11 Market-based Economic Instruments
Emission Trading

11.1 Making Business of the Environment

11.1.1 The Role of Markets in Environmental Protection

The most natural economic instruments for business, including industrial companies, are market-based ones. If resources and environmental services are bought and sold just as other items a company manages, it is easy to include them in normal operations. As mentioned in Chapter 10 it is not possible to give all environmental services and resources a correct price and thereby introduce them to a functional market. They remain external to the operations. In these cases economic instrument such as taxes, fees or subsidies are used, or regulations are introduced to correct behaviour, which does not relate to the economy naturally. However in other cases markets, where services or resources are bought and sold, do work. This is the topic of this last chapter.

It should be mentioned from the beginning that the use of a market as a frame for economic transactions and decision-making is limited, not only in environmental matters but in general. Market values are not used in for example a family economy or for that matter in a national economy. Values other than money are much more important and the price is not so relevant or simply does not exist. For example health, the desire for a good life or where to live are values which steer the decisions individuals and families take, and e.g. security may be the more important for a nation than economic development.

Nevertheless, when market mechanisms can be used, they are simple and, if the prices are right, they should at least theoretically lead to the right decision, optimising all aspects which need to be considered in a process, including the protection of the environment.

11.1.2 Economic Tools Using Market Mechanisms

The most obvious tool for markets is when a resource has a price and there is a buyer and a seller. The best examples are when a company may improve the environment by turning waste into a resource via regenerating and recycling schemes for (previous) waste material. The simplest examples are the recycled materials, such as paper, glass or scrap metal. The market for waste will be described below. Another, less common, case appears in what is called industrial symbiosis. In

In this Chapter

this case one industrial plant sells an output which normally is not seen as a product, such as energy in the form of hot water or steam, to a neighbouring activity, most often another industrial plant. Some industries sell excess heat to the municipality where they are located, for use in district heating (See further book 2 in this series).

Another case is when a service is charged on more or less commercial conditions. The services from municipalities for management of water, waste or energy belong to this category. The deviation from market conditions is of course the fact that the provider, the municipality, in reality often has a monopoly, so that there is no well functioning market. It is, however, not always so. A company may find another solution if the service offered by the local or regional authority is considered too costly or not good enough for the needs at hand. For example most industrial plants provide their own source of water, rather than buying it from the municipal water company. The charges for such services were discussed in the previous chapter.

To sell or buy the right to emit a certain amount of pollutant has been implemented for carbon dioxide as will be described below. Again a market is established. The interesting aspect of this way to deal with environmental impacts is that it is possible to find out how much the environment can handle of each specific pollutant. The total amount, the ceiling, of each specific pollutant should in principle be established. Then it is up to those who pay most to use this capacity of the environment. However, on the existing emission markets the ceiling is not established on the basis of the capacity of the environment, but rather the capacity of industry to reduce its emissions.

11.1.3 A Market for Waste

Some categories of waste can be sold; they have a market value. This includes used paper, glass, and scrap metals but also some plastics. The establishment of a market for recycled materials and goods has been very important for the improvement of the environment, and the market for recycled materials is a key economic instrument. Today close to half of the paper produced in the European Union comes from recycled paper. A cellulose fibre can be used about six times before being too short to be suitable for making paper. It is obvious that very many trees have been saved by this recycling of paper. Very important, too, is that a huge reduction of energy use and pollution is the result of recycling.

A similar comment can be made both regarding glass and metal. Close to 50% of glass production in the European Union is based on recycled glass and a sizeable amount of the iron, copper and aluminium production. In both cases the big gain is connected to reduction of the energy required. For the case of copper the reduction of resource use for the production of copper from scrap metal compared to virgin copper is about 30 times, for iron it is about six times. In a time when much effort is made to increase energy efficiency to reduce carbon dioxide emissions, this is obviously very important.

The introduction of collection and recycling of used paper, glass, metal etc was mentioned in chapter 4. Packaging waste makes up an important part of the glass and metal waste, not least in the form of beverage containers. Packaging waste is regulated by the European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste. It distinguishes between 'reuse', 'recovery' and 'recycling' in this order of priority and includes minimum targets of 50-65% of all packaging waste to be dealt with in either way by the member states. The directive authorizes use of Agreements with the relevant companies and/or business sectors as a possible instrument for reaching the targets set.

The Directive opens (article 7) for use of deposit and refunds systems to be used primarily with the general public as an incentive to return e.g. beverage containers but also used cars and other waste. Sweden has a well-elaborated deposit and refund system and manages to get more than 90% of aluminium containers returned, while the return level in countries without the deposit-refund component is much lower.

Environmental Agreements are used with companies and industrial sectors also on other types of waste than packaging waste.

The simple establishment of business operations for providing basic services in the sector of waste and solid waste management and the use of recycled material has been very important for a good environmental policy.

11.2 Emission Trading

11.2.1 The First Experiences

Tradable pollution permits are an alternative to setting emissions standards or using pollution fees. The tradable pollution permits involves the establishment of a trading system for the "right to pollute". It may be used among those living along a coast or a river, which has the capacity to adsorb a certain amount of exhausts, or more commonly among those emitting pollutants to the air in a region.

The use of pollution rights to be sold and bought on a market was first proposed in 1968 by the American economist Herman Daly. This arrangement became quite popular in the USA, in which several such markets have been established. It is mostly used for air pollutants. A condition is that it is not so important exactly where the pollutant is emitted.

The first European case seems to be that of the Polish city of Chorzow in Upper Silesia, where a trading scheme was

established between just two industries. One steel mill was in bad economic conditions with many emissions, but where these could be reduced by rather inexpensive actions. The other factory was in good economic conditions, but the reductions of emission would be comparatively expensive. The common trading scheme was successful and dramatic reductions in emissions of particles, CO, SO_2, NO_X and VOC were achieved.

The Polish scheme constituted a quite local so-called *bubble*. The maximum concentrations or amounts allowed according to the scheme set up by the authorities is called the *ceiling*.

The largest scale emission trading ever established is the EU carbon dioxide emission trading which we will now describe in some detail.

11.2.2 Trading Emissions Under the Climate Convention

The Framework Convention on Climate Change, FCCC, was signed during the UNCED Rio Conference in 1992 by 153 participating states. It entered into force in March 1994. Its intention was, and is, to stop climate change by reducing combustion of fossil fuels and the resulting green house gas emissions, but exactly how to do it was then left to further developments. A series of COPs (Conference of Parties) were staged, which, piece by piece, have formed one of the most efficient conventions ever created. The 3rd COP in Kyoto, Japan, in 1997 was especially fruitful since the levels for decreased emission of CO_2 for the so-called Annex 1 states, basically the industrialised countries, were detailed in its protocol.

The Kyoto protocol states that by 2010 (as the average of the 2008-2012 window), the parties should have decreased their CO_2 emission by an average of 5.2% as compared to the chosen base year of 1990. The commitments were unevenly distributed and for the European Union members it was -8%, for the USA -7% and Japan -6%.

The Kyoto protocol entered into force on the 16th of February 2005 after the Russian Federation had ratified the protocol as one of more than 150 States. Thereby countries, representing the requested 55% of the 1990-emission of CO_2, had ratified the protocol, which was made a precondition for its entering into force. The USA, responsible for about 35% of the global CO_2-emission, is now the only major state, which has not ratified the protocol.

Later key COPs were the one in Marrakesh in which the so-called Clean Development Mechanisms measures were agreed on, and the one in Montreal, Canada, in which a sanc-

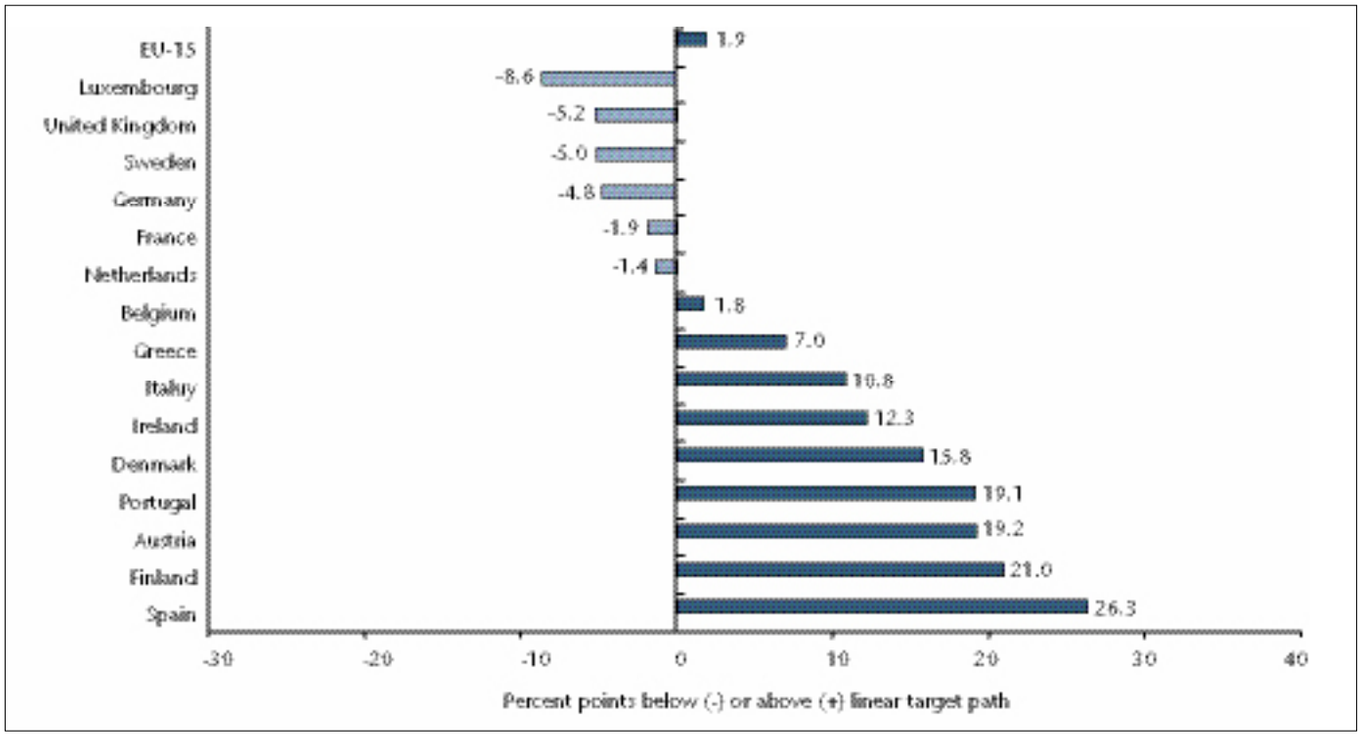

Figure 11.1 The distance-to-target indicator (DTI) measures for the Kyoto obligations. *The table shows the deviation of actual emissions in 2003 from a (hypothetical) linear path between base-year emissions and the burden-sharing target for 2010. A positive value suggests an under-achievement and a negative value an over-achievement by 2003. The DTI is used as an early indication of progress towards the Kyoto and Member States' burden-sharing targets (Source: EEA, 2005).*

tion system was outlined making the Climate Convention close to becoming a real global legal regime.

11.2.3 The EU Obligations in the Kyoto Protocol.

The EU member states (then the EU-15) have, as mentioned, made a joint plea for a reduction in CO_2 discharge of 8% by 2008-2012. The obligations were subsequently distributed among the member states with variations from reductions of 21% (Germany and Denmark) to an increase of 15-27% (Spain, Greece and Portugal). The 10 new member states had individual CO_2 targets, set under the Kyoto Protocol. They have between 6% and 8% reduction targets relative to the 1990-base line. As these countries have seen a profound economic restructuring over the 1990s with closure of a number of energy consuming industries, this reduction has been met – and more so – by this very economic restructuring. But the countries need to regain lost levels of economic performance and, in addition, continue to develop their economies to improve living conditions for their citizens, which may lead to some additional CO_2-emitting activities. This was an important part of the reason to become members of the EU anyway. A joint EU-25 plea on CO_2 emissions is therefore not foreseen.

Concerning the implementation of the Kyoto targets the EU-15 are behind schedule. Some of the countries are at this stage already unable to reach their targets, regardless of the (realistic) measures they might introduce for the remaining period up to 2012.

An EEA-report (Figure 11.1) shows substantial difference among the EU-15 countries as to attaining their target levels. The distance-to-target indicator (DTI) measures the deviation of actual emissions in 2003 from a (hypothetical) linear path between base-year emissions and the burden-sharing target for 2010. A positive value suggests an under-achievement and a negative value an over-achievement by 2003. The DTI is used as an early indication of progress towards the Kyoto and Member States' burden-sharing targets. For the following Member States the additional effects of the use of Kyoto mechanisms are included: Austria, Belgium, Denmark, Finland, Ireland, Italy, Luxembourg, the Netherlands and Spain. Additional measures are planned or already implemented to help those countries lagging behind – and thereby the EU as a whole – fulfilling or at least come closer to their target levels. The most significant initiative, already implemented, is the EU Emission Trading Scheme.

11.2.4 EU Emission Trading Scheme (EU-ETS)

The EU Emission Trading Scheme (EU-ETS) is an internal EU-emission trading system among the 25 EU member states. It was established by Directive 2003/87/EC and it is the first multi-national emission-trading scheme worldwide. It can be considered as a forerunner for the global emission trading scheme, foreseen in the Kyoto Protocol, but not realized till now, as the protocol has just entered into force. The EU-ETS is prepared to become an integrated part of a future global system under the protocol.

The principle of the ETS is to help make sure, that CO_2 emission reductions take place at installations or companies, where these savings can be made at the lowest costs. The ETS does that by providing a framework or a marketplace for buying and selling allowances for emissions. In this way those able to make savings for low costs can go further than they need to meet their own target and sell the allowances via the ETS to those which need high investments to meet their target. These last types of installations will then buy allowances to cover what would otherwise bring them into exceeding their number of allowances, and face penalties.

The EU-ETS is based upon allocation of emission allowances to 11,500 energy intensive industrial companies and installations across EU like electrical power plants, oil refineries, iron and steel plants as well as factories e.g. making cement, glass, bricks and pulp and paper. Together they account for about half of the total CO_2 emissions within the EU.

Each of these 11,500 energy intensive installations receives an emission allowance when the trading begins. The allowances were first negotiated between the EU member states. Then the national allowances were distributed between the listed installations. This way to distribute allowances is commonly called *grandfathering*, since it is decided on from "above", rather then bought, for example in an auction of emission rights.

The allocation of allowances is based on a National Allocation Plan (NAP), made by each member state and specifying for each installation the number of tons of CO_2 emissions allocated. The national plans are then checked and approved by the EU-Commission. There are three trading phases foreseen – the first in 2005-2007, due May 2004, the second in 2008-2012, due June 2007, and the third, starting 2013. Each of these will start with a total amount of CO_2 allocated. For each new phase the total amount will be reduced substantially.

The ET scheme has disadvantages in as much as it does not lead to any CO_2-emission reduction, neither short term nor long term. On the contrary, it leads to the use of a quota in the short term which should only have been used later in accordance with the actual economic development within the country, possessing it or – may be – never been used at all. This is why this Kyoto Protocol ET-scheme has been named "trading warm air", i.e. trading emission reductions which are not real or nothing at all. There are different demands for a maximum

Box 11.1 Exemplifying the ETS Working Principles

Let's say that companies A and B both emit 100,000 tonnes of CO_2 per year. The government gives each of them 95,000 emission allowances. One allowance represents the right to emit 1 tonne of CO_2. So, neither company is fully covered for its emissions. At the end of each year, the companies have to surrender a number of allowances corresponding to their emissions during the year, whatever the emissions of the individual company are. If they fail to do so, they face a fine of 40 per missing allowance during the 2005-2007 trading period, and 100 during the second 2008-2012 trading period. Companies A and B do not want to pay the fine and both have to cover 5,000 tonnes of CO_2. They have two ways of doing this.

They can either reduce their emissions by 5,000 tonnes, or purchase 5,000 allowances in the market. In order to decide which option to pursue, they will compare the costs of reducing their emissions by 5,000 tonnes with the market price for allowances.

For the sake of the example, let's say that the allowance market price is 10 per tonne of CO_2. Company A's reduction costs are 5 (i.e. lower than the market price). Company A will reduce its emissions, because it is cheaper than buying allowances. Company A may even reduce its emissions by more than 5,000 tonnes, say 10,000 tonnes. For Company B, the situation may be the opposite: its reduction costs are 15 (i.e. higher than the market price) so it will prefer to buy allowances instead of reducing emissions.

Company A spends 50,000 on reducing 10,000 tonnes at a cost of 5 per tonne and receives 50,000 from selling 5,000 tonnes at a price of 10. So Company A fully offsets its emission reduction costs by selling allowances, whereas without the Emissions Trading Scheme it would have had a net cost of 25,000 to bear. Company B spends 50,000 on buying 5,000 tonnes at a price of 10. In the absence of the flexibility provided by the Emissions Trading Scheme, company B would have had to spend 75,000.

Since only a company that has low reduction costs and therefore has chosen to reduce its emissions, like Company A, is able to sell, the allowances that Company B buys represent a reduction of emissions, even if Company B did not itself reduce emissions.

amount of a total quota to be sold to make sure that a country is not, in the short term, selling so much that it will get in trouble fulfilling its own obligation towards the Protocol later, when it has eventually had got the economy better under way.

11.3 Implementing Emission Trading

11.3.1 Assessment of Allowances

There are 12 criteria, listed in Annex 3 to the Directive, for the assessment and approval of the national plans by the EU Commission. The first and most important criterion is, that the allowances allocated in the NAP makes it possible for that state to fulfil its obligation towards the Kyoto Protocol. This will for most member states eventually mean, that the allowances in total will have to be smaller than the total present emission, as most member states have obliged themselves to bigger or smaller reductions.

The Commission demanded changes in 8 of the 25 member state NAP's for 2005-2007 with the following three types of problems as the main issues:

1. Allocations made it impossible to meet the Kyoto targets.
2. Allocations exceeded current emissions.
3. Reservations for redistribution of allowances after start of the EU-ETS, so called "ex-post adjustments", which are not acceptable.

When the ETS is running, the member states will operate an electronic registry of allowances to be able to follow the transfers of allowances, which takes place via the ETS in order to be able to keep track of where all national allowances belong at any possible time. The EU Commission is running a registry hub to be able to monitor, that the trading and transfer of allowances are in line with the directive.

The member states will collect allowances, which have to be given up by the installations in accordance with the allocation plan, and distribute allowances to new installations, being set up. It's also the member state responsibility to collect the data that each installations is obliged to produce currently on its CO_2 emission to prove that it stays within the allowances received. Finally, the member states will make a report annually to the EU Commission on the operation of the system, including the emission data collected.

Under the Kyoto Protocol, the EU-15 has to reduce its collective greenhouse gas emissions by 8% below 1990 levels during 2008-2012. This target is shared among the 15 Member States under a legally binding burden-sharing agreement [Council Decision 2002/358/EC of 25 April 2002]. The majority of the Member States that joined the EU on 1 May 2004 have individual targets under the Kyoto Protocol with the exception of Cyprus and Malta, which have no targets.

11.3.2 The Results of Trading in the First Period

The first phase began on 1 January 2005. In its first year, 362 million tonnes of CO_2 were traded on the market for a sum of 7.2 billion euros. The price of allowances increased more or less steadily to its peak level in April 2006 of ca. 30 euros per tonne CO_2, but came crashing down in May 2006 to under 10 euros/ton when it became clear that many countries had given their industries such generous emission caps (limits) that there was no need for them to reduce emissions. The prices then continued to drop through 2006 resulting in a trading price of 1.2 euros per tonne in March 2007 (Figure 11.2). NGOs have accused governments of abusing the system under industry pressure, and have urged far stricter caps in the second phase (2008-2012). Still during 2006 the total turnover of emission rights was 22.5 billion euros and 1.6 billion tonnes of CO_2. The Norwegian Consultancy Point Carbon reports that projected carbon trading for 2007 is 2.4 billion tonnes, and that the projected price for 2008 is 13.8 euros/tonne CO_2, a figure used when planning investments in European industry.

Presently an estimated 4,000 projects to reduce emissions are under way in Europe corresponding to total annual reductions of 2 billion tonnes of CO_2. The reported carbon trading is to a large extent financially motivated and corresponds only partly to actual reductions. Equally the planned projects are partly CDM projects, which neither corresponds to emission reductions within the European Union, although they are included in the Kyoto obligations.

11.3.3 Following Periods – beyond the Industrial Installations

Establishing the EU-EST is an important step forward in the efforts to attain the reductions which the EU-15 (and the 10 new members individually) undertook. But the installations, which the scheme deals with makes up less than 50% of the total CO_2-emission in EU. Other important factors are transportation, household and agriculture. Directive 2003/96/EC establishes a common minimum taxation level on all kinds of fuels for private and commercial use (transport, industrial applications, machinery used in forestry and agriculture). It raises the minimum taxation level by some 25% from 2004 – for petrol from 359 to 421 euros/1,000 l, while a second stage, decided for 2010 only means a rise for few fuels.

The second phase (2008-12) is expected to expand the scope significantly:

- All greenhouse gases, and not only CO_2 will be included.
- CDM and JI credits are expected to be introduced in second phase through the Linking Directive.
- Aviation emissions will likely be included.
- Four non-EU members – Norway, Iceland, Liechtenstein, and Switzerland – are expected to join the scheme.

The inclusion of aviation is a move considered important due to the large and rapidly growing emissions of that sector. The inclusion of aviation is estimated to lead to an increase in demand of allowances of about 10-12 million tonnes of CO_2 per year in phase two. This in turn is expected to lead to an increased use of JI credits from projects in Russia and Ukraine, which would offset the increase in prices and eventually result in no discernible impact on average annual CO_2 prices.

Ultimately, the Commission wishes the post-2012 ETS to include all greenhouse gases and all sectors, including aviation, maritime transport and forestry. For the transport sector, the large number of individual users adds complexities, but could be implemented either as a cap-and-trade system for fuel suppliers or a baseline-and-credit system for car manufacturers.

The National Allocation Plans for Phase II, the first of which were announced on November 29, 2006, will result in an average cut of nearly 7% below the 2005 emission levels.

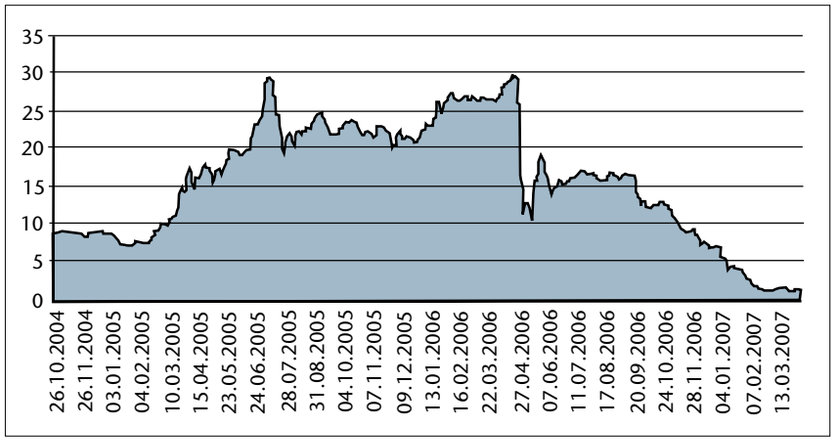

Figure 11.2 Prices of carbon emissions in Euros/tonne at the European carbon pool of the EU-ETS. *Carbon Pool Europe provides access to the carbon market that companies need to be able to actively take part in the EU-ETS. The Carbon Pool in an international trading platform for EU allowances valid under the EU-ETS. The Carbon Pool website will report daily spot prices for carbon emissions (http://www.carbonpool.eu).*

11.3.4 Policy Measures – the EU Linking Directive

Directive 2004/101/EC is called the *linking directive* because it was made to create connection between the EU-ETS and the "project-based mechanisms" in the Kyoto Protocol.

One of these mechanisms is *Joint Implementation Projects* (JI), regulated in article 6 of the protocol. It allows industrialized countries to do joint projects with other industrialized countries on at source reduction of CO_2 emissions and on creating sinks for the deposit of CO_2 and let the investing country count the reduction achieved as its own reduction and thereby serve as part of the investing country's compliance with the Kyoto Protocol. This kind of projects are first of all expected to take place in the Central and Eastern European transition economies, where the scope for reduction is high and at lower costs than in the western economies.

The next mechanism is the *Clean Development Mechanism* (CDM), regulated in article 12 of the protocol. It is designed to make industrialized countries invest in CO_2 reduction projects in developing countries, and grants the investing country the right to include documented reductions in its own CO_2-reduction budget. This mechanism was established, explicitly recalling the need to promote equitable geographic distribution of CDM's at regional and sub-regional level. It is underlined that CDM-projects cannot be funded by develop-

Table 11.1 Overview of total Allowances for the three years 2005-2007 and Kyoto targets across member states. *Divide by 3 to receive annual average. Opt-ins and opt-outs of installations in accordance with Article 24 and 27 of Directive 2003/87/EC (later used by Sweden, Finland and Estonia) are not included. Under the Kyoto Protocol, the EU15 has to reduce its collective greenhouse gas emissions by 8% below 1990 levels during 2008-2012.*

Member State	CO_2 allowances in mio. tonnes	Share in EU allowances	Installations covered	Registry functional	Kyoto target
Austria	99.0	1.5%	205	Yes	-13%*
Belgium	188.8	2.9%	363	No	-7.5%*
Czech Republic	292.8	4.4%	435	No	-8%
Cyprus	16.98	0.3%	13	No	-
Denmark	100.5	1.5%	378	Yes	-21%*
Estonia	56.85	0.9%	43	No	-8%
Finland	136.5	2.1%	535	Yes	0%*
France	469.5	7.1%	1,172	Yes	0%*
Germany	1,497.0	22.8%	1,849	Yes	-21%*
Greece	223.2	3.4%	141	No	+25%
Hungary	93.8	1.4%	261	No	-6%
Ireland	67.0	1.0%	143	No	+13%*
Italy	697.5	10.6%	1,240	No	-6.5%
Latvia	13.7	0.2%	95	No	-8%
Lithuania	36.8	0.6%	93	No	-8%
Luxembourg	10.07	0.2%	19	No	-28%*
Malta	8.83	0.1%	2	No	-
Netherlands	285.9	4.3%	333	Yes	-6%*
Poland	717.3	10.9%	1,166	No	-6%
Portugal	114.5	1.7%	239	No	+27%*
Slovak Republic	91.5	1.4%	209	No	-8%
Slovenia	26.3	0.4%	98	No	-8%
Spain	523.3	8.0%	819	Yes	+15%
Sweden	68.7	1.1%	499	Yes	+4%*
United Kingdom	736.0	11.2%	1,078	Yes	-12.5%*
Total	6,572	100.0%	11,428		

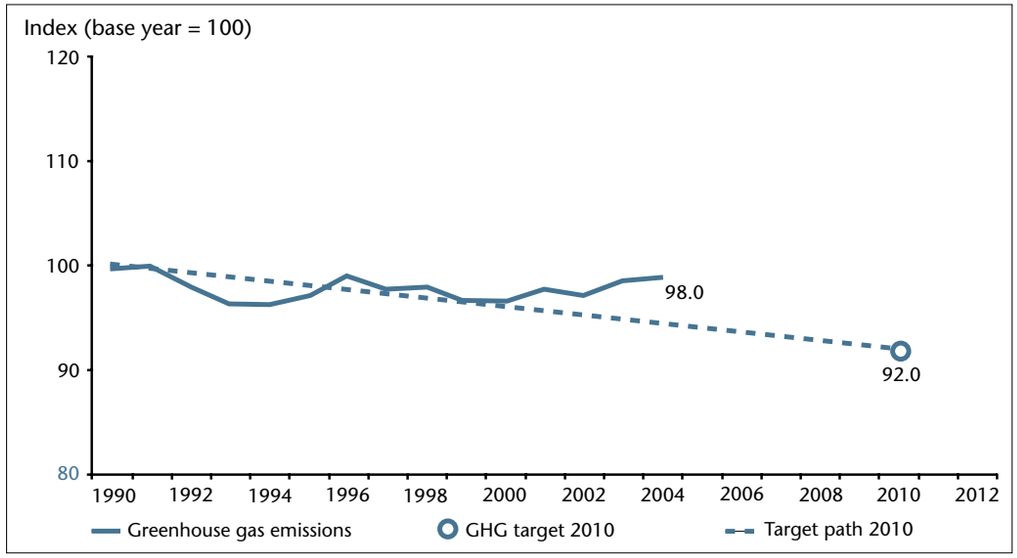

Figure 11.3 EU-15 Greenhouse gas emissions 1990–2004 compared with target for 2008–2012. *The linear target path provides a simple measure of how close the EU-15 emissions in any year are to the linear path from emissions in 1990 to the EU Kyoto target, represented by 92 percent of base-year emissions in 2010. The presentation does not take into account the use of flexible mechanisms or activities under Article 3, land-use change, on the Kyoto Protocol. The unit is index points with base-year emissions being 100. [Source: EEA, Technical report 10/2006]*

ment aid budgets in the industrialized country, but should be funded, provided extra and for the benefit of the particular CDM project.

Finally, Emission Trading (ET) is opened in the protocol by article 17. The trade is limited to take place between countries, which have got an emission limitation that is a CO_2 quota in Annex B to the Kyoto Protocol. In practice this means that countries, which had a quite high CO_2 emission in the base line year of 1990 and since then have undergone serious economic restructuring and transformation and therefore presently and within the 2012 target year will have an emission allowance surplus, can sell (part of) this surplus to industrially developed countries needing to reduce their emission. Most former Soviet Republics and some non-EU member states in Central and Eastern Europe have such a quota-surplus. The country buying emission quota or emission units from a country with a quota surplus can use the units bought in its own reduction budget.

The Linking directive is only regulating the relation to and use of the JI and CDM, because EU itself has set up the internal Emission Trading Scheme (see section 11.3.4 above), which has a clear CO_2 emission reduction perspective, underlined by the joint EU-15 plea towards the Kyoto Protocol for a joint total emission reduction of 8%. That is not possible to achieve by trading – short-term – surpluses among these same 15 countries. That can only be achieved by own reductions, and the EU-ETS is designed to support these efforts. The EU-Directive on ETS declares itself open to negotiations and possible joining of the EU-ETS and the Kyoto Protocol ET at a later stage, when the Kyoto-ET is up and running, i.e. established, based upon the same concept of contribution towards emission reduction as is the EU-ETS.

11.4 Climate Policy and Sustainable Development

11.4.1 Growth Versus Emissions

The data provided show, that there is a long way to go on the climate policy issues to reach the goals set – for EU-15 a joint reduction on 8% by 2012 of the 1990-CO_2 emission level. The IPCC 4th Assessment Report, released 4th of May 2007 underlines the problems, the current situation and recent trends. CO_2 emissions have grown between 1970 and 2004 by about 80%, and 28% between 1990 and 2004. The growth is different across sectors. The energy supply sector has increased by 145% and transport by 120%. (IPCC, Working Group III, 2007). The problems within the EU-15 is illustrated in Figure 11.3, showing the considerable deviation from the path towards the intended reduction.

The 2nd phase of the EU-ETR will mean some reductions in the caps for the NAP's and thereby for the total of EU-25. Till now about 20 of the 25 NAP's for the 2nd phase are accepted by the EU-commission. It will lead to a reduction in the overall level of CO_2 emissions from the EU-25. It is therefore responding to widespread criticism that the 1st phase caps were far too lax, voiced by NGO's and others. But it will not bring about the reduction needed for the EU-15 to reach their committed goal of the 8% reduction by 2012, while the situation is more mixed for the EU-10 (and now EU-12) having joined the EU within the last 3 years.

The EEA Report 1/2005 (EEA, 2005) 'Climate change and a European low-carbon energy system' is a very comprehensive and interesting analysis of the options available to the EU (EU-15 and EU-25/27) in order to fulfil the Kyoto-protocol obligations as well as the 2030 and 2050 requirements to stabi-

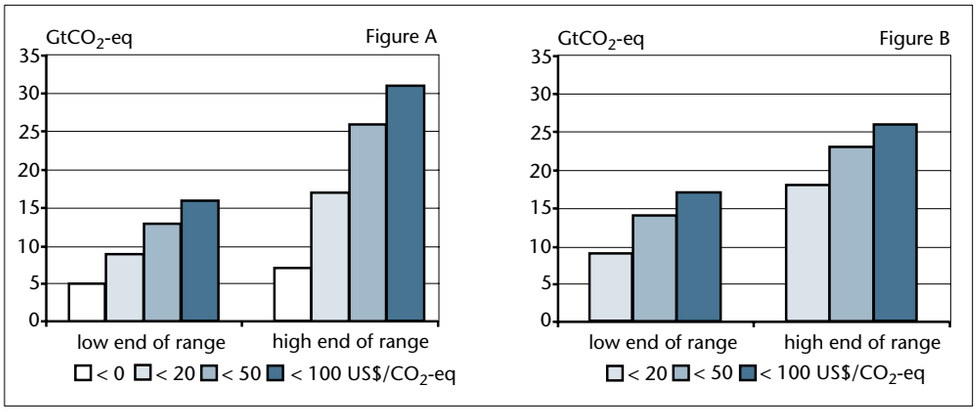

Figure 11.4. Global economic mitigation potential in 2030. *The potential reduction of carbon dioxide emissions at three different levels of carbon prices: 20 USD, 50 USD and 100 USD/t CO_2-eq. The bottom-up study (left) represents sector-based estimations. The top-down study (right) assesses the potential through economy-wide mitigations options. The top-down model has been the base for the studies on mitigation options and macro-economic assessments.*

lize the CO_2 concentrations in the atmosphere below 550 ppm. The analyses and the results in the report are very much in line with the recent IPCC 4th Assessment Report, including the calculation of the growth and general costs, this will mean for the EU member countries.

Extensive use of the connected policies in Directive 2004/101/EC (the linking directive) on Joint Implementation Projects and Clean Development Mechanisms, combined with direct purchase of surplus CO_2-emission quotas from the Central and Eastern European Countries having surpluses within the Kyoto-allocated quotas due to the profound economic restructuring after the collapse of the Soviet Union, might bring them close. But this does not bring about changes in the EU-15 countries themselves, meaning that the underlying trend here will remain unchanged, or, at least, insufficiently modified.

11.4.2 IPCC 4th Assessment Report – Taxing Carbon

The 4th IPCC-report on 'Mitigation of Climate Change' [page 4 and figure 4 / page 8] states, that:

"with the current climate change mitigation policies and related sustainable development practices global GHG emissions will continue to grow over the next few decades – the IPCC-scenarios showing an increase in 2030 relative to 2000 of between 25% and 90 %,

In the report, the IPCC panel presents the concept of 'mitigation potential', which has been developed to assess the scale of GHG reductions, relative to emission baselines, possible to achieve at a given level of carbon price, expressed in costs per unit of CO_2 equivalent emissions avoided or reduced. The potentials of this concept are described at three different levels of increased carbon price – 20 USD, 50 USD and 100 USD/t CO_2-eq (ton CO_2-equivalent) – summarized in Figure 11.4. The bottom-up approach is sector oriented while the top-down model assesses economy-wide potential of mitigations options. The top-down model has been the base for the studies on mitigation options and macro-economic assessments.

The estimation in the report of the macro-economic consequences of stabilizing the level of atmospheric CO_2 between 445 and 710 ppm CO_2-eq in 2030 is a reduction in the average annual GDP-Growth between 0.06-0.12 percentage points. It is considered a 'worst case' scenario and some models actually show over all gains for the GDP as they consider the baseline situation less than optimal and that mitigation policies like the increase of carbon prices will improve market efficiency and/or lead to increased technological change (p. 16). The modelling does not consider the consequences of change of attitudes and life-style in continuation of the proposed mitigation measures and possible positive effect this might have. These are therefore not represented in the models. These models are, of course, very complex and a number of reservations are necessary. But the conclusion on the 0.06-0.12 percentage range of the negative impact on the average GDP growth rate is labelled with the comment 'high agreement and medium evidence' in terms of backing across the scientific panel (see also the EEA Report 1/2005).

These figures should be compared to the main conclusions by a team of economists in the so-called Stern Report, published in late 2006 by the World Bank economist Sir Nicholas Stern. They concluded that about 1% of global GDP needs to be invested to mitigate climate change to avoid major problems. If this is not invested the possibility remains that a major economic depression will eventually result.

When summarising the policies and instruments available to governments, the IPCC report points out that there is a wide variety of options at hand from 'policy integration' and 'standards and regulations' till 'taxes', 'tradeable permits' and 'voluntary agreements' as well as 'R&D in support of technological advance, cost reduction and progress towards stabilization'. In consistence with the models and the mitigation concept, presented above, the report then points out that

"*Policies that provide a real or implicit price of carbon could create incentives for producers and consumers to significantly invest in low-GHG products, technologies and processes. Such policies could include economic instruments, government funding and regulation (high agreement, much evidence)*."

Further, it is stated in this context that an effective carbon-price signal could realize significant mitigation potential in all sectors. References are again made to the models, showing that carbon prices of 20-50 USD/t CO_2-eq, sustained long term, could lead to a power generation sector with low GHG-emissions by 2050 and make many mitigations options in the end-use sectors economically attractive.

The conclusion is, that the IPCC-panel considers an increase in the carbon price by taxation as a precondition for reaching the set goals. Taxation is therefore the most important policy instrument to achieve the CO_2-emission reduction (and reduction also of other GHG-gases) necessary to reach and to sustain the level of 550 ppm CO_2-eq by 2100. Other policy options and instruments, however useful and important, are supplementary or auxiliary to the carbon price increase by taxation in some form, if the key policy goal is to be achieved.

In this context it should be added that the rather "optimistic" view of fossil fuel availability that this model requires has been questioned. The Association for the Study of Peak Oil (ASPO) has predicted that the global peak of fossil fuel production – all categories – is imminent, and most likely will occur in 2008-2010. One should then expect an increase in the real price of fuels. This should make the carbon-free alternatives more attractive and thus lead to reduced emissions.

11.4.3 Sustainable Development and the Concept of an Ecological Tax Reform

The ecological tax reform (ETR) is a different concept compared to environmental taxation. The latter is about using the taxation to make people act environmentally sensibly, i.e. use economic incentives to achieve the goals for the environment which the legislation has set up. The ETR is about a completely new and comprehensive taxation strategy, shifting taxation away from labour to natural resources. The aim is still environmental, i.e. a sustainable production and a sustainable society. The higher taxation of natural resources, first of all energy resources, will put enormous pressure on industry, transportation and private households alike. The only solution will be higher energy and general resource efficiency, i.e. the introduction innovation and savings. The relation between fuel prices and fuel efficiency was shown by Weizäcker and Jeringhaus in their 1992-study on ETR (Figure 11.5).

The revenue should not be used for environmental protection. That is in principle delivered by the efficiency increase

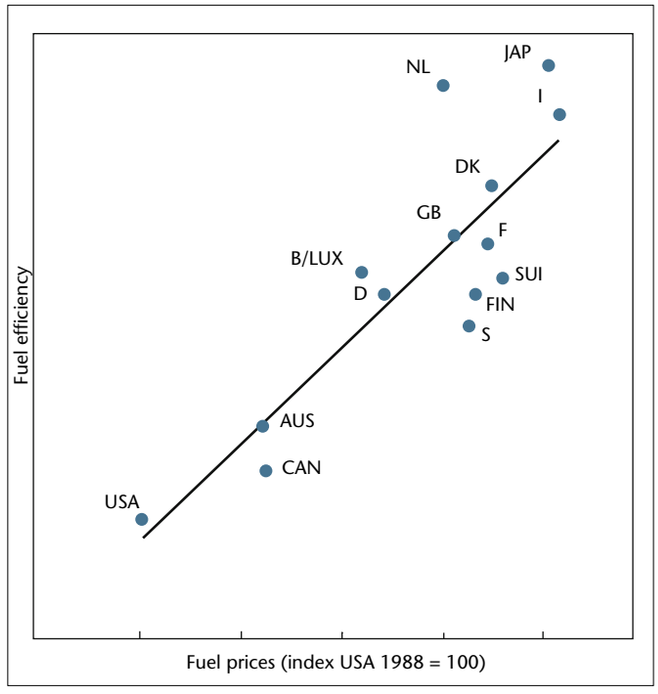

Figure 11.5. Relationship between macro-economic fuel efficiency and price. *Data from 1988 are provided for OECD countries related to 1988 US dollars. Macro fuel efficiency is calculated as the reciprocal value of per capita fuel consumption, and understood as a measure of how efficient the inhabitants of countries of similar economic performance are in their use of fuel. The macro-economic fuel efficiency (specific fuel consumption) relates positively to the price with a correlation coefficient in of r = 0.85. [source http://esl.jrc.it/dc/etr/ecological_tax_reform.htm]*

through innovation and savings, which is the expected outcome of the taxation itself. The revenue should be used to replace – wholly or to a great extent – the taxation of human activity, of labour. The concept is summarized in the following phrase: The Ecological Tax Reform (ETR) is about achieving "a wider use of labour and a wiser use of nature". The source for the total state tax revenue should, in other words, to a much greater extent be natural resources instead of labour and other human activity.

There will be a need for compensation to a part of industry to allow for time to adapt. And there will be a need for social balancing towards people with low income and/or shortage of investment or mobility options [Weizsäcker & Jesinghaus, 1992; Axelsson, 1996]. But the overall credibility of the ETR approach is further shown by the same team by the following compilation:

The relations documented in this short representation of a very extensive and still ongoing discussion on ETR and the most realistic approach are important and promising. But they are the result of a quite long and, above all, piecemeal or incre-

mental transformation process. If ETR is to be realistic according to its principles, it will mean substantial efficiency increases, which in turn will be accompanied by drastic restructuring of all sectors of industry, transportation and the public sector as well as people private lives in terms of housing, heating, shopping and personal transportation etc.. It will mean more, not less employment, but within a framework of change. This will mean a higher degree of uncertainty and anxiety among the employee population.

This restructuring will be equally drastic and difficult to plan, forecast for and hence to control for capital. Capital is focused upon being able to calculate potential profits as well as – and not least – risks and uncertainties. The ETR project will entail all the features of unpredictability which capital doesn't want, and hence be opposed by large segments of industry.

The only way to bring about real progress for the ETR-approach will be market-driven, real and not managed, energy price hikes, documenting the approaching end to the "oil-based" industrial era.

11.4.4 Towards a Sustainability Regime

Economic instruments are so far more taxes to boost the state budget than environmental protection, although things like the CO_2 tax, waste tax, adopted in some countries, and the internal EU-emission trading system are pointing in the direction of environmental protection. The charges/fees are also making alternatives to 'business as usual' attractive in some areas.

What seems to be missing is a fuller exploitation of the potentials in a combination of normative regulation and economic incentives. We need to set a final deadline for phasing out of certain fuels, compounds and electrical appliances. We need to set demand for a certain performance level for a vehicle or for the volume of CO_2 per unit produced. This will allow us to push the development towards compliance even before the deadline by setting up economic incentives, that is, carefully designed taxes.

Taxes are, however, never popular. In a liberalist political climate, these years predominant all over the western hemisphere, taxes are considered the "root of all evil". Raising environmental taxes to the level needed to offset the social costs – or to internalize fully the externalities – is therefore not likely in this political context. But a shift from tax on income to tax on use of energy and other resources could be tempting in a liberalist perspective, but only to the point where the tax burden in total would be as before, or less. In that case a reform might miss the point, as the view will be limited taxation instead of resource efficiency and a sustainable society.

If, in a less tax hostile political environment, clear goals and targets were set politically for an environmentally sustainable society and the taxes designed so that they could convince citizens of their appropriateness, an ecological tax reform could create widespread support, even if it meant that the burden of tax would have to rise to meet the targets. No government has yet dared to do that, but we might see it in the near future.

Study Questions

1. List a few cases where market mechanisms can be used as policy instrument for environmental protection.
2. Find out the market prices for some common waste materials, such as paper, glass, and scrap metal.
3. For emission trading, explain the concepts of grandfathering, ceiling, bubble, and cap.
4. Describe the components of EU-ETS, how it is implemented, and check on the Internet the current spot price for carbon emissions (euros/tonne of carbon).
5. Would you say that the EU Emission Trading Scheme is a success of failure? Justify your position.
6. What are the major advantages and drawbacks of a tradable permit system?
7. Describe the intentions of the EU Linking Directive and discuss in which ways it might weaken the EU-ETS as an instrument for fulfilling the Kyoto obligations.
8. Give/find examples of successful and unsuccessful applications of economic instruments in environmental politics and discuss the reason for success and failure.
9. Explain the concept of an ecological tax reform. What would be the social consequences of introducing an ecological tax reform? Would the richer or the poorer benefit the most from such a reform?

Abbreviations

CDM	Clean Development Mechanism
COP	Conference of Parties
DTI	Distance-to-target Indicator
EEA	European Environmental Agency
ET	Emission Trading
ETR	Ecological Tax Reform
EUA	EU Allowances
EU-ETS	EU Emission Trading Scheme
FCCC	Framework Convention on Climate Change
GHG	GreenHouse Gases
GDP	Gross Domestic Product
IPPC	Integrated Pollution Prevention Control
IPCC	Intergovernmental Panel on Climate Change
JI	Joint Implementation
NAP	National Allocation Plan
OECD	Organisation for Economic Co-operation and Development
R&D	Research and Development

Internet Resources

Resource Recovery Forum

http://www.resourcesnotwaste.org/

European Union Greenhouse Gas Emission Trading Scheme (EU ETS)

http://ec.europa.eu/environment/climat/emission.htm

EU Emissions trading – National allocation plans

http://ec.europa.eu/environment/climat/emission_plans.htm

Point Carbon (company working with carbon trading)

http://www.pointcarbon.com/

Directive 2003/96/EC on the taxation of energy products and electricity

http://www.managenergy.net/products/R538.htm

Directive 2003/87/EC on a scheme for greenhouse gas emission allowance trading

http://ec.europa.eu/environment/climat/emission/implementation_en.htm

United Nations Framework Convention on Climate Change

http://unfccc.int/2860.php

The Kyoto Protocol

http://unfccc.int/kyoto_protocol/items/2830.php

Intergovernmental Panel for Climate Change (IPCC)

http://www.ipcc.ch/

IPCCs Fourth Assessment Report "Climate Change 2007"

http://www.ipcc.ch/

Stern Review final report

http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/stern_review_report.cfm

Association for the Study of Peak Oil (ASPO)

http://www.peakoil.net/

The Ecological Tax Reform by Ernst Ulrich von Weizsäcker and Jochen Jesinghaus

http://esl.jrc.it/dc/etr/ecological_tax_reform.htm

Swedish Society for Nature Conservation's report of green tax shift (ETR)

http://www.snf.se/pdf/rap-eng-ecotax.pdf