COMMISSARIAT GÉNÉRAL AU DÉVELOPPEMENT DURABLE

Études & documents

N° spécial
Octobre
2011

DÉVELOPPEMENT DURABLE

OBSERVATION ET STATISTIQUES

Two years after the Stiglitz-Sen-Fitoussi report: What well-being and sustainability measures ?

Contributions of the Ministry of Sustainable Development

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Two years after the Stiglitz-Sen-Fitoussi report: What well-being and sustainability measures ?

Contributions of the Ministry of Sustainable Development

Contents

Foreword

Two years ago, the President of the French Republic requested that Government services implement promptly the recommendations of the Commission on the Measurement of Economic Performance and Social Progress (also known as the «Stiglitz-Sen-Fitoussi» Commission) when its report was submitted on September the 14th, 2009.

Regarding "Sustainable development and Environment", the report of the Commission recommends:

- to set up dashboards of indicators rather than a single synthetic or composite measure,
- to choose indicators providing information on sustainability, that is to say indicators that can be seen as variations of underlying «stocks»,
- to prefer physical indicators rather than monetary ones in the sphere of environment.

The Commission also recommends to involve different stakeholders to define these indicators.

For two years now, the Observation and Statistics Directorate of the General Commission on Sustainable Development (CGDD / SOeS) has undertaken many investments that follow the «Stiglitz» report's recommendations.
This publication, issued on the occasion of the October the 12th conference this year, sheds the light on what has been accomplished. It is thus designed as a compilation of pieces and summaries of publications issued by the CGDD during the past two years, all of them being closely related to the Stiglitz-Sen-Fitoussi Commission works.

1 - Sustainable Development Indicators (SDIs)

The first edition of the 15 headline indicators of the National Sustainable Development Strategy (NSDS) 2010 to 2013 was widely communicated between summer 2010 and early 2011 to various public spheres, and in particular distributed to key players in charge of public policy.

The process of updating the headline and second level indicators now comes to an end. The updated figures are included in the new 2011 report from the Government to the Parliament regarding the implementation of the NSDS, which is to be sent these days.

But the indicators are subject to permanent improvements and further developments. Therefore, the adhoc consultative Commission involving members of the National Committee on Sustainable Development and Environment Round Table (CNDDGE), the Economic, Social and Environmental Committee (CESE) and the National Council of Statistical Information (CNIS) has taken up again activities this year to review and discuss new indicators that will possibly complement existing indicators in the coming years.

Finally, 2011 was also the year of territorialization of indicators. A conference devoted to territorial Sustainable Development Indicators will take place on November 16, under the auspices of the CNIS, to put forward such important work.

2 - The consumption of materials and material productivity

The consumption of materials and material productivity are both recent indicators aiming to provide an answer to whether the evolution of our modes of production and consumption patterns lead to more sobriety vis a vis natural resources. They were calculated over the period 1990-2008, showing two decades of relative decoupling between the evolution of economic activity and consumption of materials.

These calculations, in addition to apparent consumption, also take into account the «hidden flows» of materials related to imports, exports and unused materials. The impact is far from negligible, since it doubles the yearly consumption of materials, from 14 to 28 tonnes per capita.

3 - «footprints»

The «carbon footprint» is also one of the headline indicators of the NSDS. It was developed in accordance with the recommendations of the Stiglitz-Sen-Fitoussi Commission. It measures two approaches of CO_2 emissions: production and consumption. Skipping from production to consumption approach is a significant change of point of view. Indeed, by focusing on the consumer and the citizen and not only on the producer, we are abele to take due account of the CO_2 emissions worldwide, regardless of their origin, to meet domestic final demand.

From a first calculation performed on the 2005 data for CO_2 alone, this type of work has developed further in 2011, allowing first to produce long time series, and secondly to make a first calculation of the water footprint, by applying the same methodology as for the carbon footprint. As a result, we now know that for every 100 m^3 of water consumed yearly by households per capita, four times more of this natural resource is being collected and mobilized, among which about one fifth is involved in the production of imported goods.

This work will continue in the coming months in order to extend the carbon footprint to other greenhouse gas emissions, to produce a long time series of the water footprint, and also to calculate other footprints such as one on waste.

4 - New investments

The research work underway aims at enabling to design new indicators in the coming years. This work follows two avenues of development.

The first avenue concerns biodiversity, a domain still missing internationally comparable indicators. In this context, the CGDD / SOeS develop an indicator that, if not a direct measure of biodiversity, at least approaches it through the use of land use data. The index of ecological quality of land use will see the light at the end of the year.

The second avenue is probably the most challenging as well as the most promising. It consists in the establishment of a comprehensive framework of environmental economic accounting, that will provide an overall vision and quantification of interactions between the economy and the environment. This year, the European Union took a major step forward in laying down the foundations of this edifice with the adoption of a first European regulation. Next year, the UN will endorse the first accounting standard for environmental economic accounts.

Thus, thanks to this accounting framework, consistent with national accounts, indicators of efficiency and productivity will be designed. They will quantify the balance between economic benefits of human activity and the underlying mobilization and posssible degradation of the natural capital. They will allow us to better monitor our capacity to generate economic development while preserving natural capital for future generations.

Dominique DRON
General Commissioner
for Sustainable Development

COMMISSARIAT GÉNÉRAL AU DÉVELOPPEMENT DURABLE

le point sur

n° 64
September 2010

OBSERVATION ET STATISTIQUES
DEVELOPPEMENT DURABLE

One year of implementation of the Stiglitz Commission recommendations

Towards a new generation of indicators

One year ago the Commission on the Measurement of Economic Performance and Social Progress, known as the Stiglitz-Sen-Fitoussi Commission, handed out its report to the President of France. The report - which took as a starting point the inadequacy of current statistical indicators to enlighten choices that will shape the future of society - contains recommendations intended to guide scientific investigation into progress towards the development of new and more relevant indicators able to meet the challenges of sustainable development. The report, published in 2009, was not intended to close discussions and thinking on these issues but rather to spur and guide the ongoing work that was already under way. This work, originally rather scientific by nature, aims at disseminating progressively new forms of official statistics. One year on, the moment is opportune to shed the light on what has been accomplished and what is foreseen in terms of data and indicators availability.

The gap between statistical measurements and public perception of economic performance and social 'progress' has been debated widely. It has been particularly true with Gross Domestic Product (GDP) considered as an overall indicator of such progress. Beyond this, numerous observers point out the inadequacy of current measurement instruments to make appropriate choices about the future of society**.** But decisions are affected by measurement tools: what we measure and the quality of the effective metrics determine the soundness and efficiency of the policies and actions undertaken, for both decision-makers and individuals.

The 'Stiglitz-Sen-Fitoussi' Commission, set up at the request of the President of France, reflected further from the identification of this inadequacy to scrutinise the possible improvements of the measuring instruments. In September 2009, the Commission handed out its report, structured in three parts: **'Classical GDP issues', 'Quality of life' and 'Sustainable development and the environment'.** Its executive summary puts forward 12 recommendations (*see box*) intended to drive the scientific work underway in view to design and release new more relevant indicators, meeting the current challenge of aprehending social progress beyond the production of goods and services. Such indicators also aim at measuring the capacity for a long-term development of societies, so as not to overfeed growth today at the expense of future growth, thereby reducing the chances for future generations to meet their own needs.

Some important recommendations

The Commission advises against focusing on a single summary indicator since, whatever the methodology envisaged, aggregation of disparate data is questionable in essence and, above all, because such an indicator could not possibly encompass simultaneously all the complexity of economic activity, quality of life and sustainability of development. The Commission underscores the appropriateness of GDP as a measure of production in the market economy and consequently avoids suggesting that it should be abandoned. It recommends bringing in other approaches and indicators to measure wellbeing. Furthermore, the Commission advises against composite indicators which are normative since they aggregate heterogeneous information by assigning scores and weights. Nor does it adopt the 'ecological footprint', as it also relies on specific choices for aggregation that are potentially questionable and because most of the information carried by the footprint is explained by CO_2 emissions. It is therefore simpler to use these emissions to measure the **carbon footprint** expressing human pressure on the climate, which was done when it was adopted amongst the 15 Sustainable Development Indicators (SDIs) associated with the National Sustainable Development Strategy (NSDS) for 2010-2013.

The Commission emphasises the great complexity of measuring sustainability, since it involves both the present and the future, but nonetheless proposes some tracks to follow. Where natural resources are

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concerned, for which the stake is to ascertain whether they are being over-consumed or not, ***the report recommends choosing indicators that can be interpreted as variations of underlying stocks.*** It advises against the calculation of a 'green GDP' since monetary assessment of environmental damage is extremely difficult and, above all, does not give any indication about change in stocks of natural resources, thereby failing to signal possible over-consumption and consequently to measure the sustainability of development.

The Commission finds interest for the World Bank's ***net adjusted savings*** indicator since it integrates physical and human capital and the natural resources traded on markets. It suggests that an indicator of this family could be adopted as a monetary indicator of sustainability if complemented with physical indicators measuring pressures on the environment.

One year later, a number of recommendations are being implemented

France's President requested that the different administration services implement the Commission's recommendations without delay. One year after publishing of report, *Insee* (national statistics institute) and the *Service de l'Observation et des Statistiques du Commissariat Général au Développment Durable* (CGDD-SOeS - observation and statistics directorate of the office of the Commissioner General for sustainable development) started to implement most of the recommendations. Some of this work has already been published and it will continue in the coming months and years.

It is mainly in the third part of the report that the CGDD can offer appropriate solutions and make valuable contributions in the short and medium terms (see concrete examples presented thereafter); the other two parts fall rather in the sphere of competence of *Insee* and of the statistical services in other ministries.

But the CGDD is also contributing to these other parts. In the first part, on measurement of GDP, the report recommends emphasizing the household perspective and putting the focus on consumption or income, rather than a business perspective and a focus on production. These recommendations are mainly relevant for national accounting, but they have also influenced the design of new indicators such as the **carbon footprint.** Similarly, the second part, on quality of life, sheds the light on some dimensions of wellbeing, either objective or perceived. Social perception of the environment, of environmental risks, of quality of life in housing (damp dwellings, noise, etc.) and daily environmental habits are all new themes addressed in available and forthcoming publications. The population and housing exposed to natural hazards, such as floods, have also been estimated.

Fifteen sustainable development indicators (SDI) have been selected, to support the new NSDS adopted by the *Comité interministériel du développement durable* (CIDD - Interministerial Committee for Sustainable Development) in July 2010.

Among these, the environmental SDI follow the recommendations of the Stiglitz-Sen-Fitoussi Commission, as several of them can be interpreted as variations of some 'stock', of capital used in the assessment of human wellbeing. Consequently, in each of their area, they indicate whether today's growth is depleting the capital that future generations will need to allow for tomorrow's growth. This is in particular the case for the carbon footprint, for material consumption **per capita** (*see below*), but also for artificialisation of land, or, where biodiversity is concerned, for common birds population. Moreover, these indicators could be the foundation of the 'set of physical indicators of environmental pressures' also recommended by the Commission.

The carbon footprint of final domestic demand

The Stiglitz-Sen-Fitoussi Commission recommends to use the carbon footprint indicator. It measures CO_2 emissions generated, not by businesses in their production activities, but by consumers when they purchase products. This innovative change in the point of view makes it possible to take into account the imports, component of household consumption, in order to measure the CO_2 emissions generated abroad as a result of domestic consumption.

The greenhouse gas (GHG) inventories drawn up under the Climate Convention are based on the national perimeters of the signatory countries. However, in a globalised economy it appears necessary to take into account the emissions embedded in all goods and services consumed, including those generated beyond national boundaries.

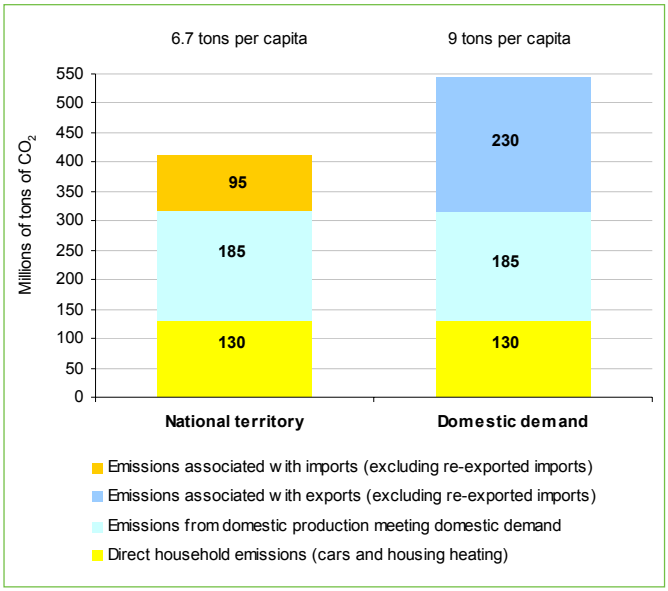
Widening the monitoring of GHG emissions beyond national territory to include the CO_2 equivalent component of international trade allows an appreciation of the global impact of a country's consumption on the climate, which is one of the global commons.

Hence, this 'carbon footprint', measured from an 'emissions embedded in domestic consumption' standpoint—wherever in the world the CO_2 emissions take place—provides the environmental pressures generated by each country with a more consistent picture than the footprint for 'emissions within national territory'. It is therefore more suitable for international comparisons.

A first estimate for France, with CO_2 emissions only, was made in 2005, the year for which the most complete data are available. It shows that France's imports alone are responsible for the emission of 230 million tons of CO_2 generated abroad to meet final domestic demand (excluding re-exported imports) out of a total of 545 million tons of CO_2. After taking account of all foreign trade, the resulting French carbon footprint for final demand per capita is 9 tons per year, whereas an average of 6.7 tons of CO_2 are emitted per capita within the French territory (*see Graphic 1*).

This indicator is relatively new and its estimation requires detailed and homogeneous data for a number of countries. It explains why there are currently few equivalent figures allowing for international comparisons. The OECD conducted a similar study in 2009 but it relates to results for 2000 (*see Table 1*). It shows that the carbon footprint was in 2000 significantly lower for France than for the other OECD countries.

Graphic 1 - In 2005, the carbon footprint for a French inhabitant amounted to 9 tons of CO_2 per year, taking account of imports and exports, i.e. of around 30% of the quantity emitted within the national territory



Note: CO_2 emitted in continental French territory in 2005, excluding CO_2 emitted from burning of biomass for energy production as well as from use or change of land and forests (UTCF).

Source: SOeS from Citepa, Insee, Eurostat and IEA. 2010

Table 1 - Comparison of carbon footprints in France and other countries

In tons of CO_2

Country	Per capita footprint from final demand standpoint (2000)
France	8.7
Germany	11.9
Italy	9.6
United Kingdom	12.3
United States	23.1
Japan	11.6
OECD countries	13.6
China	0.8
Russia	6.3

Source: OCDE 2009

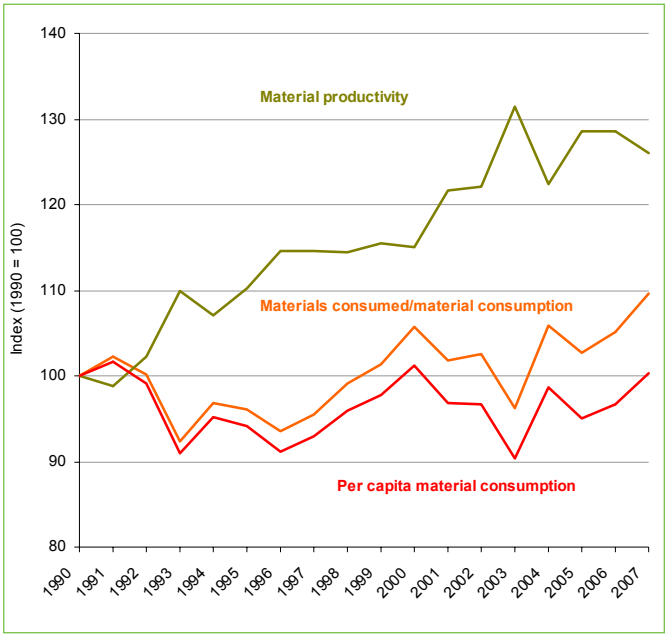
Material productivity and material consumption

Material productivity is another among the 15 SDI connnected with new challenges to be met: reorienting our production and consumption towards a sober economy less intensive in resources is indeed a major stake. The EU sustainable development strategy (SDS), like the French SDS, aims at decoupling economic growth and the associated environmental impacts connected with the use of natural resources and raw materials. Progress towards decoupling can be evidenced by material productivity indicators.

Indeed, material productivity gives a picture of an economy's efficiency by establishing the link between economic growth and the use of materials extracted within the national territory or imported as raw materials or finished goods. In this sense, it is an indicator of sustainable production, whose development is recommended by the Commission. Material productivity is equal to GDP divided by apparent domestic consumption, like productivity of labour is GDP divided by employment. For France in 2007, it was €1.90 of GDP/kg of material used, to be compared with €1.71 for EU-15. A study conducted this year by the CGDD/SOeS shows that material productivity increased in France by 26 per cent between 1990 and 2007: we produce more today with the same quantity of materials.

Material consumption is an environmental pressure indicator (a type of indicator also recommended) as it measures what is taken globally from nature. Its evolution, compared to the evolution of population, gives a hint on the direction taken towards or away from sober consumption. Per capita material consumption was 14.3 tons in France in 2007, similar to the 1990 level. It was 16 tons in Germany and 20 tons for the EU-15 (*see Graphic 2 and Table 4*). But the 'hidden flows' associated with imports, exports and unused materials, are not accounted for in the apparent domestic materials consumption. In France in 2007, these were estimated at 12 tons per capita, to be added to the apparent consumption. Unfortunately, these results cannot be compared yet with those of other countries, since homogenous international statistics are missing on this subject.

Graphic 2 - Material productivity in France increased by 26% between 1990 and 2007; however, per capita material consumption was stable



Note: continental France and overseas regions. Apparent domestic material consumption aggregates (in tons) 'fossil energy', mineral and agricultural products extracted from national territory or imported as raw materials or finished products, minus exports.

Source: SOeS, Insee 2010

Table 2 - Comparison of material consumption in France and other countries

In tons per capita

Country	Apparent domestic material consumption (2007)
France	14.3
Germany	16.0
Italy	13.6
United Kingdom	12.4
Spain	19.7
EU-15	20.0
EU-27	16.5

Note: consumption including hidden flows (among which those associated with imports) is not available per country.

Source : Eurostat

These developments are also supported at the international level

Implementing the recommendations of the Stiglitz-Sen-Fitoussi report will be all the more beneficial if the ensuing work is carried out in cooperation with other countries. **In this international context,** several initiatives under way are noticeable :

- the Eurostat-Insee partnership associating the National Statistical Institutes of 15 other EU countries. Four Task Forces have been established, three of which correspond to the chapters of the report and one dealing with coordination activities. The CGDD-SOeS represents France in the 'Environmental Sustainability' Task Force, set up in May 2010.
- the Sarkozy-Merkel request for a Franco-German report on the issue of 'What is growth in the 21st century, what is prosperity for highly developed industrial nations?'. The report is to be built on the Stiglitz-Sen-Fitoussi report. It is the responsibility of the *Conseil d'analyse économique* (Economic Analysis Council) for France and of the 'Five Wise Men' Economic Council for Germany. A conference is planned in Berlin, in December 2010, with submission of the report to the two commissioning partners.
- the OECD has incorporated the Stiglitz-Sen-Fitoussi report's recommendations into its work programme and the green growth strategy.
- the United Nations Statistics Commission has decided to add a 'Stiglitz' item to the agenda of its 2011 meeting.

For more information

Recent publications from CGDD-SOeS:

- *L'exposition aux risques environnementaux davantage ressentie dans la grandes villes.* Le point sur N° 11. April 2009.
- *Matières mobilisées par l'économie française.* Études & documents N° 6. June 2009.
- *La consommation intérieure de matières par habitant est stable.* Le point sur N° 41. January 2010.
- *Les indicateurs de développement durable.* La Revue du CGDD. January 2010 (10 articles, 100 pages).
- *An expert examination of the Ecological footprint: an expert's view.* Études & documents N° 16. January 2010.
- *10 key environmental indicators for France*. In *Repères*, 2010 issue. April 2010.
- *Données de synthèse sur la biodiversité.* RéférenceS. May 2010.
- *Les Français et la biodiversité.* Le Point sur N° 55. June 2010.
- *Les opinions et les pratiques environnementales des ménages.* In *l'environnement en France* RéférenceS. June 2010.
- *Les enjeux exposés aux risques majeurs*. In *L'environnement en France*. RéférenceS. July 2010.
- *Les indicateurs de la stratégie nationale de développement durable 2010-2013*. Repères. July 2010. (English translation underway)
- *CO_2 et activités économiques de la France: Tendances 1990-2007 et facteurs d'évolution*. Études & documents N° 27. August 2010.
- *Opinions et pratiques environnementales des Français en 2009.* Chiffres & statistiques N° 153. September 2010.

CGDD-SOeS website:
www.statistiques.developpement-durable.gouv.fr

Insee publications:
www.insee.fr

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Conception : Catherine Grosset

ISSN : 2100-1634
Dépot légal : Septembre 2010

le point sur

n° 64, september 2010

One year of implementation of the Stiglitz Commission recommendations

Towards a new generation of indicators (cont'd)

The three parts of the Stiglitz-Sen-Fitoussi report, its 12 recommendations, and completed or forthcoming corresponding work

Part 1: GDP related issues
Recommendations
R1: Look at income and consumption rather than production
R2: Emphasise the household perspective
R3: Consider income and consumption jointly with wealth
R4: Give more prominence to the distribution of income consumption and wealth
R5: Broaden income measures to non-market activities

Done and disseminated in 2009 and 2010 (1st half) in Insee publications
Recommendations
R1 and R4: inequalities between households in terms of income and consumption in national accounts
R2 and R4: taking into account social transfers in kind (education, health, etc.) when assessing inequalities
R1, R2 and R4: evolution of inequalities in standard of living between 1996 and 2007
R2 and R3: national economic wealth in 2009
R1, R2 and R4: evolution of very high incomes between 2004 and 2007
R1 and R12: a new approach to household consumption from national accounts: CO_2 emissions due to final household consumption per household category (jointly with CGDD-SOeS)
For further detail, see: www.insee.fr

Forthcoming
Recommendations
R2: 10 years evolution of households' purchasing power per household category
R3: a breakdown of households' wealth according to five household categories.
R3: households inequalities of wealth
R2 and R5: taking account of households' domestic activities as a complement to GDP, from time scheduling surveys
For further detail, see: www.insee.fr

Part 2: Quality of life
Recommendations
R6: Quality of life depends on people's objective conditions and capabilities. Steps should be taken to improve measures of people's health, education, personal activities and environmental conditions. In particular, substantial effort should be devoted to developing and implementing robust, reliable measures of social connections, political voice, and insecurity that can be shown to predict life satisfaction.
R7: Quality-of-life indicators in all the dimensions covered should assess inequalities in a comprehensive way.
R8: Surveys should be designed to assess the links between various quality-of-life domains for each person, and this information should be used when designing policies in various fields.
R9: Statistical offices should provide the information needed to aggregate across quality-of-life dimensions, allowing the construction of different indexes.
R10: Measures of both objective and subjective well-being provide key information about people's quality of life. Statistical offices should incorporate questions to capture people's life evaluations, hedonic experiences and priorities in their own survey.

Done and disseminated

Recommendations

R6: estimates of populations and housing exposed to natural hazards (CGDD-SOeS)
R6 and R8: surveys on social perception of the environment, perception of risk and on sensitivity of French people to biodiversity (CGDD-SOeS)
R7 and R9: evolution of living standards, productivity and wellbeing over a long period (Insee).

Forthcoming

Recommendations

R6 and R7: knowledge of bad housing (Insee)
R6, R7 and R8: social participation, membership of associations (Insee)
R6 to R9: objective measurement of quality of life (Insee)
R6, R7 and R9: time spent by households in their different activities (work, leisure, domestic, etc.) and how they perceive those activities (Insee)
R10: subjective appreciation of wellbeing (Insee)
For more detail, see: www.insee.fr

Part 3: Sustainable development and environment

Recommendations

R11: Sustainability assessment requires a well-identified dashboard of indicators. The distinctive feature of the components of this dashboard should be that they are interpretable as variations of some underlying 'stocks'. A monetary index of sustainability has its place in such a dashboard but, under the current state of the art, it should remain essentially focused on economic aspects of sustainability.
R12: The environmental aspects of sustainability deserve a separate follow-up based on a well-chosen set of physical indicators.

Done

Recommendations

R11 and R12: a table of 15 Sustainable Development Indicators for France is now associated with the NSDS (produced by CGDD-SOeS and Insee) and was presented in short booklet format at the meeting of the CIDD that addressed the NSDS. There are also 35 second level sustainable development indicators also associated with the key challenges for the NSDS and four context indicators (*not linked to NSDS challenges*).
Several key NSDS indicators 'can be interpreted as variations of underlying stocks' (R11): per capita material consumption, carbon footprint of final demand, changes in common bird populations, and expansion of the artificialisation of land. These can constitute the foundation of a set of physical indicators of environmental pressures (R12).
A joint action commission of the 'Governance at five' type and a national conference to define sustainable development indicators (organisers: CGDD, Cese, Criis - *general recommendation from conclusion to report*).
R12: France's 'carbon footprint': CO_2 emissions arising from final demand, including those due to imports (CGDD-SOeS)
R11 and R12: material consumption including that due to imports (CGDD-SOeS)
R12: compendium of biodiversity indicators (CGDD-SOeS)
R3 and R11: estimation of costs of environmental damage not borne by the economy: the case of global warming (CGDD-SOeS)
R11 and R12: An expert examination of the Ecological footprint (CGDD-SOeS)
R11: report on the biodiversity economy and environmental services (CAS)
R11: net adjusted savings and other approaches to sustainability, some theoretical bases (Insee)

Forthcoming (2nd half 2010-2011)

Recommendations

R11: estimation of CO_2 component of a household consumption basket (CGDD-SOeS, Ademe)
R11 and R12: 1st estimate of France's 'water footprint' using same methodology as for the carbon footprint (CGDD-SOeS)
R12: development of a territorial potential of biodiversity indicator (CGDD-SOeS, IGN, MNHN, Dreif)
R11: work in progress on sustainable development indicators (CGDD-SOeS and Insee) and on unpaid costs of depletion of natural resources (CGDD-SOeS)
R11: report from *Commission des comptes et de l'économie de l'environnement* (Environmental accounts and economy Commission) on economic drivers for conservation of biodiversity and ecosystem services (CGDD-Seeidd).

For what has been done and disseminated, see bibliographic references:
'For more information', page 4
- **www.statistiques.développement-durable.gouv.fr**
- **www.insee.fr**

Chapter 2
Quality of life

Environmental perceptions

Environmental habits under constraints, to be published in *La Revue du CGDD* entitled “Social perceptions and environmental practices of the French from 1995 to 2011“ (2 pages)

To be published in *La Revue du CGDD* entitled
"Social perceptions and environmental practices of the French from 1995 to 2011"

Environmental habits under constraints

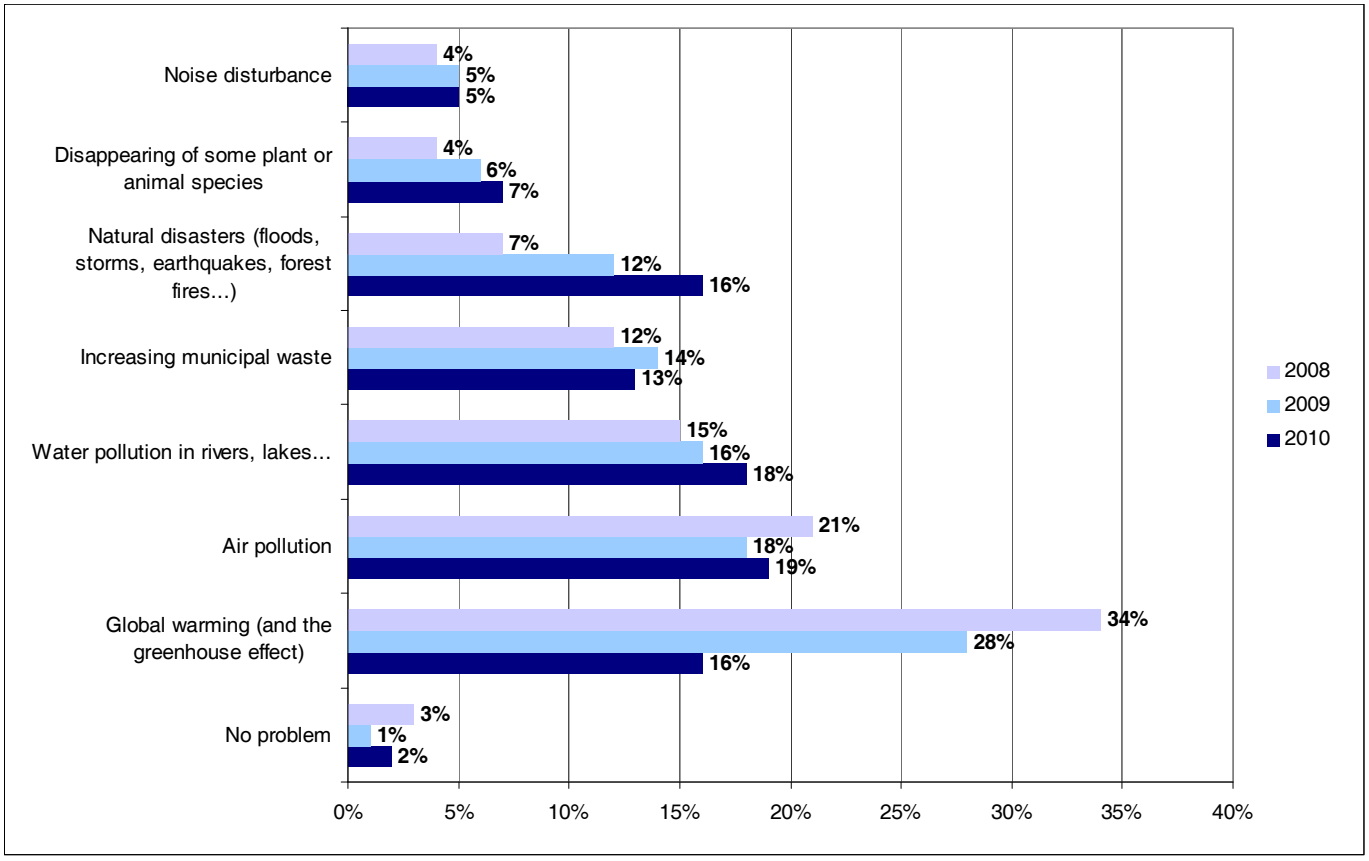
Bernard Poupat
(SOes)

The French take more and more into account the environment in their daily habits. This article offers a zoom on some of them, based on a «snapshot» taken in the end of 2010. In purchasing decisions, attention to certain criteria, such as eco-labels and distance for routing products is increasing. However, the car use remains important for daily commuting.

Evolution of the environmental awareness

As shown by the various survey vehicles, in the end of 2010, global warming was not the major environmental concern of the French. Conversely, concerns about natural disasters appear more and more clearly. The views expressed on such matters may be influenced by the headline news at the time the survey takes place. In this regard, it should be noted that events such is the Copenhagen conference on climate in December 2009, the Xynthia storm in February 2010, floods in the Var in June 2010 may have somewhat impacted the observed results. In 2010, year of biodiversity, the disappearance of some plant or animal species appears to be a rising concern, but secondary in the hierarchy of environmental problems.

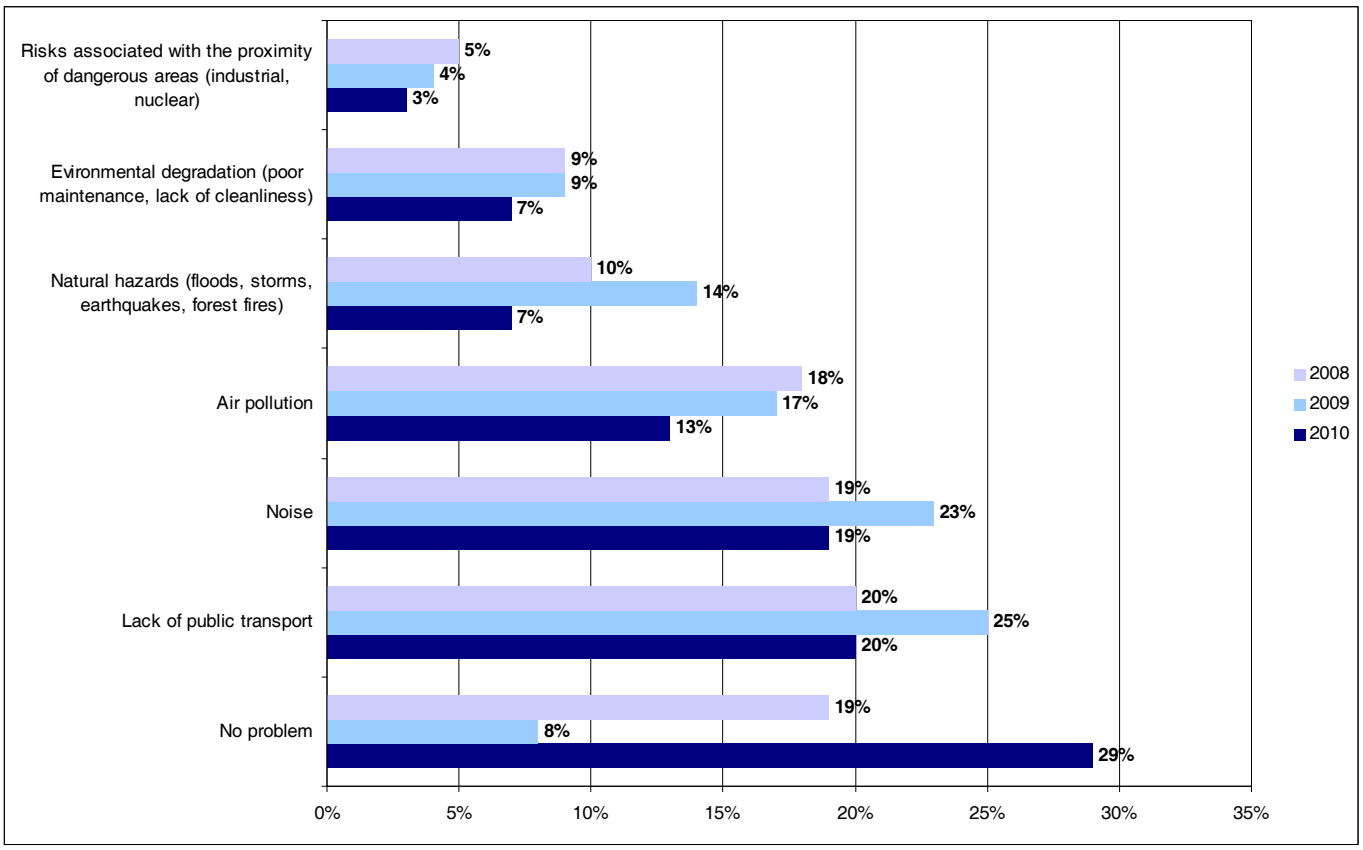
Among the following issues, in relation to damages caused to environment, which one matters most to you ?



Source : Insee, Households opinion survey, april 2008, november 2009 and november 2010.

When households are asked what is the problem that concerns them most in their neighborhood by being proposed a standard list of issues, including environmental, 29% of them answer «no problem.» The large proportion of negative responses to the environmental items proposed is very sharply increasing which suggests that the most pressing issues lie outside of this area.
Natural hazards are rarely considered as a close threat. At the scale of the neighborhood, the environmental status is primarily considered through the impacts on the quality of life that are supported or perceived daily. The lack of public transport, noise or air pollution issues are the most often mentioned among those affecting the residential area.

Among the following issues, which one matters most to you in your neighborhood ?



Source : Insee, Households opinion survey, april 2008, november 2009 and november 2010.

Chapter 3
Sustainable Development and Environment

Dashboard of sustainable development indicators

Summary and introduction of *Repères* “National Sustainable Development Strategy Indicators 2010-2013“, february 2011 (3 pages)

Repères
« National Sustainable Development Strategy Indicators 2010-2013 »
february 2011

Contents

Introduction

As intended under the Grenelle Environnement Planning Act, the Government has recently adopted the National Sustainable Development Strategy for the period 2010-2013. Numerous public and private partners were involved in preparing it throughout 2009.

The fifteen headline indicators and four economic and social context indicators presented in this document form the core of the scorecard adopted to easily monitor the NSDS and help broadcast it widely.

A national conference introduced by the State Minister Jean-Louis Borloo was held at the Palais d'Iéna on 20 January 2010 to debate the choice of these indicators. Organised jointly by Cnis, Cese and CGDD[1], it brought together the different Grenelle bodies (State, regional authorities, businesses, social partners and environmental NGOs). A Consultation Committee, made up of representatives of these various bodies and stakeholders, had prepared the proposals for debate during the fourth quarter of 2009.

This open and lively consultation conveyed the importance of a wide allocation of sustainable development indicators and their potential role in the citizens' debate. It took advantage of work carried out in 2009 by miscellaneous bodies, mainly Cese, the Stiglitz-Sen-Fitoussi Commission and the MEDDTL Statistics Department, which proposed analyses and discussions on the question of synthetic indicators.

The preparatory work for the national conference stated the criteria governing the choice of indicators.

[1] *National Statistical Information Board, Economic, Social and Environmental Council and Sustainable Development Office for the Ministry of Ecology, Energy, Sustainable Development and the Sea.*

They have been chosen to:

- illustrate the key issues in sustainable development in response to the nine key challenges of the NSDS:
  - challenge 1: Sustainable consumption and production,
  - challenge 2: Knowledge society (education and training, research and development)
  - challenge 3: Governance,
  - challenge 4: Climate change and energies,
  - challenge 5: Sustainable transport and mobility,
  - challenge 6: Conservation and sustainable management of the biodiversity and natural resources,
  - challenge 7: Public health, risk prevention and management,
  - challenge 8: Demographics, immigration and social inclusion
  - challenge 9: International challenges of sustainable development and the fight against world poverty;
- be consistent with the European headline indicators;
- be applicable to infra national territories like regions (included overseas), to express the concerns of populations as comprehensively as possible as close as possible to the roots;
- provide information on the breakdown by social categories, income classes, age or between men and women.

Three "categories" of indicators have been separated out for the scorecard: fifteen headline indicators relating directly to the strategy challenges (level 1), four economic and social context indicators and additional indicators connected to the strategic choices (level 2, not presented in this document).

Calculating and updating these indicators is coordinated by INSEE and SOeS, helped by other ministerial statistics departments. These sustainable development indicators will be presented to Parliament and made public annually from 2011 onwards.

Chapter 3
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Material productivity

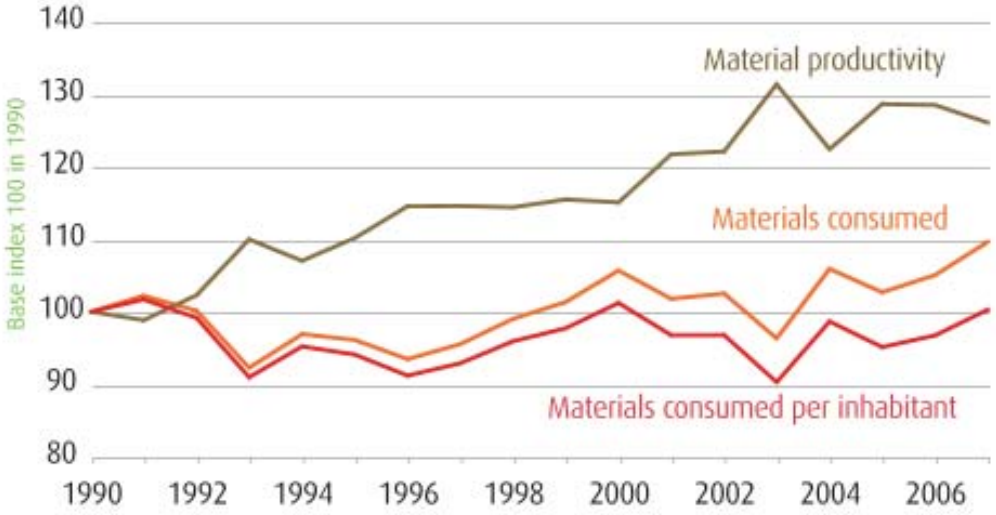
Material productivity, abstract from “National Sustainable Development Strategy Indicators 2010-2013“, *Repères*, february 2011 (2 pages)

Summary of “CO_2 and economic activities of France. 1990-2007 Trends and drivers of change“, *Études & documents n° 27*, august 2010 (4 pages)

Material productivity

Material productivity rose by 26% in France between 1990 and 2007; however, the consumption of materials per inhabitant remains stable.

Resource productivity and domestic consumption of resources per inhabitant



Note: The apparent domestic material consumption combines, in tonnes, the fossil fuels and mineral and agricultural products extracted from the national territory or imported as raw materials or finished products, less exports.
N.B.: The "hidden flows" relating to imports, exports and unused materials are not counted in the apparent domestic material consumption. They are currently being estimated.
Source: SOeS – Insee, 2010. Metropolitan France and overseas departments.

"Sustainable consumption and production" key challenge

Issues

Driving our production and consumption methods towards an economy using far fewer natural resources is a major issue. The EU strategy, in favour of sustainable development, like the French strategy, aims at decoupling economic growth and the environmental impact of using natural resources and raw materials. Progress in decoupling can be tackled through material productivity indicators. Material productivity gives a glimpse of the efficiency of an economy by linking the use of materials and economic growth.

Analysis

Material productivity is equal to the GDP divided by the apparent domestic material consumption. The French figure was €1.90 of GDP/kg of material used in 2007 compared with €1.71 for the EU-15. It increased in France by 26 % between 1990 and 2007. It corresponded to a consumption of 14.3 tonnes of materials per inhabitant in 2007, about the same as in 1990, and to 20 tonnes for the EU-15. Also, the "hidden flows" relating to imports, exports and unused materials were estimated at 12 tonnes per inhabitant in 2007 which is added to the apparent consumption.

For further information:

- http://www.statistiques.developpement-durable.gouv.fr, heading Environnement
- http://epp.eurostat.ec.europa.eu, heading Statistics > Sustainable development indicators

Summary

The amount of resources extracted (by weight) grew by 36 per cent worldwide between 1980 and 2002 and, according to OECD projections, seems set to reach 80 billion tonnes by 2020[1]. Sustainable management and use of natural resources at the global level will require the progressive uptake of a recognised system of accounting for the resources consumed by each country, both within its territory and abroad via imports. Derived indicators would also make it possible to develop and evaluate resource management policies and allow for international comparison. For example, material productivity and domestic material consumption have been adopted as sustainable development indicators in Europe and France, to monitor sustainable consumption and production.

Foreseeable growth in world resource consumption

The intensity of natural resource extraction varies depending on materials, location, level of economic development, economic structure, trade flows and socio-demographic characteristics. OECD countries occupy a significant position for both use of resources and supply of raw materials. Other countries, such as Brazil, China, India, Indonesia, Russia and South Africa are developing towards similar levels.

In the 1980–2002 period, it was extraction of metal ores which experienced the greatest growth, reaching 5.8 billion tonnes globally. This will almost double by 2020, reaching 11 billion tonnes. With projected growth of 31 per cent, biomass extraction (agriculture, forestry, fishing) will progress more slowly, resulting from a reduction in the proportion of renewable resources in global production and use of materials.

Per capita extraction levels are high in the OECD area, especially in the countries of North America and the Asia-Pacific region. They appear set to develop further, reaching 22 tonnes per inhabitant by 2020, mainly as a result of increasing demands for coal, metals and minerals for construction. Extraction levels in rapidly developing countries should increase much more rapidly in the same period (+ 50 %)[2], reaching 9 tonnes per inhabitant in 2020.

Moreover, the world population is expected to increase by around one-third until 2030, placing increasing pressure on the global environment. Sustaining economic growth and improving wellbeing in the long term, while controlling adverse environmental impacts and conserving natural capital, will be a major challenge. In this context, management of environmental impacts arising from extraction, processing, use, recycling and disposal of materials is essential. More coherent management policies are now necessary, combining integrated measures focusing on supply and demand. These will need to be based on reliable information on material and waste flows, and on resource productivity.

Global resource extraction

	World			OECD countries		
	Quantities extracted In 2002 (billions of tonnes)	**Development 1980–2002 (%)**	**Foreseeable development 2002–2020 (%)**	**Quantities extracted In 2002 (billions of tonnes)**	**Development 1980–2002 (%)**	**Foreseeable development 2002–2020 (%)**
Total	**55.0**	**36**	**48**	**22.9**	**19**	**19**
Metal ores	5.8	56	92	1.8	41	70
Fossil fuels	10.6	30	39	4.1	12	6
Biomass	15.6	28	31	4.5	11	6
Other minerals	22.9	40	54	12.6	21	21

Source : OECD, based on SERI (2006), MOSUS MFA database, Sustainable Europe Research Institute, Vienna, http://www.materiaflows.net, Giljum, et al. (2007).

Macroeconomic material flow accounting

Macroeconomic material flow accounts show, annually, all of the apparent flows:

- entering the economy,
- stored in the 'technosphere', in the form of infrastructure and durables,
- exiting the economy in the form of exports,
- discharged into the environment (emissions to the air and water, soil pollution, landfilled waste, etc.).

However, the approach also makes it possible to observe the so-called 'hidden' physical flows. In fact, every material or product imported, stored or exported weighs more heavily than by just its apparent weight, in terms of all of the physical flows used by an economy. Land, fuels and other materials have been mobilised (extracted, moved, discharged or consumed) for manufacture and transport, either within national boundaries or abroad. These hidden flows distinguish between unused domestic extraction and indirect flows associated with imports and exports. Mobilisation of these materials by an economy can have important environmental impacts such as soil clearance, impacts on

[1] *OECD Environmental Outlook to 2030. OECD (2008).*
[2] *Giljum* et al., *2007.*

natural habitats and endemic species, effects on aquatic environments, loss of soils due to erosion and degradation of landscapes.

The results presented here, for the 1990–2006 period, give an initial overall picture of the material flows mobilised by France at the macro-economic level without, for the moment, any further detail of the role of the different economic actors in relation to any given flow. The results constitute an essential part of the knowledge necessary for:
- political decision makers to analyse France's material needs and to orient strategic choices; and
- for economic actors, to gain a better understanding of their purchasing choices and behaviour, and to modify these if necessary.

Materials used by the French economy

Domestic extraction used (DEU) comprises all of the materials, solid, liquid or gaseous, extracted from the soil or subsoil within the territory and continental and marine waters. It has varied little overall in recent years and reached **700 million tonnes** in 2006. Construction minerals and biomass from agriculture constitute the main flows extracted within the territory.

Part of the materials mobilised within the territory during extraction, excavation and induced erosion are considered as 'unused' in the sense that they are not involved in subsequent transformation processes and are, therefore, without economic value. This **unused domestic extraction** was estimated at **504 million tonnes** in 2006. Excavated materials and biomass without economic value predominate.

The sum of the DEUs and the unused materials associated with their extraction gives an estimate of the **total domestic extraction: 1 204 million tonnes** in 2006.

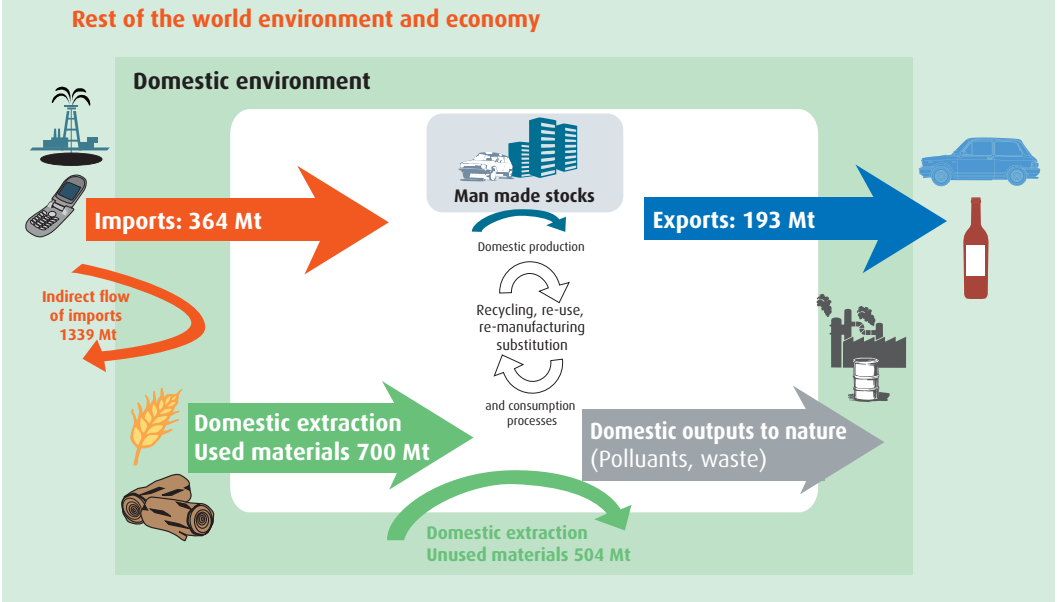
Imports (I), from raw materials to finished products, have increased (by weight) by one-third in 16 years, reaching **364 million tonnes** in 2006. They are made up of 67 per cent of fossil fuels, and of ore minerals and products derived from these resources. When the indirect flows associated with imports are included, the flow of imports accounted for at territorial borders is **multiplied by five**. The indirect flows are the materials mobilised to manufacture a product or produce a service ready to be imported, without being physically imported. A distinction is made between used indirect flows and unused foreign extraction.

Like imports, **exports** (E) have increased since 1990 (+20%), representing **193 million tonnes** in 2006. Biomass, metal ores and products derived from these two resources account for around two-thirds. Exports also have associated indirect flows.

Moreover, the nature of France's imports and exports has changed, tending towards finished products, which generate more associated indirect flows.

Domestic material consumption (DMC), is all of the materials physically consumed by the population present within the territory, excluding the hidden flows. It was estimated at **871 millions tonnes** in 2006. That corresponds to **13.8 tonnes per inhabitant**; it has not changed, overall, for 36 years. Domestic consumption is increasingly dependent on imports, particularly metal ores and derived products.

Material flow accounts diagram for France in 2006
in millions of tonnes (Mt)



Source: SOeS, 2009. Diagram according to Eurostat.

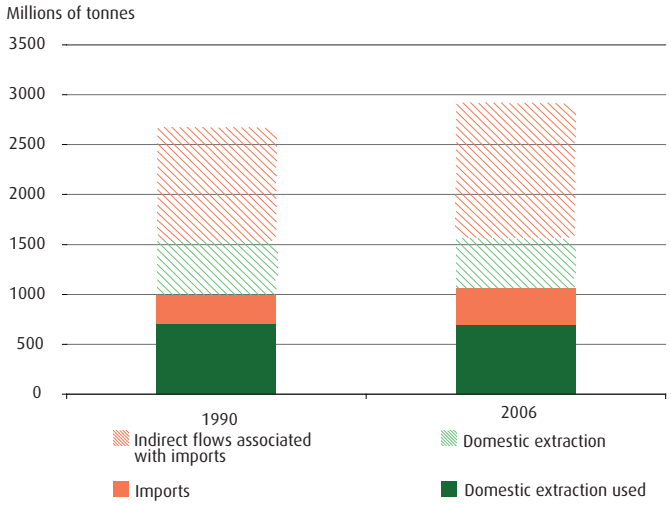
Greater material productivity but more materials mobilised

The French economy's total material requirement (TMR) corresponds to all of the materials required for the economy to function, mobilised within French territory or abroad. It can be estimated from all of the direct flows (domestic extraction and imports) and hidden flows (unused domestic extraction and indirect flows associated with imports). This total material requirement added up to **2 907 million tonnes** in 2006, i.e. around **46 tonnes per member of the French population**. 41 per cent of TMR was met from domestic extraction of raw materials and 59 per cent from imports. Direct flows account for only a little more than one-third, the other two-thirds consisting of hidden flows. This proportion reflects the importance of material flows that often go unknown.

Apparent material productivity (GDP/DEU + I), relative to direct flows only, has increased by 25 per cent in 16 years: i.e. the French economy produces more from the same quantity of materials. In 2006, 1 kg of material used directly generated €1.5 of GDP.

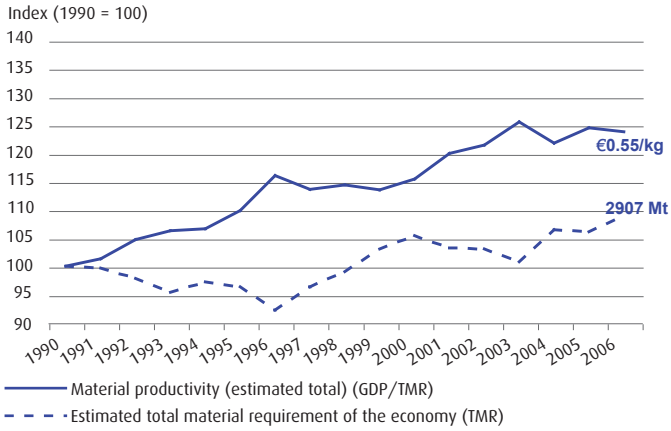
In 1990–2006, total material productivity (GDP/TMR), including hidden flows, increased by 23 per cent, but in this case 1 kg of all materials involved generated only €0.55 of GDP. However, the 9 per cent increase in the French economy's TMR corresponds to meeting the needs of the French population which itself increased, and of the rest of the world via exports. The total material productivity reflects the global impact, in France and abroad, of the flows of materials mobilised by France.

The economy's total material requirement



Source: SOeS. 2009 estimate.

Increase in material productivity and TMR



Source: SOeS. 2009 estimate.

Chapter 3
Sustainable Development and Environment

Footprints

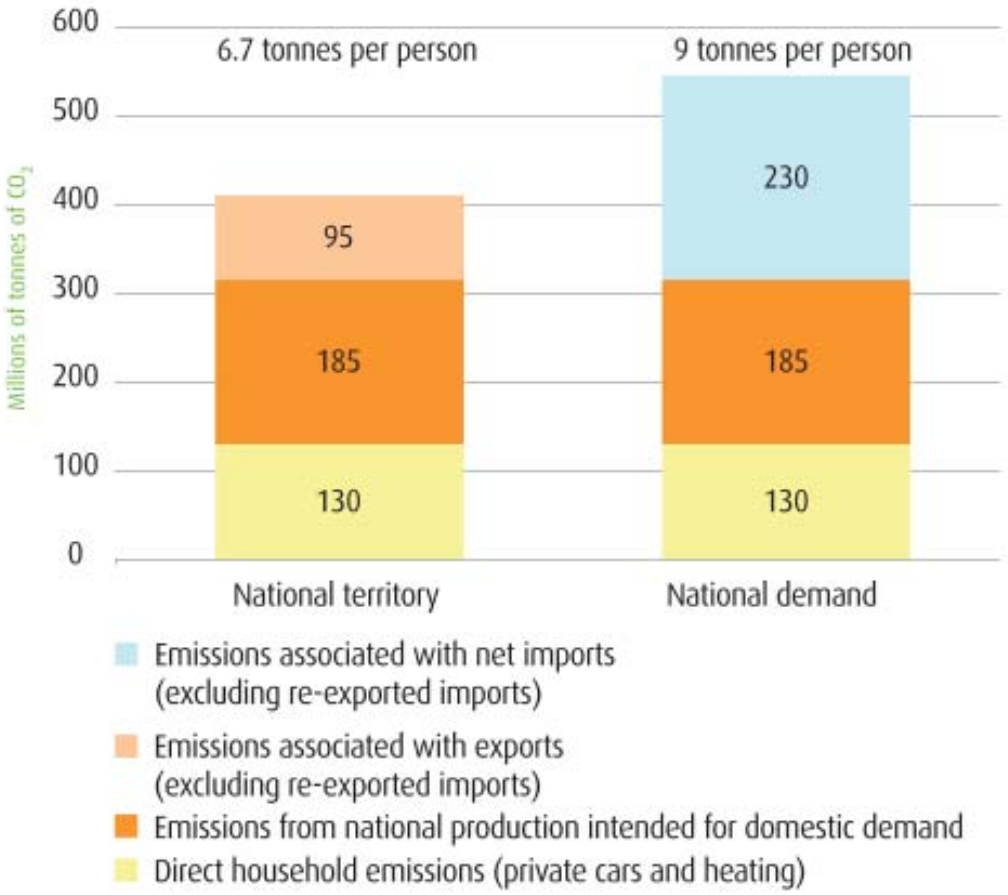
Carbon footprint, abstract from “National Sustainable Development Strategy Indicators 2010-2013“, *Repères*, february 2011 (2 pages)

Summary of “CO_2 and economic activities of France. 1990-2007 Trends and drivers of change“, *Études & documents n° 27*, august 2010 (4 pages)

Carbon footprint

The carbon footprint of a French individual inhabitant is 9 tonnes of CO_2 per year if foreign trade is taken into account, i.e. about 30% more than the amount emitted on the national territory.

Carbon footprint of the final national demand in 2005



Note: CO_2 emitted on the territory of Metropolitan France in 2005, excluding CO_2 from biomass burning for energy purposes and excluding use of land, its change and the forest.
Source: SOeS according to Citepa, Insee, Eurostat and EEA, 2010.

"Climate change and energies" key challenge

Issues

Greenhouse gas emission inventories prepared under the Climate Convention are established on the basis of the territorial perimeter of signatory countries. However, in the context of a globalised economy, it seemed necessary to take account of emissions relating to all goods and services consumed, including those generated outside the national territory, as well as transfers of activities to other countries (carbon leaks). Widening greenhouse gas emission monitoring from just the country's territorial perimeter to the equivalent CO_2 content of external trade can also assess the global impact of the country's consumption on the climate, a global public asset.

Analysis

An initial estimation was made in 2005. It showed that French imports emitted 230 million tonnes of CO_2 generated abroad to satisfy the final domestic demand (excluding re-exported imports), i.e. more than 40% of the carbon footprint of French demand. Under these conditions, the carbon footprint (estimated here for CO_2 only) of the final demand of each French individual is 9 tonnes per year, whereas an average of 6.7 tonnes of CO_2 per capita are emitted on the French territory.

For further information:

- http://www.statistiques.environnement.developpement-durable.gouv.fr, heading Environnement
- http://carbonfootprintofnations.com

Summary

Once the balance between emissions generated by imports and those generated by exports is taken into account, *France's final demand carbon footprint* is around 9 tonnes of CO_2 per person per year, i.e. 33 per cent more than the quantity of CO_2 emitted in France. In the 1990–2007 period, technological progress in France led to a reduction in the level of unit emissions of CO_2 from production and consumption. Overall, however, this reduction was offset by increased levels of production and consumption. The emissions from manufacturing industry as a whole nonetheless dropped by 10 per cent in the period. The total amount of CO_2 emitted in France in 2007 was almost identical to that emitted in 1990. Seventy per cent of emissions result from activities of production (companies and public administration). Thirty per cent are generated directly by households (cars and heating). Two-thirds of the CO_2 emissions from France's production arise from satisfaction of domestic demand; the other one-third is associated with exported production.

Combating climate change is now a priority issue in international discussions, with the aim of coordinating public policy on the global scale. In preparation for the post-2012 period of the Kyoto Protocol, the European Union member states have opted for an ambitious approach by adopting the legislative *climate-energy package*[1], of which the three main aims are now referred to as the 20-20-20 targets: 20 to 30 per cent reduction in greenhouse gas (GHG) emissions by 2020 in relation to 1990 levels; 20 per cent of energy consumed to be from renewable sources by 2020; and a 20 per cent improvement in energy efficiency[2] by 2020 in comparison with currently projected levels.

Monitoring of progress towards these objectives is based on the GHG emission inventory system put in place by the United Nations Framework Convention on Climate Change (UNFCCC). However, this system of accounting does not systematically link emissions with the activities and economic actors generating them, and fails to fully capture the international nature of economic activities. The study presented in this document, relating solely to carbon dioxide (CO_2) emissions, is based, essentially, on integrated economic and environmental accounts of the *National Accounting Matrix including Environmental Accounts* (NAMEA) type, which combine input-output tables (IOT) from national accounts with (physical) environmental accounts broken down in terms of economic activities ((Ifen, 2006).

The study covers, in order of presentation:

1) the CO_2 emissions generated in France, broken down by economic activity, and changes in those emissions in France between 1990 and 2007;
2) allocation of emissions to final demand;
3) factors influencing changes in emissions;
4) estimates of CO_2 emissions associated with imports in France.

On the basis of the accounting methods specific to the NAMEA methodology, a certain number of results, already stated elsewhere, are confirmed (reduction in CO_2 emissions from industry, and rise in those generated by the services sector, including transport), but are examined at a finer level of detail. These accounts also show the emissions generated directly by households (cars and heating systems): one-third of the national total (including use of biomass as fuel).

Attribution of emissions from domestic production to final demand, by combining emissions accounts with IOT, makes it possible to distinguish between two types of aspect: direct (fuel use) and indirect (intermediate consumption of products of which manufacture generates some CO_2 emissions). This approach reveals the underlying role of activities such as services and construction in the total of domestic production emissions, in spite of their relatively modest direct contribution. It also reveals that around one-third of CO_2 emissions from France's domestic production is generated to satisfy external demand (exports).

Analysis of the factors influencing changes in CO_2 emissions shows, at all levels (households and branches of the economy regardless of area of activity), gains made during the past two decades as a result of technological progress. However, given the increases in production and consumption, the amount of CO_2 emitted in France has, overall, remained stable.

Lastly, the initial estimate of CO_2 associated with imports gives an emissions balance for national final demand (including imports and excluding exports) considerably higher than that currently reported to the UNFCCC, which only includes the quantity of CO_2 emitted on national territory.

Breakdown of CO_2 emissions in France by economic activity, and variations between 1990 and 2007

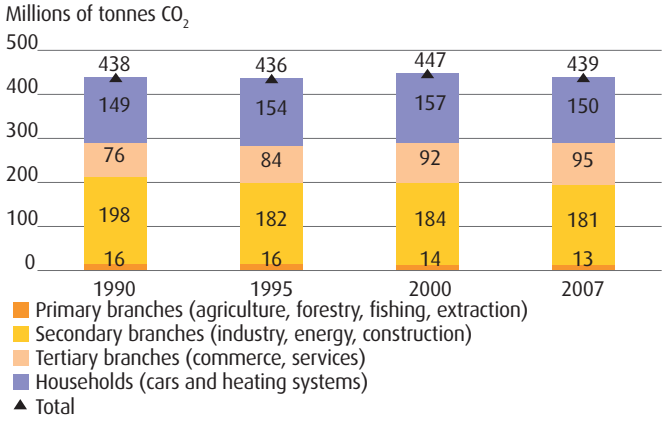
Around two-thirds of the total of CO_2 emissions (including from biomass used for energy) arise from activities of production and one-third arise directly from households (household space and water heating systems, cooking and private car use). This breakdown remained stable over the 1990–2007 period.

In 2007, residential emissions from households with their own heating systems (including hot water and cooking) accounted for 56 per cent of direct household CO_2 emissions: 38 per cent for fossil fuels and 18 per cent for biomass (mainly firewood). The total amount of CO_2 generated directly by households in 2007 is very close (+1%) to that for 1990 (the increase is 4.4 per cent excluding biomass used for energy). Residential emissions reduced by more than 5 per cent, whereas those from private vehicles increased by nearly 10 per cent.

[1] *The* climate energy package *comprises four legislative texts: directives 2009/28/EC, 2009/29/EC and 2009/30/EC and Decision 406/2009/EC) adopted by the European Council on 11–12 December 2008, approved by the European Parliament on 17 December 2009 and published in the Official Journal of the European Union on 5 June 2009 (no. L. 140).*

[2] *Energy efficiency here is seen from the macro-economic point of view and is expressed by calculating the energy intensity of the national economy (total energy consumed within national territory/gross domestic product).*

Breakdown of CO_2 emissions in France 1990–2007



Source: Citepa/SOeS.

Where branches of production are concerned, primary activities (principally agriculture as CO_2 from forestry, fishing and extractive industries are marginal in France) generate 3 per cent of the country's CO_2 emissions. Secondary activities (manufacturing industries, energy production and construction) generate a little over 40 per cent (15 per cent for energy production), and tertiary activities (commerce and services) around 22 per cent, of which 9 per cent arise from transport services)[3].

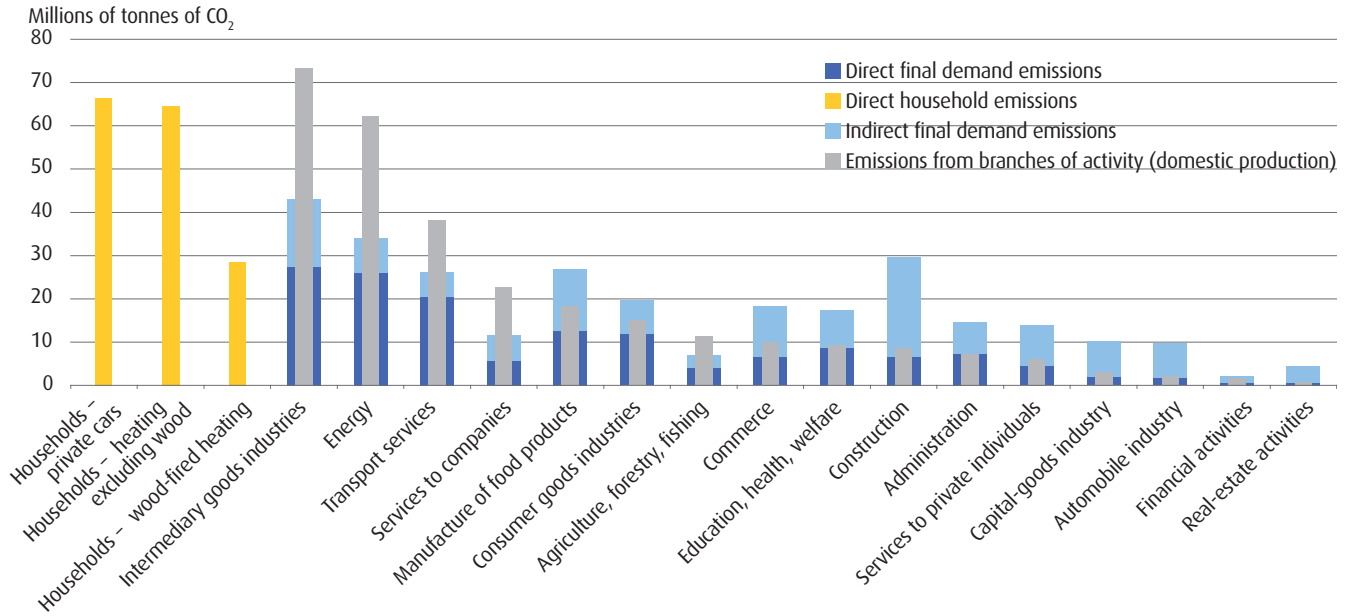
The total quantity of CO_2 emitted by production in the different branches in France in 2007 (289 Mt) was almost identical (- 0,4 %) to that for 1990. Emissions from industry reduced, overall, by 10 per cent while those from services increased by around 25 per cent; the increase was 35 per cent for transport services.

Allocation of CO_2 emissions from France's domestic production to final demand

The goods and services produced by companies and administrative activities are destined for direct final use in France (consumption by households and by administrative services, plus investment), for use abroad (exports), or for use by companies as intermediate consumption. Each of these types of consumption is embodied in a good or service destined, ultimately, for a final use, which it therefore indirectly contributes to satisfying.

A difference is observed between the distribution of CO_2 emissions from branches of activity and that for emissions associated with final demand for the corresponding products. The highest emitting branches produce intermediate goods that are consumed by other branches and used for production (e.g. cement, metals, electricity when used in industry). Conversely, some branches where production is a relatively low emitter are consumers of intermediary goods with high CO_2 content. This is the case for construction, using cement, or automobiles using metals. Some branches, such as chemistry and the food industry, generate high direct and indirect emissions.

CO_2 from domestic production vs domestic final demand, 2006



Reading the chart: companies in the construction sector emitted 8.6 Mt of CO_2 in 2006. In that same year, final demand in construction induced emissions of 29.5 Mt of CO_2 in France (imports excluded), of which 23 Mt arose indirectly via the CO_2 associated with manufacture for intermediate consumption in construction. (Some of the products of the construction branch are used as intermediary consumption by companies from other branches.)

Source: SOeS, based Citepa (emissions accounts) and Insee (IOT) calculations.

[3] This figure does not include the balance between the CO_2 emitted by French people abroad and the CO_2 emitted by foreigners in France engaged in international transport activities, as recommended by the residence principle which applies to Namea type accounts. Work has been undertaken by the SOeS with a view to applying this principle to the forthcoming version of accounts. For France, international air transport would be the main source of difference with the perimeter of national territory.

On this basis, allocating emissions to final demand indicates that consumption by France's households is responsible for 60 per cent of CO_2 emissions in France as a result of their consumption: slightly more than a third directly related to the use of their cars and heating equipment and slightly more than a quarter, via the production of companies, in order to satisfy their demand for goods and services. Public administration and non-profit organisations serving households (associations, foundations), on the one hand, and investment spending, on the other hand, account respectively for 8 and 9 per cent of these emissions. The remaining 22 to 23 per cent are linked to satisfying final demand abroad, via exports.

Factors for variations in France's CO_2 emissions between 1990 and 2007

CO_2 emissions result primarily from energy consumption[4]. However, the relationship between this consumption and the level of emissions, as well as the changes in energy consumption itself, depend essentially on technical and economic factors of which the respective importance warrants investigation. This is the purpose of the decomposition analysis of change in environmental pressures.

Improved technology of household equipment is offset by intensification of use

In addition to the general trend towards lower residential emissions and greater emissions from use of private cars, some similarities are observed in the role played by the different factors for changes in household CO_2 emission patterns. Whereas technical factors (CO_2 content of energy consumed and, above all, energy intensity[5]) have brought about a lowering of emissions, economic factors (the surface area occupied per person in the case of residential emissions and the distance travelled per person for the private car) and demographic factors have, conversely, driven emission levels upward.

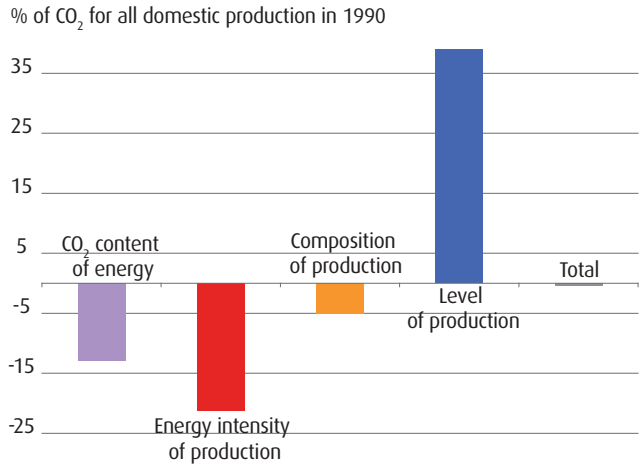
In both cases (car and household heating), there is a rebound effect, where improved environmental efficiency in the use of a resource or equipment is wholly or partially offset by increased usage of the resource or equipment. Here the reduction in average consumption per kilometre travelled or per square metre heated reduces the price of each of these, thereby allowing greater comfort or mobility at equivalent cost (in the case of residential emissions, this development has been influenced by the reduction in the average number of people per household).

Level of CO_2 emissions from production maintained in spite of relatively marked technological progress

All other things being equal, the results of technological progress (reduced energy intensity of production and reduced CO_2 content of energy used[6]) would have entailed a reduction of 33 per cent in CO_2 emissions for all branches of activity. However, given the scale of the counter-effect of the growth in production[7], the amount of CO_2 emitted in the different branches of activity in France in 2007 was more or less the same as in 1990.

This opposition between technological advance and greater volumes of production is observed, where CO_2 emissions are concerned, in most branches of activity. The effects of improved technology have outweighed those of increased production, notably for industry, whereas the converse is true for service activities.

Factors for change in CO_2 emissions from the different branches of activity between 1990 and 2007



Source: SOeS, calculations based on Citepa (emissions), CVS consultants (energy), Insee (production, chained-linked prices, baseline 2000).

Final demand, an important driver

Between 2000 and 2006, the increase in final demand would, other things being equal, have entailed an increase of more than 10 per cent in CO_2 emissions from domestic production, offsetting the effects of technological progress in the same period. This increase stems, primarily, from the increasing average standard of living (final demand per person) and very little from demographics (increase in size of the population)[8].

[4] Around 95 per cent of France's CO_2 emissions (excluding land use, change of use and forests) arise from energy consumption. However, for non-metallic mineral industries a significant part of CO_2 emissions is from decarbonation (formation of CO_2 from carbon contained in non-energy raw materials – e.g. limestone – under the effect of heat). This proportion is more than 60 per cent for cement and lime and around 20 per cent for glass and tiles/bricks. Citepa (2009b), pp. 38-39.

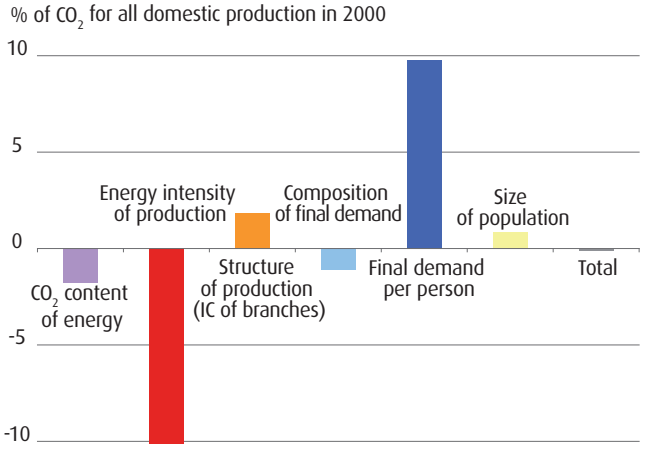
[5] Ratio of energy consumed to the service provided by the consumption (distance travelled, area heated).

[6] Energy intensity: ratio of energy consumed (expressed in physical terms) by a branch of activity or whole of the national economy to production (expressed in monetary terms) of the branch in question or the national economy. CO_2 content of energy: ratio of CO_2 emissions from a branch of activity to energy consumed by the branch.

[7] The breakdown of each effect 'other things being equal' used here does not allow appreciation of the degree to which growth in production has or has not encouraged technological development.

[8] In addition to the French population, the population concerned includes that of countries of destination for French exports.

Product-related factors for changes in CO_2 emissions (domestic production) between 2000 and 2006[9]



Source: SOeS, calculations based on Citepa (emissions), CVS consultants (energy), Insee (symmetrical IOT).

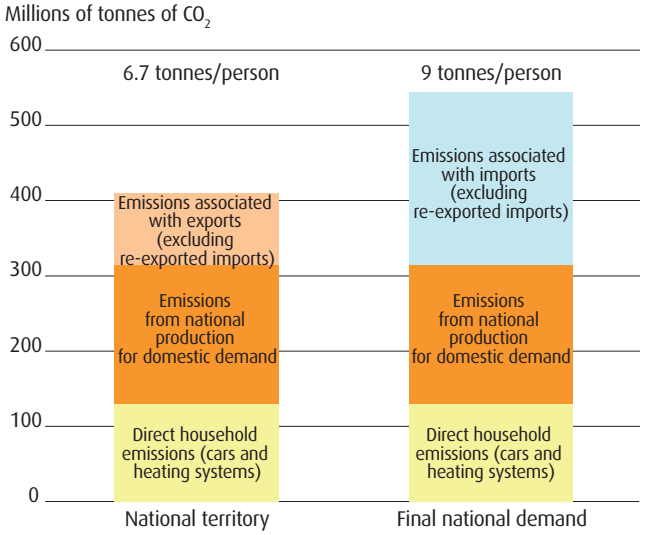
For all services and commerce, the cumulative effect of economic factors outweighs that of technological development over the period. Conversely, for industrial products taken as a whole, the effects of technological development are greater than those of economic factors.

Total quantity of CO_2 from France's final demand

In the context of a globalised economy it appears necessary to extend the current national monitoring of CO_2 emissions (and of GHG more generally) to monitoring of emissions associated with consumption by the populations concerned, in the interests of both effectiveness and equity of public policies to combat climate change. This supposes estimation of emissions associated with goods and services that are imported and exported[10].

Initial estimates for the year 2005[11] show all of France's imports to be directly and indirectly responsible for more than 340 Mt of CO_2. Part of these emissions, around 110 Mt, associated with the production of French exports (re-exported imports), cannot be allocated to French demand. All French exports, for their part, are the sources of 205 Mt of CO_2, of which 95 Mt are emitted within national territory and 110 Mt emitted in other countries (re-exported imports). The resulting balance of CO_2 emissions from France's foreign trade is 135 Mt, to be added to the 410 Mt emitted on national territory (excluding CO_2 from biomass used for energy), giving a total of 545 Mt of CO_2. This results is an increase from 6.7 tonnes of CO_2 per person per year on the basis of emissions in France to around 9 tonnes of CO_2 per person for the perimeter of France's consumption: an increase of some 33 per cent.

Domestic CO_2 emissions vs carbon footprint of French demand, year 2005



Source: SOeS, calculations based on Citepa, Insee, Eurostat and IEA.

As most of France's trading partners were other European countries in 2005, around 70 per cent of the CO_2 emission attributed to goods and services imported by France were generated in other European countries. Around 15 per cent were generated in Asia (including Middle-East), 7 per cent in North America, 6 per cent in Africa, 2 per cent in South America and less than 1 per cent in Oceania. The breakdown of countries for GHG emissions associated with France's exports is broadly similar.

[9] Breakdown based on a first version of symmetrical by volume IOT chain prices, baseline 2000). The calculations cover the 2000–2006 period because of availability of the necessary national accounting data.

[10] The resulting indicator was presented under the title Empreinte carbone de la demande finale nationale *(carbon footprint of national final demand) at the national conference on sustainable development indicators, organised jointly by the* Ministère de l'Écologie, de l'Énergie, du Développement durable et de la Mer, *the* Conseil économique, social et environnemental and the Conseil national de l'information statistique. *http://www.developpement-durable.gouv.fr/Indicateurs-du-developpement,14064.html.*

[11] These estimates use complete data (emissions and input-output tables) from five European Union member states (Belgium, Germany, Italy, Spain and the UK), countries of origin, in 2005, of almost half of France's imports in terms of value as well as CO_2 intensities of production per branch of activity in the countries, considered as representative for the other regions of the world (for more detail see chapter 'Total quantity of CO_2 from France's final demand').

Chapter 3
Sustainable Development and Environment

Research work: valuation of natural capital

Methods and reference values for valuation of services provided by wetlands, *Le point sur n° 97*, september 2011

COMMISSARIAT GÉNÉRAL AU DÉVELOPPEMENT DURABLE

le point sur

n° 97 EV
September 2011

Methods and reference values for valuation of services provided by wetlands

In order to carry out economic analyses on Wetlands (cost-benefit analysis), CGDD (General Commission for Sustainable Development) made a methodological study to evaluate the services provided by wetlands in the Regional Natural Park of Cotentin and Bessin (Normandy). It was thus able to establish reference values based on a solid methodology. The value of all the services was established in a range of 2,400-4,400 Euros per hectare. The study adopted a new approach combining different monetary valuation methods, including enquiries involving the population, to obtain values as comprehensive as possible. It demonstrates the relevance of using the willingness-to-pay method, particularly to value biodiversity, and of its complementarity with other methods.

ECONOMIE ET EVALUATION

DÉVELOPPEMENT DURABLE

Wetlands (marshes, estuaries, lagoons, bogs, lakes and ponds ... see glossary) are diverse, complex, fragile and extremely rich environments providing a variety of services. Threatened by human activities, these wetlands should be preserved. In order to prevent their artificial development, commitment No. 112 of the "Grenelle of the Environment" thus plans the purchase of 20,000 hectares of wetlands by 2015 by the Coastal Protection Service and Water Agencies. Then it may be useful to give a monetary value to the services provided by these areas; these values can be integrated into cost-benefit analyses. To achieve the latter, it will be necessary to establish baseline scenarios in which the type of land use after disapearance of wetlands should be defined.

A reference value per hectare

The present study has estimated the Total Economic Value (TEV), i.e. all services provided by wetlands (see glossary), the wetlands of the Regional Natural Park (RNP) and marshes of the Cotentin and Bessin, straddling the Departments of Calvados and Manche (Normandy). It concludes with a total economic value being in a range between 117 and 218 million Euros a year for an area of 49,000 hectares. The value per hectare, without differentiating the types of wetlands, is thus between 2,400 and 4,400 Euros (Figure 1). The differences in the ranges are due to the calculation assumptions used: population bases for services with aesthetic and recreational value and biodiversity, prices for the services provided to groundwater recharge (aquifer) and agriculture.

A new valuation of the Total Economic Value

On the average, these results are well above the figures recorded by a previous study carried out in 2009 by CGDD which obtained a range between 900 and 3,100 Euros on the basis of two approaches [4 and 5]:

- Bibliographical review of fifteen French studies estimating these benefits between 900 and 3,100 Euros per hectare ;

- A meta-analysis conducted by a Dutch team (Brander et al.) on 89 sites worldwide establishing the value of benefits at 1,600 Euros per hectare.

This difference between the results obtained for the RNP and those recorded in 2009 is largely due to the fact that the new study expands the number of services taken into account by adding climate regulation, inputs to agriculture and shellfish farming, educational and scientific value in particular.

A methodology that aims to avoid double counting

The new valuation was inspired by the work done as part of the Millennium Ecosystem Assessment (MEA) which classifies the ecosystem services provided by wetlands into four categories :

- Support services : soil formation, nutrient cycle, water cycle, habitat for animal species,

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Figure 1 - Values per hectare of the services provided by RNP's wetlands and marshes of Cotentin and Bessin (in Euros) *

Services provided by wetlands	Min.	Max.
Regulation services		
➢ Aquifer recharge and support to law water	190	370
➢ Water purification	830	890
➢ Climate regulation	1,800	1,800
Production services		
➢ Agriculture	585	750
➢ Shellfish farming	120	120
Cultural services		
➢ Hunting	170	340
➢ Amateur angling	165	230
➢ Educational and scientific value	10	15
➢ Aesthetic and recreational value	290	1,170
➢ Association with the site	Not valued	Not valued
➢ Biodiversity (non-use)	225	870
Total Economic Value of wetlands	**2,400**	**4,400**

** The Total Economic Value per hectare is obtained by simply dividing the Total Economic Value by the number of hectares of wetlands on the site. It is not the sum of individual values per hectare of different services, the latter being unevenly provided on the surface areas.*

Source: CGDD

- Regulation services : climate regulation, flood alleviation, aquifer recharge, erosion control, waterpurification, protection against storms and floods,

- Production service: freshwater, food and materials, fuel, genetic resources, pharmaceutical and medical resources,

- Cultural services: recreational, aesthetic, educational activities, spirituality and inspiration.

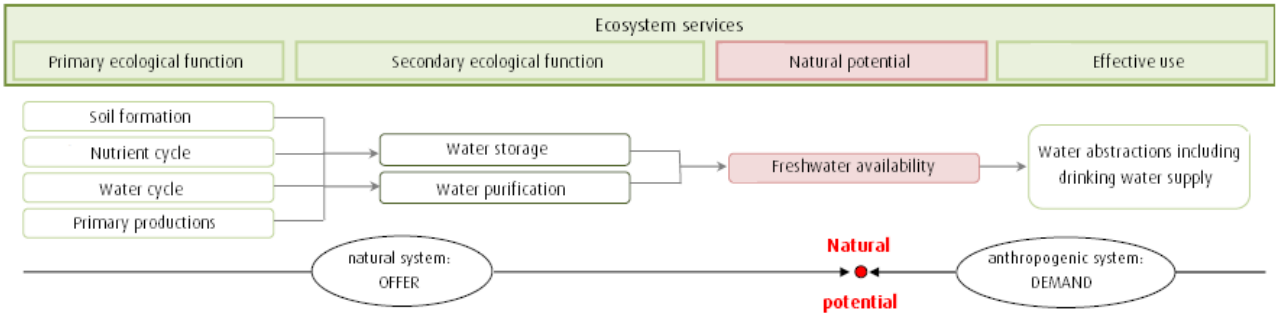
Structuring these services was then developed in order to avoid double counting. While the list of services offers a clear vision of the advantages (or benefits) provided to Man by wetlands, it does not value the maximum efficiency in economic terms. For example, the services of water purification, groundwater recharge and freshwater production overlap, the first two allow the expression of the latter, which could generate double counting.

Ecosystem services have been organised in a "logic chain" which reflects the passage from ecosystem functionality to service provision and its use (and thus benefit) by mankind (Figure 2). As an example, the economic valuation of the drinking water production service will then be done through the use (actual use) or through the services that contribute to this use (water purification and water storage).

Taking into account the natural potential

This structuring also helps highlight the notion of "natural potential" bordering the provision and demand for services. This concept of potential especially allows understanding, in an operational manner, the option value (rarely explained in the usual economic analysis), which would result from possible future use of the natural potential after human interventions that would facilitate its access (see glossary).

Figure 2 – Principle of logic chain applied to the drinking water supply service



An extensive use of evaluation methods

This work carried out on the RNP allowed combining for each service all the existing monetary valuation methods to finally keep the most appropriate for each type of service. The following methods were used:

- Methods based on the cost which infer the value of wetland (or more often of one of its functions) from the costs that would be incurred if it were to disappear. These methods have been used for one component of the water purification service;

- The revealed preference methods that infer the value of services provided from actual decisions made by individuals and observed on a market. These methods have been used for the service of aquifer recharge in particular;

- The benefit transfer methods, using the results of similar existing studies. These methods have, for example, been used for the service of educational and scientific value;

- The stated preference methods were also used to supplement the economic values obtained when using other methods. They were selected for the evaluation of services of aesthetic value and (non-use) value of biodiversity.

A stated preference articulation with other methods

Methods based on costs or revealed preferences allow measuring use values (see glossary), or possibly option values. For non-use values (existence values and bequest values) that cannot be determined by these methods, it is necessary to ask directly to the people to declare their willingness to pay to preserve the environmental goods and services studied.

A stated preference survey was therefore conducted to estimate willingness to pay. Its objective was to measure the values that could not be estimated by other methods (biodiversity) and to check the robustness of these results on other services (water purification, aesthetic and recreational value) by comparing them to the use values measured by other methods, a priori more robust. The survey used the method of joint analysis.

A survey using joint analysis proposed to respondents to choose between several scenarios consisting of different arrangements of the study site. Each scenario was proposed with a price that the respondent should pay if he kept that scenario. Prices and attributes of the scenarios are randomly chosen to obtain, after the enquiry, the average value given to each attribute.

Willingness to pay depending on the services

The questionnaire was drafted to distinguish the willingness to pay for different services in order to link the survey results with those of other monetary valuation methods used. It was selected to propose scenarios related to biodiversity, purification capacity, status of the landscape and accessibility. Biodiversity was selected by making the assumption, *a priori* reasonable, that this concept would mainly cover non-use values that could be legitimately added together with other calculated values with no risk of double counting. Indeed, the use value of biodiversity is largely or entirely evaluated through ecosystem services. Willingness to pay for purification services could be directly compared with the values obtained with other methods. The introduction of landscape into the scenario attributes aimed to estimate use and non-use values for the service of aesthetic and recreational value. Willingness to pay for maintaining the services provided (services of water purification, aesthetic and recreational value, biodiversity) by the marshes of Cotentin and Bessin is, on the average, 39 Euros per year per person for the sample of people surveyed (Figure 3). Multiplied by the population (population of Basse-Normandie for the low case, and population of Basse-Normandie + neighboring departments for the high case), this figure provides the value for the whole study area.

Figure 3 : Valuing biodiversity and water purification services, the aesthetic and recreational value of the marshes of Cotentin and Bessin (Per person per year)

Service	Willingness to pay
Biodiversity	9 Euros
Water purification	15 Euros
Aesthetic and recreational value	15 Euros
Total	**39 Euros**

Source: CGDD

A significant contribution of willingness to pay

For the purification service, subject to reasonable assumptions about the population to be taken into account to allow passing from individual willingness to pay to total willingness to pay, the values provided by the survey are of an order of magnitude quite comparable with the values provided by other methods. This validates the use of this method. Thus, adding the values obtained by different methods on different services seems legitimate.

The use of willingness to pay largely allows obtaining the total value (20 to 45% depending on the extreme ends of the range in this case). It provides a significant supplement, which cannot be substituted, to other monetary valuation tools. Its use here has been proven to be complementary to methods using the costs to approximate the value of services corresponding to non-

use values (biodiversity) or use values in the case when a market equivalent is not easy to build (aesthetic and recreational value).

This study shows that the use of different monetary valuation methods, including a survey to measure willingness to pay, is possible and allows the best use of the advantages of the different methods without suffering from their disadvantages.

Glossary

Total economic value (TEV): The concept of total economic value provides an overall measure or the economic value of any environmental goods or services.

It is divided into use and non-use values (which are themselves broken down into subcategories).

Use-value: value related to the satisfaction of using or being able to use environmental goods in the future.

Option value: use value given to the conservation of an asset for future use (for example, the preservation of a plant known for its medical value). It belongs to both categories, use value and non use value.

Non-use value: the value related to the satisfaction of knowing that an asset or a desirable state of affairs exists. These values are often linked to notions of justice or respect for nature and help justify the protection of species or known natural sites.

Existence value: non-use value merely related to the fact that something exists.

Bequest value: non-use value associated with the will for conservation for future generations.

Wetlands: Wetlands are transition zones between terrestrial and aquatic environments. They are characterised by the permanent or temporary presence of fresh, salt or brackish water on the surface or at very shallow depth in the ground. This interface explains that wetlands are among the richest natural environments in ecological terms. They host a wide variety of specific plant and animal species.

For more information :

[1] **Evaluation économique des services rendus par les zones humides – Enseignements méthodologiques de monétarisation**, Etudes & documents n°49 - CGDD septembre 2011 - Studies and Documents No. 49 - Economic valuation of the services provided by wetlands – methodological findings for monetary valuation, CGDD September 2011

[2] **Evaluation économique des services rendus par les zones humides - Complémentarité des méthodes de monétarisation,** Etudes & documents n°50 - CGDD septembre 2011 - Studies and Documents No.50 - Economic valuation of the services provided by wetlands – Complementarity of monetary valuation methods, CGDD September 2011

[3] **Donner une valeur à l'environnement : la monétarisation, un exercice délicat mais nécessaire**, La revue du CGDD - décembre 2010 - The CGDD journal - Giving a value to the environment: monetary valuation, a delicate but necessary exercise, CGDD December 2010
Donner une valeur à l'environnement : la monétarisation, un exercice délicat mais nécessaire

[4] **Evaluation économique des services rendus par les zones humides**, Etudes & documents n°23 - CGDD 2010 - Studies and Documents No. 23 - Economic valuation of the services provided by wetlands, CGDD 2010
Evaluation économique des services rendus par les zones humides

[5] Le point sur n°62 - **L'évaluation économique des services rendus par les zones humides, un préalable à leur préservation**, CGDD septembre 2010 – Review on No. 62 - Economic valuation of the services provided by wetlands, a prerequisite to their preservation, CGDD September 2010
L'évaluation économique des services rendus par les zones humides, un préalable à leur préservation

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Rédactrice en chef
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ISSN
2100 - 1634

Dépôt légal
Septembre 2011

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Impression : imprimerie intégrée du Meddtl, imprimé sur du papier certifié écolabel européen www.eco-label.com

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