# The use of market-based instruments for the implementation of environmental policy in the power sector

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## 1. Introduction

Over the last twenty years, environmental protection has become increasingly important in the policy agenda of the European Union. At the same time, the power sector has been identified as an important target of such policy, both because of the significance of the environmental impact of its activities and because, when compared with other sectors having comparable environmental impacts – such as the transport sector –, it is characterised by a relatively small – and in any case smaller - number of agents, which makes policy implementation simpler.

In this context, environmental policy affecting the power sector has been developing along three main directions:

– the limitation of emissions in the atmosphere, both of greenhouse gasses (GHG) and of other pollutants;
– the promotion of renewable energy sources;
– the improvement in energy efficiency.

This paper considers the instruments which are currently used or are envisaged to be implemented in these three environmental policy areas, both at the European Union and at national levels.

The fundamental issue in environmental policy is the mitigation of market failure. Typically, markets do not adequately price environmental goods or damages. Therefore agents, behaving rationally on the basis of the price signals that they face, do not take due consideration of the impact of their behaviour on the environment. Environmental policies are aimed at redressing these failures, by:

– either "artificially" creating prices for environmental goods and damages, so that agents take into account the environmental impact when they define their behaviour;
– or directly imposing an environmentally-sensible behaviour.

Different policy instruments may lead to a different allocation, among agents, of the physical effort required to achieve the specified targets. Different instruments may also result in different costs of achieving these targets. Finally, different instruments may require different institutional frameworks and involve different complexity in implementation. The assessment of the performance of different instruments therefore requires an analysis of all these aspects.

The special focus in this paper is on incentive-based instruments and on their suitability for implementation in the identified environmental policy areas. Incentive-based instruments work through creating price signals to modify agents' behaviour.

The paper is organised as follows. Section 2 discusses the objectives of environmental policy in the different areas identified above and the benefits that will be delivered by their achievement. Section 3 presents a taxonomy of the instruments used in environmental policy. Section 4 discusses the suitability of different instruments for use in the different environmental policy areas. Section 5 summaries the approaches followed by the European Union and the Member States in the different environmental policy areas and presents and comments on recent developments. Section 6 contains some concluding remarks.

## 2. Environmental policy objectives

As indicated above, European environmental policy, at least for that part that is most relevant for the power sector, has mainly been developed along three directions. In each of them, a variety of benefits may be realised. More specifically:

- the limitation of GHG emissions is mainly targeted to combat climate change;
- the limitation of emissions of other pollutants, such as $SO_2$, NOx and particulate matter (PM), aims at protecting air, soil and water environmental quality, both locally and in the region[1]. These pollutants are the major contributors to acid deposition and therefore the limitation of emissions reduces acidification of soils and freshwater bodies, damage to plants and aquatic habitats and corrosion of building materials. Moreover, NOx reacts with volatile organic compounds in the presence of sunlight to form ozone that can adversely affect human health and ecosystems;
- an increased use of renewable energy sources, to the extent that they displace fossil fuels, reduces the emissions of $CO_2$ and other GHG, as

[1] $SO_2$, NOx and PM can travel long distances from their sources, before being deposited onto land, surface waters or oceans, or forming ozone.

well as of other pollutants, such as $SO_2$, NOx and PM, thus delivering the benefits noted above[2]. Moreover, a greater use of renewables promotes research and technological development associated with processes exploiting such energy sources, and may create employment in the sectors producing the equipments required for this exploitation. There is also the expectation that the increased scale of deployment of renewable-based technologies will lead to a reduction in their costs. Finally, if renewable energy sources are indigenous, their use also reduces the external dependence of energy-importing systems and contributes to the diversification of the energy portfolio, thus improving security of energy supply;

– energy efficiency also delivers multiple benefits. To the extent that greater efficiency results in less primary energy being required to provide the same level of energy services, it can also reduce emissions of GHG and other pollutants associated with meeting any given level of energy service demand. And a lower requirement of fossil fuels may reduce import dependency and therefore improve security of supply. A policy to promote greater energy efficiency also stimulates research and technological development of more efficient energy appliances and better building insulation, to name only the areas with the greatest potentials.

Table 1 summarises the above considerations regarding the benefits that each of the identified areas of European environmental policy is likely to deliver.

**Table 1 Benefits delivered by Environmental Policy Objectives**

| | Benefits | | | |
|---|---|---|---|---|
| | Climate change mitigation | Protection of the local/regional environment (air, soil, water) | Reduction in external energy dependency/ greater security of energy supply | Employment and technological development |
| Geographical nature of the benefit | Global | Local/Regional | National | National |
| | | | | |
| Limitation of GHG emissions | X | | | |
| Limitation of emissions of other pollutants (SO2, Nox, PMs) | | X | | |
| Promotion of renewable energy | X | X | X | X |
| Energy efficiency | X | X | X | X |

[2] In the case of biomass and biofuels, $CO_2$ emissions from the use of these sources are offset by carbon sequestration in the fuel stock farming process. Therefore, what matters is the overall net GHG emission/sequestration of the whole fuel stock cycle. In some cases, this cycle may result in net positive GHG emissions.

As mentioned above, and highlighted in Table 1, both renewables and energy efficiency are likely to deliver a reduction in GHG and other pollutants' emissions. In fact the optimal strategy for achieving any GHG emissions target is likely to include some contribution from renewables and energy efficiency, as well as from other measures, such as fuel switching, carbon capture and storage (CCS) and carbon sequestration.

Therefore, any policy instrument which promotes the use of renewables or energy efficiency is also, indirectly, promoting the reduction in GHG and other pollutants' emissions. However, the reverse does not necessarily apply and instruments aimed at reducing emissions do not necessarily promote renewables or energy efficiency.

Another relevant aspect in comparing benefits delivered by environmental policy relates to the geographical dimension of these benefits. It is clear that the benefits from a reduction in GHG emissions are global in nature: they are the same for all stakeholders, irrespective of where the emission reductions take place. Therefore a reduction in GHG emissions in one Member State produces the same benefit for all stakeholders - inside and outside that Member State - as a similar reduction in another Member State; and even a reduction outside the EU delivers equivalent benefits. This is the rational behind the flexibility allowed in the Kyoto Protocol (KP) through Joint Implementation (JI - article 6[3]), the Clean Development Mechanisms (CDM - article 12[4]) and Emissions Trading (IET - article 17), as well as in the EU Emissions Trading Scheme (ETS), established by Directive 2003/87/EC[5], and the possibility, introduced by Directive 2004/101/EC[6], to use credits from JI and CDM projects to fulfil Member States' commitments under the Burden Sharing Agreement (BSA)[7].

[3] JI projects involve the investment of a country facing quantitative emission targets under the KP (so called Annex I country) in projects resulting in emission reductions in another Annex I country.

[4] CDM projects involve the investment by an Annex I country, or an operator in an Annex I country, in projects resulting in emission reductions in a non-Annex I country.

[5] Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003, establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC.

[6] Directive 2004/101/EC of the European Parliament and of the Council of 27 October 2004 amending Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community, in respect of the KP's project mechanisms.

[7] Council Conclusion of 16 June 1998 on the meeting of its Environmental Ministers of 15 – 16 June 1998. The BSA defines the GHG emission reduction targets which individual Member States are required to achieve to ensure that the EU, collectively, meets its commitment under the KP.

Benefits from the limitation of the emissions of pollutants, such as $SO_2$, NOx and PM, have a more localised or regional dimension.

The geographical allocation of benefits in terms of diversification of energy sources and reduced import dependence is affected by the way in which energy policy is framed; until a coherent energy supply security policy at the EU level is defined, these benefits will mostly be considered to accrue nationally. The impact on research, technological development, technological leadership and employment will also be seen to have mainly a national dimension. However, any effect of an extensive use of renewables on the cost of renewable technologies will deliver benefits to the use of such technologies globally. The same can be said with respect to a greater penetration of more efficient appliances or insulation techniques, which may reduce their costs and promote further deployment internationally.

## 3. Environmental policy instruments

Traditionally, environmental policy instruments have been classified into two main categories:

– administrative-based ("command and control") instruments; and
– incentive-based instruments.

Administrative-based instruments rely on prescriptions of standards or behaviour that agents should implement and penalties for non-compliance. Each agent is required to deploy the effort necessary to implement the defined standards or to adopt the prescribed behaviour. Therefore, the allocation of effort among different agents in achieving the overall target is predefined. The cost of achieving this target under an administrative-based instrument depends on the compliance costs faced by the different agents[8].

Incentive-based instruments rely on price signals to promote standards and behaviour by individual agents which contribute to the achievement of the overall target. Individual agents are not assigned mandatory physical effort levels (standards to be achieved or behaviour to be adopted). The physical effort that each agent deploys is not predefined and the price signals should promote an allocation of this effort among the different agents that minimises the overall cost of achieving the target.

[8] Examples of administrative-based instruments include emissions standards for power plants, energy efficiency performance standards for electrical appliances and buildings, or speed limits in road transport.

Incentive-based instruments can be divided into two main groups:

- Price-based instruments
- Quantity-based instruments

Price-based instruments aim at directly internalising environmental externalities. A price (or an incentive) is administratively assigned to a specific behaviour. The introduction of such a price is intended to internalise the environmental externalities into the choices operated by the agents and affect their attitude towards an environmentally-relevant behaviours.

Price-based instruments include[9]:

- charges imposed on environmentally-damaging behaviour;
- incentives, in the form of premia, administratively-set favourable prices (compared with those prevailing in the market) or concessionary conditions, assigned for environmentally-conducive behaviour.

Quantity-based instruments aim at creating an "environmental market" to price environmentally-sensitive activities or behaviour. In this way, internalisation of environmental externalities is achieved through a price which enters into the assessments performed by agents and which are at the basis of their behaviour. The instruments consist in both establishing a market and defining the level of one "side" of such market, either demand or supply[10].

In quantity-based schemes, the physical effort in pursuing the environmental target is reallocated through the "environmental market". In this market, agents will effectively "buy" the effort deployed by other agents as a way of fulfilling their obligations. In this sense, quantity-based instruments produce a "decoupling" of the financial and the physical efforts. More specifically, the costs of achieving the overall environmental

[9] Examples of price-based instruments include emission charges, feed-in tariffs or price premia for electricity generated from renewables, investment subsidies and favourable fiscal treatment for renewable generation or for investment in energy efficiency technologies.

[10] Examples of quantity-based instruments include the tradable emission allowance schemes and "green certificates" schemes. In tradable emissions allowance schemes agents' emissions of specified pollutants are required to be covered by emissions allowances which can be traded among agents; in this case, the total supply of allowances - i.e. the quantity of allowances made available to the agents – is defined by the policy, while the demand depends on the level of emissions. In green certificates schemes, an obligation of using a minimum share of renewable energy is imposed on agents and can be fulfilled either directly or through purchases, from other agents, of instruments representing the renewable nature of the primary energy used; in this case, the level of the obligation, affecting the demand for green certificates, is defined by the policy.

target will generally be distributed, among the agents, in a different way than the physical effort. Those agents, who are able to deploy the physical effort more effectively and therefore at lower costs, will overachieve their assigned target and will sell the excess to agents who find more expensive to comply with the target.

From a theoretical point of view, price-based and incentive-based instruments represent dual approaches and can produce identical outcomes in case of certainty and perfect information by all parties involved (policymakers and agents). However, under conditions of uncertainty and imperfect information, the two groups of instruments have distinct features.

Therefore, in the real world, where the information which policymakers possess is incomplete and imperfect and there is uncertainty about the true shape and position of the cost curves related to environmental action, policymakers are confronted with a trade-off between:

– greater certainty in the achievement of the quantitative target, but at the expense of greater uncertainty over the costs of such achievement. This will be the situation resulting from the use of quantity-based instruments;
– greater certainty about the costs of the environmental policy, at the expense of some uncertainty on the extent to which the quantitative target will be achieved. This will be the situation resulting from the use of price-based instruments.

There are various ways in which, in practice, this trade-off can be solved. One way is to use price-based instruments and adjust the price to pursue the target. However, repeated adjustments in the price, if not properly managed, can produce uncertainty and discourage investment in technologies required to meet the target.

Another way is to implement a quantity-based instrument, but at the same time to introduce a penalty for non-compliance which fulfils the obligation. In this case, marginal compliance costs will not be higher than the level of the penalty and total and average compliance costs will also be capped[11]. However, if some agents decide to pay the penalty, the overall quantitative target will not be met. Therefore, introducing a penalty which fulfils the obligation in a quantity-based instrument involves admitting that, if the cost

[11] In fact, the level of the penalty operates as a cap on compliance costs. No agent will be prepared to take action towards complying with the target/obligation at a cost higher than the penalty level, because in this case it would be cheaper to pay the penalty.

of complying with a specified quantitative target turns out to be too high (at the margin higher than the penalty), the quantitative target is relaxed with the aim of curbing compliance costs.

Finally, different instruments involve different implementation complexity and costs. Any instrument, if it is to be implemented effectively, requires that compliance can be assessed accurately and objectively. This should inevitably be based on some form of measurement of the effort deployed or, preferably, of the results obtained through this effort. When results are difficult or extremely costly to measure, they may be estimated on the basis of the effort, as long as the effort-results relationship is sufficiently predictable.

Also, difficulties in measuring – or at least estimating with an acceptable degree of accuracy - the results of actions undertaken by agents may make it impossible to implement incentive-based instruments for which compliance relates to such output.

Another implementation feature which may affect the choice of instrument is the number of agents involved. Administrative-based instruments are typically more robust to the number of agents and, among the incentive-based instruments, those which are price-based can more easily handle large number of agents.

Finally, and related to the previous aspect, quantity-based instruments require the development of new markets to deliver an efficient allocation of the effort. The European ETS and the national "Green Certificates" schemes are examples of policy approaches involving the development of such new "environmental" markets. Only if these markets work effectively and seamlessly, the optimal allocation of the effort is achieved and the instrument is able to deliver the expected reduction in the costs of achieving the overall target. Market liquidity and efficiency can be promoted by the establishment of organised trading platforms or "Exchanges". The complexity of these markets, however, has been voiced as a potential drawback of quantity-based instruments, especially with respect to the participation of smaller or less-sophisticated agents[12]. It is however the case that, as soon as new environmental markets are established, specialist intermediaries appear who are able to provide services to small agents.

[12] For example, small electricity producers from renewable energies may find it daunting to participate directly in a Green Certificates market.

Moreover, some larger players may be willing to trade directly with smaller agents on the basis of long-term contracts with prices reflecting current and expected conditions on the organised market[13]. A price-based instrument may, in this respect, be seen as a simpler alternative to implement.

Therefore, the choice of instrument(s) is dictated not only by the characteristics of the benefits which can be obtained, but also by considerations related to implementation complexity and costs.

## 4. The suitability of different instruments to pursue environmental policy objectives

Section 2 has identified the main objectives which EU environmental policy, when applied to the power sector, is aiming to achieve and the benefits that these objectives are expected to deliver. Section 3 has described and characterised the different types of policy instruments which are available to pursue these objectives. It is now possible to bring these two aspects together and to consider the extent to which the different types of instruments are suitable for pursuing the identified objectives.

To do this, it is essential to recognise that:

- as indicated in Section 2, benefits delivered by environmental policy may have different geographical dimensions (global, national, regional, local);
- as indicated in Section 3, different instruments allow different degrees of flexibility in the extent to which the physical effort in achieving the overall target is allocated among the different agents. More flexibility implies that the geographical pattern of this effort may be less predictable;
- flexibility in the allocation of the physical effort may also allow this effort to be mostly deployed by those agents for whom, and in those locations where it is cheaper to take action. In this way, the cost of achieving any specified overall target is minimised;
- there is therefore typically a trade-off between the predictability of – or the possibility of pre-defining - the (geographical) pattern of the physical effort which the instrument will promote, or impose, and the total costs of achieving the overall targets. More specifically, administrative-based instruments allow little or no flexibility in re-allocating the effort between

[13] Most organised environmental markets only execute a relative small fraction of the total volume of trading. Most trading typically occurs through bilateral contracts.

different agents and, as a consequence, they do not promote savings in the overall costs of meeting the target. Instead, incentive-based mechanisms may deliver these savings, but the allocation of the physical effort will be determined by the reaction of individual agents to the incentive provided by the instrument;

– finally, the costs of not meeting a specific target, globally or in a specific location, may vary significantly. For example, some pollutants may have an acute local effect – on health or human activities - and therefore the costs of exceeding specified concentration levels may be extremely high. Therefore, any instrument which is used to control emissions of these pollutants should ensure that concentration in any location remains within the specified limits.

The above considerations suggest that incentive-based instruments are more suitable for those situations in which the re-allocation of the physical effort among agents and different locations, or the fact that the allocation of such effort is not predictable or cannot be pre-determined, results in no or little damage or welfare loss. Incentive-based instruments are also best suited when the achievement of the overall target may involve significant costs and there are important differences in the potentials for action in pursuing the target, and on the costs of these actions, between different agents, so that an optimal allocation of the physical effort is essential for limiting costs.

Clearly, an efficient effort allocation could conceivably be achieved also using an administrative-based instrument, but this would require the policy-makers to have and process information on the potentials and costs of actions by the different agents, something which seldom occurs. Moreover, these potentials and relative costs vary over time. New technologies may become available or their massive deployment may reduce their costs. Therefore, the mandatory allocation of effort under an administrative-based instrument would have to be continuously revised and updated. The complexity of such a policy approach suggests that, in these cases, an incentive-based policy approach is used.

When incentive-based mechanisms appear to be the more effective option, the choice between price-based and quantity-based instruments should be determined by the consideration of whether it is preferable to have greater certainty on the achievement of the overall target or on the costs of such achievement. And this choice depends on the potential welfare losses associated with not achieving the target and on the compliance costs level.

If not meeting the target can result in severe welfare losses, a quantity-based instrument is more suitable. On the other hand, if costs are not well predictable but could potentially be very high (without correspondingly high welfare losses for not achieving the target), price-based instruments may be preferable.

In the context of the three EU environmental policy areas most relevant for the power sector considered in this paper, incentive-based instruments appear clearly to be the most appropriate choice for pursuing the limitation of GHG emissions, given the global impact of such emissions – which makes the distribution of the benefits independent of the distribution of the effort - and the range of technologies, characterised by different and varying costs, which are available for abating emissions. Furthermore, the global nature of the impact of GHG emissions suggests that such instruments could be implemented on an international basis. And, in fact, carbon charges and carbon tradable allowances have both been used in practice, at national as well as international levels. As the urgency of achieving concrete results in GHG emission limitation becomes more pressing, quantity-based instruments – such as the EU ETS – are to be preferred. As mentioned in Section 3, the risk of the policy resulting excessively expensive – i.e. the target excessively ambitious – can be reduced by introducing – within a quantity-based instrument - a penalty for non compliance which fulfils the obligation[14].

Energy efficiency is another area where incentive-based instruments seem to be best suited, at least in a national context. Benefits from energy efficiency in terms of reduction in fossil fuel usage - and therefore GHG and pollutants emissions - and import energy dependency and therefore greater energy supply security - do not, in fact, depend on where the improvements in efficiency are achieved. And large improvements by a few agents are equivalent, in this respect, to smaller improvements by a wider range of agents. On this respect, subsidies or tradable certificate schemes seem appropriate to promote efficiency, as long as improvements can be measured or estimated. This has been so far the main challenge in this area, as efficiency represents a reduction is energy consumption with respect to an alternative situation which, because of the efficiency improvement, does not occur. Therefore, efficiency improvements should often be computed with respect to a baseline scenario. As a result, incentive-based instruments

[14] Note that in the EU ETS, penalties for non compliance do not fulfil the obligation and therefore their level – currently equal to 100€/t$CO_2$ – do not operate as a cap on marginal abatement costs.

often focus on promoting effort, with an expectation that this would deliver the efficiency results.

At the other end of the instrument spectrum, administrative-based instruments are clearly most appropriate in the case of emissions of pollutant with very localised effect and where the impact on health and human activities is acute, so that no flexibility can be accepted in the way in which the overall objective is achieved. This is the case of some atmospheric pollutants, such as PM, which have a very localised impact, and, to a lesser extent, of pollutants with a regional impact, such as $SO_2$. In this latter case, when an incentive-based instrument is used, it is often quantity-based, so that more certainty exists on the achievement of the overall emissions target, and its geographical scope is limited.

As indicated in Section 2, the promotion of renewable energies, to the extent that they replace fossil fuels, delivers benefits in terms of reduction in emissions of a range pollutants, with global and local environmental impacts, as well as benefits in terms or reduced external dependency for those countries which import a large share of their fossil fuel requirement. In this sense, the considerations developed above with respect to these different benefits apply concurrently. And to the extent that these considerations lead to different indications regarding the choice of the most appropriate policy instrument(s), such a choice is in this case quite complex. On the one hand, in fact, if attention is mainly posed on the effect of renewables in reducing GHG emissions, the resulting benefits would be the same, irrespectively of where renewables are used and an international incentive-based instrument may appear appropriate. On the other hand, if the main benefit is deemed to be the reduction in external energy dependency and therefore the increase in energy supply security, the geographical equivalence of effects is restricted to the national context, which is the one most relevant for such security, and the geographical scope of any incentive-based instrument would have to be defined accordingly. Finally, if reductions in emissions of pollutants with mainly local impact are considered, then the location of renewable energy use becomes even more important and the geographical equivalence is restricted to more limited areas.

## 5. The European experience with environmental policy instruments

The promotion of renewable energy and of energy efficiency has been part of environmental policies at the European and national levels for many years (more than ten in the case of renewables). With the agreement on the KP, the European Commission (EC) has also become an active participant in the flight against climate change: the BSA in 1998, defining how Member States would pursue collectively their joint target under the KP, represented a strong commitment for a common policy on climate change and the ETS the main instrument for implementing such policy.

More recently, the European Union has stepped up its environmental policy objectives. In particular, in its meeting on March 8th and 9th, 2007, the European Council:

(a) made "a firm independent commitment to achieve at least a 20% reduction of greenhouse gas emissions by 2020, compared with 1990". At the same time, the Council endorsed "an EU objective of a 30% reduction in greenhouse gas emissions by 2020 compared to 1990 as its contribution to a global and comprehensive agreement for the period beyond 2012, provided that other developed countries commit themselves to comparable emission reductions and economically more advanced developing countries to contributing adequately according to their responsibilities and respective capabilities"[15];

(b) approved an Action Plan, the "Energy Policy for Europe" (EPE)[16], which establishes specific quantitative environmental targets for energy efficiency and renewables penetration, to be also achieved by 2020. More specifically, these targets require:

   i. an increase in energy efficiency which will deliver a 20% reduction in primary energy consumption with respect to the trend scenario;
   ii. a 20% penetration of renewables in primary energy production[17].

[15] Council of the European Union, Presidency Conclusions of the Brussels European Council (8/9 March 2007), 2 May 2007, paragraphs 31 and 32, page 12.
[16] Communication from the European Commission to the Council and the European Parliament, An Energy Policy for Europe, 10 January 2007, (COM(2007) 1 final).
[17] An additional target is set for the use of biofuels in the transport sector, requiring a 10% penetration by 2020.

Later in the same year, a different definition of the target for renewables penetration was proposed, which applies the 20% target to final energy consumption, rather than to primary energy demand.

In January 2008 the EC put forward a package of proposals – the "Climate action and renewable energy package" (CAREP) – intended to pursue the challenging objectives set out by the Council in March 2007. The package included, *inter alia*:

– a proposal for modifying the ETS beyond 2012;
– a proposal relating to the sharing of efforts to meet the Community's independent GHG emissions reduction commitment in sectors not covered by the ETS (such as transport, building, services, smaller industrial installations, agriculture and waste); and
– a proposal for a new Directive promoting renewable energy.

The CAREP was finally approved by the European Council on December 11th and 12th, 2008, with some significant changes with respect to the EC's proposals.

This section describes the main features of the approaches adopted in the European Union in the three environmental policy areas:

– energy efficiency;
– promotion of renewable energies; and
– GHG emissions limitation[18].

It also illustrates and discusses the main features of the CAREP, as approved by the European Council.

## 5.1. Energy efficiency

The promotion of energy efficiency has been so far pursued mainly by the setting of Community-wide and national targets, of labelling requirements and of standards for specific energy uses[19].

[18] Emissions of other pollutants have so far been addressed through administrative-based instruments. For example, in the case of large combustion plants, concentration limits for emissions of SO2, NOx and PM are defined by Directive 2001/80/EC of the European Parliament and of the Council of 23 October 2001 on the limitation of emissions of certain pollutants into the air from large combustion plants.

[19] Over the last few years, EU-wide rules have been introduced, *inter alia*, on standards for energy efficiency in building (Directive 2002/91/EC), on the promotion of cogeneration (Directive 2004/8/EC), on the fiscal treatment of energy products and electricity (Directive 2003/96/EC), on appliance labelling

In 2005 the EC published the Green Paper on Energy Efficiency[20], launching a consultation of stakeholders. On the basis of the responses received, in October 2006 the EC issued an "Action Plan for Energy Efficiency: Realising the Potential"[21] indicating that "even though energy efficiency has improved considerably in recent years, it is still technically and economically feasible to save at least 20% of total primary energy by 2020 on top of what will be achieved by price effects and structural changes in the economy, natural replacement of technology and measures already in place" and defined ten priority actions.

The "Impact Assessment Report for the Action Plan for Energy Efficiency 2006"[22] specifically identifies 54 policy options for pursuing energy efficiency and estimates the energy saving potential associated with each of them. According to these estimates, the greatest potentials are associated with the extension of the application of the Energy Performance Building Directive (EPBD - Directive 2002/91/EC[23]) to smaller buildings, inspections and higher standards for public buildings - expected to deliver annual saving of approximately 80 Mtoe[24], or 21% of the potential savings from additional policies and measures (P&M) – and with the EU-wide implementation of White Certificates Schemes, after the evaluation of existing national schemes – which is expected to deliver annual savings of approximately 60 Mtoe, or 15% of the potential savings from additional P&M. And, in fact, energy efficiency certificates schemes have already been introduced in a number of Member States to pursue energy efficiency objectives in the most efficient way. 0 presents the main features of the existing schemes.

(Directives 2002/31/EC, 2002/40/EC and 2003/66/EC) and on labelling of energy consuming appliances used in offices (Regulation 2001/2024).

[20] Commission of the European Communities, Green Paper on Energy Efficiency or Doing More With Less, 22 June 2005 (COM(2005)265 final).

[21] Commission of the European Communities, Communication from the Commission, Action Plan for Energy Efficiency: Realising the Potential, 19 October 2006 (COM(2006)545 final).

[22] Commission of the European Communities, Commission Staff Working Document, Impact Assessment Report for the Action Plan for Energy Efficiency 2006, undated.

[23] Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the energy performance of buildings.

[24] Millions of tonnes of oil equivalent.

**Table 2 Existing Energy Efficiency Certificates Schemes in the EU**

| Jurisdiction | Obligated Entities | Target Customers | Target-setting Authority | Administrator | Trading |
|---|---|---|---|---|---|
| Flanders (BE) | E D | Res & non energy intensive industry and services | G | G | N |
| France | All S | All except EU ETS | G | G | Y |
| Italy | EG D | All (including transport) | G | R | Y |
| UK | EG S | All | G | R | Y (b'ween S) |
| Ireland | E D | All (except transport) | R | R | n.a. |
| Denmark | EGH D | All (except transport) | G | R | n.a. |

Notes:
Obligated Entities: E = Electricity, G = Gas, H = Heat, D = Distribution Companies, S = Suppliers
Target-setting Authority and Administrator: G = Government (Ministry), R = Regulatory Agency

While these schemes diverge in many respects, there are some notably common features. The obligation is typically imposed on distribution companies or suppliers (of electricity, possibly gas and, in the case of Denmark, of heating as well). The schemes aim at promoting savings in all or many sectors – in same cases including transport; harnessing energy efficiency where it can be achieved more effectively – and therefore considering the widest possible range of options – is in fact one of the advantages of a certificates scheme.

The longest running national scheme in the EU was introduced in Italy 2005[25], and was modified in some relevant features in 2008[26]. The Italian scheme has many typical characteristics of this type of instruments and therefore could be used as a relevant example. The scheme is based on the definition of overall energy efficiency targets – increasing over time - and on the allocation of these targets to the obligated entities – large and medium

[25] On the basis of Ministerial decrees 24 April 2001 and 20 July 2004.
[26] Ministerial decree 21 December 2007.

electricity and gas distribution companies[27].

Obligated entities can achieve their own targets through projects developed internally or by affiliate companies, or through the purchase of Energy Efficiency ("White") Certificates (TEECs) related to projects developed by other distribution companies or Energy Service Companies (ESCOs)[28]. One of the remarkable aspects of the Italian experience is that the largest majority of the energy saving achieved, at least in the first three and a half years of operation of the scheme, have been produced by projects developed by ESCOs[29]. This pattern seems to suggest that the scheme has been able to harness initiatives outside the obligated companies which would have probably not been mobilised otherwise.

TEECs are issued by the Electricity Market Operator, on the basis of energy savings delivered by projects and certified by the Regulator[30]. TEECs are generally issued for the first five years of the project[31]. Energy savings can be quantified according to three different types of evaluation methodologies, which need to be defined or approved by the Energy Regulator:

– standard evaluation, which assigns a pre-defined level of energy saving to each physical unit of a specific technology or appliance (such as fluorescent bulbs, A/A+/A++ electrical appliances, condensing boilers, double glazing). So far the Regulator has defined standard evaluation methodologies for 18 types of projects;
– analytical evaluation, in which an algorithm is used to determine the level of energy savings on the basis of some parameters of the project. So far the Regulator has defined analytical methodologies for 4 types of projects;
– ex-post evaluation, which is used when, because of the nature of the

[27] Initially the obligated distributors were defined as those serving at least 100,000 customers. In 2008 the threshold was reduced to 50,000 customers.
[28] Electricity and gas distribution companies receive compensation, through the tariff system, for the cost incurred in achieving the target. The compensation is set at a predefined level for each toe of energy saving achieved.
[29] For the period January 2005 to May 2008, the share of TEECs issued with respect to projects developed by ESCOs has been equal to 77%, while projects developed by electricity and gas distribution companies on which the energy efficiency obligation is imposed accounted for only 12% of total savings. These figures and others quoted later in the text are obtained from the 2008 Annual Report on Energy Efficiency Certificates Mechanism (Autorità per l'energia elettrica e il gas, Terzo rapporto sul meccanismo dei titoli di efficienza energetica, 2 dicembre 2008, http://www.autorita.energia.it/pubblicazioni/eerapporto_08.pdf).
[30] Autorità per l'energia elettrica e il gas.
[31] Eight years in the case of some projects related to building insulation.

project, energy savings cannot be estimated using standard or analytical methodologies and a project-specific methodology should be defined by the project developer and approved by the Regulator.

So far, most energy savings have been produced by project evaluated using standard methodologies[32]. On the one hand, this has simplified the evaluation process for most of the projects; on the other hand, it suggests that, as it could have been expected, the initial effort promoted by the scheme has been devoted to the simplest (and possibly cheapest) ways of achieving energy savings[33] and that little technological innovation or new processes have been so far promoted.

However, the scheme has delivered quantitative results well above expectations. In the period until May 2007, the energy saving certified by the TEECs issued reached a level more than twice as high as the targets imposed on the electricity and gas distribution companies for the period to 2006. Over the twelve months to May 2008, TEECs issued referred to energy savings 40% higher than the 2007 targets. The excess supply of TEEC resulted, on the one hand, in a significant reduction of their price in the market; on the other hand, in some changes in the rules governing the scheme. More specifically, at the beginning of 2008, energy efficiency targets were reviewed upward and it was also provided that, in the future, excess supply of TEEC will result in further increase in the targets[34]. In this way, the scheme should promote further effort to increase energy efficiency, by reducing the risk that excess supply of TEECs results in a reduction in their value.

[32] Over the period from January 2005 to May 2008, projects evaluated using standard methodologies accounted for 85% of total energy savings, while projects evaluated using analytical methodologies accounted for an additional 5%. The remaining 10% was obtained through projects evaluated using ex-post methodologies.

[33] More than half (59%) of the energy savings achieved in the period until May 2008 have been obtained from a more efficient use of electricity in the residential and tertiary sector. Over the same period, the deployment of compact fluorescent bulbs – in 469 projects, almost 90% of which carried out by ESCOs - has accounted for 64% of total energy savings, while the deployment of low-flow shower faucets in the residential sector and the substitution of public lighting lamps have accounted for additional 12% and 7% of total energy savings, respectively,

[34] At the same time the differentiation between TEECs issued with respect to projects delivering savings in electricity consumption, gas consumption and consumption of other energy vectors, as well as a 50% minimum own-sector energy saving requirement in the obligation imposed on electricity and gas distribution companies were abolished. Moreover, some flexibility in the way in which obligated entities comply with their targets was introduced, with the possibility for these entities to postpone for one year up to 40% of their obligations.

The development of a EU-wide TEEC scheme to which the EC seems to hint raises the question – discussed in Section 2 – of the geographical dimension of the benefits arising from energy efficiency improvements and can only be rational in the context of an organic EU energy supply security policy.

## 5.2. Renewable energy

The penetration of renewable energy sources has been promoted through the setting of Community-wide and national targets and standards, as well as through incentive-based mechanisms. So far the promotion of renewables has been based on national policies, aimed at achieving targets agreed at the EU level[35], focussing mainly on three sectors: power generation, heating and cooling and transport. These policies have been in place for several years.

In the power generation sector, feed-in tariffs have been the most widely used instrument for promoting the use of renewable sources, with a few Member States - notably Belgium, Denmark, Italy, Poland, Sweden and the United Kingdom – introducing Renewables "Green Certificates" Schemes. Investment subsidies and fiscal measures are the most common approaches in the heating and cooling and transport sectors, respectively. Table 3 summarises the main instruments currently used for the promotion of renewables in these three sectors in the different Member States[36].

[35] The 1997 White Paper on Renewable Sources of Energy set a "political and not legally binding" target for the penetration of renewables in primary energy demand of 12% for the EU as a whole, to be achieved by 2010.

[36] Table 3 has been compiled using information contained in Member States Fact Sheets published by the European Commission: http://ec.europa.eu/energy/climate_actions/facts_en.htm.

**Table 3 Main instruments for renewables support in the EU**

| | RES-E | RES-H | Biofuels |
|---|---|---|---|
| AT | FIT | ISS | TER |
| BE | RTC + ISS | ISS | TER |
| BG | FIT | ISS | TER |
| CY | FIT + ISS | ISS | TER |
| CZ | FIT/TPB | | MMQ |
| DK | FIT/TPB (TEN) | TER | TER |
| EE | FIT (TPB+RTC) | | TER |
| FI | TER + ISS | TER + ISS | TER + MMQ |
| FR | FIT (TEN) | TER + ISS | TER + MMQ |
| DE | FIT + ISS | ISS | MMQ (TER) |
| GR | FIT | (TER) | TER |
| HU | FIT (RTC) | | TER |
| IE | FIT | ISS | TER |
| IT | RTC (FIT) | | ISS + TER |
| LV | FIT + MMQ | | |
| LT | FIT | ISS | TER |
| LU | FIT + ISS | ISS | TER |
| MT | FIT + TER | | TER |
| NL | TPB + RTC | (ISS) | TER |
| PL | RTC + TER | | TER + MMQ |
| PT | FIT + TEN | ISS | TER |
| RO | RTC | | |
| SK | FIT + TER | ISS | MMQ |
| SI | FIT/TPB + ISS | ISS | TER + MMQ |
| ES | FIT + ISS | MMQ + ISS | TER |
| SE | RTC | (ISS) | TER |
| UK | RTC + ISS | ISS | RTC + TER |

FIT = Feed-in Tariffs
ISS = Investment Subsidies and Support Schemes
MMQ = Mandatory Minimum Quotas
RTC = Renewable Targets and Tradable ("Green") Certificates
TEN = Tendering Procedures
TER = Tax Exemptions and/or Rebates
TPB = Tariff Premia or Bonuses
() = Codes in brackets indicate secondary instruments or instruments being temporarily suspended

In January 2008, as part of the CAREP, the EC published a proposal for a Directive aiming at defining new targets for the penetration of renewables in energy consumption. The proposal also included provisions for establishing a new EU-wide, market-based system for the promotion of the use of renewable energy sources in the generation of electricity and for heating and cooling purposes (the "community system").

The Directive was finally approved, with some significant modifications, by the European Council in December 2008[37] and finally adopted in April 2009 (Directive 2009/28/EC)[38]. In particular, as it will be better described below, the community scheme was replaced by "statistical transfers" between Member States.

The new Directive envisages that:

– Member States are assigned individual overall targets[39] for the share of renewable energy sources in final energy consumption in 2020[40].

  It is worth emphasising that, in setting the 2020 renewable penetration targets, no consideration has been given to the renewable potentials of the different Member States or to the costs of the different renewable endowments.

  Table 4 compares the targets set for the individual Member States by the new Directive to the actual penetration level in 2005.

[37] The Directive is intended to complement and extend the provisions contained in Directive 2001/77/EC (of the European Parliament and of the Council of 27 September 2001 on the promotion of the electricity produced from renewable energy source in the internal electricity market) and Directive 2003/30/EC (of the European Parliament and of the Council of 8 May 2003 on the promotion of the use of biofuels and other renewable fuels for transport), which have already contributed to an increase in the use of renewables in electricity generation and of biofuels in transport.
[38] Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.
[39] These targets have been defined by:
- using the 2005 penetration level as the starting point. For those Member States where renewable penetration increased by more than 2% between 2001 and 2005, the starting point is defined by subtracting one third of this increase from the actual 2005 penetration level;
- adding:
  - a 5.5% increase, equal for all Member States;
  - an additional increase, differentiated between the different Member States, and based on GDP;
- capping the 2020 renewable penetration target at 50%.
[40] For the purpose of calculating the renewable penetration level, final energy consumption of renewable energy sources is defined as the sum of: i) final electricity consumption from renewable energy sources; ii) final consumption of energy from renewable sources for heating and cooling purposes; and iii) energy from renewable sources consumed in transport.

**Table 4 Renewable Penetration in Total Final Energy Consumption: 2005 Actual vs. 2020 Targets**

| | Share of Renewables in Total Final Energy Consumption | |
|---|---|---|
| | 2005 Actual | 2020 Target |
| Belgium | 2.2% | 13% |
| Bulgaria | 9.4% | 16% |
| Czech Republic | 6.1% | 13% |
| Denmark | 17.0% | 30% |
| Germany | 5.8% | 18% |
| Estonia | 18.0% | 25% |
| Ireland | 3.1% | 16% |
| Greece | 6.9% | 18% |
| Spain | 8.7% | 20% |
| France | 10.3% | 23% |
| Italy | 5.2% | 17% |
| Cyprus | 2.9% | 13% |
| Latvia | 34.9% | 42% |
| Lithuania | 15.0% | 23% |
| Luxembourg | 0.9% | 11% |
| Hungary | 4.3% | 13% |
| Malta | 0.0% | 10% |
| Netherlands | 2.4% | 14% |
| Austria | 23.3% | 34% |
| Poland | 7.2% | 15% |
| Portugal | 20.5% | 31% |
| Romania | 17.8% | 24% |
| Slovenia | 16.0% | 25% |
| Slovakia | 6.7% | 14% |
| Finland | 28.5% | 38% |
| Sweden | 39.8% | 49% |
| United Kingdom | 1.3% | 15% |
| EU-27 | 8.5% | 20% |

– an indicative trajectory for achieving the 2020 targets is identified[41];
– Member States should adopt a National Action Plan which contains the targets for the share of renewable energy in transport, electricity, and

[41] This trajectory is defined in terms of the proportion of the distance between the 2020 target and the 2005 actual level which should be covered by subsequent two-year periods, starting from 2011 - 2012. More specifically, the above proportion is set equal to 20% for the 2011 – 2012 period, to 30% for the 2013 – 2014 period, to 45% for the 2015 – 2016 period and to 65% for the 2017 – 2018 period.

heating and cooling and the measures – and support schemes - to be implemented to achieve them, including national policies to develop biomass resources and bring them into use[42];
- the target for the share of renewable energy sources in final energy consumption in transport in 2020, specified in the National Action Plans, should not be below 10%.

As already mentioned, the original Directive proposal from the EC included a community scheme. This scheme was based on tradable "guarantee of origin" (GoO), issued in respect to electricity and heating and cooling produced from renewable energy sources, and would have allowed Member States to fulfil their renewables penetration targets by using renewables domestically, by virtually trading electricity or heat produced from renewable energy sources in other Member States, or by physically trading electricity and heat produced from renewable energy sources in third countries[43].

Virtual trading referred to the trading among Member States, or individual operators, of GoO representing the "renewable value" of the electricity or heat produced from renewable energy sources. Physical trading referred to the simultaneous trading of GoOs and of an equivalent amount of electricity or heat.

Energy (electricity and heat) producers from renewable sources would have had different possible uses of the GoOs that they were to receive. More specifically, they would have been able to:
- participate in a national support scheme or a national renewable obligation scheme, not necessarily in the Member State in which the energy is produced. In this case they would have had to submit the GoOs to the competent body of the Member State in which the scheme is established[44];

[42] If a Member State's renewables penetration level falls below the indicative trajectory, a new Action Plan should be submitted which indicates how the renewables penetration level is brought back into line with the indicative trajectory.
[43] Trading of electricity or heat produced from renewable energy sources in third countries was conditional on such production being carried out in new installations – i.e. installations which became operational after the entry into force of the proposed Directive - and being certified according to a guarantee scheme which is equivalent to the one introduced in the EU by the proposed Directive.
[44] The decision to participate in a national support or renewable obligation scheme would have bound the energy producer for the remaining life of the installation producing energy from renewable sources, in the sense that the producer would have been committed to participate in the same scheme – and therefore submit the GoOs to the same competent body - for all future production of energy from renewables by the same installation.

– sell the GoOs to other operators, in the same or in other Member States, who would have used them:
  – to fulfil their commitment under a renewable obligation scheme; or
  – in the case of suppliers and consumers, to prove – by submitting GoOs to a competent body - the share of renewables in their energy mix, even when they do not claim benefits under a national scheme.

It was moreover clear that the community system would have coexisted with the national support schemes - which are based on a variety of instruments, such as feed-in tariffs, premium tariffs, tendering systems or green certificates.

The ability of an electricity or heat producer from renewables holding GoOs to access national support schemes in other Member States or to transfer the GoOs to operators in other Member States would have been in any case limited to the GoOs issued in relation to electricity or heat produced from renewables by new installations[45] and could have been further restricted by the requirement of prior authorisation which Member States would have been allowed to impose.

Eventually, the GoO trading scheme was abandoned and, in the Directive approved by the European Council in December 2008 and adopted in April 2009, it was replaced by a system of "statistical transfers" between Member States. This system restricts "trading" in renewables, in a sort of virtual way, to Member States.

Therefore, electricity or heat producers from renewables in one Member States will not be able to access support schemes in other Member States or to sell the renewable value of their energy to operators in other Member States. It will be for Member States to decide how much of their target they intend to achieve domestically and how much they are prepared to trade "statistically" with other Member States.

Directive 2009/28/EC therefore designs a system in which:
– the individual targets assigned to Member States determine the allocation of the "financial" responsibility for achieving the EU objective – i.e. the way in which the overall costs involved in achieving this target are allocated among the different Member States;

[45] I.e. installations which will become operational after the date of entry into force of the proposed Directive.

– the outcome of the "statistical transfers" between Member States will determine the total cost of achieving the EU target, as well as the way in which the additional "physical" effort, and therefore the benefits, will be allocated among the different Member States.

The "statistical transfer" will therefore allow the decoupling of the allocation of the "financial" responsibilities from the allocation of the physical effort in deploying renewables.

As individual Member State targets have been defined on the basis of the "ability to pay" of the different Member States – with no regard to their renewable potentials or the cost of their renewable endowment –, these targets should be interpreted as mainly defining the financial contribution towards the cost of meeting the overall target, rather than envisaging the effort that Member States should put in physically using renewable energy sources. It is therefore quite clear that the objective of the EC, in setting the targets, was to distribute the financial responsibility for the overall cost of meeting the objective and not the assignment of the responsibility for physically developing renewables, which could be (re-) allocated optimally through "trading". It is likely that the GoO trading scheme proposed by the EC, if left to operate unhindered, would have resulted in an efficient allocation of the effort, as market participants would have taken advantage of most, if not all, trading opportunities. The statistical transfers scheme will inevitably lead to a lees efficient outcome: it is in fact unlikely that all opportunities for statistical transfers will be taken up by Member States. In fact, as highlighted in Section 2, Member States characterised by higher compliance costs will be facing the dilemma posed by statistical transfer of renewables from lower-costs Member States. While such transfers may reduce compliance costs, they will lead to benefits accruing to the transferring Member State.

### 5.3. GHG Emission Limitation

The EU strategy on climate change has moved directly to a EU-wide approach, with the BSA and the establishment of the EU ETS. The ETS was launched in 2005 and it is the first EU-wide environmental market (and the first environmental market in the world covering different national jurisdictions)[46]. As already mentioned, in December 2008, the European

[46] Since 2008, the ETS also covers Norway, Iceland and Liechtenstein.

Council approved the EC proposal, as part of the CAREP, for modifying the ETS from 2013, on the basis of the experience gained in its first years of operation. A new Directive 2009/29/EC was adopted in April 2009[47].

The ETS operates according to consecutive multi-year trading periods. Directive 2003/87/EC envisaged an initial three-year trading period (2005 – 2007), followed by five-year trading periods (the first of which running from 2008 – 2012). However, Directive 2009/29/EC envisages that, from 2013, the length of the trading periods will be extended to 8 years, so that the third period would run from 2013 to 2020.

At present the ETS covers only some of the sectors responsible for GHG emissions (the so-called "trading sectors", which currently include power generation and other combustion installations, mineral oil refining, production and processing of ferrous metals, some mineral industry sectors – such as cement, glass and ceramic – and pulp and paper production) and, therefore, it is complemented by (mainly national) P&M aimed at reducing emissions in the other sectors (the non-trading sectors). It is envisaged that aviation will be included in the ETS before the end of the current trading period. Directive 2009/29/EC further extends the scope of the ETS from 2013 to include additional installations[48], as well as additional gases[49].

Under the ETS, emissions from installations included in the trading sectors should be covered by allowances, which the operator of the installation should surrender by the end of April each year, with respect to emissions in the previous calendar year.

So far allowances have been allocated by Member States. More specifically, for each trading period, each Member States has been required to develop a National Allocation Plan (NAP) which defines the total quantity of allowances which it intends to issue and how these allowances will be allocated to the different installations in the trading sectors. The NAP should conform to a number of criteria[50], the most relevant of which

[47] Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009, amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community.
[48] In the aluminium, ammonia and petrochemical sectors, as well as carbon capture and storage installations.
[49] $N_2O$ emissions from the production of nitric, adipic and glyoxylic acid and perfluorocarbons from the aluminium sector.
[50] Annex III in Directive 2003/87/EC originally listed 11 criteria. Directive 2004/101/EC introduced an additional one.

require the allocation to be consistent with the country's path toward the achievement of the emission target set in the BSA, with emissions developments and with the potential for reducing emissions. Therefore, even countries for which emission levels are already below their BSA targets (e.g. most Eastern European Member States, due to the economic downturn in the 1990s) have been required to reduce emissions according to technical potentials. The NAP indicates the number of allowances to be allocated to each participating installation in each year of the trading period. For the first trading period (2005 – 2007), at least 95% of the allowances were to be allocated free of charge (the alternative would have been allocation through auctions); for the second trading period (2008 – 2012) the minimum share of freely allocated allowances was set at 90%. In practice, most Member States allocated all allowances free of charge.

The allowances allocated are then released annually, by the end of February. Allowances can be banked within each trading period, and, from 2008, also between one trading period and the next.

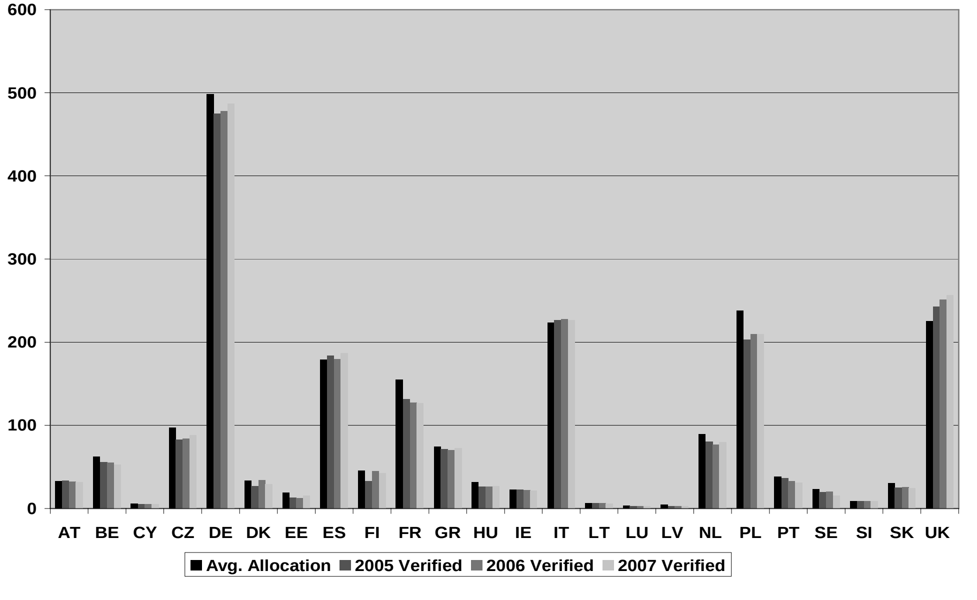
Allowances, which are dematerialised and are recorded as entries in national and EU registries, are freely traded. A number of organised trading platforms have been established by Commodities Exchanges (e.g. ECX) and Power Exchanges (e.g. the Scandinavian NordPool, the German EEX, the French PowerNext and the Italian GME).

Directive 2004/101/EC – the so called "Linking directive" - introduced the possibility for operators of installations in the trading sectors to use "Kyoto credits" to cover part of their annual emissions. Kyoto credits include Emission Reduction Units (ERUs) - arising from emissions avoided by a JI project and the use of which has been allowed since the beginning of the first trading period in 2005 - and Certified Emission Reductions (CERs) – issued in respect to emission reductions achieved by CDM projects and the use of which has been allowed since the beginning of the second trading period in 2008. The use of Kyoto credits is limited by the requirement imposed on Member States to comply with the "supplementarity principle". The quantitative interpretation of this principle adopted by the EC limits the use of Kyoto credits to 50% of the total emission reduction effort required to a Member State for achieving its BSA target[51].

[51] This effort is defined as the largest of the following three "distances":
- the distance between the 1990 emission level and the BSA target;
- the distance between the 2004 emission level and the BSA target;
- the distance between the 2010 emission level under the reference scenario – i.e. the scenario which

The experience of the initial three-year trading period has been mixed. On the one hand, despite some initial delays, the ETS was put in place within a remarkably short period of time (less than 15 months from the date the Directive 2003/87/EC was adopted). Moreover, after initial problems with some national registries, which led to delays in the allocation and release of allowances, trading developed smoothly and, as already indicated, a number of trading platforms emerged. The main shortfall was associated with what eventually emerged as significant over-allocation of allowances. In fact, prior to the establishment of the ETS, very little reliable information was available on emissions of individual installations and therefore, for the first trading period, allowances were allocated on the basis of inadequate emissions data. When information on verified emission for 2005 was released in May 2006, it became immediately clear that the overall volume of allowances allocated would have exceeded emissions. This became even clearer when the data for 2006 were released in May 2007. Figure 1 compares the average annual volume of allowances issued in the different Member States for the first trading period with the level of verified emissions in the three years included in this period.

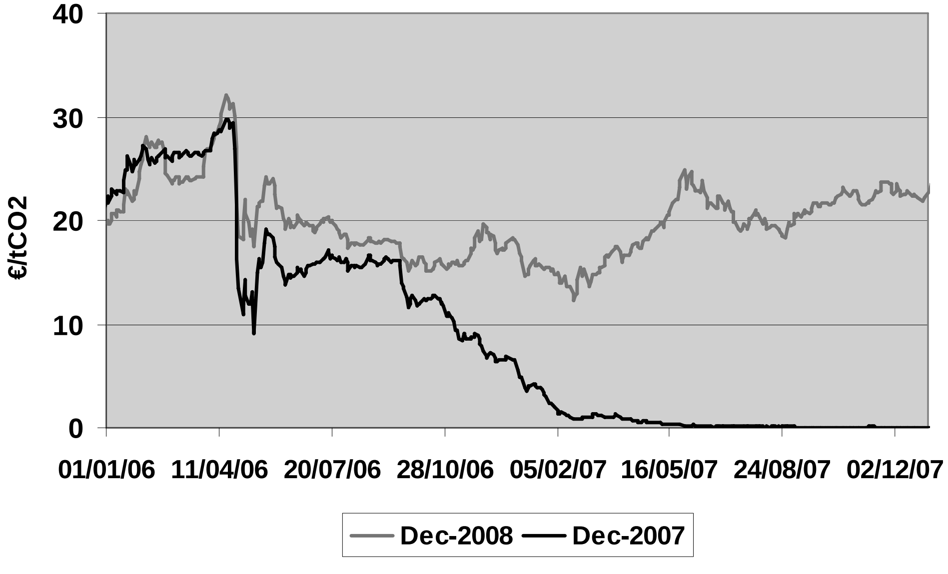
**Figure 1 Annual Average Volume of Allowances issued in the First Trading Period and Verified Emissions in 2005, 2006 and 2007**




includes the effect of existing policies and measures - and the BSA target.

As a consequence of the emerging excess supply, the price of allowances, which had remained mostly in the 20€/t$CO_2$ to 30€/$CO_2$ range from January 2005 to April 2006, and was close to the upper limit of the range at the end of this period, dropped to around 10€/t$CO_2$ in May 2006 and, after a few months in which it stayed between 10€/t$CO_2$ and 20€/t$CO_2$, by the end of the year was below 10€/t$CO_2$. In the second half of 2007, after the 2006 verified emissions data were released, it fell further to levels below 1€/$CO_2$. Figure 2 illustrates the trend in the price of allowances for the first and second trading period[52].

**Figure 2 Emission Allowance Prices for the First (Dec 2007) and Second (Dec 2008) ETS Trading Periods**




This experience served as the basis for the changes in the allowances allocation method, introduced by Directive 2009/29/EC and to be implemented from 2013. In particular:

– a EU-wide allowance cap will be defined by the Commission. This cap will be consistent with the objective of achieving a 20% reduction in emissions by 2020 with respect to 1990 levels. Emission reduction

[52] Figure 2 is based on the allowance prices recorded at the Leipzig-based EEX - European Energy Exchange.

targets have been redefined with respect to emissions in 2005 (the first year for which verified emission data are available) and have been set separately for trading (-21%) and non-trading (-10%) sectors according to their respective potentials for emissions limitations;

- sector allocations will be determined according to common rules. Therefore, the allocation of allowances will no longer be based on nationally defined NAPs;
- as a general rule, allowances will be auctioned off. This will be the case, from the beginning of the third trading period (2013) for the power sector[53,54], refineries and CCS installations, which are deemed not to be exposed to international competition. For most other sectors, auctioning will be applied to an increasing share of the allocated allowances, starting at 20% in 2013, reaching 70% in 2020 and 100% in 2027[55]. Aviation and sectors which are exposed to international competition and for which there is a significant risk of "carbon leakage"[56] will continue to receive all their allowances free of charge[57];
- allowances to be auctioned off will be allocated to Member States proportionately to verified emissions in 2005, with some corrections to favour Member States with lower per-capita income and higher growth prospects.

[53] During the first and second trading periods, a debate developed as to the extent to which the additional costs faced by electricity generators related to the ETS should have been reflected in wholesale electricity prices. In theory, even though generators received (almost) all the allowances for free and therefore (almost) no monetary costs were involved, they were still facing an opportunity cost in using allowances to cover emissions, as the alternative would have been to sell these allowances on the market for a price; therefore, the value of the allowances should have been reflected in the wholesale electricity price. In practice, this "pass-through" occurred to a different degree in different Member States and many generators refrained from reflecting the (opportunity) cost of allowances in their pricing for fear of been accused of benefiting from windfall profits (an accusation which in fact was voiced). With the auctioning of the allowances, the issue is solved, as monetary and opportunity costs coincide and generators will clearly include these costs in their pricing.

[54] In the final decision by the European Council, Member States which fulfil certain conditions - related to the interconnectivity of their electricity grid, share of a single fossil fuel in electricity production, and the level of per capita GDP in relation to the EU-27 average - are allowed an optional and temporary derogation from the rule that no allowances are to be allocated free of charge to electricity generators as of 2013.

[55] The original EC proposal called for full auctioning of allowances by 2020.

[56] Carbon leakage refers to the possibility that production activities in the sector are relocated in jurisdictions (outside the EU) which are not subject to the ETS.

[57] The debate that led to the European Council decision focused much on the criteria for identifying sectors which are facing the risk of carbon leakage and which therefore are entitled to receive allowances free of charge. Eventually it was agreed that the EC will issue criteria and come up with a first list of sectors subject to carbon leakage by the end of 2009. This list will then be subject to regular review.

## 6. Conclusions

Directive 2003/87/EC establishing the ETS represented an historic step in EU environmental policy, and one which is likely to have implications far beyond the borders of Europe. In fact, while other environmental markets were established – e.g. in the US – in the 1990's, never before they reached the geographical extension and the size of the ETS. In the run-up to the decisions on the future of climate change policy beyond the KP, the ETS inevitably represents a reference for any market-based instrument which may be introduced, at the international level, to implement such policy.

As already indicated, despite some initial problems – due to the over allocation of allowances in the first trading period and delays in the setting up of registries – the ETS should be considered as a success. Within less than two years a EU-wide environmental market, the first of its kind in the world, was established, with the participation of more than ten thousand operators.

With the CAREP the EC has tried to introduce Europe-wide market mechanisms in other areas of European environmental policy, more immediately in the promotion of renewables, but also hinting at the possibility of extending the use of tradable White Certificates schemes.

However, as indicated in Section 2, the distinct nature of the benefits delivered by actions in the three main directions of EU environmental policy have important implications for the choice of environmental policy instruments. More specifically, as mentioned in Section 4, market-based instruments are more suited to be implemented where the benefits are global, or their allocation within the geographical area covered by the instrument is not relevant. These conditions clearly apply in the case of policies aimed at reducing GHG emissions. In the case of energy efficiency and the penetration of renewables, the benefits are more geographically defined and the decoupling of the distribution of benefits from the allocation of costs which market-based instruments produce implies that the beneficiaries may be different from those who bear the costs of environmental action.

The above decoupling may reduce the "political appeal" of market-based instruments in certain areas of environmental policy, despite the potentials of such instruments to reduce overall compliance costs. This explains the more cautious approach that the EC has taken in proposing a market-based instrument for the promotion of renewables, where cross-border GoO trading would have been subjected to a prior authorisation by the Member State(s) involved. Eventually, even this scheme was considered to introduce too much flexibility and was replaced with the "statistical transfer" mechanism which gives Member States full control over the way in which the individual national targets are achieved (either completely through domestic action or partly through the statistical transfer of quantities of energy produced by renewable sources in other Member States).

It may well be that a similar situation arises if and when the EC were to propose a EU-wide energy efficiency certificates scheme.

In both cases - renewables and energy efficiency – the lack of a well-defined and credible EU energy policy on some important issues - e.g. on security of supply – makes it difficult for Member States convincingly to participate in EU-wide market-based schemes. In fact, such participation would reduce Member States' ability of controlling the way in which the respective national targets are achieved and therefore the extent to which the achievement of these targets contributes to other objectives, such as supply security, which, in the absence of a common EU policy, are still seen as predominantly of national concern.

Therefore, the future prospects for a wider use of EU-wide market-mechanisms in European environmental policy much depends on developments in more general EU policy on energy supply security.