LETTER

Liberté • Égalité • Fraternité
RÉPUBLIQUE FRANÇAISE

N°19
October 2007

TRÉSOR-ECONOMICS

The use of economic instruments for environmental policies

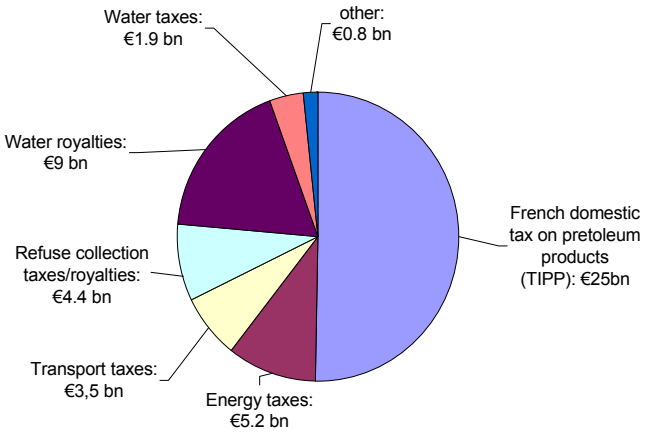
- Protecting the environment is a major policy challenge for the coming decades. Whether the aim is to combat climate change, preserve biodiversity, or reduce water and air pollution, it is vital to start framing effective environmental policies today. These must achieve a high level of protection while minimising the costs of this effort to society.

- Governments can draw on a broad array of instruments for that purpose. While regulation is a classic instrument designed to constrain polluters' behaviour, economic instruments work through incentives aimed at fostering better behaviour.

- Environmental taxation and permit markets are the main types of economic instruments and are already used in the European Union and in a number of OECD countries. By setting a price for environmental goods via the rate of the tax or the price of the permit, they act as an incentive to polluters to modify their behaviour. They offer several advantages over the regulatory approach. By eliminating all forms of action whose cost outweighs the price of the permit or the amount of the tax per unit, they first of all achieve an environmental objective at least cost. They also act as a permanent spur to seek cheaper solutions and amplify economic actors' efforts to innovate: this can prove decisive in the long run.

- It is therefore possible to rank instruments by their effectiveness depending on the environmental problem in question. For example, a market in permits can guarantee *ex ante* a given environmental outcome, whereas an environmental tax serves to set *ex ante* the cost of this policy to agents. Regulation, meanwhile, may be perfectly legitimate in certain cases, particularly when faced with the risk of catastrophic and/or irreversible damage.

Environmental taxation in France in 2003



Source: National Accounts.

DGTPE
DIRECTION GÉNÉRALE DU TRÉSOR ET DE LA POLITIQUE ÉCONOMIQUE

1. The current situation in France and the world

1.1 The European Union is increasingly resorting to economic instruments to deal with major environmental challenges

Faced with the major environmental challenges of the coming decades—fighting climate warming, improving air quality, protecting water quality, preserving biodiversity—it is vital to adopt the most effective instruments in order to achieve a high level of protection for the environment while minimising the cost of this effort to society.

Table 1: Environmental tax revenues in the EU in 2004 (as a % of GDP)

Country	% of GDP
EU 15	2.9
Denmark	4.8
Netherlands	3.9
Finlad	3.9
Sweden	3.3
Ytaly	2.9
Great Britain	2.6
Germany	2.5
France	2.1
Spain	2.0
EU 25	2.9[a]
Cyprus	4.1
Slovenia	3.4
Malta	3.2
Czech Rep.	2.7
Poland	2.3

a. *in 2003*

Source: Eurostat 2006

With that end in view, economic instruments, and especially taxes and permit markets, offer a number of advantages worth exploring

Several countries, for the most part European, have introduced major "green" tax reforms. These experiences have demonstrated the effectiveness and benefits of the approach. The Scandinavian countries and the Netherlands pioneered the approach in the early-1990s. These positive experiences cover a variety of environmental aspects, including local pollution, the greenhouse effect, waste, the natural heritage, and so on. The agents concerned may be households, businesses, or local authorities, with, for example:

- a combination of taxes on input fuels, negotiated agreements, and a market in permits in the United Kingdom (Climate Change Levy);
- the market in nitrogen oxides (NO_x) and sulphur dioxide (SO_2) emissions quotas in the Los Angeles area;
- the Federal market in SO_2 quotas in the United States;
- taxation of NO_x emissions in Sweden;
- taxation per kilometre travelled of goods transported by road, in Austria, Germany and Switzerland;
- taxation of nitrogen utilisation in several Northern European countries;
- the Irish tax on bags at supermarket check-out counters.

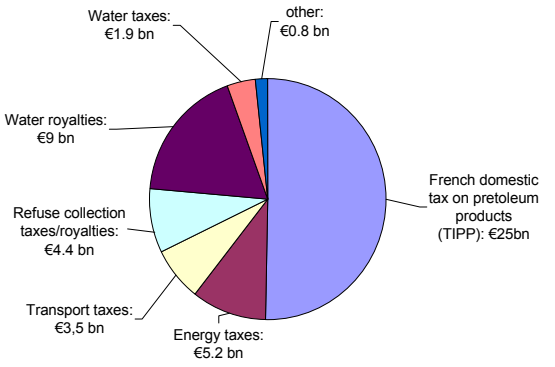
1.2 The use of economic instruments in environmental policies in France today

French experience with economic and environmental policy tools is both long-standing, with the introduction in 1964 of the Water Boards' royalty system, or again with the domestic tax on petroleum products (TIPP), and recent, with the introduction in 1999 of the general tax on polluting activities (TGAP) and the European market in CO_2 emissions quotas in 2005.

In France, the use of economic instruments in the form of environmental taxes[1] originally arose not in order to discourage polluting behaviour but rather to raise revenue. By contrast, the "TGAP" was the first tax to be presented from the outset as being intended to modify behaviour in a more environmentally respectful manner.

Although the TIPP was not created for environmental purposes, its impact on fuel consumption now appears to be broadly recognised.

Chart 1: Breakdown of environmental taxation in France in 2003



Source: Commission des comptes et de l'économie de l'environnement.

(1) According to the definition common to OECD and Eurostat, environmental taxation comprises all tax measures whose base—product, service, equipment, or emissions—has an impact on the environment. The 2005 Report of the French *Conseil des impôts* (Tax Council) on taxation and the environment (*Fiscalité et environnement*) listed 44 environment-related taxes.

A feature of French environmental taxation is the broad diversity of tax bases, chargeable events and beneficiaries. Altogether these taxes represented €50 billion in 2003 and nearly 3% of GDP[2]. As in most countries, the tax take is dominated by fuel taxes (€25 billion), water royalties (€9 billion) and, finally, taxes and royalties on refuse collection (€3.5 billion). Amounts raised from other areas of the environment (noise, scenic pollution, air pollution, pressure on natural resources, prevention of hazards) are modest. The TGAP currently comprises eleven taxes covering different areas, totalling €470 million in 2004.

2. Economic theory and environmental policies

The use of taxes and permit markets for environmental policy purposes offers a number of advantages according to economic theory

2.1 A brief recapitulation of the fundamentals of environmental policies

In the absence of specific policies, prices fail to reflect the potential environmental damage caused by the consumption or production of goods and services supplied by these markets. Economic agents consider environmental goods to be free and tend to over-consume them. Moreover, they fail to take into account the negative effects on other economic agents of the consumption or production of certain goods and services such as transport or energy, for example, and thus fail to consider the associated environmental disamenities (or externalities).

In other words, **the social costs connected with the consumption or production of these goods and services is greater than their private cost. In the absence of public intervention, agents ignore this difference, which results in a non-optimal situation.**

2.2 Regulation or economic instruments: constraint or incentives?

Environmental policies can take a variety of forms, including standards, bans, voluntary agreements or economic incentives (through taxes, subsidies and tradable permits).

Regulation consists in imposing obligations to do something (such as fitting catalytic exhaust systems to all new vehicles) **or to refrain from doing something** (not exceeding a quantitative threshold for the emission of polluting substances, for example).

A major problem with regulation, from an economic standpoint, is that it applies uniformly to all agents irrespective of differences in the cost of depollution for individual firms. But it remains indispensable for dealing with forms of pollution deemed particularly hazardous to health (e.g. the ban on the sale and use of asbestos), or where there is a risk of irreversible and/or very substantial effects.

In theory, economic instruments serve to minimise the total cost to society of achieving a given environmental objective. By reflecting the cost of environmental damage in the price, it restores the equality between social cost and private cost, obliging each agent to arbitrate between the marginal cost of cutting pollution by a single unit and the cost of paying a tax[3] or purchasing a permit to emit that same unit. In so doing it incites the agent to implement depollution measures whose marginal cost is less than the tax or the price of the permit (see Box 1). Firms able to introduce depollution measures at a marginal cost below that of the tax, the subsidy or the price of the permit will cut their emissions. Those for which these costs are too high will avoid this depollution effort by paying the tax, forgoing the subsidy or purchasing permits. As a result, abatement efforts will be directed to where they cost least.

Unlike regulation, economic instruments incite firms to go beyond compliance with simple standards, since by further reducing their pollution they can save an amount equivalent to the tax or the price of permits. They therefore act as a stimulus to innovation and research and help to bring down the cost of cutting emissions in the long term. Contrary to regulation based on best-available technologies, economic instruments even have the advantage of being dynamically efficient.

(2) This figure differs from the one given for France in Table 1 due to the scope utilised in the definition of ecological taxation. Here, we consider a broad definition that notably includes the water boards' royalties (€ 9 bn) and the taxes and royalties on refuse collection (€ 4 bn). For international comparisons, OECD and the European Commission exclude taxes and royalties for services rendered.

(3) In a static mode of reasoning, the effect of a subsidy for depollution is equivalent to that of a tax on pollution (assuming that an opportunity cost is as effective as a tax). In a dynamic form of reasoning, however, a subsidy may create inefficiencies by altering long-term competitive equilibria. That is because subsidies tend to favour the growth of the most polluting industries at the expense of cleaner activities, by making them more profitable. Conversely, taxes send a long-term economic signal to agents reflecting the social cost of their activities, serving to align private interests and the general interest in their decisions to enter and leave an activity

Box 1: **Regulation or economic instruments**

We consider here three polluters that differ by their possibilities of cutting pollution ("abatement"). The curves CmAb1, CmAb2 and CmAb3 represent the marginal cost functions of abatement, i.e. the costs of abating an additional unit of pollution.

The first charts synthesise a regulatory approach consisting in obliging each agent to cut its emissions by half. The marginal cost of abatement to each of the three agents differs according to the quantities of pollution authorised: agent 3 is clearly characterised by having the highest marginal cost, and agent 2 the lowest. This kind of intervention is economically inefficient in the sense that it does not minimise the total cost of abatement for a given quantity of pollution. This is because it is possible to reallocate the quantity of pollution authorised between the agents in such a way as to reduce the overall cost of the desired depollution. One could, for example, authorise agent 3 to pollute by one additional unit and, in exchange, oblige agent 2 to pollute by one less unit.

We now consider the effect of a tax at a rate T* (second chart). It is in the interest of each agent to implement any abatement action whose marginal cost is less than the rate of the tax, which leads to the equalisation of these two variables for each of the agents. The marginal costs of abatement are thus equalised, leading to an economically efficient situation. In our example, agent 2 is led to cut his pollution by 70%, while agent 3, for whom reduction is more expensive, cuts his pollution by only 25%. The total gain to society then is equal to the area of triangles C2 and C3.

A permit market operates in a similar manner from the standpoint of the allocation of the quantity of pollution authorised, the market price of quota P* replacing the tax rate in the role of price signal.

The three agents are globally allocated an initial quantity of quotas equivalent to half of the pollution they would emit in the absence of public intervention, as in the case of the previous regulation. But now they can trade these quotas. The market mechanism leads to an equilibrium quota price matching supply and demand for pollution.

Chart 2: regulatory approach

Marginal cost of abatement

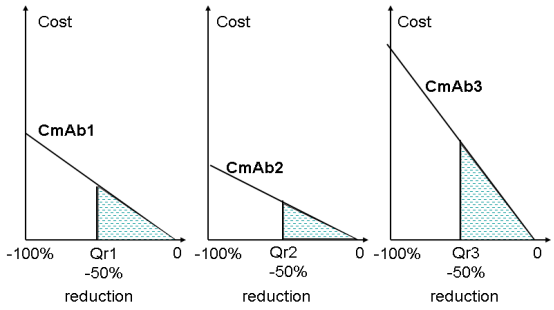
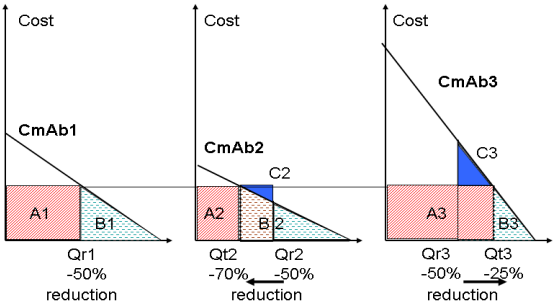


Chart 3: Tax-based approach

Marginal cost of abatement and price



3. What determines the effectiveness of economic instruments?

3.1 The effectiveness of an environmental tax depends on its base and its rate

To be effective, environmental taxation needs to be based on emissions of pollutants or on the consumption of goods that cause polluting emissions, such as fossil fuels in the case of greenhouse gas emissions, for example at the final consumption stage for inputs in the production process. Determining the optimal tax base is awkward in cases where emissions pollute only above a certain threshold that is hard to evaluate and verify, as for example in the case on nitrogen-based fertilizers used in farming, a fraction of which is absorbed by crops.

Moreover, to reduce pollution to the socially optimal level, the environmental tax rate needs to be equal to the marginal cost of the damage caused by an additional unit of pollution (e.g. the taxation of NOx in Sweden). In that case, agents would need to carry out all acts of depollution whose private cost is less than the rate of taxation, and hence less than the social benefit produced by the depollution. All depollution efforts carried out within this framework will thus produce positive gains for the community. The sum of the two costs (depollution and damage resulting from residual pollution) will be minimised.

It may be difficult, in certain cases, to put a value on the environmental damage resulting from the emission of an additional unit of pollution, for example due to lack of information about its impact or to the existence of threshold and nonlinearity effects. This is notably the case with the greenhouse effect. In that case one can choose to set a quantitative depollution target *ex ante* and deduce from that the level of taxation required to meet that target.

3.2 In a permit market, the number of permits initially allocated determines the final level of pollution

Permit markets are based on the principle of indirectly assigning a market value to an environ-

mental good—for example a unit of pollution or a unit of natural resources—**by imposing quantitative constraints on a group of agents**. The different agents are allocated an initial volume of permits or quotas, which they can then trade among themselves. Each agent must ensure at the end of the period that he holds either as many quotas as the quantities he has emitted or extracted, which implies the need to institute control mechanisms and appropriate penalties. In the case of emissions trading markets (e.g. the European CO_2 market or the American SO_2 market, etc.), each agent must arbitrate between emissions cutting measures or the purchase of a permit by comparing the cost of the investment with the price of a quota on the market. The mechanism is the same for a market based on extraction of a natural resource (e.g. fishing or water withdrawal quotas, etc.), and each agent will compare the marginal benefit to be obtained from consuming one additional unit of the resource with the price of the quota.

The final level of emission or extraction is determined *ex ante* by the total quantity of permits allocated. This in turn determines the overall effort demanded of the economy, and its cost. The method of allocation and the initial distribution of quotas among the firms concerned has no impact, in principle, on this outcome, provided the transaction costs are not too high.

4. The choice of the most appropriate instrument depends, among others, on the characteristics of the environmental damage and the polluters being targeted, as well as on redistributive aims

If the regulator is perfectly informed of the cost functions of depollution and environmental damage, he can achieve the social optimum equally well either by introducing a tax at the optimal rate or by allocating the quantity of permits corresponding to the optimal level of pollution achievable with this tax. Nevertheless, this property of equivalence is not fully verified if there is an asymmetry of information between polluters and the regulator as to the possibilities and costs of cutting pollution. The choice as between these two types of instrument depends on three categories of argument.

4.1 A permit market can be used to control the aggregate level of pollution *ex ante*, whereas a tax can be used to control the cost of depollution

The choice of whether or not to institute an emissions permit market entails a degree of uncertainty as to the cost of the emissions reductions to be carried out by participating firms: this cost will be determined by the equilibrium price on the permit market, which is uncertain at the start, in principle. Conversely, by choosing to tax, one can limit with certainty—at the level of the tax—the maximal cost of the depollution effort demanded of firms. In this latter case, this certainty as to economic costs implies a degree of uncertainty as to the environmental outcome (i.e. the final level of pollution) of the mechanism. A process of trial and error as to the level of the tax may be needed to achieve the desired level of pollution if this type of target is preferred.

This difference between, on the one hand (with a permit market) certainty as to the level of pollution and uncertainty as to costs and, on the other (with an environmental tax) an uncertainty over the level of pollution and certainty as to costs, is useful in determining which instrument may be preferable depending on the type of pollution considered. In a case where the marginal damage increases only slightly with each additional unit of emission, a tax will be preferable to a permit market that could impose a needlessly costly effort on firms if the initial allocation is too small. As opposed to this, where the marginal damage increases rapidly beyond a certain threshold, a permit market is preferable since it serves to control the level of pollution: this appears to be the best method, since it is hard to vary the tax rate in accordance with this marginal cost.

4.2 The use of permit markets can serve to limit levies on polluters for a theoretically identical environmental effect

In the case of an initial allocation of emission permits *via* auctions, taxes and permit markets are strictly equivalent in terms of the levy they represent on the agents concerned. However, in the case of a free initial allocation, the institution of a permit market will limit the levies on polluters for a theoretically identical environmental effect.

An environmental tax obliges those subject to it to pay a tax on all of their emissions, whereas a quota market with a free initial allocation will penalise them only for their additional emissions (via a levy at the margin). But, for certain sectors of the economy extensively exposed to international competition, the recourse to an instrument implying a blanket—but in principle lower—levy could prove crucial in gaining acceptance for this kind of economic instrument.

4.3 Environmental taxation is generally preferable when polluters are numerous and scattered

In this kind of case, for example for private vehicles or farms, an allocation of emissions quotas to all polluters would entail high transaction costs. Here, an environmental tax would appear to be best suited. An environmental tax based on a diffuse form of pollution can also entail substantial administrative costs, in particular costs of control and verification[4], but a permit market would in addition entail transaction costs connected with participation in quota swaps. Overall, the choice and calibration of tools (for example the level at which the constraint is

brought to bear, i.e. end-consumer or distributor) ought therefore to take all the resulting transaction costs into account for optimally effective public intervention.

4.4 What are the consequences for French environmental policy?

As far as environmental policies are concerned, the challenge facing public decision makers is to formulate an approach combining a comprehensive array of tools geared to the degree of dissemination of information, the number of players, the type of pollution, the greater or lesser heterogeneousness of abatement curves, the underlying potential for technological innovation, etc.

In view of the current situation in France, there is considerable scope for developing the use of efficient economic tools[5], because these reforms will ultimately serve to reconcile environmental goals with growth. This point is also attracting close attention at the level of the European Community, the European Commission having published a Green Paper[6] on the subject in March 2007.

5. From theory to practice: avenues for future reforms

Before contemplating the creation of new taxes or new permit markets, it is worth examining possible avenues for reforming existing tools such as the TGAP instituted in 1999, and the introduction of the European greenhouse gas emissions allowance trading scheme in 2005.

In particular, one could start by envisaging:

- reviewing environmentally-damaging counter-incentives and subsidies. These cover all those subsidies and exemptions, etc. that modify agents' behaviour and ultimately have a negative impact on the environment[7];
- making existing taxes more efficient by modifying their basis, establishing the closest possible linkage between them and the damage caused[8] and by adjusting their rate, which is generally well below the level of margin damage and too low to have a truly incentive effect. The increase in the TGAP rates in 2007 (under the 2006 Supplementary Budget Act) is consistent with this logic.

Over and beyond the theoretical position on the criteria of efficiency of economic instruments, in practice a variety of conditions need to be met in order to ensure the acceptability and efficacy of a reform aimed at making environmental taxes and permit markets more widely used. These conditions come under three main headings.

5.1 Developing ecotaxes while reducing the most distorting levies

At the end of the 1980s the idea gained ground that, for a given level of revenues, replacing levies on work by environmental taxes would produce a "double dividend", by cutting pollution (first dividend), and by cutting unemployment (second dividend). This view sparked sharp controversy, since the interactions with the labour market are complex and heavily dependent on the national situation as a whole.

In any case, ecotaxes are justified in the first place by their environmental aims and the incentive they provide to behave more virtuously. Secondly, this need not prevent certain environmental taxes from contributing to wider tax reform, by facilitating the reduction of previously existing distortions (affecting labour or capital), thanks to the revenues they generate.

Consequently, without diminishing the priority these instruments give to the environment, the possibilities they offer for shifting part of the tax burden—notably by reducing the most distorting levies—is a second argument in their favour. The question then arises as to the level of revenues actually raised and how they evolve over time, the expected change in agents' behaviour leading to a shrinking of the tax base (due to their environmental impact) and hence to lower revenue. However, in the absence of very high elasticity or prohibitive rates, this tax base will not disappear (as we have seen in the case of energy taxes) and the level of revenues will remain substantial.

5.2 Ensuring the success of the reform

The various examples from abroad show that financial neutrality is one of the main keys to the acceptability of reform. The aim of economic instruments is not to boost the total volume of tax or public revenue nor the total tax take. As a general rule, the introduction of new instruments should respect this principle of financial neutrality, and should be accompanied by appropriate compensatory measures or a redistribution of tax revenue.

(4) This is not the case with the TIPP, for example, since there is a close link between a form of pollution and an easy-to-tax fuel.

(5) See "Environmental Performance Reviews – France", *OECD, June 2005*

(6) "Green paper on market-based instruments for environment and related policy purposes", *European Commission, March 2007*.

(7) Examples include the exemption from the TIPP for farmers, reduced-rate VAT on plant health products, and so forth.

(8) For example, in most municipalities, refuse collection tax payable by each household is calculated on the basis of the rental value of the dwelling, regardless of the quantity of waste produced.

In theory, this principle needs to be viewed at the level of the economy as a whole. Treating it as a sectoral objective would be liable to limit the environmental impact of the measure. In practice, though, one can seek a transitory and intermediate solution, with targeted recycling of revenue serving as a lever to gain acceptance for the reforms, by cancelling out or reducing the impact on the competitiveness of affected sectors and the redistributive effects on households.

For example, in the absence of international tax harmonisation and when it is considered too difficult to institute an adjustment tax on imports at the border (or an export subsidy), a partial or total refund of ecotaxes to polluters may be justifiable in order to preserve the competitiveness of the worst affected industries. This form of recycling attenuates the incentive nature of the tax, but it does not cancel it out if the redistribution criterion is not perfectly correlated with the pollution emitted. Thus Sweden's NO_x emissions tax on combustion installations is redistributed in proportion to the amount of energy produced by those subject to the tax. This tax has been an outstanding success, having had a pronounced impact on emissions without harming the competitiveness of the firms that pay it[9]. Moreover, opting for a permit market with a free (or partially free) initial allocation, as in the case of the European CO_2 market, can limit the redistributive effects of the tax (see above).

Finally, to overlook the redistributive dimension when designing and implementing these instruments is to run the risk of rapid rejection and failure of an environmental policy. After all, all economic instruments have two dimensions: they influence the allocation of resources (which is their *raison d'être* from the environmental policy standpoint) and, simultaneously, they affect income distribution. This effect depends on the level of constraint represented by the efforts required of agents, on their cost of abatement, and on the choice of instrument (a tax without redistribution can generate substantial financial flows). One can thus envisage specific instruments such as a cut in direct taxation, for example.

5.3 Framing a credible governance structure for today and tomorrow

The issues at stake with regard to environmental policies raise the question of the credibility of the governance structures put in place and of the durability of the instruments envisaged. Negotiations accompanying the introduction of instruments may culminate in lower tax rates, exemptions for certain categories, or to generous emissions quotas. In this situation it is vital to **continue to conduct evaluations and to raise the actors' awareness so as to emphasise the issues underlying the policies being considered.**

The first need is to evaluate the damage, i.e. the impact of agents' behaviour on the environment, and then to put an economic value on this. This is essential in order to calibrate the environmental policy instruments and to gauge the effort demanded of agents in terms of either the tax rate or the total envelope for the permit market. In the field of climate change, the work of the Intergovernmental Panel on Climate Change (IPCC) and the publication of the Stern report illustrate the evaluation work needed in order to devise effective environmental policies.

The choice of instruments also depends on the associated transaction costs. Overall, these costs can indeed curb, or even cancel out, the economic efficiency of the tools put in place, owing to increased administrative costs. Consequently, a permit market would appear to be preferable when the actors being targeted are few in number and identifiable, and when their abatement costs are heterogeneous.

Moreover, one could also envisage a progressive approach, to leave the actors time to adopt these new tools, while leaving it open to the authorities to trim their policies and increase the effort demanded. This is the logic underlying the design of the European greenhouse gases market, with an initial experimental phase covering 2005-2007.

Finally, the introduction of economic instruments can act as a "shock" to households and firms, requiring an adjustment. This adjustment will be all the easier—and the instruments all the more acceptable and efficient—depending on economic agents' capacity to modify their behaviour in response to incentives. For example, measures to dissuade households from using their cars will be more effective if there is a well-developed public transport system.

Because the long-term price elasticity of behaviour is far greater than the short-term elasticity, **the design and implementation of instruments need to be viewed within a continuous, long-term perspective**. If allo-

(9) In Sweden, the gas-fired boilers and turbines used to heat buildings, produce electricity and power industrial processes are taxed on their nitrogen oxide (NO_x) emissions for all production of useful energy exceeding 25 GWh. In 2004 this system concerned 405 production units. The rate for this tax is set at 40 SEK/kgNO_x, or more than €4,200/tNO_x. The original feature of this system lies in the recycling of the revenues generated, which are redistributed among the firms subject to the tax in proportion to the useful energy they produce. €64 million were redistributed in this manner in 2004. The Swedish experience thus demonstrates the feasibility and efficiency of this kind of system. Indeed, since its inception in 1992, average emissions of NO_x per MWh have been cut by nearly 40% in the installations concerned.

wance is made for future adjustments, technologies can be adapted and equipment can evolve. Given the time needed to renew equipment, a sound policy will send out credible and comprehensible signals regarding long-term price trends, without imposing unduly harsh breaks with the past entailing additional costs in the short term for agents for no environmental benefit[10]. It would require a continuity of action over and beyond the administrative and political decision-making cycles.

France set up an "Economic Tools and Sustainable Development" working group in 2006, along the lines of the Green Tax Commission (Sweden (1997), Netherlands (1995), Norway (1990), etc.) with a view to boosting the recourse to economic instruments in the service of environmental policies, while making due allowance for the demands and problems facing the various parties concerned. More broadly, the French government has embarked on an ambitious and far-reaching consultation on the environment this autumn (2007), known as the "Grenelle de l'environnement". These various actions will lead to the taking of concrete measures aimed at improving the effectiveness of environmental policy.

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Box 2: **The emergence of permit markets**

The first country to introduce a permit market as an environmental policy instrument (the EPA Emissions Trading Programs) was the United States, in 1979, in order to reduce the cost of air quality regulations. However this market's rules proved too complex to yield satisfactory results. The second experience was the creation in 1982 of a market between refineries and refining firms aimed at cutting the lead content in petrol, and this proved distinctly more successful. The Los Angeles area NO_x and SO_2 quotas market (the Regional Clean Air Incentives Market, 1994), followed by an SO_2 quotas market covering the whole of the United States (in 1995) confirmed this instrument's economic efficiency.

In Europe, countries have favoured tax instruments at the national level. Faced with the difficulties of arriving at a consensus among all the Member States on rules for an energy tax (at the Community level, decisions on taxation must be taken unanimously), the introduction of a CO_2 quotas market represents a significant step forward. This market began operating on 1 January 2005. It concerns in the first place producers of electricity and heating, along with major energy-consuming industries such as refining, steelmaking, cement and brickmaking, paper, glass, and ceramics. An initial allocation was made for the period 2005-2007 (156.5 MteCO_2 a year for French industries). Each year the industrial firms covered by the quota scheme are required to hand back to the authorities a quantity of quotas corresponding to the emissions recorded. Allocations for the period 2008-2012 are now under consideration.

For the market's initial operating period (2005-2007), actual emissions recorded in 2005 were 4.4% below the amount of quotas allocated to all industrial firms. For the next period (2008-2012), actors are expecting a tightening of the constraint on the supply of quotas, the European Commission having recommended using 2005 emissions data to calculate allocations. Given the forecast growth in output for the sectors concerned and the technical possibilities for cutting emissions, this approach would imply a greater effort than previously, and hence, in principle, a higher price for the quotas

(10) Given France's targets of cutting its greenhouse gas emissions by four between now and 2050, one could, for example, one could for example provide for a progressive adjustment of the TIPP until it reaches its optimal levels.

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Publisher:
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Page layout:
Maryse Dos Santos
ISSN proceeding