is shared by the whole car industry. Sub-contractors are affected by technological changes in their sector: they may design lighter components with to improve the energy performance of vehicles or help to develop alternative technologies.

This type of carbon accounting allocates observed GHG emissions to economic agents with the decision-making power and leverage required to reduce them.

'Issue'-based carbon accounting allows the 'levers for action' of each economic activity, which corresponds to the choice of technological processes used in that activity as well as quantities of assets and services offered, to be made clear. It differs from 'scope'-based approaches which reflect the ownership of sources of emissions or the carbon content of purchases and sales.

### A macro-economic approach:

'Issue'-based accounting brings together all the economic agents in a value chain around a single issue. Thus, in the case of the car industry, it is necessary to bring the industry together with all sub-contractors, but also the repair, rentals and sales industries. The objective is to have the whole economic unit in question focus on a specific climate issue. As such, 'issue'-based accounting results in sectors of activity being designed to adapt to the scale of the issues, with basic needs at their heart: to be housed, fed, to move around, produce energy, produce industrial assets etc.

The result is that the analysis is based on a small number of sectors. This type of accounting feeds into macro-economic thinking and cannot go deep into the economic fabric at the sector level as defined by economic classifications such as NACE.  However, it results in values that can be combined: the sum of 'issues' of the economic activities in one territory is equal to the emissions of this territory. It establishes a direct one-to-one relationship between each quantity of GHG emissions associated with an 'issue' and each economic activity: all emissions are divided between the different activities according to their 'issue'. As a result, 'issue'-based accounting guarantees the absence of any multiple counting and the resulting figures can be consolidated.

## 1.4. Main conventions used in this guide

**The emissions taken into account are the annual GHG emissions by sector and by country.** The methodology does not take into account cumulative historic (past) emissions nor future emissions.

**These emissions are allocated on a pro-rata basis according to finance and investment in the economic sectors.**

**Global GHG emissions are allocated to economic production activities, i.e. corporate finance** (and marginally to States, which finance the government sector). Thus, according to this methodology, all global GHG emissions are 'allocated' to sectors whether emitted by businesses or households (see boxed text on the methodology).
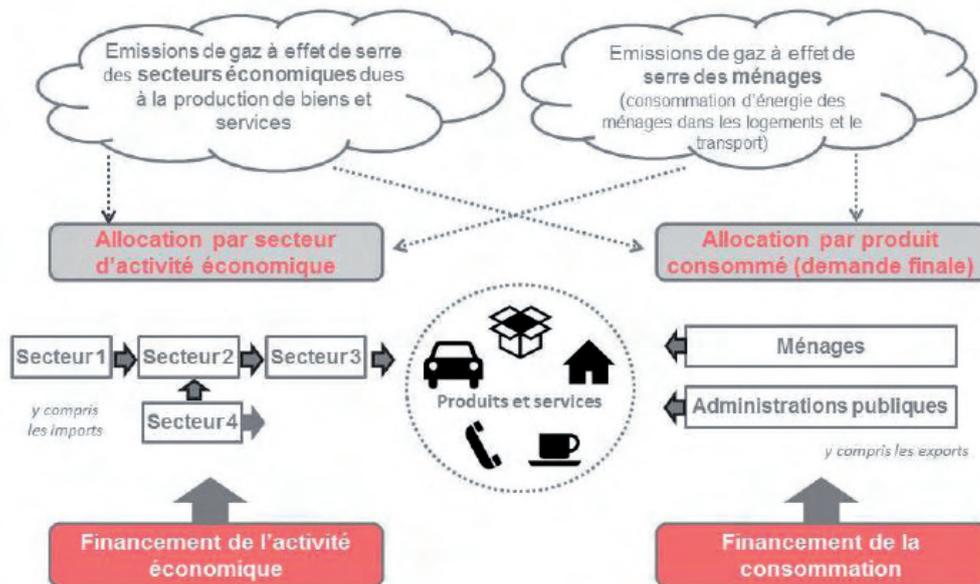


*Figure 2: Illustration of one of the methodological conventions of the method, according to which GHG emissions are allocated to the financing of the economy (and not the financing of consumption.)*

*A word on methodology: allocation to production and/or consumption*

The methodology is based on a convention for allocating GHG emissions to production rather than to household consumption. This convention can be subject to discussion as a different convention may have a significant impact on the results of the analysis.

The convention proposed here is based on the premise that the consumer does not buy a car that emits GHGs for the GHG emissions resulting from its use, but is acquiring a means of transportation. The consumer has needs that the market is there to meet. Generally, the consumer chooses from products on the market based on the quality/efficiency/price ratio of those products and regardless of the GHG emission from them. From this perspective, the choice of technology is the result of strategic decisions by manufacturers subject to the regulatory restrictions placed on them by public authorities. This interpretation results in the whole 'issue' being allocated to production activity and no GHG emissions being allocated to consumption.

Another methodological convention might be to focus on the levers for action available to households to reduce their greenhouse gas emissions. Using this approach it should also be possible to allocate global GHG emissions to end consumption (of households and public administrations) and thus the financing of consumption. Such an approach would be preferable in the case of industry players with activity that is particularly focussed on private individuals and/or government.

Similarly, rules for allocating GHG emissions to intermediary activities could be determined, for example by breaking GHG emissions down according to source ownership: companies, households and administration. This option has the benefit of allowing the financing of production and consumption to be consolidated but necessarily dilutes the carbon signal between producers and consumers.

All GHG emissions are allocated to financing the 'real' economy. By convention, the methodology allocates no emissions to market transactions between two financial players which do not result in the financing of economic sectors (swaps, hedging products) and refinancing operations between financial players (interbank lending).

Finally, the methodology is based on the premise that the purpose of finance for States, local authorities and quasi-public entities is to fund their operations, i.e. the 'back office'. The methodology does not involve quantifying the impact of any sovereign finance reinvested by States in economic sectors. As financing States, local government and quasi-public entities may represent a significant share of investment banks' assets, this methodological limit must be properly understood and incorporated into the analysis of results.

> ### A word about methodology: National inventories and emissions related to economic activities
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> National GHG Inventories (published under the auspices of the UNFCCC) record GHG emissions by country according to the location of emission sources. As such, French emissions are emissions that are actually emitted in France, whatever the nationality of the owner of the source (for example: emissions from foreign lorries travelling through France). Nor does this allocation take into account emissions from the country's imports or exports, even though these are key in the context of globalisation. For an improved analysis of the 'economic cycle' of GHG emissions, carbon accounting methods based on public accounting tools (input-output matrix) have been developed which allocate GHG emissions in two ways: on the one hand to production activity and on the other to products ultimately consumed by households (see SOes, NAMEA). The 'scope'-based perspective of the methodology allows emissions relating to production activities to be quantified whilst taking into account the 'economic cycle' of emissions.

### 1.5. Calculation principles

Financed emissions are calculated according to the formula below:

$$\text{Financed emissions (s,p)} = \text{Commitment (s,p)} \times \frac{\text{Emissions (s,p)}}{\text{Total finance (s,p)}}$$

With:
- **Financed emissions** (s,p): Emissions generated by finance and investment, by macro-sector and by country (or by geographical zone) in tonnes CO2eq.
- **Commitments** (s,p): Outstanding amount of loans and investments in the balance sheet of the financial institution by sector and by country or geographical zone (non-public data).
- **Emissions** (s,p): Emissions by sector and by country, according to the scope of emissions in question in tonnes CO2eq.
- **Total finance** (s,p): Total finance by sector and country (debt + equity).

Ratios $\dfrac{\text{Emissions (s,p)}}{\text{total fiance(s,p)}}$ by sector and by country (or by geographical zone) are the 'emission factors' of the method, shared by all players

Commitments by country and by sector are the financial institution's activity data.

This calculation principle is an integral part of the proposed methodology. However, the sources used to calculate emission factors may (and should) change, in particular to account for improvements in GHG emissions databases and the financing of sectors.

### 1.6. Emission factors

The emission factors proposed in the methodology correspond to emissions generated over one year by sector and by geographical zone:

$$Facteurs\ d'émissions = \frac{Emissions\ GES\ (secteur, pays)}{Financement\ total\ (secteur,\ pays)}$$

As explained above, these emission factors can be constructed according to several perimeters: taking into account scope 1 emissions, scope 1+2, scope 1+2+3 or with an allocation of global emissions by 'issue'.

### 1.7. Activity dataé

In accordance with the principles of the methodology, only assets corresponding to finance and investment operations in 'actual' sectors of activity (emitters of GHGs) should be taken into account.
- Bank loans (to companies or public and quasi-public entities);
- Bonds held by the financial institution;
- Equity share (company equity).

The assets detailed below will not be taken into account in the data set as the methodology allocates zero emissions to them by convention, in order to prevent any double counting of GHG emissions.
- Consumer finance (personal loans, property loans etc.), as emissions are allocated to production;
- Interbank lending and refinancing operations (which are not activities to finance the 'real' economy and cancel each other out between financial players);
- Tangible and intangible assets (already accounted for in the entity's scope 3a above (see Volume 2) on emissions from operations)
- Off-balance sheet (derivatives, protections etc.) and financial assets such as swap/hedging type operations (as they cancel each other out between the two players having contractualised these assets)

**Particular case of 'Retail':** for banks with a network of branches, 'retail' assets may amount to financing households and/or SMEs. The emissions associated with financing households are zero by convention in this methodology.  These may be incorporated in any 'top-down' methodology that is specific to retail banks. In both cases, emissions associated with finance and investment in SMEs must be taken into account (these are indeed assets that amount to finance and investment in economic sectors). It is necessary therefore, to separate out assets relating to SMEs, then, if possible, to break them down by economic sector. Where a breakdown by economic sector is not possible, an average default emission factor may be used for that country or even an average emission factor for the world. Should you wish to implement a standard 'top-down' method for a retail bank whose activities are restricted to a single company, it is possible to draw on national environmental accounts to develop more detailed emissions factors.

## 2. Implementing the methodology

### 2.1. Scope of emissions taken into account

Emissions are taken into account annually (tCO2eq generated each year by the economic activities associated with the balance sheet assets), in order provide a snapshot (at a given time) of emissions financed by financial players. This choice is consistent with the data source: the balance sheet represents a stock of assets[3].

## 2.2. Breakdown by sectors of activity

The data must be collected according to a classification that is compatible with the emission factors of the method, i.e. with the same classification or one which is similar and for which a correlation table can be produced.

To calculate emissions by 'scope', activity data (balance sheet assets) must be collected by economic activity and by country, according to the NACE rev 1 classification with no more than 33 sectors (see methodological annex). To calculate emissions by 'issue', activity data can be collected using this same classification or with a smaller number of sectors (see methodological annex).

If finance or investment is not initially allocated to the list of chosen sectors, it is important to try to allocate these assets to the most relevant sector. Otherwise, it is possible to use an average emission factor for the country or even the world.

## 2.3. Breakdown by geographical zone

It would seem worthwhile to use country-specific emission factors. Calculating financed emissions by sector and by country allows emissions to be mapped in detail and any differences between countries to be calculated (differences in GHG emissions by sector, differences in company finance practices etc.). In the current version of the methodology, analysis by country and by sector is confronted with two main limitations:
- GHG emissions by sector are not available for all countries in the world or the 'scope'-based perspective. For the countries in question, sector-based emission factors for 'other countries in the world' are suggested. This difficulty should disappear as environmental accounting initiatives are rolled out in the countries in question.
- The country where the assets are located is not necessarily the location of the financed economic activity (see paragraph on the concept of 'country risk').

Given the limitations set out above, and depending on the structure of each financial entity and its assets, it may be appropriate to group certain countries or sectors together on a case-by-case basis. For example, it may be appropriate to use average global emission factors for certain sectors of activity (for example, the 'Mining and Quarrying' sector). In any event, it is not advisable to carry out a 'line-by-line' analysis of the balance sheet to identify assets which have a different geographical location to the economic activity: this very time-consuming exercise would add little of value to the analysis and would mean straying from the 'top-down' analytical concept of the methodology.

### 2.3.1. The concept of country risk

The data on the assets side of a bank's balance sheet must be collected by country or otherwise by geographical zone. The objective of the analysis is to determine the country where GHG emissions associated with an asset are located, i.e. the 'physical' location of the investment or finance. In the case of so-called structured financing (project finance, buyer's credit etc.), this country is known. It should be noted that this type of technique is used when financing specific assets or commercial operations in developing countries.

With regards for non-specific (or corporate) finance activities which represent the majority of assets of a financial sector player, the 'actual' country where the investment takes place remains unknown to the financial player. In both cases, financial players generally use the concept of country risk which is the best estimate of the 'actual' geographical location of the finance or investment activity and allows an assessment of risk, particularly in geopolitical terms. The country of risk may differ from where the financial transaction is entered in the accounts, the location of the parent company or indeed the country of the counterparty

**Definition of the country of risk**

The best estimate by the bank or financial institution of the geographical location of the risk.

Given the objectives of the method, it is advisable to extract stock data according to the country of risk. Otherwise, it is possible to extract data according to the location of booking but this may result in bias in the geographical distribution of emissions generated (the location of booking is not necessary the location of GHG emissions).

## 2.4. Adapting the methodology to specific constraints

The methodology is designed to be flexible: the objective is to make use of the most suitable public data available (on greenhouse gas emissions and finance and investment by sector and geographical zone) for the identified need as they are created or updated. It is also transparent and as such can evolve according to how available data are classified in organisations' internal management systems. Two detailed versions of conventions and boundaries proposed in the approaches by 'scope' and by 'issue' respectively are supplied in the annex. These versions are not intended to be definitive and may be developed according to the requirements of players and changes in available data sources.

## 2.5. Operational implementation

Data collection may prove complex, at least for the initial exercise. In particular, it is a case of identifying internal contacts liable to provide activity data, understanding the classification of these data and their compatibility with the methodology and of managing any confidentiality issues.

The main constraint in using the method is the availability of consolidated data for the assets according to the classification used. The methodology may use difference sources of data on GHG emissions and assets by sector and area and should evolve as these sources of bibliographical data improve. As such, the compatibility of the methodology with the company's internal management systems may change through time. In the case of the method set out here, emission factors are proposed by NACE sector (Statistical classification of economic activities in the European Community) for the 'scope'-based approach and by macro-sector for the 'issue'-based approach.

## 2.6. Internal data sources

The stock data by sector and by geographical zone may be available from different divisions within organisations and particularly from:
- The risk management division
- The financial team

## 2.7. Management information systems

In-house management information systems tend to be the result of the organisation's history, including mergers and acquisitions.  It is therefore possible that several management systems coexist with varying levels of detail in terms of data (for example, by country or by sector). In this case, as for any GHG reporting, a pragmatic approach should be taken:
- '80/20' rule: focus analysis on the most significant balance sheet assets
- Take an iterative approach: depending on your objectives, focus analysis on certain countries, sectors or subsidiaries initially, even if this means extending the boundaries later.

## 2.8. Emission factors
The emission factors proposed in the methodology correspond to financed emissions by economic sector and by geographical zone:

$$Facteurs\ d'émissions = \frac{Emissions\ GES\ (secteur, pays)}{Financement\ total\ (secteur,\ pays)}$$

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As explained above, these emission factors can be constructed according to several scopes: taking into account Scope 1 emissions, Scope 1+2, Scope 1+2+3 or with an allocation of global emissions by 'issue'. Emission factors are in tonnes CO2eq/€ per asset.

One of the methodological difficulties lies in determining the amount of total finance of companies by country and by sector as no database has been identified which provides this information directly. A workaround for this problem has been found using Value Added. The amounts of value added by sector and by country are available and it is possible to reach an approximate ratio of value added / total finance using central balance sheet databases.

Emission factor calculations are thus broken down into two stages according to the formula below:

$$\text{emission factors} = \frac{\text{GHG emissions (sector, country)}}{\text{value added (sector, country)}} \ x \ \frac{\text{value added (sector, country)}}{\text{total finance (sector, country)}}$$

With:
- **GHG emissions** (s,p): GHG emissions by sector and by country (or by geographical zone)
- **Value added** (s,p): Value added by sector and by country (or by geographical zone)
- **Total finance** (s,p): Total finance by sector and country (debt + equity)

The calculation of emission factors (specific to 'scope'-based or 'issue'-based approaches) and financial ratios (Total finance (s, p)/Value added (s, p)) using the European balance sheet database, BACH (Bank for the Accounts of Companies Harmonised) is detailed in the methodological annex of this guide.

## 2.9. Managing uncertainties

Uncertainties associated with results of the analysis are due to uncertainties relating to emission factors and to uncertainties relating to activity data collected (players' balance sheet stocks and their classification).
Overall, the analysis is associated with high levels of uncertainty, which appears on the whole higher than those generally encountered when estimating a Scope 3 GHG balance sheet.  Nevertheless, the uncertainties associated with the analysis should not call into question the method objectives, i.e. to calculate an order of magnitude of financed emissions. The ranking of sectors and geographical zones in terms of GHG emissions has enabled a player to identify sectors where action is a priority.

Principle of simplicity

In order to cover significant share of balance sheet assets, the methodology draws on analysis of a small number of sectors (10 to 30 depending on the chosen approach). This choice is justified by a principle of simplicity and a desire to reduce the uncertainties associated with analysis.

Each of the steps involved in calculating emission factors contributes to the uncertainty of the calculation:
- The GHG emissions data by sector and by country are taken from public databases: WIOD database (research project funded by the European Commission) for GHG emissions by 'scope' and National GHG Inventories (collected by the United Nations as part of the Framework Convention on Climate Change – UNFCCC) for GHG emissions by 'issue'. However, the quality of data varies greatly according to the country or geographical zone in question (no doubt of good quality for OECD countries and less good quality for developing countries).
- For the 'scope'-based perspective, the quantification of indirect emissions (scope 2 and 3) is based on the NAMEA method: 'National Accounting Matrix Including Environmental Accounts.' This tool for analysing relationships between the economy and the environment has been developed by EUROSTAT (the European Commission's statistical service), and allows reliable estimates of direct and indirect emissions from economic sectors of activity in Europe.
- Finally, the term 'Total Finance' is estimated based on financial ratios collected by European central banks in the BACH database (Bank for the Accounts of Companies Harmonized). In the absence of equivalent databases identified to date for other geographical zones, these same ratios have been extrapolated for global geographic zones for the 'scope' and 'issue'-based approaches. Of course, this represents a significant bias but one which is not specific to the methodology presented here. This source of uncertainty is merely the consequence of a lack of data.

In terms of the uncertainties associated with activity data, i.e. assets by sector and country, several factors should be considered:
- The classification of assets by sector of activity and by country may depend on in-house systems of management, interpretation and classification practices.
- The geographical booking of assets may result in bias in the geographical distribution of financed emissions: the location of the booking is not necessarily the location of the risk (see paragraph on the concept of country of risk)
- The sectoral booking of assets may result in bias in the sectoral distribution of financed emissions: certain support activities may or may not be classified with the sectors they support: the classification of diversified industrial groups may be tricky (between holdings and specialised subsidiaries for example.

The quality of emission factors suggested in this methodology may be assessed against different criteria:

| Quality criteria for suggested emission factors (emission factors by 'scope') | |
|---|---|
| Technological representativeness | Emission factors reflect the average emission factors of each sector in each country for 33 sectors of activity (for 'scope'-based emission factors). 0They are representative of the state of technology of a sector in a country at a moment in time as they are based on national emissions inventories (for more details, see 'third party' rules used for inventories). However, they do not allow the analysis to be refined according to the different types of technology in a given sector. |
| Temporal representativeness | Detailed emission factors are available for 40 countries, representing 85% of global production combined (for 'scope'-based emission factors). For other countries , sector-based average emission factors for 'other countries in the world' are suggested. As such, all global emissions are indeed taken into account in the suggested emission factors. |
| Représentativité temporelle | Emission factors are annual emission factors which must be regularly updated using the national accounts. |
| Completeness | Depends on the quality of national inventories. |

In all circumstances the emission factor should be standardised and consistent with the activity data used. Given the uncertainties associated with the analysis, this methodology does not allow comparisons to be drawn between financial players. Nor does this methodology allow objectives to be set for the reduction of financed emissions.

## 3. Applicability of the methodology to the various businesses in the financial sector

### 3.1. Applicability of the methodology to the banking sector

The P9XCA methodology in its existing form is applicable to c**orporate and investment banking (CIB)** and to '**proprietary investment**'.  In both cases the methodology allows financed emissions, i.e. emissions associated with assets held by the entity (and included on its balance sheet), to be quantified. Off-balance sheet assets, consultancy and trading activities are not taken into account. The general principles of this method may apply to **retail banking** in a different form. Indeed, the methodology only allows the quantification of emissions associated with balance sheet assets corresponding to the financing of economic activities. By convention, no emissions are allocated to consumer finance.  This convention may be revised in order to create a methodology adapted to retail banking. In the case of a retail banks, it may also be worthwhile to use sectoral emission factors that are more detailed than those suggested here, provided that the country in question has detailed environmental accounts (which is the case, for example, for France, Germany or the United States).

Finally, the methodology is not recommended for assets management for which other 'bottom-up' methodologies exist (see boxed text below and volume 1 of the guide).

### Methodological issue raised by traded stock

Le calcul des facteurs d'émissions repose sur la somme «equity + dettes» des entreprises (passif des bilans) issue Calculating emission factors is based on the sum of 'equity + debt' of companies (liabilities side of the balance sheet) from national statistical data on company accounts. This factor is applied to the assets of financial institutions by sector. The method for calculating balance sheet assets should therefore be compatible with the methodology's parameters for calculating emission factors.

The question of the potential difference in value between the amount of equity and a company's acquisition cost (on the market or over the counter) is raised for listed shares and for unlisted assets. For listed shares, financial institutions' assets do not correspond to the share of equity of the holding but to the purchase or market value (share of that company's market capitalisation). For unlisted assets there may be a goodwill excess over the equity share.

In the case of unlisted assets, in practice goodwill is usually amortised over time. At a given time, the value of goodwill thus generally remains on average low compared to the valuation of shares on the balance sheets of financial players. The difference in valuation therefore results in uncertainties that are acceptable in terms of orders of magnitude, bearing in mind the objectives of the methodology and the approximations that are inherent to the exercise.

For listed companies, market capitalisation is often higher than the amount of equity. The market capitalisation of CAC40 stocks thus appears on average 18% higher than the shareholders' equity (Group share) of the same stocks over the last three years. Based on the scenario of gross financial leverage of 70% (average value on 1/9/2014 of the ratio of gross indebtedness/equity of non-financial CAC40 companies), the methodology overestimates the emissions of a portfolio of shares by 11%:

*(Emissions / (Debts + Equity) ) / (Emissions / (Debts + Market Capitalisation) ) = (Debts + Market Capitalisation) / (Debts + Equity) = (Equity x (0.7 + 1.18)) / (Equity x (0.7+1)) = 1.88 / 1.7 = 1.11*

With these scenarios, on average the total calculation overestimates financed emissions by 1.1% if the portfolio represents 10% of assets, by 3.3% if it represents 30% and by 11% if it represents 100%.

The average difference between equity and market capitalisation varies through time and according to the type of shares. In the event of over-valuation by over 50%, the methodology would overestimate emissions by 2.9%, 8.8% and 29% respectively depending on the size of the portfolio of shares.

The error in the total results resulting from the over-valuation of stocks in relation to equity appears marginal where shares represent only a small proportion of assets (10% for example).

Where the proportion is higher but not predominant (30% for example), the error remains low but non-negligible. It is possible to use an adjustment factor (dividing the value of stocks by the average % of over-valuation). However, the adjustment factor must be calculated carefully and take into account in particular the date of market prices, the nature of shares and offsetting factors (stocks may be valued at a lower acquisition value than the market value, equity may be greater than the group's equity share etc.).

Finally, where the proportion of shares is predominant, applying this methodology as is is not advisable while there is no change in the order of magnitude of the total calculation. Other methodologies where this is not an issue can then be applied.

### 3.2. Off-balance sheet assets

The purpose of the methodology is to quantify financed emissions and as such it does not cover off-balance sheet assets. In particular, market, consultancy and syndication transactions are not covered by the methodology.

### 3.3. Applicability of the methodology to the insurance sector

From the perspective of an insurer such as la MAIF, this methodology applies to investments from members' contributions and life insurance premiums. The limited granularity of the model due to the approach by sector and country of risk, serves to simplify the estimation of GHG generated by investments compared with a 'bottom-up' methodology. The methodology also allows indirect emissions (so-called Scope 3) of financed companies to be taken into account, this scope being still difficult to approach through a 'bottom-up' type methodology (although certain bottom-up methods also suggest evaluating emissions according this scope). Nevertheless, this methodology has limitations that must be born in mind. In particular, it does not help in investment decisions or reflect the impact of investment choices within the same sector on GHG emissions. Indeed, this methodology results in a very general overview of the carbon impact of investments and does not allow a detailed comparison between the environmental performances of various projects or investment choices. As a response to the issue of comparing environmental impact, the 'bottom-up' model for evaluating GHG emissions should, therefore, be chosen. Finally, the volumes of emissions estimated by the 'top-down' method are only an order of magnitude, the accuracy of which depends intrinsically on the quality and accuracy of data and conventions used when calculating emission factors.

This methodological work on quantifying financed GHG emissions by investing members' subscriptions and fees has raised interesting questions about carbon risk and offers additional insight into our responsible investment practices

## 4. Interpreting results and changes

Interpreting the results of the quantification of emissions generated by the balance sheet assets of a financial player means separating out:
- Total, direct and indirect emissions from sectors of activity (in Tonnes CO2eq)
- Emissions from sectors of activity compared to the added value of companies in the sector (in kgCO2eq/k€ of AV)
- Emissions from sectors of activity compared to the capital intensity of companies in the sector (in kgCO2eq/k€ of financial asset).

Thus, GHG emissions are usually considered according to the first two parameters (total emissions and emissions per € of AV) but rarely the third.  The two graphs below show an example of GHG emissions compared to the capital intensity of companies in the sector (which correspond to emission factors of the method according to the 'scope'-based approach, see annex for detailed emission factors):
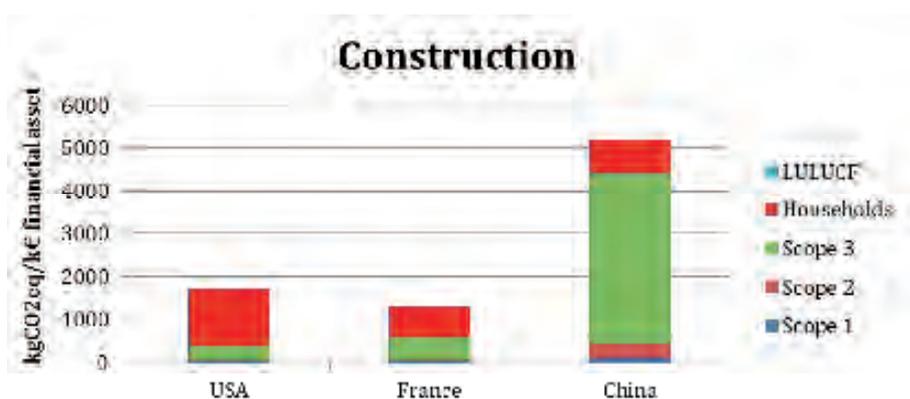


*Figure 3: Emissions by € of assets and by country for the construction sector*
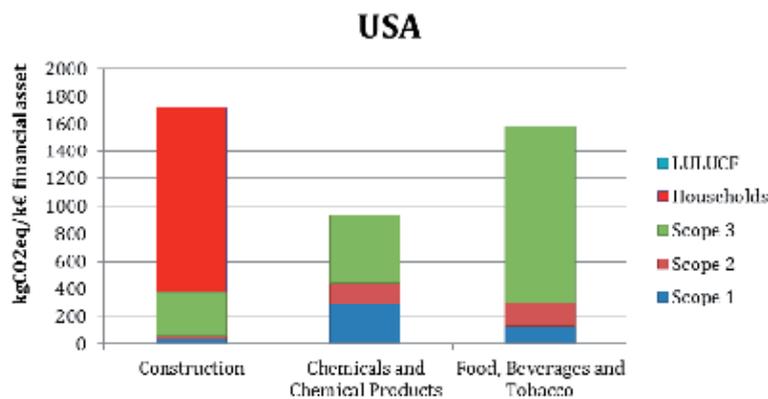
## 5. Conclusions and recommendations for use

**Using a macroeconomic approach to quantify financed GHG emissions resolves the issue of how to consolidate emissions data encountered when using 'bottom-up' methodologies on the scale of financial players with a very wide scope of activity. It also allows financed emissions to be mapped out by sector and geographical zone**

The methodology appears particularly relevant for corporate and investment banking as its basic principles lead to an analytical focus on the financing of economic sectors (0 emissions allocated to households). The methodology also applies to retail banks and insurance under certain conditions.

Given the uncertainties associated with the analysis (see above), this methodology does not allow for the comparison of results obtained by different organisations, as with a GHG report.

The objective of the methodology is to provide an order of magnitude estimation of the emissions financed by a large, diversified financial player as well as to map these emissions by sector and geographical zone. As with any methodology for quantifying emissions generated by financial activities, this does not claim to meet all of players' objectives. Indeed, it is merely a first step towards having access to the strategic tools or measuring climate and carbon risks.

One of the limitations of this approach is particularly related to existing classifications of economic activities which are the result of history and may not seem adapted to the carbon issue. For example, in national accounts, the 'energy' sector is not separated into high-carbon and low-carbon energies. As a result, exposure to the energy sector merely translates into the energy mix of each country or geographical zone in question. As such, it can be worthwhile for this sector, as for others, to combine the 'top-down' methodology with other calculations such as 'bottom-up' estimations.

However it allows the values calculated for several businesses within a single financial institution to be consolidated and by today's standards represents a truly innovative approach allowing financial institutions to quantify their financed GHG emissions in a simple, fast and cost-free way.

**Methodological Preamble:**

The methodology is designed to be flexible: the objective is to make use of the most appropriate public data available (on GHG emissions and finance and investment according to sector and geographical zone) for the identified need as they are created or updated. The methodology may also evolve according to the granularity of data available in organisations' internal management systems. As such, the version of the methodology proposed in this guide is not intended to be definitive. On the contrary, future developments should be expected based on the needs of stakeholders and changes in the sources of available data.
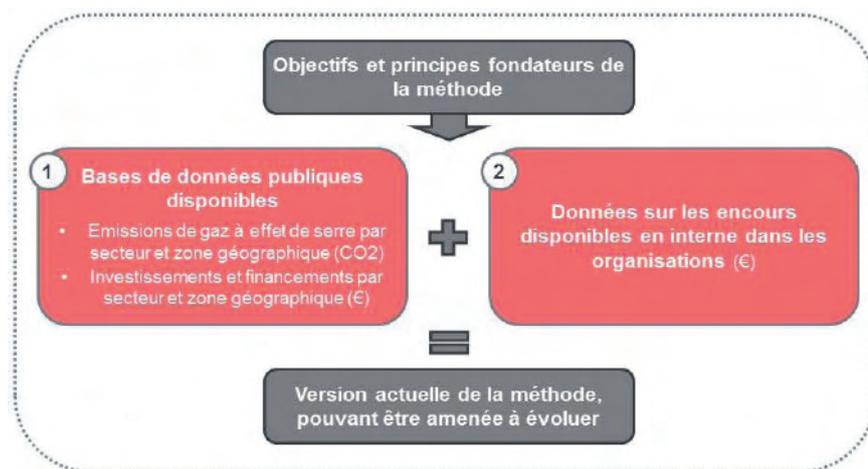


*Figure 5: A flexible methodology, based on basic objectives and principles*

This methodology has arisen from academic work by the Finance and Sustainable Development Chair of the University of Paris-Dauphine. Many passages of this methodological annex are extracts from the thesis of Antoine ROSE, 'La comptabilité des émissions de GES par enjeu: un outil d'analyse des impacts du changement climatique sur les activités d'une BFI' (September 2014).

**1. Methodology: general aspects**

Emission factors are thus calculated in two stages using the calculation formula below:

$$emission\ factors = \frac{GHG\ emissions\ (sector,\ country)}{value\ added\ (sector,\ country)} \times \frac{value\ added\ (sector,\ country)}{total\ finance\ (sector,\ country)}$$

With:
- GHG emissions (s,p): GHG emissions by sector and by country (or by geographical area)
- Value added (s,p): value added by sector and by country (or by geographical zone)
- Total finance (s,p): Total finance by sector and country (debt + equity).

The first stage, the calculation of GHG emissions by sector and by country, is specific to the approach used: by 'scope' or by 'issue'. The second stage, i.e. calculating total finance (debt+equity) by unit of value added by country and by sector is common to both approaches and is set out below.

**Total finance by sector and country, by unit of value added**

Financial ratios (Total Finance (s,p)/Value added (s, p)) or (Total Finance (s,p)/ Production (s,p)) are calculated using the European balance sheet database, BACH (Bank for the Accounts of Companies Harmonised). This database contains aggregated data on the balance sheets and profit and loss accounts of non-financial companies by NACErev2 economic activity in 11 countries (Germany, Austria, Belgium, Spain, France, Italy, Luxembourg, the Netherlands, Poland, Portugal and the Czech Republic).

In order to take into account all financial assets, the lines on the liabilities side of the balance sheet of non-financial companies taken into account in the calculation are:
- Total equity – E
- Bonds and similar commitments – L1
- Amounts held by other credit institutions – L2
- Other financial debt – L31

As the BACH database only contains information for certain European countries (Germany, Austria, Belgium, Spain, France, Italy, Luxembourg, the Netherlands, Poland, Portugal and the Czech Republic), extrapolations were carried out for other countries. The weighted average of the value added of the ratios for Belgium, France, Germany, Italy, Portugal and Spain is used as an approximation for other Western European countries. The ratios of Poland and the Czech Republic are used as an approximation for other European countries. The weighted average of the value added of all countries in the BACH database is used as an approximation for OECD countries, and by default for other countries.

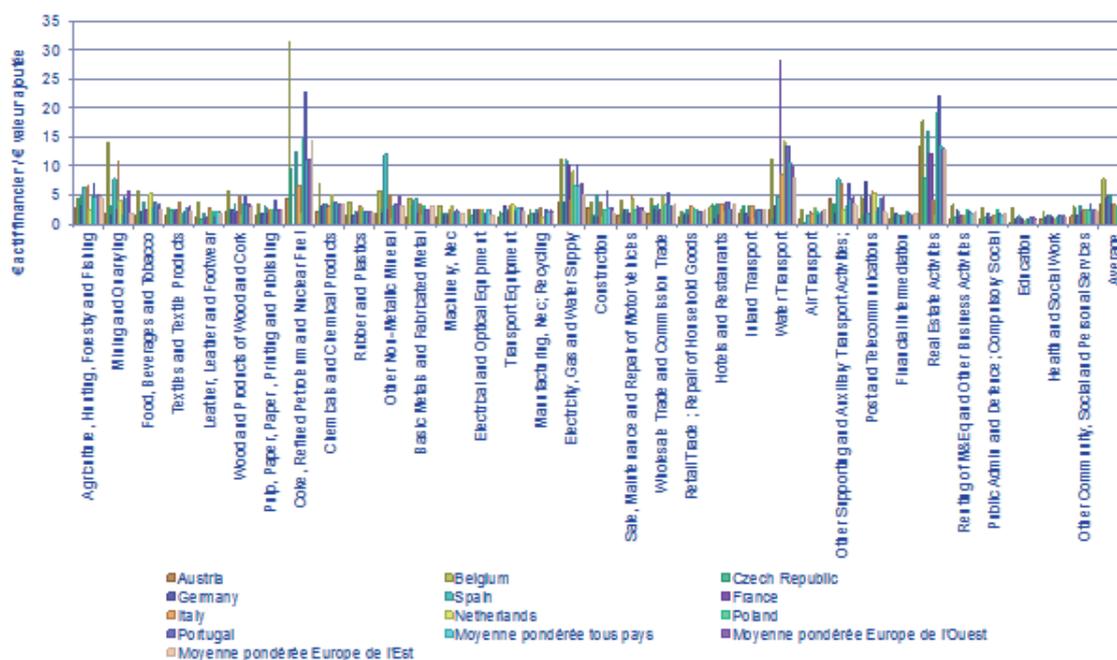The ratios obtained are presented in a graph below:



*Fig.6: extracts of ratios of financial assets by unit of value added taken from the BACH database - 2009*

## 2. Specific information for the 'issue'-based perspective

To develop an issue-based perspective by sector and by country, and to develop emissions ratios by Euro of value added, in the methodology all GHG emissions from production and consumption are taken into account and allocated to economic players according to original principles (Antoine Rose 2014 thesis: issue-based accounting.

'Issue'-based accounting allows GHG emissions to be distributed according to levers for action in terms of their reduction by economic players. It is a radically different perspective to the issue-based perspective which involves an in-depth redefinition of the parameters of economic agents in relation to their real sensitivity to the challenges raised by the need to reduce our GHG emissions.

The following are extracts from the thesis of Antoine ROSE, 'La comptabilité des émissions de GES par enjeu : un outil d'analyse des impacts du changement climatique sur les activités d'une BFI' (September 2014).

**Definition of the 'climate issue' (Rose, 2014)**

'Issue'-based accounting explores a means of justifying this allocation other than ownership, consumption or dependency. It is a form of carbon accounting based on the decision-making and the lever for action of economic agents, i.e. the climate 'issue' that characterises their activities. The 'issue' of an economic agent is defined as the quantity of GHG emissions that this agent could reduce in an economy where heavy restrictions on GHG emissions were introduced. Under restrictions relating to GHG emissions which are reflected in the cost of emissions, the internalisation of these additional costs entails a reduction in the demand for high-carbon goods in favour of lower-carbon equivalents. The agent producing high carbon goods must then respond to changes in demand through 'process innovation' (efficiency savings in design and manufacture) and 'product innovation' (efficiency savings throughout the product life). The GHG emissions targeted by these innovative approaches are the climate 'issue' for the agent.

Let us take a few examples to illustrate this concept. The car manufacturing industry consumes intermediate products and possesses plants where it assembles vehicles powered by internal combustion engines which emit GHGs when in use. What is the climate 'issue' associated with the car manufacturing industry? Is it about knowing whether the assembly plant has solar panels or whether it was painted with a certain type of paint or indeed if it was built according to environmental quality standards? The 'issue' for this economic activity is the technology which will be chosen to design the engine and thus provide the end consumer with transportation. Indeed, in an economy with high restrictions on GHG emissions, consumers tend to choose low-emission vehicles. Will the car industry supply these? It is the answer to this question which will make it possible to state whether or not the car industry has risen to the challenge to fight climate change. This 'issue' is the same for the whole car industry. Sub-contractors are affected by technological changes in their sector: they may design lighter components to improve the energy performance of vehicles or help to develop alternative technologies. Hire companies must also adapt their fleet to meet customer need. Although they lack the leverage to affect innovations in the car manufacturing industry, they contribute to change through their demand for high-performance vehicles.

In this example, GHG emissions associated with the construction of the car plant are the climate issue of the construction sector which must improve construction techniques and the energy efficiency of buildings to meet demand in a carbon-restricted economy. Similarly, the GHG emissions of paint solvents used in the plant are the issue of the paint manufacturer; those of the manufacture of solar panels are the issue of the panel manufacturer. In these examples, only emissions from industrial processes are taken into account. Indeed, the emissions from generating electricity consumed in the manufacture of the paint or solar panels are the climate issue of the electricity producer who must adapt their energy mix.

This type of carbon accounting allocates observed GHG emissions to economic agents with the decision-making power and leverage required to reduce them. Issue-based carbon accounting allows the 'levers for action' for each economic activity, which corresponds to the choice of technological processes used in that activity as well as quantities and quality of goods and services offered, to be made clear.

Thus, 'issue'-based accounting links GHG emissions to the decision on the technological process used. It is important to remember that justification is not based on production. It is not about systematically taking into account the GHG emissions of the production activity or the GHG emissions when the product is used. This may sometimes be the case but it is not the rule for allocation: for cars, the emissions taken into account are those from the use of products, whereas for the food industry, the emissions taken into account are those from the processing of food.

**Based on a classic economic model according to which levers for action and consumption are analysed (Rose, 2014)**

The corollary of this climate 'issue'-based approach is that all GHG emissions observed are allocated to production rather than consumption. Without denying the role of the consumer in the act of consumption, this corollary analyses the producer/consumer relationship in a different way. Let us continue with the example of the car: the consumer does not buy a car that issues GHGs for the GHG emissions but purchases a means of personal transport. The consumer has needs that the market is there to meet. The consumer responds to the quality/price ratio of products offered to her by the market. In other words, she maximises her utility (which incorporates her preference for the environment), following a price signal, but does not take a position on a particular form of technology, no matter how high in carbon emissions. The car's emissions appear secondary for the consumer. The purchase price, maintenance cost and resale price all determine her final decision in relation to her own utility function. From this perspective, the choice of technology is the result of strategic decisions by manufacturers subject to the regulatory restrictions placed on them by public authorities. This interpretation results in the whole climate 'issue' being allocated to production activity and no GHG emissions being allocated to consumption.

According to the same logic, the lever for action on technical solutions used to build houses, for example, lies with the construction sector. For example, the corollary means that the decision of whether to use concrete or wood lies with construction engineers rather than the future occupant who, a priori, has no preference for either of the technologies.

But more in-depth discussion of the consequences of allocating GHG emissions to production activities alone is required. The 'issue'-based GHG emissions accounting framework amounts to an economic model in which the consumer is considered as passive but perfectly well informed of the characteristics of the products she consumes.

The climate issue is defined as the relevant economic agent's potential for reducing GHG emissions. The suggested allocation in 'issue'-based accounting (allocation of all GHG emissions to production activities) therefore leads to the assumption that consumption activities do not have the potential to reduce GHG emissions. However, it seems obvious at first sight that consumers can modify their behaviours where supply (quantity and quality of products) is constant. Indeed, taking the car example again, the consumer (vehicle owner) can a priori opt to drive the same vehicle in a more efficient way. Indeed, in the face of high economic restrictions on carbon (sharp, significant and sustained rise in the price of carbon), the consumer (motorist) will adapt her behaviour and drive differently, using her car only at weekends, for example. As such, the car industry's potential to reduce GHG emissions would appear to lie, on the one hand, in the initial supply of vehicles by the manufacturers (consequences of innovations in processes and products) and, on the other hand, in consumer behaviour.

The concept of climate issue as defined here has a different outcome. Let us continue with the transport sector. How households move around depends on their lifestyle. Depending on their geographical location and needs (commuting and/or travel for leisure), in addition to the model of vehicle purchased (the technical characteristics of which depend on the manufacturer's innovative choices in terms of processes and products), households have the option of choosing an alternative means of transport to avoid using their personal vehicle: public transport, low-pollution or even non-polluting (bicycle etc.), alternative means of transport and solutions for optimising their personal vehicles such as car-sharing for example. Information on these possible alternatives is a key factor in the the consumer's choice of transportation (with the consumer assumed to be passive according to this economic model). Thus GHG emissions corresponding to changes in the way in which emitting products are used, such as the car in our example, are in reality the climate issue of economic agents correcting imperfect information and not the climate issue of consumer agents. As such, GHG emissions related to the ways in which cars are used are the climate issue of the public authorities insofar as they contribute to creating and promoting the public transport service, but also the issue of any economic player (whether private or public) involved in circulating information allowing the end consumer to optimise their travel according to the economic conditions (levels of restrictions on GHG emissions produced by the journeys): information platforms on travel conditions, calculation tools for identifying the most efficient transport solution, platforms for organising car-sharing etc.

**A tool that is macro-economic by definition: benefits and limitations (Rose, 2014)**

'Issue'-based accounting brings together all the economic agents in a single value chain around a single issue. Thus, as shown by the example of the car industry, it is necessary to consider the whole car industry (including manufacturers, but also sub-contractors, repair, hire and dealership industries), as well as related economic agents allowing the optimisation and/or substitution of car use (public authorities, service providers, information platform managers etc.). The objective is to have the whole economic unit in question focus on a specific climate issue. So, 'issue'-based accounting means designing macro-sectors and territories that are adapted to the scale of the issue based on the basic needs of populations: housing, heating, food transport, entertainment.

The result is that the analysis is based on a small number of macro-sectors. This type of accounting feeds into macro-economic thinking and is not intended to go into the minutiae of the economic fabric at the sector level as defined by economic classifications (Statistical Classification of Economic Activities in the European Community - NACE, for example). 'Issue'-based accounting provides macro-economic figures of an accuracy that is compatible with this scale. The results of 'issue'-based accounting are closer to orders of magnitude than accurate estimates. However, they can be aggregated according to sector and geographical zone: the sum of the climate issues of the economic activity of a territory is equal to the emissions of that territory and the sum of the climate issues of the regions of a territory is equal to the emissions of that territory. It establishes a direct two-way relationship between each quantity of GHG emissions associated with a climate 'issue' and each economic activity: all emissions are divided between the different activities according to their climate 'issue'. As a result, 'issue'-based accounting guarantees the absence of any multiple-counting and the resulting figures are necessarily consolidated.

Beyond the macro-economic aspect needed to estimate GHG emissions generated by the whole portfolio of banking activities (consequences of the optimisation of the interest-cost ratio of implementation), the different classifications of source data are also a limitation resulting in calculations with low levels of granularity.
Data from National GHG Inventories are structured by the CRF classification and do not always allow the climate issue corresponding to each economic agent to be identified.

The bank's internal data are organised into sectors which only partially overlap with the classification of economic activity in national accounts. It is not easy to draw correlations between the various classifications of economic activities (NAF, NAE, CITI etc.) as well as their various versions (Rev 2, Rev 3 and Rev 4). Finally, these classifications do not always allow sectors to be identified according to their impact on climate change. For example, in the current state of statistical systems, it is not possible to identify the value added of electricity production by energy type, although this aspect is essential to differentiate between renewable energies (the focus of the energy transition) and non-renewable ones (fossil fuels for the most part).

Due to these difficulties it is necessary to define 'common denominators' which necessarily lead to macro-sectors.

**Pilot in French investment banks: adapting the methodology to the internal classification which requires the regrouping of categories. (Rose, 2014)**

Based on the sectoral and geographical classifications used by corporate and investment banks and classifications of data sources for GHG emissions and economic and financial data, we obtained the following grid.

## Geographical distribution

The geographical distribution of corporate and investment banking activities reflects the distribution of the bank's portfolio of activities: its granularity is adapted to the strategic and commercial interests of the geographical area for the bank. The portfolios in question were centred around France and Western Europe, with a strong presence in North America (particularly in the United States).

Thus, we have the following geographical grid, with an emphasis on the countries of strategic and commercial interest.

| | |
|---|---|
| France | EUROPE |
| United Kingdom | |
| Germany | |
| Italy | |
| Spain | |
| Other Western European Countries | |
| Other European Countries | |
| United States | NORTH AMERICA |
| North America (other than the United States) | |
| Japan | ACIA AND AUSTRALASIA |
| China | |
| India | |
| Asia (other than Japan, China and India) | |
| Africa and the Middle East | AFRICA AND THE MIDDLE EAST |
| Latin America | CENTRAL AND SOUTHERN AMERICA |
| Others and Supranational organisations | INTERNATIONAL ORGANISATIONS |

*Table of geographical areas under consideration*

Economic databases (OCED, UN) and financial databases (BACH) also use the country as a basic level of classification. As such, the correlation between the different data required to estimate GHG emissions generated is immediate.

## Sectoral distribution

This is the result of different classifications that structure the data needed for calculations. In the case under consideration, 23 sectors are considered and correspond to macro-sectors. They are defined according to the classification of economic activities NAF (Nomenclature des Activités Française) Rev 2 of rank 4, compatible with NACE (Statistical classification of economic activities in the European Community) Rev 2. These classifications now align with the ISIC (International Standard Industrial Classification of All Economic Activities) Rev 4 of rank 4. However, economic and financial data from the OECD or the BACH database are not available in rank 4 but only in rank 2. An initial 'simplified' correlation between the sectors and classifications of NACE Rev 2 and ISIC Rev 4 is therefore needed.

| | | NACE rev2 | ISIC rev4 |
|---|---|---|---|
| 01 | Air Transport | 51 | H51 |
| 02 | Water Transport | 50 | H50 |
| 03 | Other transport | 30, 53 | C30, H53 |
| 04 | Manufacture of food products | 01-03, 10-12 | A, C10t12 |
| 05 | Insurance | 65 | K65 |

| | | NACE rev2 | CITI rev4 |
|---|---|---|---|
| 06 | Car | 29, 45, 49, 77 | C29, G45, H49, N77 |
| 07 | Heavy Industry | 05, 07-08, 20, 22, 24-25 | B05, B07t08, C20, C22, C24t25 |
| 08 | Other Industry | 27-28, 33 | C27t28, C33 |
| 09 | Banking | 64 | K64 |
| 10 | Other financial service activities | 66 | K66 |
| 11 | Timber/Paper/Packaging | 16-17 | C16t17 |
| 12 | Building and public works | 23, 41-43 | C23, F |
| 13 | Distribution/Industry Consumer goods | 13-15, 31-32, 47, 95-97 | C13t15, C31t32, G47, S95t96, T97 |
| 14 | Energy | 06, 09, 19, 35, 52 | B06, B09, C19, D, H52 |
| 15 | Real estate | 68 | L |
| 16 | Information/Technology | 26, 62-63 | C26, J62-63 |
| 17 | Media/Publishing | 18, 58-60, 73 | C18, J58t60, M73 |
| 19 | Health/Pharmaceuticals | 21, 75, 86-88 | C21, M75, Q |
| 20 | Non-commercial services | 84, 85, 94, 99 | O, P, S94, U |
| 21 | Telecom | 61 | J61 |
| 22 | Tourism/Hotels/Food services | 55-56, 79, 90-93 | I, N79, R |
| 23 | Utilities | 36, 37, 38, 39 | E |
| 24 | Miscellaneous | 46, 69-72, 74, 78, 80-82, 98 | G46, M69t72, M74, N78, N80-82, T98 |

*Simplified table of correlations between the sectors and classifications NACE Rev 2 and CITI Rev 4.*

These sectors do not easily overlap with the NACE rank 2 countries and still less with the major groups of these classifications (rank 1). The two classifications differ greatly in terms of the logic used to put together sectors of activity. The mismatch between classifications is a first source of inaccurate calculations.

Unfortunately, economic and financial data have not always been collected and organised according to the ISIC Rev 4 classification. For many countries they are still presented in the ISIC Rev 3 format. The difference between these two versions are important and it is difficult to draw correlations with rank 2 (the rank 4 correlations are available on the United Nations website). To calculate estimates of emissions generated in the largest number of countries, we suggest the following correlation between sectors CA-CIB and those of the classification ISIC Rev 3 (in rank 2).

| | | CITI rev3 |
|---|---|---|
| 1 | Air Transport | 62 |
| 2 | Water transport | 61 |
| 3 | Other transport | 35, 60, 62 |
| 4 | Manufacture of food products | AtB, D15t16 |
| 5 | Insurance | J66 |
| 6 | Car | 34, 50 |
| 7 | Heavy Industry | C10, C13t14, 25, 27t28 |
| 8 | Other Industry | 29, 31, 33 |
| 9 | Banking | J65 |
| 10 | Other financial service activities | J67 |
| 11 | Timber/Paper/Packaging | 20, 21 |
| 12 | Building and public works | 26, F |
| 13 | Consumer Goods Distribution/Industry | 17t18, 19, C36, G52, O93, P |
| 14 | Energy | C11t12, 23, E40 |

| | | CITI rev3 |
|---|---|---|
| 15 | Real estate | 70 |
| 16 | Information/Technology | 30, 32, 72 |
| 17 | Media/Publishing | 22 |
| 18 | Health/Pharmaceuticals | 24, N |
| 19 | Non-commercial services | L, M, O91, Q |
| 20 | Telecom | 64 |
| 21 | Tourism/Hotels/Food services | H, O92 |
| 22 | Utilities | 37, E41, O90 |
| 23 | Miscellaneous | G51, 71, 73, 74 |

*Simplified table of correlations between the sectors and the ISIC Rev 3 classification*

| Macro-Sectors | | Economic sectors | Climate issues |
|---|---|---|---|
| AAgriculture & Land Use | 4 | Agriculture and food | GHG emissions from crops, livestock and forestry, including emissions related to the use and change of soil |
| | 11 | Timber/Paper/Packaging | |
| Construction & Housing | 12 | Building and public works Distribution/Industry | GHG emissions from construction (including those from the manufacture of materials) and heating of all buildings |
| | 13 | Consumer goods | |
| | 15 | Real estate | |
| | 20 | TelecomTourism/Hotels/ | |
| | 21 | Food services | |
| Energy | 14 | Energy | GHG emissions from the production of fuel and electricity |
| Industry | 7 | Heavy Industry | GHG emissions from industrial processes |
| | 8 | Other Industry | |
| | 16 | Information/Technology | |
| Transport | 1 | Aerospace | GHG emissions from the use of all means of transport |
| | 2 | Water transport | |
| | 3 | Other transport | |
| | 6 | Cars | |
| Services | 5 | Insurance | No identified climate issue |
| | 9 | Banking | + |
| | 10 | Other Financial Activities | Multiple counting of GHG emissions from the financial and banking sector |
| | 23 | Miscellaneous | |
| Waste Management | 22 | Utilities | GHG emissions related to waste management |
| Public Administration | 19 | Non-Commercial Sector | GHG emissions specific to States which do not already fall within the scope of macro-sectors |
| Others | 17 | Media/Publishing | Pas d'enjeu climatique identifié |
| | 18 | Health/Pharmaceuticals | |

*Table of correlations between the macro-sectors and economic activities.*

Although there may be limited granularity, it should be specified that this is often a limitation of the statistical data used. For example the macro-sector 'Energy' includes renewable and non-renewable energy.  However, this distinction, which would seem fundamental in assessing the impact of finance and investment activities in the energy sector, cannot be made in the internal databases of banks or national accounts. Electricity production is considered regardless of the type of energy.

## Source data

In the 'issue'-based approach, GHG emissions by economic activity and by country are calculated based on national accounts of GHG emissions consolidated by the UNFCCC (United Nations Framework Convention on Climate Change) and the CAIT-WRI (Climate Analysis Indicators Tool – World Resource Institute).

| Macro-Sectors | CRF Categories (Detailed version) | (Simplified version) |
|---|---|---|
| Agriculture | 1A4c, 1A2d, 1A2e, 2D, 4, 5 (5bis) | 4, 5 (5bis) |
| Construction | 1A3, IB | 1A3, IB |
| Energy | 1A1, 1B | 1A1, 1B |
| Industry | 1A2a, 1A2b, 1A2c, 1A2f, 2B, 2C, 2D, 2E, 2F, 2G, 3 | 1A2, 2, 3 |
| Transport | 1A4a, 1A4b, 2A | 1A4 |
| Services | | |
| Waste | 6 | 6 |
| Public Adm | 1A5, 7, Multilateral | 1A5, 7, Multilateral |
| Other | | |

*Table of correlations between the climate issues of macro-sectors and the CRF classification of national GHG inventories. (Rose, 2014)*

The simplified version applies to inventories which do not have enough detail to allow the correlation of the detailed version to be applied.

Data from national accounts (Value added (s, p)) are from the OECD and UN's databases. The relationship between the macro-sectors and the UN data calibrated across the OECD countries (linear regressions) was used to calculate the value added of the macro-sectors of non-OECD countries.

**The tables of emission factors calculated in this way are available to download at LINK**

Alongside this 'issue'-based perspective, the working group developed a 'scope'-based perspective, taking distance from the levers for action available to economic agents for reducing GHG emissions but drawing on current carbon accounting standards.

## 3. Specific information for the 'scope'-based perspective

In order to develop a 'scope'-based perspective of emissions by sector and by country, and to construct emissions ratios by Euro of value added, the methodology takes into account the following emissions:
- Emissions associated both with the direct and indirect activity of economic sectors broken down by scope (1, 2 and 3) similar to the GHG emissions accounting conventions used as standard by companies (ISO, ADEME and GHG Protocol).
- Emissions from households from the combustion of natural gas, oil and electricity consumption by households for heating and specific uses (household appliances, lighting etc.) in housing. According to this methodology these emissions are allocated to the 'Construction' sector.

- Household emissions due to the combustion of petrol by personal vehicles. According to this methodology these emissions are allocated to the sectors 'Transport equipment' and 'Sale, Maintenance and Repair of Motor Vehicles and Motorcycles; Retail Sale of Fuel', in proportion to their value added.
- Emissions due to the use of soil and forests, so-called LULUCF (Land Use, Land Use Change and Forestry). These emissions may be positive or negative (in this case, carbon is stored by the ground and forests). According to this methodology these emissions are allocated to the sector

'Agriculture, Hunting, Forestry and Fishing';

All of these emissions allow emissions generated by economic activities, and therefore their finance, to be quantified according to a wide scope, upstream in the value chain for the use of goods by households.
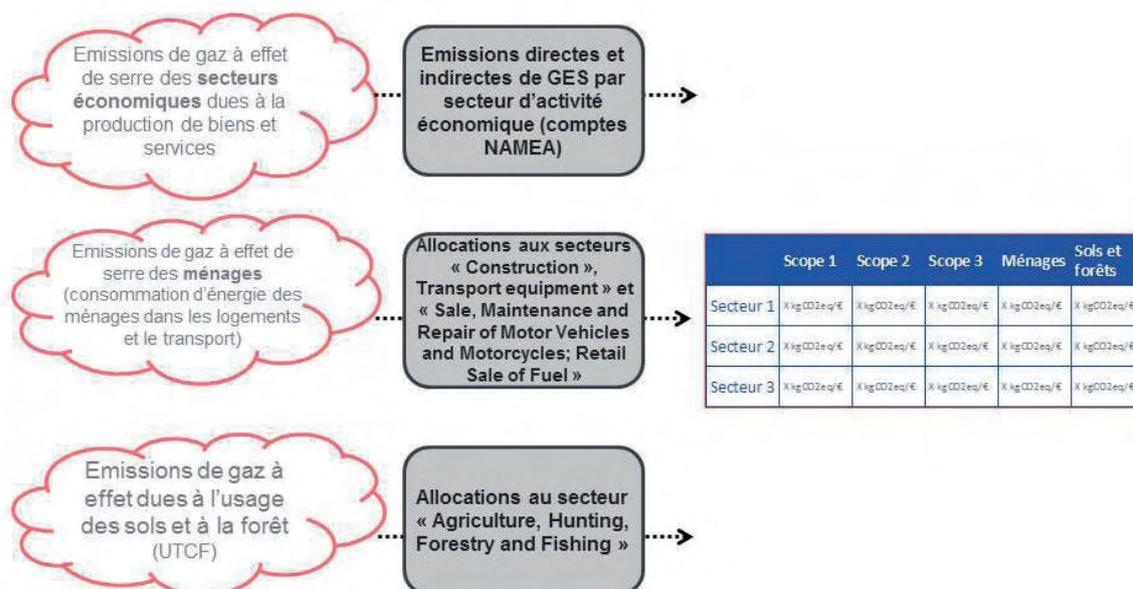


*Figure 7: Methodology for calculating the 'scope'-based perspective*

'Scope'-based GHG emissions are calculated according to the principles of the NAMEA methodology ('National Accounting Matrix Including Environmental Accounts'). This methodology allows the physical counts of direct GHG emissions by economic activity and country to be combined with the input-output tables of national accounts to produce direct and indirect emissions for each sector of activity.

In concrete terms, NAMEA accounts offer a description of the flow of natural resources and pollution generated both directly and indirectly (i.e. through intermediary consumption in each sector) by economic activities. In particular, these accounts are used to quantify greenhouse gas emissions associated with the final consumption in each country, offering a perspective that complements that of the national GHG inventories which only take into account the direct (Scope 1) emissions of sectors. This method allows GHG emissions of economic sectors to be reallocated to final demand and emission factors to be produced per Euro of end product (in kgCO2eq/€ product).

The NAMEA accounts thus allow all GHG emissions generated across the value chain of an industry to be quantified. For example, direct (Scope 1) emissions from the car industry are low (fossil fuel consumption of car assembly plants is low). In this sector, the carbon issue of production lies more around the manufacture of steel, glass, plastic and the necessary equipment for manufacturing the vehicle, as well as the consumption of fuel by the end user.

NAMEA accounts allow all indirect emissions generated by purchases in the branch to be estimated. These are referred to as the 'upstream emissions of sectors' which correspond both to the consumption of intermediary goods (purchases of products from other sectors) but also imports of foreign products (upstream indirect imported emissions'). Moreover, the NAMEA accounts allow the whole supply chain to be taken into account. For example, the 'Hotel and food services' branch purchases food products from the 'Agri-food industry' branch. In order to manufacture these products the 'Agri-food industry' branch had to purchase other products, particularly agricultural products, the manufacture of which meant that the emission of greenhouse gases was necessary.

The NAMEA accounts allow emissions to be taken into account across the whole value chain of an economic activity. So here, 'Scope 3' is used to refer to indirect 'upstream' emissions. Only emissions that correspond to purchases of products and services between branches are counted. Emissions that do not correspond to purchases by branches are not taken into account and, in particular, emissions from the use and end of life of products sold (partially taken into account in household emissions), emissions due to commutes and visitor transport.

### Granularity of activity data to be collected

For the 'scope'-based perspective, activity data must be collected based on the granularity of sectors defined below:/

| NACE rev 1 code (level 1 & 2) | Economic sectors |
| --- | --- |
| AtB | Agriculture, Hunting, Forestry and Fishing |
| C | Mining and Quarrying |
| 15t16 | Food, Beverages and Tobacco |
| 17t18 | Textiles and Textile Products |
| 19 | Leather, Leather and Footwear |
| 20 | Wood and Products of Wood and Cork |
| 21t22 | Pulp, Paper, Paper , Printing and Publishing |
| 23 | Coke, Refined Petroleum and Nuclear Fuel |
| 24 | Chemicals and Chemical Products |
| 25 | Rubber and Plastics |
| 26 | Other Non-Metallic Mineral |
| 27t28 | Basic Metals and Fabricated Metal |
| 29 | Machinery, Nec |
| 30t33 | Electrical and Optical Equipment |
| 34t35 | Transport Equipment |
| 36t37 | Manufacturing, Nec; Recycling |
| E | Electricity, Gas and Water Supply |
| F | Construction |
| 50 | Sale, Maintenance and Repair of Motor Vehicles and Motorcycles; Retail Sale of Fuel |
| 51 | Wholesale Trade and Commission Trade, Except of Motor Vehicles and Motorcycles |
| 52 | Retail Trade, Except of Motor Vehicles and Motorcycles; Repair of Household Goods |
| H | Hotels and Restaurants |
| 60 | Inland Transport |
| 61 | Water Transport |
| 62 | Air Transport |
| 63 | Other Supporting and Auxiliary Transport Activities; Activities of Travel Agencies |
| 64 | Post and Telecommunications |
| 70 | Real Estate Activities |
| 71t74 | Renting of M&Eq and Other Business Activities |
| L | Public Admin and Defence; Compulsory Social Security |
| M | Education |
| N | Health and Social Work |
| O | Other Community, Social and Personal Services |
| P | Private Households with Employed Persons |
| Q | Extra-territorial organizations and bodies |

Depending on the classifications used in the internal management systems of organisations, it is also possible to collect data according to economic classifications for which there are tables of correlation with the NACE rev 1 classification in particular:

- NACE rev2 classification: in order to produce an accurate table of correlation with classification NACE rev 1, where possible data should be extracted at level 4 (by category)
- ISIC 4 classification: in order to produce an accurate table of correlation with classification NACE rev 1, where possible data should be extracted at level 4.

Comments:
- In both cases correlations with the NACE rev1 classification are not 100% perfect. Indeed, a NACE rev2 category (at level 4) may correspond to several NACE rev 1 categories and vice versa. Nevertheless, these cases are limited (around 90 level 4 categories out of 600) and a 'common sense' allocation (according to the dominant economic activity) is possible in all cases.
- It is also possible to extract NACE rev2 or ICIC 4 data at level 3 or level 2. In this case, the correlation with classification NACE rev1 will be less accurate.
- For other types of classification (for example ICB and MSCI classifications which may be used for indirectly managed assets) there is no correlation with NACE classification rev1. In this case, it would appear not to be possible to use the methodology in the current version unless more accurate correlations are drawn 'by hand'.

### Geographical granularity

The WIOD database can be used to quantify emissions associated with economic activities in 40 countries in the 'rest of the world'. The pilot carried out by financial players has allowed certain values of emission factors to be identified that are not consistent with expected orders of magnitude, particularly in the case of small countries such as Taiwan, Cyprus, Luxembourg, Latvia and Estonia. Consequently, the small countries listed above are not included in the suggested emission factors used as part of the methodology.

### Data sources

The data sources used to calculate emissions by 'scope', sector and country are summarised in the table below:

| Data | Source | Comments |
|---|---|---|
| Direct GHG emissions (scope 1) of sectors by country | WIOD Socio Economic accounts, http://www.wiod.org/new_site/database/seas.htm | 2009 data |
| Output by sector and by country | WIOD Socio Economic accounts, http://www.wiod.org/new_site/database/seas.htm | $CO_2$, $CH_4$ and $N_2O$, with GWPs of 1, 25 and 298 respectively |
| Value added (VA) by sector and by country | WIOD National Input-Output Tables, http://www.wiod.org/new_site/database/niots.htm | 2009 data |
| National input-output tables by country | WIOD World Input-Output Tables, http://www.wiod.org/new_site/database/wiots.htm | 2009 data |
| World input-output tables | Household emissions: WIOD Environmental accounts Heating and transport breakdown: Eurostat, Air emissions accounts by industry and households (NACE Rev. 2) [env_ac_ainah_r2] | 2009 data |
| Household emissions from heating and transport | Heating and transport breakdown: Eurostat, Air emissions accounts by industry and households (NACE Rev. 2) [env_ac_ainah_r2] | 2009 data Heating and transport breakdown: Extrapolation from the European average for countries not included in the database |
| LULUCF emissions: Land use, Land Use Change and Forestry | UNFCC, GHG profiles for Annex 1 and non-Annex 1 parties https://unfccc.int/ghg_data/ghg_data_unfccc/ghg_profiles/items/3954.php | 2009 data for countries in Annex 1 of the Kyoto Protocol The most recent data available for other countries |

2009 was chosen as it was the most recent year for which emissions by sector and by country are available in the WIOD database.

## Calculating emissions by 'scope' and by sector: breakdown of the calculation stages

Emissions by 'scope' for the various economic activities can be calculated in five stages. These emission factors are provided in this methodological guide so there is no need to recalculate them. So, as this part is given for information, the reader can move onto the next paragraph.

- **Stage 1:** Calculating direct and indirect emissions from the final demand of each sector and by country according to the NAMEA methodology (sometimes referred to as 'Leontief'), for national output (excluding imports). This first stage allows the GHG emissions generated by final demand in each country to be determined by first assuming that countries are 'closed' (no purchases outside the country). Domestic output is expressed:
$P = CI^d.U + DF^d$

  *With:*
  - *P: Vector for output by sectors on the national territory*
  - *CI: Matrix for intermediary consumption: symmetric national input-output table*
  - *U: Unit column vector (vector filled with 1)*
  - *$DF^d$: Vector for final demand for products from domestic branches (excluding imports aimed at directly meeting final demand)*

  By dividing each line of the CI matrix of intermediate consumption by the total output of the branch in question, a so-called 'technical coefficient' matrix is created. $A^d$ such as:
  $P = A^d.P + DFd$

  We get:
  $P - A^d.P = DF^d$
  $P = (1 - A^d)^{-1}.DF^d$

  This equation allows output to be directly related to final demand. Thus, for the final demand for a given product, we can determine the combined output of all branches of the economy generated by this demand. This calculation allows us to 'go up' the supply chain to obtain all initial 'output' generated by the final demand for a given product.

  In order to estimate the national direct and indirect emissions generated by final demand, it is assumed that emissions related to a branch j are structurally proportionate to the quantity of products Pj produced by the branch. Coefficients for the direct environmental pressure of each branch (GHGd) are then calculated such as the ratio of direct GHG emissions per output of each branch:
  $GES^d = P^{-1}.EM^d$

  With:
  - *$EM^d$ : National GHG emissions by branch*
  - *$GHG^d$ : Coefficients of environmental pressure of sectors (direct national emissions)*

  Finally we get the emissions generated by the final demand for products of each sector with the formula below:
  $GHG^{DF,d} = DF^d.(1- {}^t A^d)^{-1}.GHG^d$

  where ${}^t A^d$ is the transposition of matrix $A^d$.

  Stage 1 is carried out for all countries included in the methodology (contained in the WIOD database) as well as for a group of countries classified 'Rest of the world'.

- **Stage 2:** Calculating direct and indirect emissions from the final demand of each sector and by country according to the NAMEA methodology (sometimes referred to as 'Leontief'), for imports. The second stage involves calculating GHG emissions overseas related to importing products. This means counting emissions overseas in the corresponding branch, but also additional upstream emissions from all intermediate goods used by this branch.

It is therefore necessary to have coefficients for the direct environmental pressure of each branch in the rest of the world as well as the structure of the productive apparatus in the rest of the world (i.e. the input-output table for the rest of the world), to perform a similar calculation to that set out in stage 1.

For the purposes of this methodology, a simplified scenario has been used: it is assumed that imports come from a single country, i.e. a 'World' country. The emissions generated by the manufacture of products in the World are calculated based on the rules of the method of stage 1, to give the vector $GHG^{Output,world}$

Input-output tables give imported products by branch (imported intermediary consumption) as well as imports aimed at meeting final demand directly. Emissions generated overseas by the consumption of products imported by the branches are expressed:

$$GHG^{DF,imp} = (DF)^d.(1-{}^t A^d)^{-1}.{}^t A^{imp}).(1-{}^t A^{Monde})^{-1}.GHG^{d,World}$$

With:
- $GHG^{DF,imp}$: GHG emissions generated overseas by the consumption of products imported by the national branchess
- $DF^d$ : Domestic final demand
- ${}^t A^d$ : Matrix of technical coefficients transposed
- ${}^t A^{imp}$ : Matrix of imported technical coefficients transposed
- ${}^t A^{world}$ : Matrix of world technical coefficients transposed
- $GHG^{world}$: **Coefficients of direct environmental pressure from the world**

Based on the results of stages 1 and 2 it is therefore possible to calculate the ratios of GHG intensity of the products consumed in each country, taking into account the whole domestic and imported value chain (excluding final demand directly met by imports):

$$GHG^{Products} = \frac{GHG^{DF,d} + GHG^{DF,imp}}{FD*}$$

With :
- $GHG^{Products}$: GHG intensity (in kgCO2eq/k€) associated with the production of end products for each sector
- $FD*$: Final demand by economic activity, excluding final demand directly met by imports.

For Stages 1 and 2 we invite the reader to refer to the bibliography for a detailed description of the methodology of NAMEA accounts.

- **Stage 3:** Application of GHG ratios to the input-output tables of each country, sector-by-sector, to quantify the emissions generated by the purchases of intermediary products by each branch from other branches.

For this stage, it is assumed that the GHG intensity of an end product from a sector is identical to the GHG intensity of intermediate products supplied by that sector to other sectors for intermediate consumption. This scenario allows 'Scope 2' and 'upstream Scope 3' emissions to be calculated along the lines of the usual carbon accounting conventions used by companies (ISO, ADEME or GHG Protocol).

In particular, a scenario is applied whereby purchases of products from the 'Electricity, Gas and Water Supply' branch (both domestic and imported) are 'Scope 2' emissions. Intermediary consumption from other branches are 'scope 3' emissions. 'Scope 1' emissions are directly calculated based on the direct emissions of each branch within the WIOD database.

- **Stage 4:** Allocation of household emissions (heating and transport) and emissions from land and forests. Emissions from households from the combustion of natural gas, oil and electricity consumption for heating and specific uses (household appliances, lighting etc.) are allocated to the 'Construction' sector

Household emissions due to the combustion of oilby personal vehicles are allocated to the sectors 'Transport equipment' and 'Sale, Maintenance and Repair of Motor Vehicles and Motorcycles; Retail Sale of Fuel', in proportion to their value added.
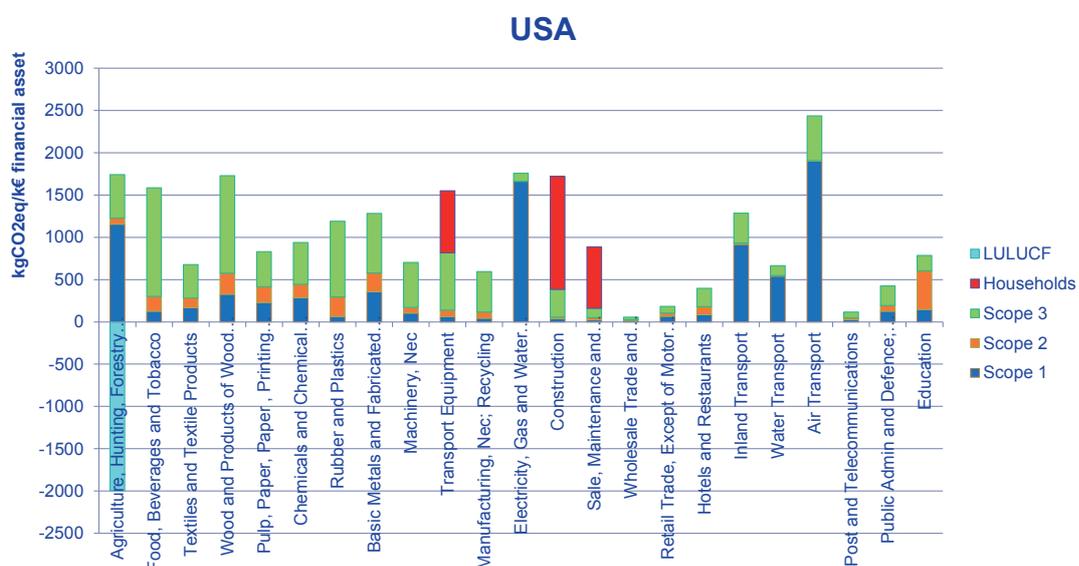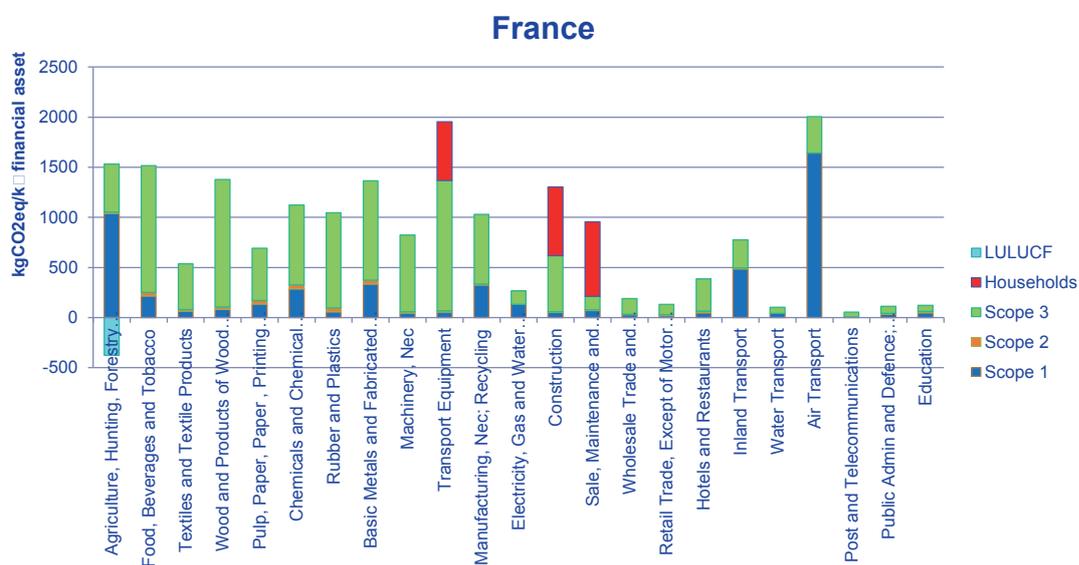
Emissions due to the use of land and forests, so-called LULUCF (Land Use, Land Use Change and Forestry) are allocated to the sector 'Agriculture, Hunting, Forestry and Fishing'.

- **Stage 5**: Breakdown of all emissions obtained according to the value added of each sector in the various countries.

Finally, the last stage involves dividing the emissions from sectors obtained (Scopes 1, 2, 3, households and LULUCF) by the output of each sector.

### Emission factors

The emission factors by country, by sector and by scope to be used are broken down below in kgCO2eq/k€ (data available in the form of tables and with a few illustrative graphs):
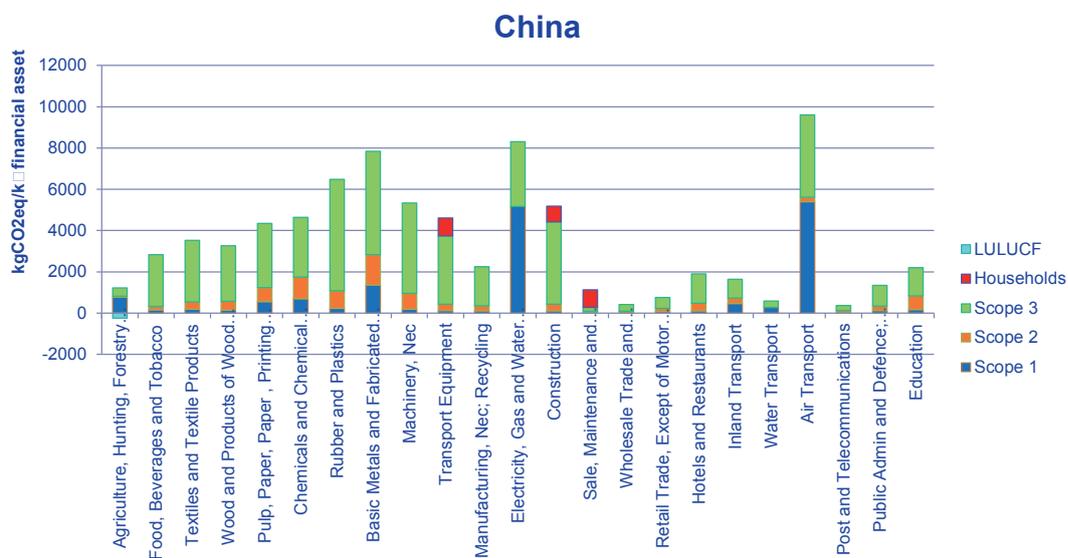
**China**

*Figure 8: Emission factors for the 'scope'-based perspective in France, China and the United States*

## 4. Matrix to facilitate the interpretation of 'scope'-based results

Emission factors are broken down by country, by sector and by scope below in kgCO2eq/k€ (data available in the form of tables and with a few illustrative graphs, household and land use emissions are not included in the table below):

| | | Scope 1 | Scope 2 | Scope 3 |
|---|---|---|---|---|
| AtB | Agriculture, Hunting, Forestry and Fishing | Emissions due to direct energy consumption (diesel for fishing, operational machinery, natural gas for heating buildings and greenhouses etc.), methane emissions (CH4, mainly from the enteric fermentation of cattle, waste from farms and rice production) and nitrous oxide (N20, mainly from fertiliser spreading and farm waste). | Emissions due to the purchase of electricity, steam and cold for heating and cooling buildings (hangars, greenhouses etc.) and for electrical equipment. | Emissions due to the purchase of goods and services. The main purchase categories are the purchase of products from the same sector (seed, animal feed etc.), purchases of fertilisers and chemical products and upstream emissions due to the production of energy consumed. |
| C | Mining and Quarrying | Emissions due to the consumption of fossil fuels for the extraction of coal, oil products, natural gas, uranium, metallic minerals and other quarry materials. | Emissions due to the purchase of electricity, steam and cold, for example for grinding extracted materials. | Emissions due to the purchase of goods and services. Emissions are mainly due to the purchase of non-metallic materials, the purchase of equipment (machines) and upstream emissions due to the production of energy consumed. |

| | | Scope 1 | Scope 2 | Scope 3 |
|---|---|---|---|---|
| 15t16 | Food, Beverages and Tobacco | Emissions due to the consumption of fossil resources (fuel, natural gas, coal) on production sites and for own transport. | Emissions due to the purchase of electricity, steam and cold, for example for the management of cooling systems or for the operation of processing chains. | Emissions due to the purchase of goods and services. Emissions are mainly due to the purchase of products from agriculture, hunting and fishing. |
| 17t18 | Textiles and Textile Products | Emissions due to the consumption of fossil resources (fuel, natural gas, coal). | Emissions due to purchases of electricity, steam and cold. | Emissions due to the purchase of goods and services. Emissions are mainly due to the purchase of chemical products, products from agriculture (for example cotton) and purchase of products from the same sector. |
| 19 | Leather, Leather and Footwear | Emissions due to fossil fuel consumption. | Emissions due to purchases of electricity, steam and cold. | Emissions due to the purchase of goods and services. Emissions are mainly due to the purchase of chemical products, plastics, rubber and the purchase of products from the same sector. |
| 20 | Wood and Products of Wood and Cork | Emissions due to fossil fuel consumption, for example for the heat used in industrial processes to process wood (drying etc.), fuel for machinery and own transport. | Emissions due to the purchase of electricity, steam and cold, for example to operate industrial machines to process wood (sawing etc.). | Emissions due to the purchase of goods and services. Emissions are mainly due to the purchase of products from the agriculture and forestry sector and the purchase of products from the same sector. |
| 21t22 | Pulp, Paper, Printing and Publishing | Emissions due to fossil fuel consumption, for example for the heat used in industrial processes to produce pulp and paper and for own transport. | Emissions due to the purchase of electricity, steam and cold, for example to operate printing machines. | Emissions due to the purchase of goods and services. Emissions are mainly due to the purchase of products from the same sector (paper pulp sold for the manufacture of paper, paper sold to printers) and the purchase of chemical products. |
| 23 | Coke, Refined Petroleum and Nuclear Fuel | Emissions due to the combustion of fossil resources when crude oil is transformed into refined oil products (refinery), coal and nuclear fuel. | Emissions due to purchases of electricity, steam and cold. | Emissions due to the purchase of goods and services. The main emissions are due to the extraction of crude energy products purchased from the 'Mining and Quarrying' sector and to upstream emissions due to the production of energy consumed. |

| | | Scope 1 | Scope 2 | Scope 3 |
|---|---|---|---|---|
| 24 | Chemicals and Chemical Products | Emissions due to the consumption of fossils during the production process.<br>Comment: fossil products (naphtha, propane, ethane etc.) are also used as raw materials and do not generate GHG emissions during production (as they are transformed to produce the chemical product). | Electricity used in the chemical product production process (electrolysis, driving force etc.) for example to produce chlorine. | Emissions due to the purchase of goods and services. The main emissions are due to the purchase of products from the same sector and upstream emissions due to the production of energy consumed (as raw materials or as an energy source). |
| 25 | Rubber and Plastics | Emissions due to the consumption of fossils during the plastic and rubber production process. | Electricité, vapeur et froid utilisés dans les process de production. | Emissions dues à l'achat de biens et services. Les émissions principales sont dues à l'achat de produits chimiques (par exemple chlore et éthylène pour la production de PVC). |
| 26 | Other Non-Metallic Mineral | Comment: fossil products are also used as raw materials and do not generate GHG emissions during production (as this matter is transformed to produce plastic). | Electricity, steam and cold used in production processes. | Emissions due to the purchase of goods and services. The main emissions are due to the purchase of chemical products (for example chlorine and ethylene for the production of PVC). |
| 27t28 | Basic Metals and Fabricated Metal | Emissions due to the consumption of fossils in the process of producing glass and products of mineral origin: ceramics, clay, cement, plaster. | Electricity, steam and cold used in production processes. | Emissions due to the purchase of goods and services. The main emissions are due to the purchase of materials from quarries, the purchase of metals and the purchase of products within the same sector. |
| 29 | Machinery, Nec | Emissions due to the consumption of fossils during the process of producing iron, steal, precious metals and non-metals.<br>Emissions due to the transformation of metals for the production of finished and semi-finished products (fully composed of metal). | Electricity, steam and cold used in production processes. | Emissions due to the purchase of goods and services. The main emissions are due to purchases of products within the same sector (for example the purchase of steel coil for steel processors). |
| | | Emissions due to the consumption of fossils during the production process (processing raw materials and assembly) and own transport. | Electricity, steam and cold used in production processes and buildings. | Emissions due to the purchase of goods and services. The main emissions are due to the purchase of metals. |

| | | Scope 1 | Scope 2 | Scope 3 |
|---|---|---|---|---|
| 30t33 | Electrical and Optical Equipment | Emissions due to the consumption of fossils during the production process (processing raw materials and assembly) and own transport. | Electricity, steam and cold used in production processes and buildings. | Emissions due to the purchase of goods and services. The main emissions are due to the purchase of metals and the purchase of products within the same sector. |
| 34t35 | Transport Equipment | Emissions due to the consumption of fossils during the production process (processing raw materials and assembly) and own transport. | Emissions due to the purchase of electricity, steam and cold used in production processes and buildings. | Emissions due to the purchase of goods and services. The main emissions are due to purchases of products within the same sector and the purchase of metals. |
| 36t37 | Manufacturing, Nec; Recycling | Emissions due to the consumption of fossils during the process of manufacturing all types of equipment not included in other sectors and during the recycling process. | Emissions due to purchases of electricity, steam and cold. | Emissions due to the purchase of goods and services. The main emissions are due to the purchase of metals and wood products. |
| E | Electricity, Gas and Water Supply | Emissions due to the production of electricity from fuel, natural gas or coal.<br>Emissions due to the consumption of direct energy needed to transport and distribute natural gas and water. | N/A (not applicable, even if the transportation and distribution of electricity, gas and water require electricity consumption) | Emissions due to the purchase of goods and services. Emissions are mainly due to purchases within the same sector (purchase/resale of electricity and gas( purchase of materials from quarries (raw energy products), processed energy products (refined oil products, nuclear fuel…). |
| F | Construction | Emissions due to the consumption of fossils for building activities (construction equipment, fret materials…). | Emissions due to purchase of electricity, steam and cold. | Emissions due to the purchase of goods and services. Emissions are mainly due to purchase of raw materials (metals and non-metallic materials as cement) and purchase of products within the same sector. |
| 50 | Sale, Maintenance and Repair of Motor Vehicles and Motorcycles; Retail Sale of Fuel | Emissions due to the combustion of fossils, for heating (fuel and natural gas) and transport. | Emissions due to purchases of electricity, steam and cold, for buildings and shops (heating, lighting, air-conditioning etc…). | Emissions due to the purchase of goods and services. The main emissions are due to the purchase of vehicles within the "transport equipment" sector. |

| | | Scope 1 | Scope 2 | Scope 3 |
|---|---|---|---|---|
| 51 | Wholesale Trade and Commission Trade, Except of Motor Vehicles and Motorcycles | Emissions due to the combustion of fossils for heating (oil and natural gas) and own transport. | Emissions due to the purchase of electricity, steam and cold, for example for buildings and shops (heating, lighting, air-conditioning etc.) | Emissions due to the purchase of goods and services. Emissions are mainly due to the purchase of road freight services, the renting of equipment and business services (IT etc.) and upstream emissions due to the production of energy consumed. |
| 52 | Retail Trade, Except of Motor Vehicles and Motorcycles; Repair of Household Goods | Emissions due to the combustion of fossils, for heating (fuel and natural gas) and transport. | Emissions due to purchases electricity, steam and cold, for example for buildings and shops (heating, lighting, air-conditioning,etc.). | Emissions due to the purchase of goods and services. Emission are mainly due to purchase of air-conditioning road freight, equipment rental and business services (I.T. etc.) and upstream emissions due to the production of energy consumed. |
| H | Hotels and Restaurants | Emissions due to the combustion of fossils for heating (oil and natural gas). | Emissions due to the purchase of electricity, steam and cold for heating and for equipment that runs on electricity (cooking, lighting, air-conditioning). | Emissions due to the purchase of goods and services. The main emissions are emissions due to the purchase of agricultural products, food products and drinks. |
| 60 | Inland Transport | Emissions due to the combustion of fuel for transport. | Emissions due to purchases of electricity, steam and cold. | Emissions due to the purchase of goods and services. The main emissions are upstream emissions due to the production of fuels consumed and the purchase of products and services from the same sector. |
| 61 | Water Transport | Emissions due to the combustion of fuel for transport. | Emissions due to purchases of electricity, steam and cold. | Emissions due to the purchase of goods and services. The main emissions are upstream emissions due to the production of fuels consumed and the purchase of products and services from the same sector. |
| 62 | Air Transport | Emissions due to the combustion of kerosene for aeroplanes. | Emissions due to purchases of electricity, steam and cold. | Emissions due to the purchase of goods and services. The main emissions are upstream emissions due to the production of fuels consumed, the purchase of transport equipment and the purchase of products from the same sector. |

| | | Scope 1 | Scope 2 | Scope 3 |
|---|---|---|---|---|
| 63 | Other Supporting and Auxiliary Transport Activities; Activities of Travel Agencies | Emissions due to the consumption of fuel for storage and warehousing, loading freight and other services related to the transportation of goods and passengers. | Emissions due to purchases of electricity, steam and cold. | Emissions due to the purchase of goods and services. The main emissions are emissions due to the purchase of products and services within the same sector, the purchase of air transport services, upstream emissions due to the production of fuels consumed and emissions due to the renting of equipment and business services (I.T. etc.). |
| 64 | Post and Telecommunications | Emissions due to the consumption of fossil energies, for example, for oil generators, the transportation of operational teams (maintenance, upkeep) and the heating of buildings. | Emissions due to the purchase of electricity, steam and cold, for example for telephone lines, data centres, and buildings. | Emissions due to the purchase of goods and services. The main emissions are due to the purchase of electronic products, the purchase of products from the same sector and emissions due to the renting of equipment and business services (I.T. etc.). |
| 70 | Real Estate Activities | Emissions due to direct energy consumption. | Emissions due to purchases of electricity, steam and cold. | Emissions due to the purchase of goods and services. The main emissions are due to the purchase of services within the same sector, the purchase of buildings and works from the construction sector and purchases from the 'Other Community, Social and Personal Services' sector. |
| 71t74 | Renting of machinery and equipment (71), Computer and related activities (72), Research and development (73), Other business activities (74) | Emissions due to direct energy consumption. | Emissions due to purchases of electricity, steam and cold. | Emissions due to the purchase of goods and services. The main emissions are due to purchases of services within the same sector. |
| L | Public Admin and Defence; Compulsory Social Security | Emissions due to direct energy consumption for heating (gas, oil) in the government and administrative, defence and social security sites. | Emissions due to purchases of electricity, steam and cold. | Emissions due to the purchase of goods and services. The main emissions are due to the purchase of transport equipment, renting of equipment, business services (I.T. etc.) and the purchase of R&D services. |

| | | Scope 1 | Scope 2 | Scope 3 |
|---|---|---|---|---|
| M | Education | Emissions due to direct energy consumption for heating (gas, oil) in the sites. | Emissions due to the purchase of electricity, steam and cold for heating and cooling buildings and for equipment that runs on electricity. | Emissions due to the purchase of goods and services. The main purchase categories are emissions due to the purchase of food products and drinks, emissions due to the renting of equipment, business services (I.T. etc.) and the purchase of R&D services. |
| N | Health and Social Work | Emissions due to direct energy consumption for heating (gas, oil) in the sites. | Emissions due to the purchase of electricity, steam and cold for heating and cooling buildings and for equipment that run on electricity (in particular medical equipment). | Emissions due to the purchase of goods and services. The main purchase categories are emissions due to the purchase of food products and drinks, emissions due to the purchase of chemical products, emissions due to the renting of equipment, business services (I.T. etc.) and the purchase of R&D services. |
| O | Other Community, Social and Personal Services | Emissions due to direct energy consumption for heating (gas, oil) in the sites. | Emissions due to purchases of electricity, steam and cold. | Emissions due to the purchase of goods and services. The main purchase categories are the purchase of products and services from the same sector emissions due to the renting of equipment and business services (I.T. etc.) the purchase of paper and books and upstream emissions due to the production of energy consumed. |

**Adaptation to climate change**
Adaptation to climate change refers to the strategies, initiatives and measures taken by individuals or groups (businesses, associations, administrations etc.) to reduce the vulnerability of natural and human systems against the actual or anticipated effects of change.

**Anthropogenic emissions**
Emissions resulting from human activities. This is used to describe any emissions caused directly or indirectly by human activities: soil erosion, atmospheric pollution etc. From the Greek 'anthropos' (man).

**Approximate data**
Primary or secondary data related to a similar activity which can be used instead of representative data. These existing data are used directly without adjustment.
Ex : données de consommations énergétiques d'un bâtiment dans les Vosges non corrigées du climat pour d'un bâtiment similaire située dans les Landes.

**Assets under management**
Assets under management are all assets held at a given time. This could refer to stocks or banking customer loans. As such this refers to money that has been tied up and not yet recovered.

**Best in class**
In the field of asset management, the Best-in-Class approach is a type of selection involving favouring those businesses with the best rating against certain performance criteria set by the asset manager within a given sector. The Best-in-class approach used extensively by French SRI fund managers, enables them not to separate the sectoral distribution of a fund from that of its baseline index, unlike in the case of ESG thematic approaches or sectoral exclusions.

**Bottom-up**
Type of methodological approach used to quantify financed GHG emissions. A micro-economic approach which involves incorporating the GHG emissions of customers of a financial institution line-by-line. 'Bottom-up' methodologies are based on emissions data produced by financed companies or projects as part of dedicated environmental reporting.

**Choice of allocation**
The choice of allocation by sector and geographical zone will result in significant methodological differences.

**Climate change mitigation**
Mitigation is defined as the human efforts aimed at reducing GHG emissions of various sources or increasing carbon sinks. Mitigation coupled with adaptation contributes to meeting the objective set under Article 2 of the UNFCCC's Convention on Climate Change.

**Commitments**
Financial organisation commitments by sector and by country or geographical zone (non-public data).

**Direct emissions**
GHG emissions from sources belonging to or under the control of the organisation and usually referred to in certain frameworks as Scope 1.

**Double-counting**
Emissions from a single source are counted twice or several times. Double-counting may arise between organisations where at least two organisations report the same GHG emissions or capture. Double-counting may also arise within a single organisation where GHG emissions or capture are taken into account in different emissions categories.

**Emission categories**
GHG emissions from homogeneous sources or types of source. An emission category may be combined with a sub-category.

**Emission category**

All GHG emission categories. Three emission categories can be distinguished, direct GHG emissions, indirect GHG emissions from energy and other indirect GHG emissions. These categories are referred to as 'scope' in certain international classifications.

**Emission factors**

Emission Factor (EF): emission rate of a given GHG for a given source, relative to units of activity.

**Emissions from operations**

Scope 1, Scope 2 and (partially) Scope 3 emissions. Emissions arising from an organisation's back-office functions. In the case of the financial sector, emissions from investments and the use of products sold are not included.

**Extrapolated data**

Primary or secondary data related to a similar activity which are adjusted or tailored to a new situation.
Ex : données de consommations énergétiques d'un bâtiment dans les Vosges corrigées du climat pour un bâtiment similaire située dans les Landes.

**Financed emissions**

Financed emissions are defined as greenhouse gas emissions generated by holding a financial asset. The emissions of a given industrial activity, for example, greenhouse gas emissions produced by the construction of this industrial facility, its maintenance and operations. The financial activity (finance, investment etc.) which made this industrial activity possible may, therefore, in some ways be associated with these emissions, having helped to produce them (without finance, the industrial activity would not have seen the light of day, nor would its GHG emissions.)

**GHG (Greenhouse gas)**

Greenhouse gas. A gas in the natural or anthropogenic atmosphere that absorbs and emits radiation within the thermal infra-red range emitted by the earth surface, atmosphere and clouds. The six gases included the Kyoto protocol, i.e.:
- Carbon dioxide ($CO_2$)
- Methane ($CH_4$)
- Nitrous oxide ($N_2O$)
- Hydrofluorocarbons (HFC),
- Perfluorinated Hydrocarbons (PFC)
- Sulfur hexafluoride ($CF_6$)
-

**GHG sources**

Physical unit or process releasing a GHG into the atmosphere (e.g. a thermal engine, thermal boiler, cow etc.)

**Greenhouse Effect**

The sun's rays that reach the Earth reheat its surface and two thirds of them are absorbed. With reverberation, the remaining third is sent back into space in the form of infra-red rays but is partially trapped by a layer of gas in the lower atmosphere: this sends the heat back toward the Earth and contributes to warming it further. Through this natural phenomenon called the greenhouse effect, the average temperature of the air at the Earth's surface is around + 15°C. Without this natural thermostat, the average temperature would be around 33°C cooler at around – 18°C. In large part they are of natural origin, but the proportion due to human activity, known as 'athropogenic', has been increasing since the beginning of industrial times (1750). The result is global warming.

**Gt $CO_2$**

1 gigatonne of carbon (GtC) = 1015 grammes of carbon. It corresponds to 3.667 GtCO2. A unit used by IPCC in particular.

**IEA**

The International Energy Agency which works to ensure reliable, affordable and clean energy for its 29 member countries and beyond. The main areas of IEA focus are: energy security, economic development, environmental awareness worldwide.

**Indirect emissions**
GHG emissions from sources arising from the consumption by an organisation of purchased electricity, heat or steam and GHG emissions (usually referred to in certain frameworks as Scope 2 emissions, and any other GHG emissions resulting from the activities of an organisation but from greenhouse gas sources belonging to and/or controlled by other organisations (usually referred to in certain frameworks as Scope 3).

**IPCC**
Intergovernmental Panel on Climate Change.

**'Issue'-based perspective**
This approach is based on the rule of specific allocation of global greenhouse gas emissions by macro-sector. This means allocating GHG emissions to sectors according to their capacity for reduction (Rose, 2013, 2014). The 'issue' of an economic agent is the quantity of GHG emissions that this agent is liable to reduce in an economy where heavy restrictions on GHG emissions are introduced (carbon prices, taxes, standards). In this context the internalisation of any additional cost would lead to a reduced demand for high-carbon, in favour of lower carbon, goods. The producer of the high carbon goods should then respond to the change in demand through 'innovation in processes' (efficiency savings throughout the product life). The GHG emissions targeted by these innovative approaches are the producer's 'issue'.

**NACE**
NACE2: Statistical classification of economic activities in the European Community NACE rev. 2 was the subject of regulation n°1893/2006 published in the Official Journal of the European Union on 30 December 2006. NACE has 615 categories each with a 4 digit code. NAF rev. 2 is the French classification of economic activities and corresponds directly to NACE ref. 2. NAF has 732 subcategories. NAF codes are made up of the NACE digits plus a country-specific letter.

**Natural capital**
Environmental accounting aimed at high sustainability is based on the principle of keeping natural capital and its elements apart on the grounds that, at least in terms of what is referred to as critical natural capital (CNC), which assures the vital functions of humanity and, more broadly, of biodiversity, this type of capital cannot be substituted by financial capital (non-substitutability assumption).

**Operational boundaries**
Operational boundaries may be defined as the list of emissions categories chosen for the calculation as deemed to be relevant.

**Organisational boundaries**
Organisational boundaries can take two forms:
- The 'control' approach involves the reporting organisation counting emissions from the sites over which it has financial or operational control.
- The equity share approach involves counting the emissions from sites in proportion to equity share.

**Ppm**
Parts per million. Measure of the concentration of GHG emissions. Ratio of the number of gas molecules out of the total number of molecules in dry air.

**Primary data**
Data observed, taken from information systems and physical samples belonging to or used by the administration or company (or a company in its supply chain).
E.g. actual fossil fuel consumption.

**Quick win**
This term general refers to actions that can be achieved quickly and easily. They generally require little or no financial investment.

**Secondary data**
Generic or averaged data from published sources which are representative of the activities of a company or its products or the public administration and the area it covers.
E.g: Average national energy consumptions for a city-based petrol powered car.

**Sectoral approach**
An approach involving the production of a sectoral guide which sets out the principles for producing a greenhouse gas emissions report for the organisations within a given sector or branch. There is a particular emphasis on defining sources, types of gas, the necessary data and calculation processes for each significant issuing category and/or each category with relevance for the sector in question, in order to optimise GHG emissions reporting. A sectoral guide is drafted with the aim of improving the quality of GHG emissions reporting within the sector, in accordance with the following principles: Relevance, completeness, consistency, accuracy and transparency (ISO 14064-1, GHG Protocol).

**Stock picking**
A market strategy involving trying to find within a market the shares that will offer the best returns. Stock picking is based on a strategic and financial analysis of companies.

**Temporal boundaries**
Boundaries that may vary through time according to the changes in the country's boundaries: acquisitions, disposals, mergers etc.

**Top-down**
Type of methodological approach used to quantify financed GHG emissions. A macro-economic approach which involves attributing global GHG emissions to sources of finance based on their market share by economic sector and geographical zone. Under such an approach an order of magnitude calculation of global financed emissions is produced and emissions are mapped by sector and geographical zone.

**Uncertainty**
Uncertainty is a parameter, associated with the result of measurement that characterises the range of the values that could be reasonably attributed to the measured quantity. Uncertainty information generally specifies the quantitative estimates or probable range of values and a qualitative description of the possible causes of the range. Uncertainty can usually be differentiated from emissions factors on the one hand and the accuracy/quality of data on the other.

## Annex 3: Bibliography

**General standards, methods and frameworks for quantifying the GHG emissions of organisations**
- ISO 14064-1, ISO 14069
- The method for GHG emissions reporting, in accordance with article 75 of French law n°2010-788 of 12 July 2010.
- Bilan Carbone®
- GHG Protocol: A Corporate accounting and reporting standard
- GHG Protocol: Corporate Value Chain (Scope 3) accounting and reporting standard
- European Committee for Standardization (CEN): Calculating GHGs in high energy intensity industries.
- Other sectoral guides (institutional or private), Sectoral guide for the level above For example, 'Guidance for Measuring & reporting GHG emissions in the Chemical Sector, WBCSD' used as a reference document for the chemical sub-sector).

**On the issue of uncertainty, the European Commission's environmental footprint method is interesting:**
http://ec.europa.eu/environment/eussd/pdf/footprint/OEF%20Guide_final_July%202012_clean%20version.pdf
(from page 45)

**'Issue'-based perspective**
- Reports by the Finance and Sustainable Development Chair of the Université Paris Dauphine are available here:
- http://events.chairefdd.org/
- Rose, A. (2014), La comptabilité des émissions de GES par 'enjeu': un outil d'analyse des impacts du changement climatique sur les activités d'une BFI, doctoral thesis in economic science, Université Paris-Dauphine, presented on 17/09/2014.
- Rose, A., Cochard, E. et Courcier, J. (2013). De la RSE au risque, Pour une approche catabolique de l'empreinte carbone induite des établissements financiers. Analyse financière n°46, January-March 2013, p10-11.

**'Scope'-based perspective**
- Report: Les émissions de CO2 du circuit économique en France, Fabrice Langlart, Christophe Lesieur, Jean-Louis Pasquier, L'économie Française, Edition 2010.
- Etudes & documents n°27: CO2 et activités économiques de la France, Tendances 1990-2007 et facteurs d'évolution, SOeS CGDD, Août 2010.
- Manual for Air Emissions Accounts Eurostat Office for Official Publications of the European Communities, Luxembourg, 2009.
- Connaissances approfondies de 10 secteurs d'activité prioritaires, ADEME, 2013 .

**Product Category rules, type 1 environmental labelling rules according to ISO 14024 (e.g. European eco-label)**

**Public life-cycle analysis, preferably with critical review and published in academic journals with peer review.**

**ADEME guides**
- 'Lignes directrices pour le développement d'un guide sectoriel bilan d'émission de gaz à effet de serre' – September
- Guide pour la mise en place, la construction, et le suivi des plans d'actions de réduction des émissions de GES, December 2014
- Quantifier l'impact GES d'une action de réduction des émissions, ADEME, 2014
- Réalisation d'un bilan d'émission de GES, Secteur tertiaire non marchand, 2012

**Other materials**
- IPCC reports, particularly AR5 synthesis report published on 31/10/2014
- Stern reports: The Stern Review on the Economics of Climate Change, 30 October 2006 and The New Climate Economy Report, October 2014.

## About ADEME

ADEME, the French Environment and Energy Management Agency, is involved in the implementation of public policies in the fields of the environment, energy and sustainable development. It offers its expertise and advice to businesses, local government, public administrations and the general public. It also helps them to finance projects and conduct research in the following fields: waste management, soil conservation, energy savings and renewable energies, air quality and noise control.  ADEME is a public agency under the joint authority of the Ministry for Ecology, Sustainable Development and Energy and the Ministry for Higher Education and Research.

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