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An ever less carbonated Union?

Towards a better European taxation against climate change

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Towards a better European taxation against climate change

by Eloi LAURENT and Jacques LE CACHEUX

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Introduction: 20 years later

> « **W**ith the completion of the Internal Market, the European Community will be the biggest economic/trading partner in the world with the potential to exercise an important level of moral, economic and political influence and authority. As such the Community owes it to both present and future generations to put its own house in order and to provide both leadership and example to developed and developing countries alike in relation to protection of the environment and the sustainable use of natural resources ».
>
> *A Community Strategy to limit Carbon Dioxide emissions and to improve energy efficiency, European Commission, 1991.*

Nearly two decades have passed since the first meeting, in autumn 1990, of environment and energy ministers where the subject was the stabilisation of carbon dioxide emission in the European Community. Barely two years after the creation of the IPCC (Intergovernmental Panel on Climate Change), Europe was gaining a major head-start on the crucial question of climate change. Only a year later, on

14 October 1991, the European Commission proposed creating an economic instrument which might revolutionise European tax systems and induce a lasting reduction in the carbon intensity of both production and consumption. This was the European carbon tax.

Since then nearly 20 years have been lost, and this project is today more necessary than ever. The European Union has become the incontestable leader in the world's fight against climate change, the only power able to push global negotiations towards reasonable solutions. But Europe's environmental strategy still lacks cohesiveness and even credibility. The powerful economic instruments at the EU's disposal deserve to be made more coherent in order to bolster Europe's comparative ecological advantage.

This study will propose a reform of Europe's tax regime for carbon – a reform both of the European carbon permits market and of the individual carbon tax regimes – in order to establish a "European carbon price" as close as possible to the scientific consensus.[1] In choosing this new ambition, the EU would be working in its own interest in three ways: in its geopolitical interest, assuming its historical responsibility for climate change in the eyes of the emerging and developing world, and guaranteeing its energy independence; in its economic interest, strengthening its position as the least carbon-intensive developed economy in a world where "green growth" will dominate the future; and in its democratic interest, helping to mitigate the risk of extreme climatic events, which will be a critical danger to the Union's most vulnerable citizens. It would also be working, in an even more fundamental sense, to open new horizons, with a new ideal which might help strengthen the bonds – somewhat enfeebled – between member states.

The Union would also be revisiting its origins, since energy policy was a foundation of political unity in Europe. The ECSC was an institutional laboratory for the future Rome treaties; its aim was to place in common the raw materials of war in order to make such war impossible. Today Europeans need to control their economic development to prevent its exhaustion, and to relaunch sustainable growth in living standards. The development of coal production was at the heart of the ECSC; the

1 On this idea, see box 1

reduction of carbon consumption must now mobilise the European Union. This study proposes to place carbon-tax reform at the heart of this ambition.

A clarification is in order. In the pages that follow we will not examine the validity of European climate-change objectives (cf. infra). What concerns us here is the degree to which objectives fit instruments in the EU as, too often, there is a damaging gap between them.

I - The past and the future of an ambition

How are we to understand that the European Community came so close to creating a European tax on carbon in 1991 and that so little progress has been made since then to take the step? It is firstly necessary to understand the genealogy of what might be called the European carbon policy, before making our analysis of the policy and formulating proposals to reform it.

As already mentioned, the story begins in 1991 with the European Commission's communication, "A community strategy to limit the emissions of carbon dioxide and improve energy efficiency". The proposal, whose details we will return to, aimed to institute a hybrid community tax on energy and carbon (in equal measure). The project was clarified by a communication of 30 June 1992 and submitted for the consideration and approval of member states. It was initially rejected due to opposition by the United Kingdom, which was not prepared at any cost to see the Community get involved in national tax affairs[2]. It was rejected a second time in 1994 when the Commission proposed an amended version of the plan allowing member states to determine their energy taxation together or separately, but with

2 In 1993 the Clinton administration also envisaged a tax on energy, and was obliged to abandon the plan under the pressure of energy and industrial lobbies.

guidelines and common target values. A major difference with the two first projects was the fact that this taxation was no longer conditional on equivalent efforts from other OECD countries. The proposal also included the possibility of compensating for the tax's impact on competitiveness in energy-intensive sectors (the notion of "carbon leakage" appeared around this time in European vocabulary).

The Commission's plan was rejected a third time in 1997[3], even though the new version proposed no more than coordination of energy tax regimes, using existing dispositions for mineral oils (Directive on mineral oils 92/82/EEC), rather than harmonisation of national measures (the plan mentioned the obligatory "flexibility" accorded to member states, a priority which needed to be compatible with "common rules"). The directive included the following clauses:

> ***Article 4***
>
> *1. The levels of taxation which Member States shall apply to the energy products listed in Article 2 may not be less than the minimum levels prescribed in this Directive.*
>
> ***Article 5***
>
> *1. Member States may apply differentiated rates of taxation according to the use or quality of a product provided that they respect the minimum levels of taxation set out in this Directive and that they are compatible with Community law.*

It was not until twelve years after the first text that a decidedly pale directive on energy taxation was adopted in 2003. It is true that this directive widened the range of energy products concerned by community law (to natural gas, coal and electricity), but it only proposed differentiated minimum tax rates on these products, rather than the integrated taxation envisaged at the beginning of the 1990s. At the end of this process, then, the only imperative that member states must follow in the area of energy taxation is the following: establish minimum rates for the products covered by the 2003 directive.

3 Proposal for a Council Directive restructuring the Community framework for the taxation of energy products COM/97/0030 final (97/C 139/07) COM(97) 30 final - 97/0111(CNS) http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:51997PC0030:EN:HTML

And yet, in parallel to the first European efforts, four Nordic countries – of whom only one was a member of the EU – were able to put in place a tax on carbon: Finland and Sweden in 1990, Norway in 1991 and Denmark in 1992[4]. A second wave of green energy taxation would follow these first measures in the mid to late 1990s, in the Netherlands (1996), Slovenia (1997), Germany (1998) and the United Kingdom (2000).

Given these repeated failures and despite these national policies, Europe's strategy for fighting climate change has resolutely taken the path of a "Coasian solution" to its emissions of greenhouse gases (GHGs) (see box 1). As centrepiece of this strategy, the EU emission permits market was created in January 2005, in application of the Kyoto Protocol (cf. infra). Renouncing the idea of a common regional tax regime, Europeans have thus ended up adopting an economic instrument to which they were initially opposed during international negotiations and which the United States managed to impose as the central mechanism of the Kyoto Protocol.

This solution might appear to be the only practical one, allowing the problem of unanimity in tax matters to be avoided. But such a strategy does not lack an economic basis. Emission permits markets theoretically guarantee that a given level of emissions will not be exceeded, in such as way that they are well calibrated to become instruments of simulation models which function by thresholds (of temperature, of concentration and of emissions). In addition, these markets are particularly suited to centralised pollution patterns resulting from a small number of controllable actors. Lastly, in terms of political economy the markets are better accepted by business than a new tax.

Twenty years later, the legal and institutional problem which led the European authorities to abandon a common ecological tax remains, even if new means exist to surmount it (cf. infra). However, the economic logic behind the exclusive use of emissions markets is today contested on four fronts: the types of pollution of most concern – because most dynamic – are diffuse and therefore not covered by the European carbon market; the market itself shows worrying signs of weakness

4 It is certainly possible to speak of a "Nordic model" of environmental tax reform (we will return to this in detail in the third part of the study with the Swedish experience). Its main characteristics are, firstly, to form part of a general reform of compulsory taxes, and, secondly, to be carried out by means of public involvement aiming at social consensus. On the question of the growth and governance strategy of "Nordic model" countries and in particular on the case of Sweden, see for example Grejbine and Laurent (2008).

and seems not at all to be reducing uncertainty; the problems associated with "carbon compensation" in particular are reducing the market's ecological efficiency, already affected by the quasi-competitive derogations obtained by member states; and the concessions made to business seem too large, posing the question of "ecological equity".

The European Commission itself (European Commission, 2007) seems ready to rethink the effectiveness of Europe's economic instruments against climate change, including the tax tools. What is more, the Swedish presidency of the EU (July-December 2009) was quick to highlight its wish to advance the debate on European environmental taxation, and even explicitly evoked a "European carbon tax".

The position taken by this study is fully inscribed into the current European debate. We do not aim for a gradual but total replacement of emissions markets by tax instruments, which have their own flaws and gaps (see below). It is more important both to "taxify" these markets to better assure their ecological effectiveness and to complement them by tax instruments – which can be put in place according to different scenarios. A European carbon tax system improved in this way – because integrated and coherent – is the solution that is capable of reducing the carbon intensities of our economies. Before imagining the practical details of this new system, we first need to examine the current state of European emissions, in order to understand why new instruments are needed.

Box 1: Social objective and economic instruments in the fight against climate change

Financial analysis of environmental questions is based on the simple idea that the price system undervalues the utilisation of natural resources. In actual fact, the social cost of the consumption of these resources is often superior to the private cost. In theory there are three possible causes of this undervaluation: poorly defined property rights, poorly understood externalities, and poorly targeted public subsidies. It is therefore a question of knowing how to recreate the "ecological truth" of prices where the goods depend directly or indirectly on the use of natural resources. In the case of climate change, how can the price system be obliged to reflect the social cost of the intensive use of carbon in today's society? This question relates to two dimensions of public policy: the ecological objective (the "social" price which must reflect the "social" cost of carbon and be determined by the public authority); and the instruments used to achieve this objective (regulation, emission permits market or environmental tax).

The notion of a social price of carbon rests on two imperatives. The first is to take into account the negative externalities attached to the use of carbon in the economy – externalities which need to be "repatriated" within the price system, which implies calculating their cost and thereby, for example, flexibly assessing climate change's damage to the community. The second "social" dimension of the carbon price is related to the effect of this price on consumers and producers in the present and future. The carbon price is thus a "signal" sent to society to bring it to realise the real cost of its economic practices. Determining empirically the social price of carbon is therefore particularly complex, and in practice depends on different methods (social cost, aggregate or marginal; damage; cost of emissions allowance), on a multitude of projections (including that of fossil energy prices) and on certain critical criteria – of which the first is the environmental objective sought (for example, a given maximum concentration of greenhouse gas in the atmosphere) and the rate of conversion to current values (dependent in particular on the degree of intergenerational equity, a normative choice falling to the current residents of the planet).

There have been many exercises to determine the social price of carbon over the last few years (the table below presents three recent governmental examples*). Their essential hypotheses are similar, but it is not surprising that medium- and long-term results can differ markedly. Nevertheless, assuming hypotheses are made explicit, it is possible to define a social price of carbon – and therefore, in the European Union's case, a "European price" of carbon (in the long term, it is of course desirable that this price be harmonised worldwide).

Price of a ton of CO2 in 2008 euros

	France	United-Kingdom	EU
2010	32	40	--
2020	66	49	40
2030	100	60	55
2050	200	88	85
Objective of concentration (ppm)	450	450-550	450
Discount rate	4%	3.50%	4%

France : Commission Quinet (2008)
UK : DEFRA study (2007)
EU : IMPACT study (2007)
Source : Commission Quinet (2008)

To reach this objective, economic instruments must be used which will allow the value of environmental resource use to be as close as possible to the social value desired. Three public policy solutions may be envisaged: regulatory, Pigouvian and Coasian.

The regulatory solution, or regulation policy ("command and control"), consists of imposing on producers and consumers compulsory standards which respect environmental objectives as defined by the public authority. The "Coasian solution" (inspired by an article by Ronald Coase, 1960) rests on the idea that once property rights are correctly defined and distributed, the market can efficiently reduce environmental evils such as greenhouse gas pollution. The role of the state is to create a "market for rights to pollute", whose "cap" it defines and whose free functioning will result in a "trade" of permits between companies – in turn determining the social price of carbon. The "Pigouvian solution" (posited by Arthur Cecil Pigou, 1920) aims to use tax to modify relative prices and thereby incite actors to better integrate environmental preservation into their plans for consumption and production. This implies the creation of environmental "eco-taxes" which, in the case of climate change, take the form of a carbon tax.

* For a wider selection of the research on this subject, see in particular Tol (2002a et 2002b), which also notes large gaps between the recommended values in different studies examined.

II - The state of GHG emissions in the European Union

The last full inventory of greenhouse gas emissions by signatories of Annex I of the Kyoto Protocol leaves no doubt as to the European Union's position as leader in the fight against climate change. The 15 EU countries committed themselves to reducing their emissions by 8% against the 1990 level by 2012; the reduction was 4.3% between 1990 and 2007. In the same period, the 27 EU countries together reduced emissions by 9.4%. It is a better showing than Japan (+8.2% for a target of -6%), the United States (+16,8% for a target of -7%), Canada (+26.2% instead of -6%) or Australia (+30% instead of +8%). The EU-US comparison is particularly striking: provisional figures show that American emissions grew by 1.4% between 2006 and 2007 while the EU 15 recorded a reduction of 1.5%. This indicates that the transatlantic gap since 1990 is now passing 20 percentage points. The EU 15 emits 40% less greenhouse gas that the United States, with a GDP 10% higher and a population 20% higher.

By the same token, detailed comparison of the change in emissions since 1990, both by inhabitant and by wealth level (carbon intensity of growth) confirms the ecological lead of the EU-15 states over other developed countries[5].

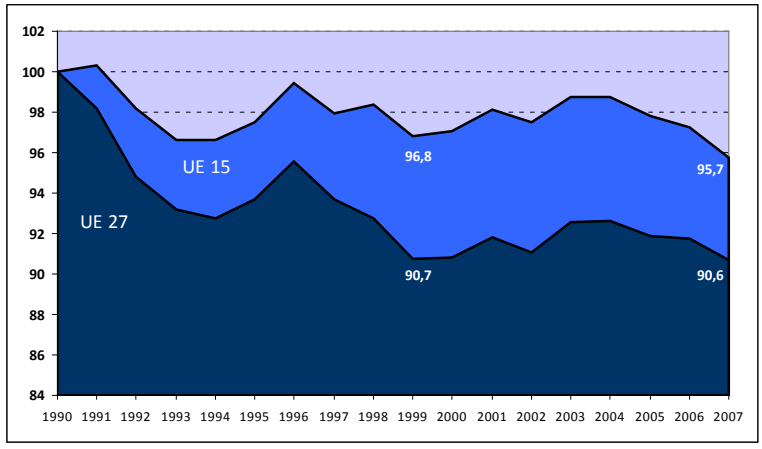
5 See for example the data gathered in the 2007-08 edition of the United Nations Human Development Report, available at http://hdr.undp.org/en/reports/global/hdr2007-2008/

The European strategy of sustainable growth, reflected by the course of sustainable development chosen at the European Council of spring 2007 and confirmed by the adoption of the "climate and energy package" in December 2008, is both compatible with the scientific consensus and realistic. If the EU 15 achieves its Kyoto target on time and then follows the calendar planned, it will almost meet the developed-country targets of the International Panel on Climate Change (IPCC) for 2020 (of which the lowest variant aims for a reduction of 30% since 1990). With redoubled effort, it may then achieve the IPCC's target for 2050.

The EU is thus able to play a pivotal world role, since it is formed of developed countries which are also low-carbon economies. These countries share the same environmental concern and can make use of common institutions and a longstanding culture of cooperation backed up by powerful economic instruments.

Nevertheless, this relatively favourable picture must be qualified in three ways. Firstly, the performance since 1999 is substantially weaker than that since 1990 (see graph 1) (-0.1 for the EU 27 and -1.1 for the EU 15, against -9.2 and -3.2 respectively for the period 1990-1999). This suggests that the EU is not yet on a trajectory of low-carbon growth, and that it must thoroughly reform its production and consumption methods if it is to reach its ambitious medium- and long-term goals.

Graph 1. GHG emissions for the EU 15 and the EU 27, 1990-2007 (1990 = 100)



Source : European Environment Agency (EEA). All EEA data presented in this study is available free of charge on the EEA site.

Secondly, Europe's performance is not homogenous: it varies markedly between economic sectors, which make unequal contributions to European emissions (table 1).

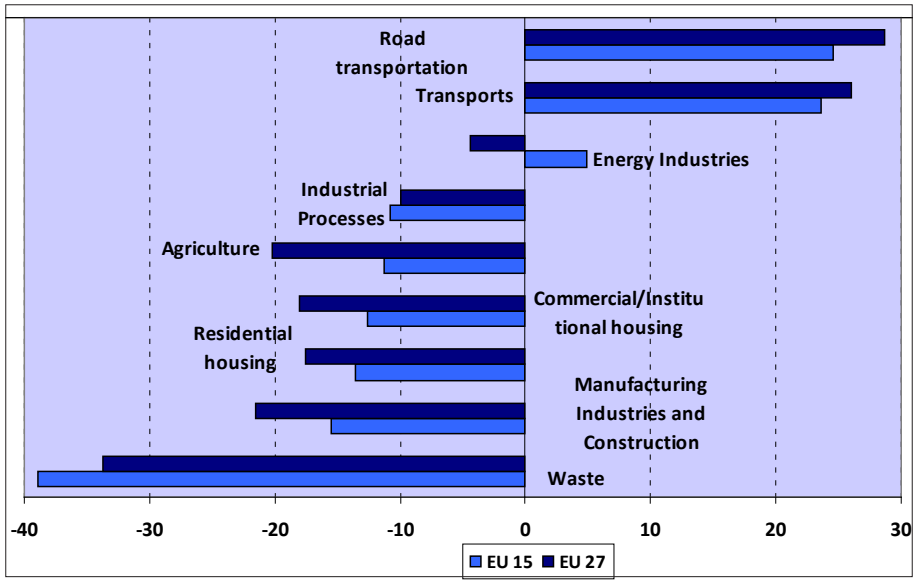
Table 1. Shares of economic sectors in European GHG emissions, 2007, in %

	EU 15	EU 27
Energy industry	30.1	31.9
Transport	21.3	19.5
total	51.4	51.4
Manufacturing industry and construction	13.0	12.7
Agriculture	9.2	9.2
total	73.5	73.3
Residential housing	8.9	8.5
Industrial processes	8.2	8.5
total	90.7	90.3
Commercial and institutional housing	3.5	3.3
Waste	2.6	2,8
total	96.8	96.4

Source : EEA.

An obvious problem is road transport, whose contribution to climate change is climbing without apparent limit (see graph 2). The emissions of the transport sector (90% due to road transport) represent 19% of the EU 27's total (21% of the EU 15), just behind energy (30% for the EU 15 and 32% for the EU 27) – whose contribution is increasing in the EU 15 but slightly lower since 1990 in the EU 27. In other words, more than half of GHG emissions in the EU are subject to worrying and unsatisfactory change.

Graph 2. GHG emissions by sector, change between 1990 and 2007, in %

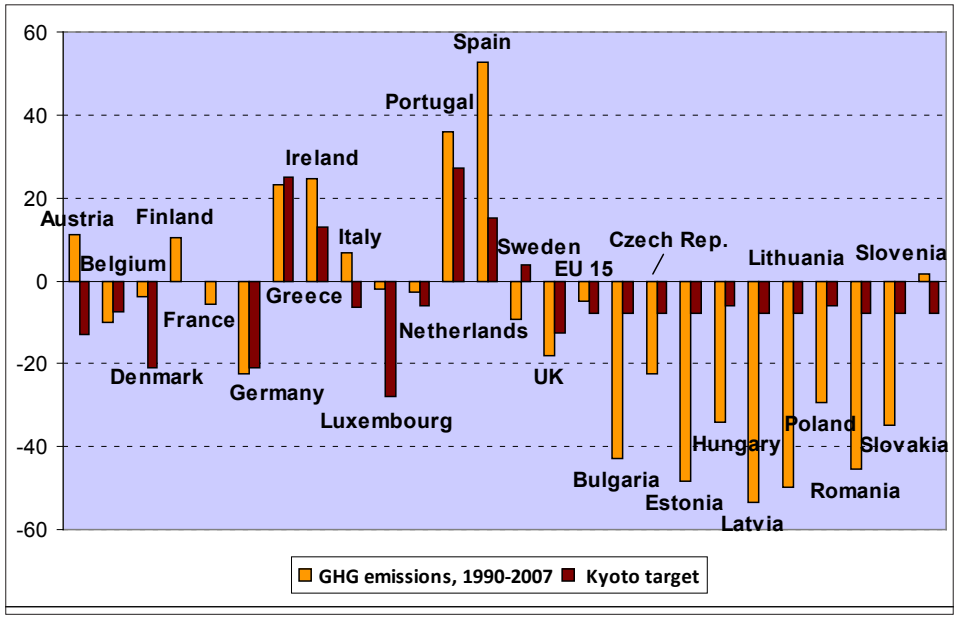


Source : EEA.

Lastly, member states are not progressing at the same rate towards their Kyoto objectives. This indicates a lack of cohesion in Europe's environmental strategy – whose success depends precisely on its overall coherence. It is not just a matter of performance – which in itself is not a problem because the EU benefits from a group agreement allowing it to apportion targets between members of the EU 15. The problem is the distance between performances and objective. This suggests that certain member states compensate others, because the overall performance is good.

This implicit solidarity must be made explicit. A shared profile is in fact emerging, but it concerns just the new member states which are not involved in the group agreement.

GRAPH 3. NATIONAL GHG EMISSIONS PERFORMANCE AND KYOTO TARGET*



* CYPRUS AND MALTA DID NOT RATIFY THE KYOTO PROTOCOL.
SOURCE : EEA.

This divergence is a problem even when we consider the fact that EU GHG emissions are concentrated in a small number of countries (just as at the international level): eight countries of the EU 27 account for 77% of total emissions. But the performances of these countries diverge (table 2).

Table 2. The 8 largest emitters of GHG in the EU 27, in %

		Gap relative to the Kyoto target
Germany	19	-
UK	12.6	-
Italy	11	+ +
France	10.5	-
Spain	8.8	+ + +
Poland	7.9	- - -
Netherlands	4.1	+
Romania	3	- - -
Total	76.9	

Source : EEA. The + and – signs indicate the larger or smaller distance (respectively positive or negative) in comparison to the Kyoto target.

It is against these three limits that the state of Europe's climate change policy must be judged. The policy needs not only reform but also new economic instruments to bolster it.

III - The state of Europe's strategy against climate change

There is now only one European policy to limit climate change: the strategy called "20-20-20", adopted at the European Council of March 2007. Having been the subject of intense negotiations between member states, alas resulting in multiple waterings-down (cf. infra), the "climate and energy package", with its "20-20-20" strategy, was adopted at the end of the French presidency in December 2008 and formally confirmed by the Council in April 2009. It entered into force in July 2009. A careful examination of the components of three European economic instruments– in their current form after this legislative process – shows that they are unsuited to the EU's ambitions.

3.1. The European carbon market

Since January 2005 the main pillar of Europe's environmental strategy is a market for emission permits, the EU Emission Trading Scheme (EU ETS). The economic logic of this instrument, inspired by the work of Ronald Coase (see box 1), was clarified by Weitzman (1974, 2007). Weitzman shows that the climate change issue is characterised by strong uncertainty as to the occurrence of extreme events

whose effects could be especially damaging. In this context, restricting quantities – by establishing an emissions ceiling which is reduced over time – appears in theory to be a better option than acting on prices whose sensitivity is uncertain.

The growing importance of the European carbon market is impressive. With 3.09 billion tons exchanged in 2008, it represents 64% of the world carbon market and 94% of allocation markets[6] (table 3). From 2007 to 2008, its development was also spectacular (+66%).

Table 3. The European system for exchanging emission quotas in international comparison.

	2007		2008	
	Volume ($MtCO_2e$)	Value (MUS$)	Volume ($MtCO_2e$)	Value (MUS$)
ETS (EU)	2 060	49 065	3 093	91 910
New South Wales (Etats-Unis)	25	224	31	183
Chicago Clim. Exc. (Etats-Unis)	23	72	69	309
RGGI (Etats-Unis)	NA	NA	65	246
Total allocations markets	2 108	49 361	3 276	92 859
Total carbon markets (inlcuding Kyoto mechanisms)	2 984	63 007	4 811	126 345

Source : World Bank, *State and Trends of the Carbon Market* **2009.**

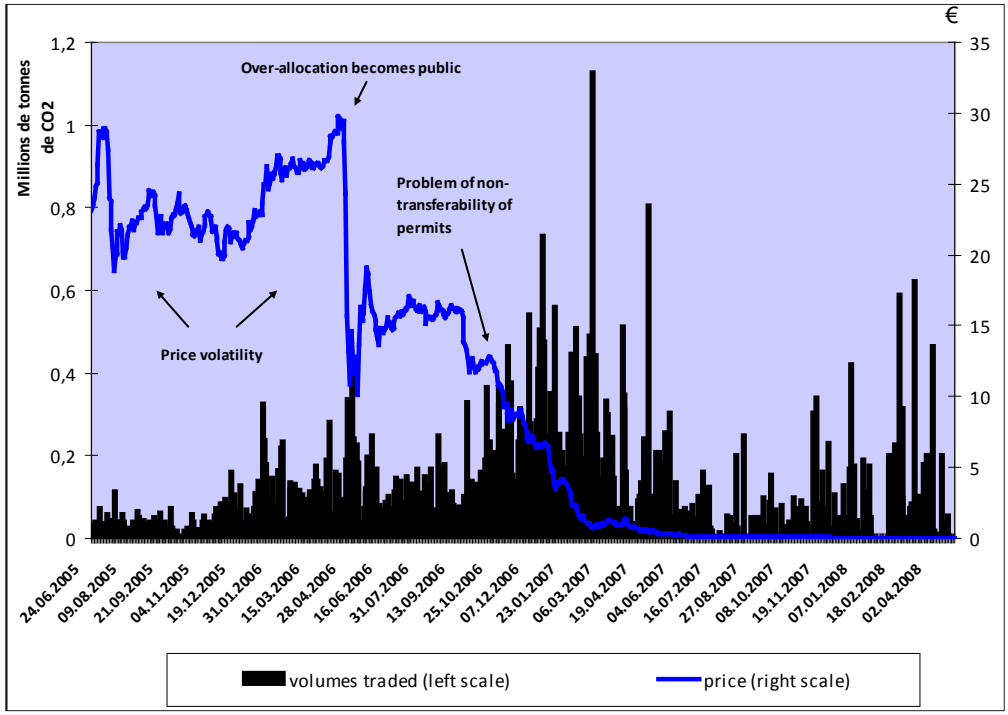
In practice, however, the functioning of the European carbon market since its creation suggests that there is a need to revise any *ex ante* optimism. The EU ETS suffers from three serious functional problems which together cloud the price signals that it is meant to send to producers and the economy in general – and without ensuring that the emissions ceiling is respected.

The most obvious problem is the volatility in the price of a ton of CO2 (this amount represents an allowance, or permit, of emission). In April-May 2006, the price collapsed from 32 euros to 10 euros due to the announcement of an over-

6 In its accounting the World Bank distinguishes between two types of carbon-credit exchanges: transactions which place weight on projects linked to the Kyoto Protocol's clean development mechanism (cf. infra) and transactions made possible by an initial allocation of emission permits, as with the EU ETS.

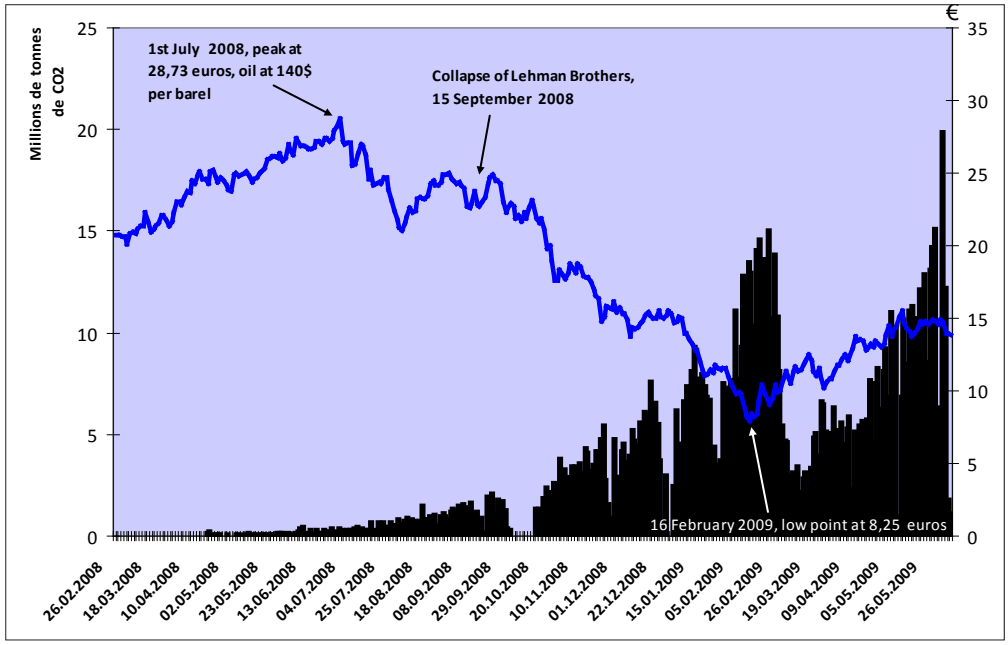
allocation of permits by national governments. It was the fall in emissions (by around 3%), against a background of European recession, which in 2008-2009 caused a new fall in the price of a ton of CO2 (see graphs 4 and 5).

Graph 4. Volumes traded and cash prices for the European carbon market between 2005 and 2008 (Blue Next Spot EUA 05-07)



Source : Bluenext (http://www.bluenext.fr/)

Graph 5. Volumes traded and cash prices for the European carbon market between February 2008 and May 2009 (Blue Next Spot EUA 08-12)



Source : Bluenext (http://www.bluenext.fr/)

The successive nature of the two phenomena is something of a paradox and requires explanation. During phase I of the market's operation, from 2005 to 2007, national governments systematically allocated too many emission permits to companies by means of national allocation plans (NAPs); these allocations were then drastically reduced under pressure from the European Commission, which rejected numerous initial versions of the NAPs for the phase II (2008-2012). But the world crisis pushed down emissions in 2008 so that the price collapsed once again despite the reduction of allocations. There was thus "over-allocation" (2005-2007) followed by "under-emission" (2008), each time with an unfavourable effect on the price of a ton of CO2.

The result, both times, was a massive clouding of the carbon price signal. After attaining 29.75 euros on 18 April 2006, the ton of CO2 lost 65% of its value, settling at 10.14 euros on 12 May 2006. Similarly, from the peak of July 2008 (28.7 euros) to the trough of February 2009 (7.9 euros), the price fall was 75%.

However, the accompanying graphs demonstrate that the highest volumes of trade occurred when prices were falling. It is thus possible to calculate that the average price of the ton of allocations in 2005-2007 was 10.36 euros, but that the average price weighted according to the quantity exchanged was only 9.16 euros. The same is true for 2008-2012 allocations up until May 2009: the average price of the ton of CO2 is 18.96 euros, but the average price weighted according to the quantity exchanged is 13.54 euros.

Put differently, the EU ETS in practice has not managed to determine a price for a ton of CO2 which is both sufficiently high and sufficiently stable. This poses two problems for the long-term objectives of the European carbon market. The first is related to the signal given to companies to encourage them to improve "technological efficiency" (the most technologically advanced companies are supposed to be rewarded by attractively priced carbon permits, which they may sell to less advanced competitors). The second relates to the absence of a stable price for carbon in the long term, which has a damaging influence on the profitability of low-carbon technologies and on the incentive that exists to adopt them. A stable and sufficiently high "carbon price" is advantageous in that it encourages the adoption, by companies and households, of technologies which save fossil energy or bypass it completely – and when these technologies do not exist, it incites the research and development which may help them emerge quickly. A number of these technologies – renewable energy (wind, solar, marine, biomass, in particular), carbon capture, thermal insulation of buildings, etc. – are already available, but mostly with investment costs which mean that profitability is only reached at a relatively high cost of fossil-energy use, and therefore a relatively high per-ton price for CO2.

As an illustration, its current price (about 15 euros) represents between a third and a half of the tutelary carbon price recommended by the Quinet and DEFRA studies mentioned above in box 1, which many specialists judge too low. And it is difficult to see how the price could recover significantly before 2012, the ceiling

of state-distributed pollution permits having been fixed in 2007 by the European Commission for the whole phase II of the market. This indicates that the European carbon market will likely continue to function poorly for at least as long as the economic crisis persists. To interpret the current malfunction of the EU ETS as proof that it functions (emissions having been reduced due to the rise in fossil-fuel prices in summer 2008) would appear optimistic.[7]

Lastly, due to pressure from Germany, Italy and Poland, the "climate and energy package" introduced two additional weaknesses into the functioning of the EU ETS. The first and most serious concerns the option given to member states of realising 50% of their emissions reductions before 2020 outside European territory, via the Kyoto Protocol's mechanisms for joint implementation and (above all) clean development (CDM), according to the principle of certified emission reductions (CERs)[8]. This idea of carbon compensation between developed and developing countries is theoretically compatible with the nature of climate as an international public good, and with the fact that the cost of reducing emissions is less in developing countries. But the available assessments of the CDM in practice show major points of dysfunction, to the point that between one third and two thirds of projects do not in fact result in genuine emissions reductions[9].

The second special dispensation concerns the legal recognition of a risk of "carbon leakage" (the risk of relocation by European industries subject to restrictive environmental standards from which their competitors are exempt). The conditions to be met in order to obtain free permits due to "carbon leakage" are particularly flexible: if an industry can demonstrate that the purchase of its emission permits is increasing its costs by more than 5% of its added value and that it is exposed to non-European trade beyond 10%, it can obtain the free allowances. In practice, this mechanism seems to allow whole sections of European industry to escape the

7 Commenting on the 3% reduction in GHG emissions between 2007 and 2008 in the EU ETS sectors, the European environment commissioner Stavros Dimas declared in May 2009: "The 3% reduction was partly the result of measures taken by companies to reduce their emissions in response to the high carbon price which prevailed until the start of the recession. This confirms that the EU has a trading system which works well, with a robust ceiling, a clear price signal and a liquid market, which helps us to reduce emissions in a cost-effective way."

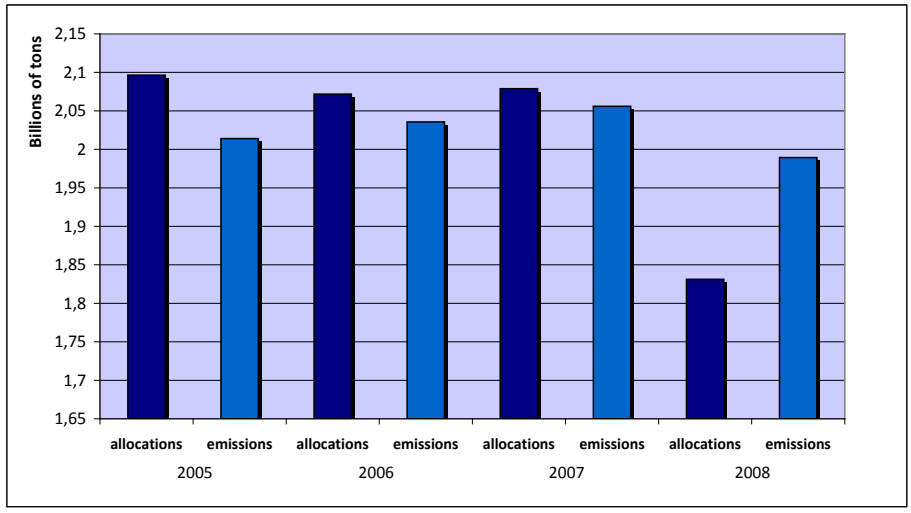
8 The Kyoto Protocol sets out three "flexibility mechanisms" to allow signatory states to meet the restrictive targets ETS they are assigned. The first is the establishment of a market for emission permits, such as the EU ETS; the second is joint implementation, which allows carbon credits to be exchanged between Annex I states on the basis of projects allowing GHG emission reductions; the third, the "clean development mechanism", makes use of the same principle but between states of Annex I and developing countries.

9 On this subject, see in particular Wara and Victor, "A realistic policy on international carbon offsets". Rep. PESD. Working Paper nº 74, Program on Energy and Sustainable Development, Stanford University, April 2008.

auctioning of permits, which in any case will only be introduced gradually (3% from 2008 to 2012, 20% in 2013, 70% in 2020 and 100% in 2027).

What can be concluded about the ecological effectiveness of the European carbon market? Examining the most recent data made public by the European Commission, we can measure that European emissions in sectors subject to the EU ETS in fact increased between 2005 and 2007, by 2% (graph 6). However, they decreased substantially from 2007 to 2008, by 3.2%. The cumulative fall is therefore 1.2% since 2005, a rhythm clearly insufficient to achieve the target reduction of 21% by 2020 in the sectors bound by the EU ETS (this objective assumes an annual reduction of 1.75%).

Graph 6. Emissions and allocations on the European carbon market, 2005-2008



Source : EEA.

The fundamental reason for the choice of an emissions market as a means of reducing uncertainty therefore seems questionable. The European carbon market must be taxified (cf. infra) to make it better able to guarantee that emissions will fall in such a way that the 2°C temperature-increase threshold is not breached.

But more than that must be done. The EU ETS in any case only covers about 40% of European GHG emissions and its coverage is not planned to exceed half of the EU's emissions, even after the inclusion of the air transport sector in 2012. This clearly raises the question of complementary economic instruments in the system. This is all the more the case given that the emissions not covered by the EU ETS are the diffuse ones (transport and housing). The sector of transport is where the development of GHG emissions is the most worrying (cf. supra).

3.2. The regulatory policy

In the EU, regulatory policy is concentrated on the question of emissions standards for light vehicles. This is the subject of regulation (EC) No 443/2009, whose content has been diluted and implementation postponed. The regulation was adopted in the framework of the "climate and energy package"[10] and was bitterly contested – in particular by Germany, whose car makers are less advanced in this matter than French and Italian ones. It is true that this new regulation places the European Union in a favourable situation internationally, with particular regard to the United States and also Japan (after the decision by the Obama administration in 2009, the US will only reach current European standards in 2016 – see table 4)[11].

Table 4. Emissions standards (g/km) and consumption standards (L/100) for light vehicles

	2008	2015/2016
European Union	160 g/km ≈ 6,6 L/100	2015 : 130 g/km ≈ 5,4 L/100 (18 % reduction)
United States	236 g/km ≈ 8,6 L/100	2016 : 155 g/km ≈ 6,6 L/100 (30 % reduction)

Source : European Commission and US federal government, author calculations.

10 All official documents relating to the climate and energy package are available at: http://ec.europa.eu/environment/climat/climate_action.htm
11 See Laurent and Le Cacheux, 2009.

However, a careful examination of the characteristics of emissions in the road transport sector shows that technical advances will not suffice to stop their progression. According to the European Environment Agency (2009), the fossil-fuel combustion intensity of passenger-transport road vehicles dropped by more than 40% between 1990 and 2005, and their carbon intensity dropped by about 2%. However, the number of travelled kilometres exploded, increasing by more than 100% in this same period; in addition, the number of private cars in the total fleet increased (by nearly 10%). Freight transport saw similar change, with an 80% increase in kilometres and a 40% increase of the share of vans in the total fleet – while their carbon intensity dropped (by 2%), along with their combustion intensity (by nearly 30%).

In other words, technological innovations[12] are not sufficient to compensate the volume effect of road transport since 1990. It is therefore imperative to take action on this volume if we want to reduce GHG emissions in the European Union. Specifically, it is here that the question arises of a new environmental taxation[13].

3.3. Environmental taxation

Among OECD countries, EU countries are distinguishable by relatively high environmental taxation – in particular when compared with the United States, Japan, Canada and Australia. But the overall level of their environmental taxes, as defined by Eurostat (see box 2), remains week, both in terms of GDP percentage and total tax revenues.

12 Which, for example, allowed a reduction of 12% in CO2 emissions of new private vehicles between 1995 and 2004.
13 Even if this is of course not the only conceivable policy option (in particular, investment in public transport is a possibility).

Box 2: What is environmental taxation?

Environmental taxation is defined as the taxation targeting goods and services which have an effect on the environment. For Eurostat, these are taxes "whose base is founded on environmental harm". The tax provisions can be "positive" measures affecting prices and household incomes, or "negative" measures causing increased prices for goods and services. The OECD, in its definition, emphasises the real and potential effect of a tax on the environment – that is, the effect on relative prices and on behaviour.

Environmental taxation can be loosely defined in terms of three distinct approaches:

- Declared intention: any tax measure where the legislator's intention is to improve the environment. This aim is clearly mentioned in the law;
- Behaviour: any tax measure which results in an economic incentive encouraging improvement of the environment;
- Product or pollutant targeted: any tax measure aimed at a physical good which has a negative impact on the environment.

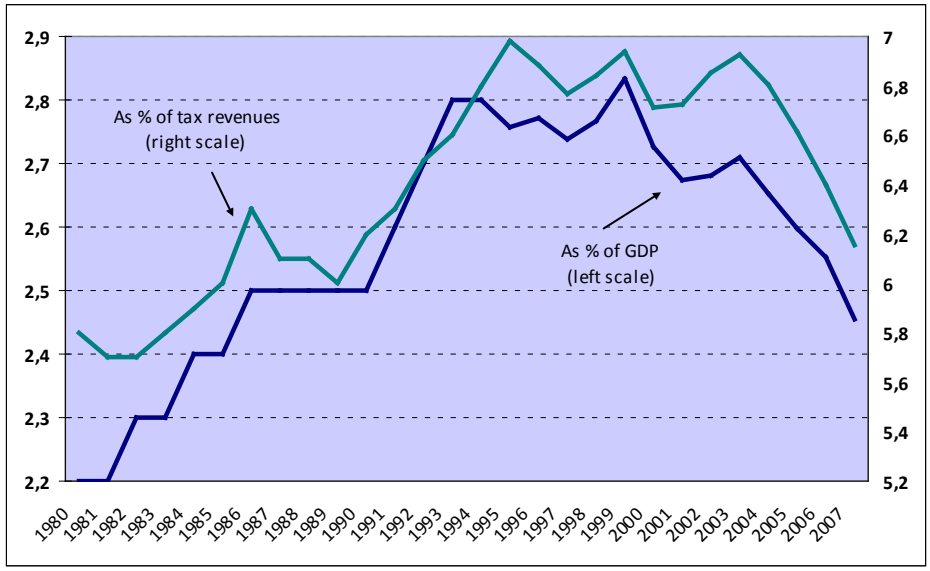
Environmental tax measures can also be analysed in terms of:

- The tax nature of the measure, distinguishing taxes, fees, exemptions, tax credits, direct subsidies, etc.;
- The level of coverage: town, region, country;
- The destination of revenues (in the case of taxes): to the state budget, to special accounts, to public or private bodies, etc.

Source : Consultation nationale pour la Charte de l'environnement, French Ministry for Ecology and Sustainable Development, 2005.

Three movements over time can be observed in the level of environmental taxation in the European Union. In the first, at the start of the 1980s, there was slight increase in the level. At the start of the 1990s, the increase accelerated: the Nordic countries were implementing their taxation against climate change (cf. supra). But this dynamic did not last (despite tax reforms at the end of the 1990s and beginning of the 2000s) and by 2007 environmental taxation had returned to its level at the end of the 1980s. The "green shift" made by the Nordic tax systems did not spread into the European Union of 15. The average European environmental taxation has never exceeded 3% of GDP and 7% of tax revenues over more than 25 years.

Graph 7. Environmental taxation in the EU* (weighted average), 1980-2007, in %



*** EU 15 before 1999, EU 25 after.**
Source : Eurostat.

However, since this study is focused on climate change, it would seem useful to concentrate on energy taxation, which in the EU represents three quarters of environmental taxation. CO2 emissions are taxed indirectly when energy is taxed[14], fossil or otherwise (since electricity can be produced from coal, as is overwhelmingly the case in Poland and to a lesser extent in Germany). It turns out that energy taxation has seen a similar evolution to environmental taxation, but even more marked – progressing from 1.8% of GDP in 1980 to 2.1% in 1993, before falling to 1.8% in 2007 (from 1995 to 2007, this rate therefore fell for the EU 25 by 0.4 points).

Beyond the relationship of energy taxation to GDP or to total tax revenues, the implicit rate of energy taxation (tax revenues based on energy divided by the

14 According to Eurostat's definition, taxes on energy include taxes on energy products, such as mineral oils, gas, and electricity – both for transport and fixed uses. Within this energy taxation, taxes on fuel accounted for 80% in 2007 in the EU 27.

quantity of primary energy consumed), deflated, gives an indication of how much the tax instrument is used against climate change in the European Union. The rate has fallen over the last decade in the EU 25 and it has fallen considerably for the euro zone countries since 1995 (table 5).

Table 5

	Gap in percentage points	
	1995 to 2006	2000 to 2006
Weighted average euro zone	-6,9	-8
Weighted average EU 25	6	-12,7

Source : Eurostat.

What is more, this taxation level should be further lowered to represent the effective rate of taxation (tax revenues actually received from energy, divided by the quantity of primary energy consumed), because in all EU countries there exist many waivers and exemptions which further weaken the effect of this economic instrument.

European environmental taxation, and more precisely energy taxation, therefore appears not only weak in general, but also in retreat. However, two positive developments can be observed.

The first is a convergence of energy taxation levels within the EU. The standard deviation of energy tax rates in relation to GDP fell by 44% between 1995 and 2007; that of energy tax rates in relation to total tax revenues fell by 25%; and the standard deviation of implied rates of energy taxation fell by 15%. There has therefore been a fall, but convergence in the fall – meaning that even if this taxation is today weaker than ten years ago, it is also more homogenous within the EU.

The second favourable development is the introduction, already mentioned, of carbon taxes – that is, tax instruments specifically created to target CO2

emissions and not simply energy consumption (this is the case of Denmark, Sweden and the United Kingdom).

The combination of these two developments, together with the various of analyses presented so far, leads us to ask questions of the relevance, the methods and the conditions under which a new European carbon tax may be established.

IV - The economics of carbon taxes

4.1. The theory

The economic theory of environmental taxation goes back to the work of Pigou (1920)[15], whose idea was to internalise external environmental damage by means of taxation. With this objective, carbon taxation aims to integrate the "social cost" of carbon (climate change, health, etc.) into the cost of the private use of fossil energy. But in practice the costs are difficult to estimate and the optimal amount for the tax therefore becomes uncertain. A more pragmatic approach is that of Baumol and Oates (1971)[16], which aims to determine an environmental objective and to design an instrument to reach this objective.

The first purpose of carbon taxation is to dissuade, in the sense that it aims to discourage use of fossil energy – the main source of GHG emissions – by intentionally increasing the cost of this use. In the absence of any perfect market mechanism which may determine a carbon price, the tax's objective is to establish such a price – by shifting onto the economic agents that emit carbon or whose consumed products have "carbon content" (due to the process and energy used to produce, stock and transport them, etc.) the economic costs that these emissions inflict

15 Pigou A. C. (1920), *The Economics of Welfare*, Macmillan, London.
16 William J. Baumol & Wallace E. Oates, The Use of Standards and Prices for Protection of the Environment, 73 SWED. J. OF ECON. 42, 42–51 (1971)

on the planet. According to Pigouvian terminology, it is therefore a question of remedying a "market failure" - that is, the non-existence of a private market in which a carbon price is established based on all of the consequences of its emission. This is why, as Coase (1960) showed, the creation of private property rights – in this case "rights to emit carbon" – and a market in which these rights may be traded freely, could represent an alternative solution to the taxation of emissions. In both cases, the objective is the establishment of a "carbon price" and, as our scenarios indicate (cf. infra), the two solutions can be considered complementary, provided that they are managed in a coherent way.

The introduction of a carbon tax, whatever its functional details, does not however aim to "punish" consumers of fossil energies, or "hit their wallets", or make them feel guilty. A high price certainly has the effect of dissuading the use of the good in question; but also sends the signal that it is convenient to favour, wherever possible[17], technologies which help to save a costly resource. In the case of carbon tax, it is important to establish quickly and durably a "carbon price" sufficiently high that it encourages the adoption, by companies and households, of technologies which save fossil energy or spare it completely, and encourages research and development to help these technologies emerge when they do not yet exist. Many of these technologies – renewable energy (wind, solar, marine, biomass in particular), carbon capture, thermal insulation of buildings, etc. – are already available, but mostly with investment costs which mean that profitability is only reached at a relatively high cost of fossil-energy use[18]. Others will appear after the financial incentive becomes suitable and durable.

Why not then allow the markets to work unhindered? After all, without public intervention the oil price reached nearly 150 dollars a barrel during summer 2008. Sooner or later, with the renewed world growth that will come one day, it will probably reach this price again and even exceed it – to the extent that the planet's oil resources dwindle and the exploitation costs of new discoveries rise. At the root of the problem, the fossil energy market is too volatile to determine a reliable price and to guarantee sufficient visibility to investors and households; in addition, each rise in the oil price causes substitution towards other fossil fuels – in parti-

17 This is where the question arises of the value of consumption elasticity in relation to the price of energy (cf. infra).
18 The Stern report provides the profitability thresholds for a number of these technologies. See Nicholas Stern, *The Economics of Climate Change: The Stern Review*, Cambridge University Press, 2007.

cular coal, whose emissions of GHGs (among other pollutants) are higher; lastly, the rise in fossil energy prices risks being too late, whereas urgency demands technological choices as soon as possible. The market imperfections and failures must therefore be compensated by including in the private cost of fossil energy the estimated cost of the climatic consequences of emissions. It is probably even a good idea to set this additional cost at a somewhat high level, rather than to announce that it will increase in the future (public decision-makers will be tempted not to do this, just as it has not been done for most new tax charges). A low initial figure risks being ineffective at triggering the needed reorientations, and anticipation of a future rise could incite producer countries to accelerate the extraction and marketing of fossil energy resources, knowing that demand will fall in the future.[19] The all-important reduction in emissions will then be delayed.

4.2. Advantages and disadvantages of different instruments of intervention

As theory suggests, several means of intervention may be envisaged. Their effectiveness in terms of reducing GHG emissions, and their effects on the various economic aspects of the problem (competitiveness of businesses, household purchasing power, fairness, etc.) differ. In general authorities resort to a mixture of various instruments, in a range of proportions.

Very often used, and favoured by both bureaucrats and to an extent public opinion, the regulatory solution (technical standards on car emissions, industrial pollution, product ingredients, etc.) has the advantage of being explicit and easy to understand: why not outlaw what is judged socially damaging? But there are numerous disadvantages. Firstly in terms of inspection, which is difficult when there is a large volume of users – this is why such tools generally target large industrial users, or manufacturers of products subject to technical standards (car builders, for example). In addition, the establishment of thresholds often gives rise to interminable negotiation and therefore results in compromises which could be judged insufficient (see the example of the REACH directive on chemicals). Lastly, from

19 This aspect of the problem, which concerns the supply of fossil energies, is analysed by Hans-Werner Sinn, *Public Policies Against Global Warming*, NBER Working Paper No. W13454, September 2007.

the point of view of economic efficiency, technical standards have the flaw of not taking account of the differences between individual economic agents – regarding both costs and preferences. By nature they are uniform, or when they are adjusted it is done technocratically and somewhat arbitrarily, thus suffering from the flaw of all state planning.

Implementation of a Pigouvian tax, which rests on the principle of "polluter pays", is practised in many fields where the negative external effects are accepted. Acting directly on the price of the item causing the social harm, the tax intentionally distorts the structure of incentives – thereby violating the traditional principle of tax neutrality to influence the choices and behaviour of individual economic agents. From an economic point of view, the advantage of this method is that it preserves the decentralised nature of decisions, only "correcting" a "market failure". But it has disadvantages. Calibration is difficult, because of the difficulty of assessing the "marginal social damage" caused by the activity at the source of the external effect and because of the uncertainty over the amount of demand elasticity of the item taxed – that is to say, the magnitude of the response by economic agents to a modification of the price signal. Its negative effects on purchasing power – unequally and unjustly spread between taxpayers, as a result in particular of the varying size of the parts of the household budget devoted to the consumption targeted by the tax – are visible and generally provoke strong opposition, particularly among low-income taxpayers. This situation also arouses suspicions that the real motive of the tax is to raise funds, rather than to change behaviour.[20] It should also be noted that the tax can be levied either on fossil energy consumption[21] – the source of GHG emissions – or on the final consumption of goods and services, in which case its calculation is founded on the total quantity of GHGs emitted during the process of producing, transporting and distributing each of the goods and services taxed. This method has never been implemented because it is considered technically complex, but it has numerous theoretical advantages: it creates greater visibility

20 These arguments are well-known and regularly used in relation to the taxation of tobacco, fuels, etc. The unequal distribution of the negative impact on purchasing power is also characteristic of technical standards; but in this case it is less visible and less directly measurable, therefore less often criticised.
21 "Classic" taxation of fuel could be considered as carbon taxation. In this case, it would be possible to raise the tax rather than to create a new one specifically aimed at GHG emissions. Two objections can be made about this solution: firstly, in practice fuel taxes are not calibrated in accordance with carbon emissions, and over time they have accumulated countless special dispensations (agriculture, fishing, road transport, domestic heating, etc.); secondly, "carbon" taxation should in time extend to cover all GHG emissions (methane, in particular), even if it rarely concerns these today.

for the consumer, distorts relative prices less, and takes into account the whole "social cost" of each final act of consumption.[22]

The third method, called "cap and trade", was invented more recently. The first full-scale example was the market for permits to emit sulphur dioxide (SO2), created in the United States in the 1970s. The method is favoured by many economists but arouses suspicion in public opinion, which sees in it a licence granted to behave in ways deemed socially harmful. The creation of emission permits, which are none other than "rights to produce" – like all production quotas, but in this case to produce harm – accompanied by an organised system for trade, allows public authorities to combine a chosen total quantity which may be produced (defining the total supply on the market – "cap") with the mechanism of the free market ("trade"). Faced with demand from emitters, who are obliged to possess a sufficient quota to cover their emissions – and therefore, if necessary, to procure them from those willing to sell – the supply, initially established by the authorities, determines a market price. The emitters may then choose to be sellers or buyers according to the cost represented to each party by the effort to reduce emissions. The mechanism's decentralisation and the modulation of emissions reductions that it encourages together constitute the main advantage in terms of economic efficiency. But the "market price" resulting from this mechanism does not have the exogenous and semi-incontestable status that is often assumed in debate. Resulting from the interplay of a supply fixed exogenously by the authorities and a demand which depends on available technologies and the level of productive activity, the price may be directed in the medium term by the authorities; yet, as the potential object of speculation and the creation of derivatives, like all raw-material markets, the price may also fluctuate erratically in the short term, which can do lasting damage to the incentives it is supposed to provide. In addition, an effective implementation of such a mechanism assumes that it is possible to inspect actual emissions, which in practice has led to it being limited to the most concentrated and high-emission industries. Lastly, the permits are allocated without charge, but their distribution between emitters is by definition arbitrary and subject to intense

22 This corresponds to the Carbon-Added Tax, proposed in Laurent & Le Cacheux (2009b), or to the carbon tax on final consumption, proposed by Jim Hansen in the United States in January 2009. Among other things, such a tax has the merit of affecting imports, which increases its effectiveness in terms of reducing emissions and reduces the problems of cost-competitiveness (cf. infra).

lobbying – because it gives rise to rents which generate private gain, while securing no revenues for states. The solution therefore consists of allocating permits after a process of auction bids – but in this case there is strong pressure from producers in favour of free permits.

In most cases the three methods described above are combined in varying proportions, based on technical considerations (feasibility) and political choices (in terms both of efficiency with regard to different economic sectors, and of the distribution of costs and rents). All three[23] have similar effects on short-term production costs and therefore on the competitiveness of the producers in the area in question. This is the notorious problem of "carbon leakage", capable of causing certain businesses to disappear or relocate to countries free of such constraints. Citing these damaging effects – real but of debatable importance beyond the short term – many producers oppose the different mechanisms mentioned and often obtain special dispensations (exemptions from certain regulations, tax exemptions or reductions, distribution of free permits, etc.) which seriously harm the effectiveness of the mechanisms in terms of emissions. This is especially true given that such dispensations are generally given to the most emissions-intensive operations. In the longer term, however, it seems that the constraints thus imposed are an incentive to adopt lower-emitting technologies and to innovate, in such a way that their effects on competitiveness are positive and often spectacular.[24]

To compensate for the negative short-term consequences of the above-described mechanisms on the cost-competitiveness of domestic producers and the lack of incentive for foreign producers to reduce their emissions, it is desirable to complement them with a carbon levy at borders, which hits imports from countries which do not impose such constraints on their producers. Such a levy – in principle conforming to the rules of the World Trade Organisation (OMC) – is necessary to ensure the that the mechanisms are effective in terms of reducing emissions, and it heads off producers' pressure for special-dispensation regimes (cf. infra).[25]

23 Except, in the case of regulations, if these are imposed on the products rather than the process.
24 For a theoretical analysis which concludes thus, see the recent article by Acemoglu, Aghion, Burnstin and Hemous (2009). Using their conclusions we may cite the case of Denmark, currently European leader in wind turbine technology, or Germany, principal producer of numerous thermal-insulation materials and renewable-energy equipment. At the other end of the spectrum is the hard-hit American car industry, in part a victim of obsolete technological choices due to a long-standing lack of incentives to reduce GHG emissions.
25 On this point, see the recent opinion of the WTO (box 3) and the analyses of Guesnerie (1998) and Godard (2006).

Box 3. THE POSITION OF THE WTO ON CARBON TARIFFS

The objective of a border tax adjustment is to level the playing field between taxed domestic industries and untaxed foreign competition by ensuring that internal taxes on products are trade neutral. In the context of climate change, the debate has mainly focused on two aspects: the extent to which domestic carbon/energy taxes (which are imposed on inputs, such as energy) are eligible for border tax adjustments; and the extent to which BTAs may be limited to inputs which are physically incorporated into the final products. The general approach under WTO rules has been to acknowledge that some degree of trade restriction may be necessary to achieve certain policy objectives, as long as a number of carefully crafted conditions are respected. WTO case law has confirmed that WTO rules do not trump environmental requirements. If, for instance, a border measure related to climate change was found to be inconsistent with one of the core provisions of the GATT, justification might nonetheless be sought under the general exceptions to the GATT (i.e. Article XX), provided that two key conditions are met. First, the measure must fall under at least one of the GATT exceptions, and a connection must be established between the stated goal of the climate change policy and the border measure at issue. It should be noted in this regard that WTO members' autonomy to determine their own environmental objectives has been reaffirmed by the WTO's Dispute Settlement Body on a number of occasions (for example, in the US - Gasoline and the Brazil - Retreaded Tyres cases). Although no policies aimed at climate change mitigation have been discussed in the dispute settlement system of the WTO, it has been argued that policies aimed at reducing CO2 emissions could fall under the GATT exceptions, as they are intended to protect human beings from the negative consequences of climate change; and to conserve not only the planet's climate, but also certain plant and animal species that may disappear as a result of global warming.

Second, the manner in which the measure in question will be applied is important: in particular, the measure must not constitute a "means of arbitrary or unjustifiable discrimination" or a "disguised restriction on international trade". GATT case law has shown that the implementation of a measure in a way that does not amount to arbitrary or unjustifiable discrimination or to a disguised restriction on international trade has often been the most challenging aspect of the use of GATT exceptions.

Source : WTO/UNEP (2009).

4.3. In practice

The ideal carbon tax would therefore result in the establishment of a unique carbon price by targeting the carbon (or CO2) content of all products or at least fossil energies. In practice carbon taxes are imperfect, because they discriminate among users and also because they are hybrid (carbon-energy) and their rate is

thus determined neither by energy intensity nor by carbon intensity (or better still GHG intensity). In addition, they suffer from numerous special dispensations.

In 2009, many European countries already have some experience of carbon tax, but using extremely diverse methods (see table 6). Several other countries have either recently introduced a carbon tax (France, on 1 January 2010) or plan to do so soon (Japan, since the recent election). It seems however that only Sweden has conducted a permanent and sufficiently coherent policy to have significant results. Nonetheless, it is particularly difficult to assess empirically the effects of the various mechanisms on changing emissions of carbon, since numerous other modifications over the period can have their own effects on emissions.[26]

26 The figures appearing in the last column of the table must therefore be interpreted with the greatest prudence.

Table6 : The practice of several European countries in Carbon Taxation[27]

Country	Year of implementation	Level of tax (€ 2009/ton of CO2)	Tax rate in relation to GDP/inhabitant (OCDE, 2007) in %	
United Kingdom – « Climate Change Levy »	2001	GPL : 5.49 Oil: 7.73 Gas :13.09 fixed rate in £ since 2001 mixed carbon-energy tax	Gas : 0.050 O : 0.030 GPL : 0.021	
Netherlands	1990	12 Combination of two carbon-energy mixed taxes	0.036	
Denmark	1992	12.09 13.43 in 1992 (reduction due to parallel introduction of energy tax in 2005) Increases by 1.8%/yr until 2015	0.044	
Finland	1990	20 Only $1.45 in 1990 Increases from 2011	0.071	
Norway	1991	34.4	0.062	
Sweden	1991	108 100 in 2007 43 in 1991 (indexed for inflation)	0.40	

27 Extract of the study by Ombeline Gras (2009), *L'introduction d'une taxe carbone et ses effets sur la compétitivité en France*, internship report, OFCE, September 2009.

	Form of redistribution chosen	Exceptions	Recorded impact on GHG emissions (1990-2007)
	Reduction of employer social charges, subsidies to environmental projects via the Carbon Trust	- Does not concern households. Only on coal, natural gas, GPL and electricity. - 80% under conditions (objectives of energy efficiency)	- 17.4%
	Initially reduction of income tax, then lowered employer charges	- 3.40€/t for sectors of high energy intensity - 50% for non-profit organisations - Conditional exemption for gas and electricity for electricity production Coverage rate for all emissions: 0.3	-2.1%
	Reduction of employer social charges, family allowances, reduced income taxes on low incomes, 20% of revenue allocated to programmes to improve energy efficiency	1992: exemption for all businesses. 1993 to 1995: -50% (or more, up to -90% for energy-intensive activities) Since 1996: discrimination according to use (heating, lighting, etc.). Exemption for electricity production	-3.5%
	Mostly reduced income tax (since 1996). Since 2009, abolition of social contributions by employers, financed by future rise in green taxes	- Use as industrial material - Fuel for trains, aircraft and boats - Electricity for greenhouses - No tax for electricity production - 50% for natural gas	+10.6%
	Support for projects of research and development, allowances for households	Exemptions for heavy industry, fishing, air and maritime transport Coverage for all emissions: 0.64	+18.7% (between 1990 and 1999)
	Reduction of income tax, extension of VAT base, lowering of social charges on employers since 2001, R&D	Originally no allowance for industry, but all green taxes capped at 1.2% of sales. Since 1997, limited to 0.8% for certain activities	-9.1%

Sources :

- ***En attendant la taxe carbone... Enjeux et outils de la réduction des émissions de CO2*, Report by Fabienne Keller, on behalf of the finance commission, n° 543 (2008-2009) - 8 July 2009,**
- ***The Reality of Carbon Taxes in the 21st Century*, A Joint Project of the Environmental Tax Policy Institute and the Vermont Journal of Environmental Law Vermont Law School, January 2009,**
- **FMI, World Economic Outlook Database, April 2009,**
- **European Environment Agency, *Annual report of the European Community on greenhouse gases*, inventory report 1990-2007 and 2009**

The OECD (2006a) nonetheless shows that the environmental effectiveness of the ecological taxes implemented since the start of the 1990s is high: "There is no doubt that many taxes contribute to improving the environment. Their increase results in a rise in prices which causes a reduction in demand for products harmful to the environment. The consumption of fuel has thus fallen significantly in recent years, following the rise in the price of crude and taxes on fuel." Similarly, the comparative study by Agnolucci (2004) provides interesting means of assessing the various national mechanisms in place.

The national studies that are available confirm the OECD's judgement in the Nordic countries and also in countries which have introduced carbon and/or energy taxes more recently. Studies by the German federal agency, conducted to measure the impact of reforms carried out between 1999 and 2003, show that energy consumption has fallen and that CO2 emissions might have been reduced by 2% to 3%. The study by Cambridge Econometrics (2005) on the British case also shows a 2% reduction in CO2 emissions attributable to the tax measure called the "Climate Change Levy".

In addition, the available studies indicate that the elasticities of different energy demands in relation to their prices are moderate in the short term, but quite high in the long term (table 7).

Table 7. Elasticities in the consumption of oil products

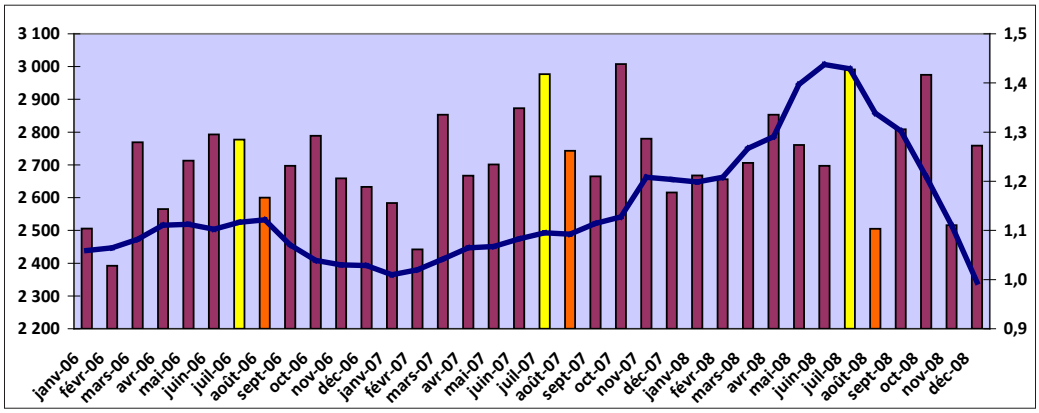
Nature of data used	Short term	Long term
International comparison	Average: –0.26 (from 0 to –1.36)	Average: – 0.58 (from 0 to –2.72)
Time-based series	Average: –0.27	Average: – 0.71
Transversal section	Average: –0.28	Average: –0.84

Source : OECD (2006b).

The short-term effect can be illustrated using a recent example. The episode of summer 2008 in France (graph 8) demonstrates well that short-term constraints are strong (elasticities are weak) for motorists, but that the development of

alternatives will loosen these constraints (elasticities rise over time, due to the substitutions and technological changes which come with new equipment, investments and durable goods). Thus, the French did not reduce their diesel consumption in July 2008 in comparison to July 2007, although its price had substantially increased (going on holiday requires using one's car). However, consumption fell sharply in August (when the car is less necessary), which suggests that, when they can, consumers reduce their consumption as an effect of a higher price.

Graph 8. Price (in euros / litre) and consumption in volume of diesel (thousands of tons)



Source : Ministère de l'industrie et UFIP. July in yellow, August in orange.

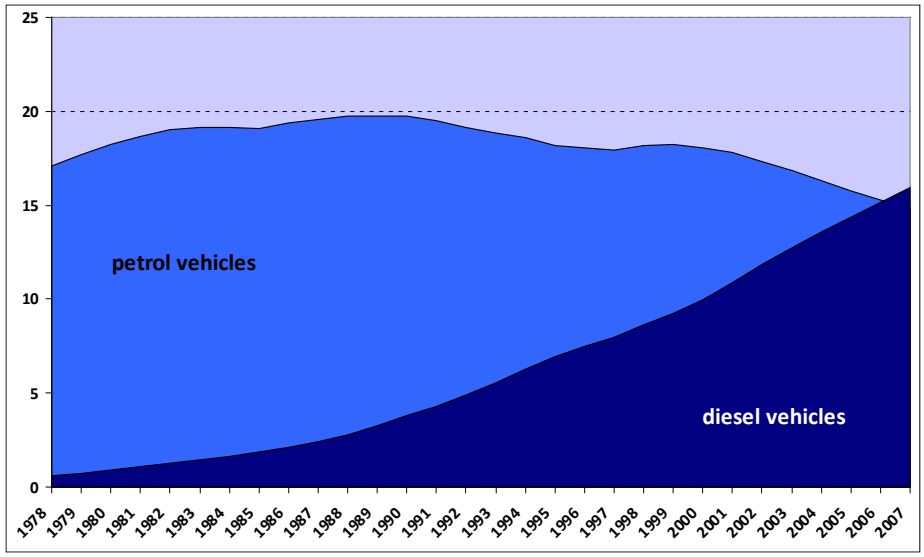
But the effect on supply is also a means of measuring the effectiveness of carbon taxation. By contrast, there is the effect of the French *Taxe intérieure sur les produits pétroliers (TIPP)*, which taxes diesel less than petrol (see table 8), and has had the effect of significantly encouraging the use of diesel vehicles in France (graph 9). In general, and in all countries, it appears that the car types and changes thereof are very sensitive to the structure of taxation on fuel.

Table 8. Price difference between petrol and diesel in France, in euros/l, 29 May 2009

	SSP 95	Diesel	Difference
Gross	0.293	0.293	
TIPP	0.606	0.428	0.178
VAT on product before tax	0.083	0.076	
Fixed VAT on TIPP	0.1190	0.084	0.0350
Added value of refining	0.046	0.014	
Added value of distribution	0.087	0.08	
Difference linked to TIPP			0.213
Total	1.234	0.975	0.259

Source : UFIP.

Graph 9. Changing number of vehicles in France, 1978-2007, in millions



Source : UFIP.

V - Scenarios for a new European tax on carbon

The diversity of potentially usable tools, and existing national experience, suggest the possibility of advancing in different directions.

5.1. Four scenarios

Four scenarios can be imagined for a new European carbon tax system, each corresponding to a level of political ambition – and therefore to a level of results to be expected in terms of reducing GHG emissions. There will also be different effects on the distribution of costs between countries and between economic actors, and different impacts in terms of economic efficiency.

Scenario 1 (basic): "Taxify"

This first scenario consists simply of "taxifying" the EU ETS, and exempting completely all the sectors involved from all energy or carbon taxes that member states might impose (as already in the case in several countries, and recently announced

by the French government). In this scenario, the basic logic of the European climate-change strategy is not modified. No new tax tool is introduced, but there is an effort to optimise existing tools. By taxifying the EU ETS, we internalise the external costs of carbon emissions for the sectors concerned, but, as compensation, we exempt them totally from any increased energy or carbon taxation motivated by climate change.

"Taxify" means both strengthening the obligation and making it more predictable, in order for the EU ETS to have effects comparable to a tax. Several non-exclusive measures to taxify the EU ETS may be envisaged. The first, which is by far the most desirable from the perspective of efficiency, consists of creating a floor price. Respect for this price would be assured by a mechanism of public intervention on the market (perhaps using the European budget) to remove excess supply in case of an excessive drop in price – following a procedure similar to the market support used in the past for certain agricultural products, with destruction of the excess.[28] The second mechanism consists of auctioning the permits at a faster pace starting with phase III of the market (2013). Lastly, it would probably be useful to reduce considerably the exemptions for "carbon leakage" and, given their poor performance, to further limit the possibilities of carbon compensation.

This solution has the advantage of being highly feasible. But it does not affect a part (around 40%) of Europe's GHG problem, and therefore risks being insufficient to tackle climate change effectively.

Scenario 2: "Climatic conversion"

The second scenario complements scenario 1 by establishing a tax on sectors not covered by the EU ETS. It is based on a proposal made by the European Commission (2007) to make a "climatic conversion" of existing taxation by using the hybrid energy-climate model of 1991-1992. The idea is to depart from the minimum rates of the 2003 directive on excise duties applicable to fossil fuels, by distinguishing between an "energy" component and a "climate" component. The fuels would be

28 The establishment of a minimum price, or a price tunnel, for carbon has been discussed by several authors, recently including Tirole (2009). According to the argument developed here, there is little reason to impose a price ceiling.

taxed uniformly according to their energy content and in a differentiated fashion according to their carbon intensity.

This solution, feasible and much more ambitious than the previous one, would nonetheless remain within the outlines chosen at the end of the 1990s and beginning of the 2000s, aiming to create minimum rates in the European Union – which does not settle the question of the optimal rate of taxation, and therefore of the single price of carbon. Combined with scenario 1, it would however have the merit of instituting a "minimum carbon price", thereby ensuring better coherence and visibility for the EU's climate strategy – and avoiding the risks of "carbon dumping".

Scenario 3: The "European green shift"

In this scenario, the "taxified" EU ETS of scenario 1 would be complemented by a genuine European energy-carbon tax on "dispersed sectors" (transport and housing). From this point of view, the European proposition of 1991, amended in 1992, has numerous attractive features. Firstly, it is a hybrid system (energy and carbon)[29], a structure which still today seems the most likely to be effective, given Europe's political economy (cf. infra).

The Swedish example is also particularly interesting in this scenario, for four reasons.

- The Swedes (like the Slovenes, and unlike the British) converted their tax regime for energy (where the first elements go back to the 1920s) in order to adapt it to the climate-change question, in the early 1990s. A European carbon tax was be created out of nothing, but rather existing taxes were be converted to make them compatible with the climate-change challenge, and then brought together to make them coherent.
- The Swedes opted for a hybrid energy/CO2 system, by instituting a gradual increase of the CO2 component, which is today greater than the energy

29 The carbon component (50%) was fixed at 2.81 ECU per ton of CO2 and the energy component, which excluded renewable energies (50% of the total), at 0.21 ECU per gigajoule. The total amount was therefore equal to 17.75 ECU per ton, or $3 for a barrel of oil. The idea was to increase, each year from 1993 to 2000, the amount by $1 in order to reach $10 a barrel in 2000 – this being the ultimate objective, which was supposed to allow a stabilisation of EU CO2 emissions.

component. This is particularly important in case of Europe, where such a hybrid system is necessary for questions of political economy (table 12)

- The Swedes immediately imposed high rates of taxation without loss of competitiveness nor growth of inequalities, with the help of a system of exemptions for the industrial sector, from 1993, and redistribution for households (see table 9). Formally, this distribution of the tax burden is similar to the initial situation in Europe, where industrial sectors are already subject to the EU ETS; it allows compensation for households, which avoids exacerbating inequalities (cf. infra).

Table 9. Swedish taxation of energy and CO2, in euros per 1000 L

	Total taxation (energy and CO2)	Tax on energy	Tax on CO2	Total tax burden for industry
1990	143.3	127.6	0	143.3
1991	168.5	72.2	96.3	168.5
1992	167.3	71.7	95.6	167.3
1993	160.1	59.2	100.9	25.2
1994	165.8	61.3	104.4	26.1
1995	167.1	61.8	105.2	26.3
1996	193.1	69.3	123.8	31.0
1997	197.0	75.6	121.4	30.4
1998	202.0	83.3	118.7	59.3
1999	202.7	83.6	119.1	59.6
2000	213.3	88.0	125.3	62.6
2001	239.3	74.3	165.0	57.8
2002	273.4	77.2	196.3	58.9
2003	317.2	78.9	238.3	59.6
2004	365.0	80.2	284.7	59.8
2005	360.3	79.2	281.1	59.0
2006	363.3	79.9	283.4	59.5
2007	369.0	81.1	287.9	60.5

Source : Milne (2009).

The Swedish economy has reduced its energy and carbon intensity without suffering in term of growth or jobs, and while developing its "green economy".

The obvious problem posed by this scenario, like the previous one, is that of legal and institutional feasibility – due to the unanimity required in tax matters. The solution might be for a group of countries to launch an "enhanced cooperation" initiative in order to implement the measure.

Scenario 4: "European carbon-added tax"

The fourth scenario is the most ambitious. It is also the only one which allows for a single carbon price and thus permits a coherent management of the Union's climate policy. It is different from the previous scenario in that it provides for the creation of a genuine European carbon-added tax (CAT), in principle similar to VAT.[30]

Levied on all consumption in accordance with its carbon content, this European CAT also has the advantage of being compatible with the EU ETS – which would be deductible – and of showing the consumer the "carbon cost" of each act of consumption. Unlike the other options discussed, the CAT also affects imports, which considerably reduces problems of competitiveness and thereby weakens the argument of industries demanding exemptions in the name of "carbon leakage". This scenario is therefore the only one which does not raise the problem of a carbon levy at borders. The "carbon-added tax" solution is clearly superior to the "border levy", since even if such a levy is not incompatible with the WTO charter (box 3)[31], it risks provoking retaliatory trade measures, whereas in the case of the CAT the law of the single market would demand non-discrimination between European and foreign products.

It is true that the European CAT poses numerous problems of feasibility, both legal and institutional – in particular that of unanimity, as with the two previous scenarios. It also poses a technical problem, often cited in recent debates (particularly in France) in criticism of such a mechanism. This problem does not however

30 For a carbon-added tax proposal for France, see Laurent and Le Cacheux (2009b).
31 See also Godard (2006).

seem insurmountable, to the extent that an increasing number of businesses make "carbon reports" on which the European CAT could be based. Determining the "added carbon" made by companies involved in the production-transport-distribution sphere assumes that the companies do a sort of "carbon bookkeeping", which the "carbon report" technique allows for. As with existing national carbon taxes, it would then suffice to impose on each company an amount per tonne of "added carbon". The end consumer would thereby pay, on each purchase made, an amount corresponding to the total carbon emitted during production, treatment, transport, storage, etc., of the product purchased. He or she would thus be directly exposed to the "carbon cost" of his or her consumption.[32]

These different scenarios differ according to three criteria: their ecological effectiveness, their technical feasibility and their institutional feasibility. The following table summarises these features and suggests that the scenario of "climatic conversion" is able to garner the widest support.

Table 10. Features of the different scenarios envisaged

	Ecological effectiveness	Technical feasibility	Institutional (legal/political) feasibility
Scenario 1 : Taxify	--	+	+ +
Scenario 2 : Climatic conversion	+	+ +	+
Scenario 3 : « European green shift »	+	-	--
Scenario 4 : ECAT	+ +	--	--

32 The "Emission factors guide" (Ademe, http://www2.ademe.fr/) provides an interesting illustration of such carbon accounting. There is also the practice of carbon labelling, which certain large retail chains are starting to implement (for example, Casino in France, Tesco in the UK). It is true that such a carbon-added tax should be put into practice in a pragmatic manner, just as French VAT was, given that many small businesses do not practice real bookkeeping. It is also true that determining the carbon content of imports assumes a level of traceability that will probably not be immediately feasible; but it is possible to apply average coefficients.

5.2. Use of revenues

Whatever the characteristics of the carbon taxation, the choice of how to use the revenues is crucial – both for the tax's political acceptability and from the point of view of effectiveness against climate change, and also perhaps for its role in increasing the Union's energy independence. It is well known that taxes based (directly or indirectly) on energy consumption have a regressive effect: low-income households spend more of their budget on energy, and so carbon taxation will tend to weigh more heavily on them. Such a regressive effect is particularly easy to compensate given that the carbon tax does not aim to increase tax revenues – it is rather destined to be redistributed. But the possible choices of destination are numerous and have important consequences for the effectiveness of the policy.

Certain governments have been able to take measures to reduce and even compensate for the effects, generally socially regressive, of the implementation of environmental taxes (in particular, Germany with the 1999 tax reform and Sweden with its reform of 2001). There is a question over what type of compensation best allows a maximal effectiveness of climate taxation. In this regard, direct compensation measures (rebates, tax credits, financial transfers) are preferable to measures of exemption or tax reduction. Yet, according to the OECD (2007), in practice governments are often far from this integrated social-ecological approach: "In certain cases, considerations of redistribution are not at all taken into account, or else only at a late stage in the process of designing the policy, meaning a less coherent treatment. The result can be strong opposition and ineffective environmental measures, hence higher costs for society than is necessary."

In the European context, the question of how to use the revenues is further complicated by the debate surrounding the reform (universally desired) of the European budget and the possible introduction of a new "own resource" – which could be the revenues from the auction of EU ETS permits, a carbon levy at EU borders or even all or part of the European CAT[33]. Such an allocation of funds would produce

33 The "European carbon tax" is one of the options for new own resources discussed in the study by Begg, Enderlein, Le Cacheux and Mrak (2008) on reform of the financing of the European budget. But it must also be remembered that in spring 2008 the European Council declared itself in favour of returning to member-state budgets the revenues from auctions of emission permits, when such auctions are organised.

resources necessary to finance the carbon-conversion assistance promised to developing countries. At around 15 billion euros per year at a minimum, according to recent European Commission figures, there is little chance that this aid will be financed from national budgets (given the present state of European public finances) and the current size of the European budget does not suffice. Similarly, the European budget could potentially assume an important share of the EU's spending on "energy and climate conversion", in particular where such spending has a quality of "European public goods" – research and development, infrastructure of transport or energy distribution, etc. This would add a supplementary justification to the choice to direct these revenues to the Union's budget.

As with the methods of taxation, there exist several possible options for the allocation of revenues. Three principal ones are mentioned here. It is perfectly conceivable to combine the options: most of the countries with experience in carbon taxation have done so.

Scenario 1: "Double dividend"

Talked about for as long as European ecological taxes have been studied[34], the solution capable of generating a "double dividend" – that is, a reduction in GHG emissions and a positive effect on growth and jobs – is particularly attractive from the point of view of business competitiveness. In this scenario, carbon-tax revenues would be used to reduce charges on labour. The increased tax on businesses' energy consumption or sales would thereby be compensated with lighter labour costs. The option is particularly attractive in a context of high unemployment and, according to available assessments[35], generally results in increased growth and a weak impact, if any, on average prices.

Scenario 2: "Direct redistribution"

Carbon levies – whatever their exact features – have a generally negative impact on household purchasing power, so it can be tempting to redistribute revenues to

34 See in particular the study by Pierce and Smith (1991) and the survey by Chiroleu-Assouline (2000).
35 See in particular the recent assessment made for the French economy by Combet, Ghersi and Hourcade (2009). However, it must be noted that the conclusions of such assessments are somewhat unreliable and particularly dependent on their underlying hypotheses and the choice of numeric values. Precise analyses at the level of the European economy would be useful.

households as compensation. This is the "green cheque" idea, promoted in France by Nicolas Hulot and included, in the form of a tax credit, in the French version of carbon tax introduced in autumn 2009[36] . In various forms, it is also the solution chosen by most countries which have already experimented with carbon taxation. Direct redistribution to households has another important advantage in terms of political economy – it makes clear that the objective of the new tax is not to procure additional revenues for European public bodies, a suspicion always present in the minds of tax-wary citizens. In addition, such a solution makes possible the precise targeting of redistribution, which can be calibrated by socio-economic criteria. In terms of disadvantages, it generates less growth and employment than the previous scenario, and it neglects direct compensation for the higher production costs of businesses. Neither does it assist the carbon conversion of households, and it therefore risks having poor efficiency in terms of climate change.

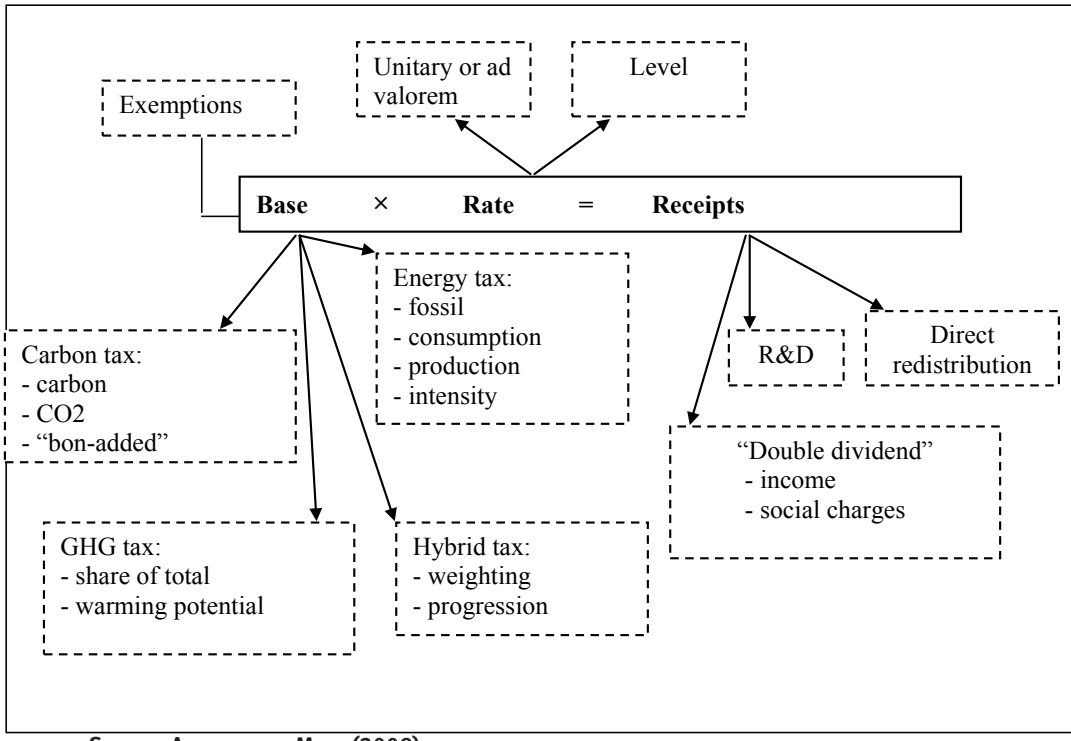
Scenario 3: "European budget"

If the aim is to maximise the impact of the new carbon tax in rapidly reducing GHG emissions, the most efficient solution is probably to use all or some of the tax revenues to finance spending which assists the climatic conversion of Europe's economy – concerning both producers and consumers. In this scenario, public spending on research and development (in particular from the European budget) could naturally be targeted, but it would also be possible to finance European low-carbon transport infrastructure, energy distribution networks, etc. Also in this rubric, programmes of energy conversion for housing would enable – as in the previous scenario – the targeting of the poorest households; the resulting lower energy consumption would represent a permanent compensation for the lower purchasing power caused by the carbon tax.[37] Lastly, revenues could help finance international aid for climatic conversion, promised to developing countries in exchange for their far-reaching commitments to control emissions (in the framework of the Copenhagen climate conference of December 2009). The financing of adaptation in developing countries – which will bear 80% of the consequences of climate

36 Note that in his proposal for a "general tax on carbon" in the US (January 2009) Jim Hansen also suggested returning to households the totality of revenues in the form of a fixed payment.
37 In this scenario, it is also possible to imagine a specific agricultural policy aiming to assist the "climatic conversion" of European agriculture. It should be remembered that agricultural GHG emissions, which include methane as well as carbon dioxide, are sizeable and pose a problem specific to this sector: efficiency of the climate policy demands that all emissions be taxed, but the cost for the sector would then be very high.

change (latest estimate of the World Bank) even though they only contribute 30% of world GHG emissions – could in this way become both sufficient and stable. A decision to create a carbon levy at EU borders and to use all revenues to finance climatic conversion in emerging countries would make this measure more politically acceptable; it could also represent the planet-scale equivalent of assistance for the climatic conversion of households.

Graph 10. Features of a European carbon tax



Source : Adapted from Milne (2009).

VI - Considerations of political economy

The economic issues examined so far cannot clarify fully the political decision to be taken on carbon taxation – particularly for a regional ensemble as vast and complex as the EU. To close, then, we will look closely at three considerations of political economy which should throw light on the conditions and the potential consequences of implementing the measures we advocate – distinguishing between the international level, the intra-EU situation, and the support of European citizens.

6.1. The international political economy of carbon

From the perspective of geopolitics, the European Union has a double interest in committing itself to one of the policy options sketched out here to tax carbon more effectively.

Firstly, it has every interest in consolidating its relationships with the major emerging countries by taking more fully its share of the historical responsibility for climate change – an acknowledgement which can be made explicit by a redoubled

effort to tax GHG emissions efficiently. The context of this commitment – negotiations for the Copenhagen summit and beyond – give the EU a pivotal role on the world stage. With more commitment to reducing its own GHG emissions, the EU could unblock the international climate negotiations. Europe's objectives are by far the most ambitious yet placed on the table by developed countries, but they still lack credibility, given the flaws in the economic instruments used to achieve them – flaws that the climate-energy package has only partially dealt with (cf. supra).

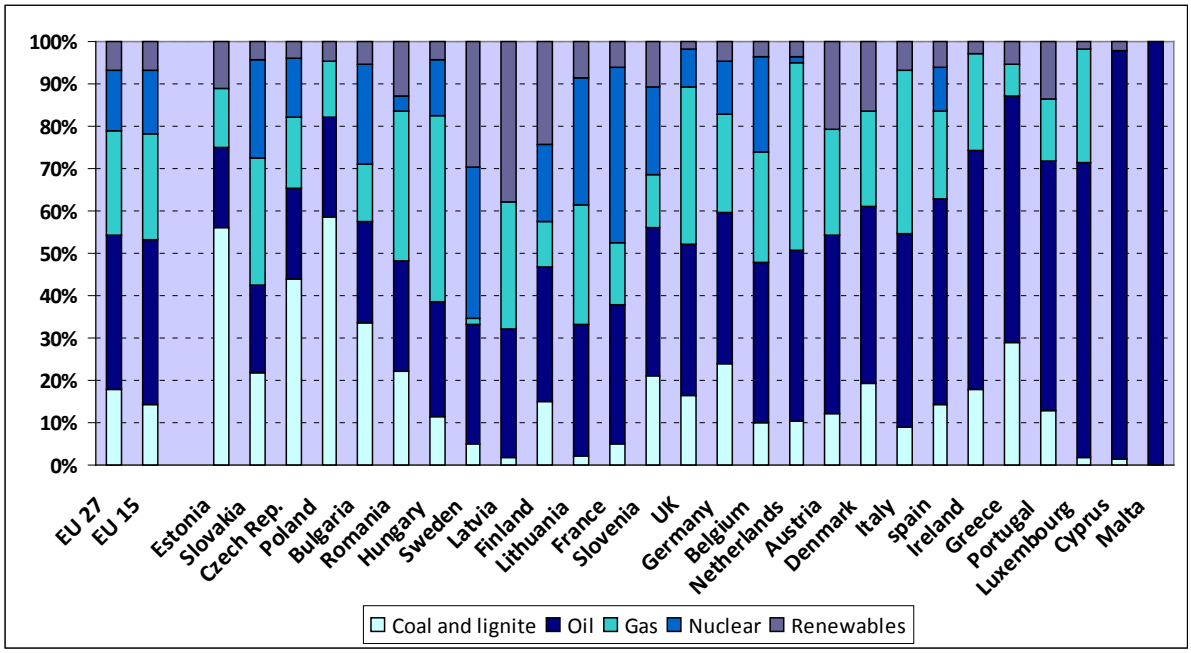
At the same time, it will be easier to obtain an international accord that resembles the IPCC's recommendations if there is an effective means of pressure to persuade emerging countries to commit themselves to sustainable development. Carbon tax is one such means, and it does not necessitate discriminatory customs adjustments at the border if all products are taxed. The question of climate change must become the priority area in which the EU exercises its power to set standards.

6.2. The political economy of European energy

The other obvious geopolitical issue is the EU's energy security, which today suffers from the massive dependence on imported fossil energy, above all Russian. In its "European action plan for security and energy solidarity", presented in November 2008, the European Commission made progress in acknowledging this major challenge for the EU, but there is a mountain to climb. The total volume of imports as a share of primary-energy consumption is not only considerable (54.2% in 2005) but it is increasing (by 4 points since 2000). Russia alone provided 18% of the EU's primary energy, up 5 points since 2000. In total, in 2005, 40% of European CO2 emissions from coal and 90% of emissions from oil products were derived from foreign supplies. There is thus a link between carbon taxation, de-carbonated growth and energy security which must serve as the foundation for a new European approach to the energy issue.

Of course, major obstacles obstruct the paths of the scenarios we propose. The most important is the diversity of Europe's energy mixes (see graph 12).

Graph 12. Energy mixes in the EU 27, in % of consumption of primary energy, 2005



Source : EEA.

The way forward is to find the most efficient and fair key to distributing effort in order to determine a possible level of taxation of energy and carbon.

It should be noted that targets for reductions of GHG emissions outside the EU ETS have already been calculated and negotiated, and that these must therefore represent the starting point for any new discussion. Nonetheless, it remains possible to examine targets other than these – ones focused on the evolution of GHG emissions and the European economics production structures.

A first possible key for distribution would be the responsibility of individual member states in GHG emissions, which can be judged in two ways: by the share of the total EU emissions, and by emissions per inhabitant (table 11).

Table 11. Member states and GHG emissions in 2007

	Emissions per inhabitant, in Mg tons CO2 e	Share of country in total GHG of EU 27
Luxembourg	27.1	0.3
Estonia	16.4	0.4
Ireland	16.0	1.4
Finland	14.8	1.6
Czech Republic	14.7	3.0
Cyprus	13.0	0.2
Netherlands	12.7	4.1
Belgium	12.4	2.6
Denmark	12.2	1.3
Greece	11.8	2.6
Germany	11.6	19.0
Austria	10.6	1.7
UK	10.5	12.6
Poland	10.5	7.9
Slovenia	10.3	0.4
Spain	9.9	8.8
Bulgaria	9.9	1.5
Italy	9.3	11.0
Slovakia	8.7	0.9
France	8.4	10.5
Portugal	7.7	1.6
Hungary	7.5	1.5
Malta	7.4	0.1
Lithuania	7.3	0.5
Sweden	7.2	1.3
Romania	7.1	3.0
Latvia	5.3	0.2

Source : EEA.

In view of a hybrid carbon-energy taxation it would probably be necessary to combine this first indicator with two other criteria: energy intensity and carbon intensity. Respectively, these measures – per unit of GDP – the quantity of energy used and the carbon emitted. Here it is useful to distinguish between the EU 15 and the new member states, given the gaps in development. As an illustration, Table 12 is an equal-share weighting of energy and carbon intensity.

Table 12. Energy and carbon intensity of states in 2005

	Carbon intensity (ratio of tons of CO2 and 1000s of US $ at 2000 PPP)	Energy intensity (1000 TOE per billion euros in PPP)	Hybrid indicator, equal weighting
Austria	0.33	150	75
Belgium	0.51	203	102
Cyprus	0.53	209	105
Denmark	0.32	105	53
Finland	0.37	230	115
France	0.24	177	89
Germany	0.39	162	81
Greece	0.42	613	307
Ireland	0.31	112	56
Italy	0.34	152	76
Luxembourg	0.45	184	92
Malta	0.56	222	111
Netherlands	0.54	183	92
Portugal	0.35	210	105
Spain	0.38	194	97
Sweden	0.22	175	88
UK	0.32	131	66
Average	0.39	201	101
Hungary	0.39	434	217
Poland	0.63	435	218
Slovakia	0.52	702	351
Slovenia	0.42	296	148
Latvia	0.32	375	188

Lithuania	0.37	479	240
Estonia	0.95	200	101
Bulgaria	0.84	1110	555
Czech Republic	0.63	609	305
Romania	0.54	734	367
Average	0.56	537	269

Source : EIA and EEA.

Lastly, it is important to know the current rate of implied taxation of the CO2 content of fossil energy. To do this, we exclude from energy revenues those which are based on electricity production from renewable or nuclear power, and we divide this amount by CO2 emissions.

Table 13. Effective tax rate (in euros per ton of CO2) in 2004

	Tax rate on fossil fuels
Denmark	66
Sweden	64
Italy	63
France	63
Austria	63
Luxembourg	62
UK	61
Portugal	53
Ireland	43
Germany	42
Spain	35
Belgium	33
Netherlands	29
Greece	17
Average	50

Source : ADEME.

6.3. The political economy of European public opinion

What do we know about the opinions of citizens on the climate change question, and about their willingness to pay more for energy as part of the fight against climate change? Eurobarometer[38] tells us about the level of concern among citizens over climate change, and it appears particularly high.

The latest Eurobarometer findings on "attitudes of Europeans concerning the environment" shows that environmental protection is judged "very important" by 64% of citizens questioned (96% judge it "very" or "somewhat" important). Moreover, Europeans now consider that environmental policy should be made at EU level (67%) rather than national level (21%). 82% of them say that harmonised European environment legislation is necessary, and nearly 80% would accept that the EU spends more on environmental protection even if this means less spending in other areas. Among environmental topics, climate change is the number-one concern, cited by 57%.

According to the survey on "Attitudes of Europeans towards climate change", 62% of European citizens consider that "global warming / climate change" is the most serious problem confronting the world (the second highest figure, just behind "poverty, lack of food and drinking water"). The survey confirms numerous other studies on this question.

More unusually, the survey also asks about the cost of fighting climate change. 44% of Europeans declare themselves willing to pay between 1% and 30% more for green energy, whereas 30% are not prepared to pay more. The citizens most willing to pay more reside in Denmark, Greece, Slovenia and the Netherlands. Romanians, Germans and British are the least inclined to spend more. In terms of the exact amount that citizens would be prepared to spend in addition, on average, we note that Danes, Swedes and Bulgarians seem to be the most generous, and Portuguese, Spanish and Austrians the least.

38 « Europeans attitudes towards climate change », Eurobameter September 2008 and « Attitudes of Europen citizens towards environment », Eurobameter March 2008.

Table 14. European households' willingness to pay

Personally, how much would you be willing to pay for energy produced from sources which emit less greenhouse gas, in order to fight climate change? How much more, on average, as a percentage, would you be willing to pay?

	Willing to pay more	Not willing	Average extra spending consented to, as % increase
EL	71%	16%	11.1
NL	68%	19%	13.1
SI	68%	16%	11.5
SE	68%	15%	18.7
BE	64%	25%	10.8
FI	59%	25%	13.8
CY	58%	14%	15.2
AT	57%	21%	9.7
SK	49%	17%	12.4
PL	48%	22%	12.6
HU	47%	24%	12.2
EE	44%	27%	13.7
LU	44%	22%	12.3
DE	42%	42%	10.5
FR	42%	38%	12
LT	42%	32%	12.9
CZ	42%	24%	12.2
IT	41%	16%	11.9
ES	40%	23%	8.3
IE	39%	19%	14.6
UK	36%	41%	13.3
LV	31%	38%	14.8
RO	29%	49%	16.6
MT	27%	36%	14.8
BG	27%	33%	18.2
PT	26%	32%	7.2

CY (TCC)	**46%**	**13%**	**31**
TR	**63%**	**37%**	**12.9**
HR	**61%**	**20%**	**14**
MK	**45%**	**18%**	**16.4**

Source : Eurobarometer.

Conclusion: debate is fine, but it is time to decide

The aim of this study was not (as we have reiterated already) to assess the effectiveness of Europe's strategy on climate change – that is, the strategy's relevance to this unprecedented challenge to our societies. We have sought, rather, to measure the efficiency of the strategy – in other words, the relationship between declared ambitions and mobilised means.

This exercise seems timely to us because in 2009-2010 the EU is winding up the period begun in 2000 at the Lisbon Council and preparing to make sustainable development the centrepiece of its new growth strategy for the coming decade. The European environmental strategy must not turn out in 2020 like the Lisbon Strategy in 2010 – victim of a persistent gap between declarations and results. As we have tried to show, this is a question not only of the European Union's interest but also of the global public interest.

At the conclusion of this study, we perceive three certainties. The first is that in spite of the considerable progress made, the tangible reality of a low-carbon European economy will only come about if carbon taxation is thoroughly reformed. The second certainty is that this reform is anything but obvious: numerous options exist and only a wide-ranging democratic debate will allow a choice between their

respective merits. The third certainty is that this debate will be long, complex and difficult. It must be begun without delay. The European Union cannot allow another twenty years to be lost in the struggle against climate change. In autumn 2009 both the Swedish presidency of the Union and the European Commission have announced initiatives for a new European carbon tax. Will they finally be put into effect?

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Competition, Cooperation, Solidarity

An ever less carbonated Union?

Towards a better European taxation against climate change

As Europe prepares to put sustainable development at the centre of its growth strategy for the coming decade, it seems opportune to examine the effectiveness of European action against climate change. The European Union has become the undisputed world leader on the issue, it is true. But the Union's environmental strategy still lacks coherence and even credibility. The powerful economic instruments created by the EU need to be reformed and completed if carbon is to be taxed more effectively.

This study proposes just such a reform of Europe's carbon taxation, concerning both the emission permits market and Europe's various carbon tax regimes. The authors survey the unhealthy trend of carbon emissions in the EU and look closely at the instruments available to fight climate change: emission permits market, regulation, and environmental tax. It emerges that these tools, in their current form, are poorly suited to the declared aims of the EU. On the basis of this observation, four scenarios for a new European carbon taxation are sketched out, each corresponding to a different degree of political ambition.

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