Will Emission Trading Promote End-Use Energy Efficiency and Renewable Energy Projects?

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ABSTRACT

Will emissions trading, as currently applied in Europe and planned elsewhere, trigger sufficient additional investments in end-use energy efficiency (EUEE) and renewable energy sources (RES) in the near-term? Answering this question requires an in-depth analysis of emissions trading schemes, RES and EUEE investment criteria, market dynamics, and inertia in the energy system as well as the climate system and its sensitivity to GHG stabilization levels, among other things. Because this is a task too ambitious within the scope of the current paper, we narrow the discussion to analysis of currently applied emissions trading schemes, notably the EU Emissions Trading System and provide our observations related to this question. Market-based instruments (MBIs)[1] that foster sustainability in the energy sector have been introduced to promote electricity from renewable energy sources and cut harmful emissions. Quota systems coupled with tradable green certificates have been developed and tested in several European countries and some states in the US. Another widely analysed MBI is the tradable emission allowance; the first international CO_2 emissions trading system is starting in the European Union. This paper explains the concepts of emissions trading, and of the policy instruments that involve green and white certificates. It discusses the effect of emissions trading on EUEE and RES and the conditions, including design specifics that may hamper or facilitate the wider introduction of EUEE and RES projects. Finally, the paper reviews the desirability and practicality of integration of green and white certificates and their introduction in emission trading.

Emissions Trading: Concept, Implementation and Impacts on EUEE and RES

An emissions trading scheme creates a market for emission allowances and in principle enables emission reductions to take place where it is most cost effective. In the European Union (EU) the Emissions Trading System (EU ETS) has commenced in January 2005; in the U.S. some states discuss regional trading.

In 2003 the EU adopted a Directive (2003/87/EC) introducing a cap-and-trade scheme within the Community. The *EU ETS* is the first trans-national emissions trading scheme; it is supposed to cover about 46 % of the EU-15's total CO_2 emissions in 2010 (the first three-year trading period 2005-2007 is limited only to CO_2) and involves about 12,000 installations that fall

[1] We recognize the difference between **policy instruments** that harness market forces to achieve a certain policy goal (such as renewable energy quotas or renewable portfolio standards) and the **market instruments** themselves (namely carbon allowances, green and white certificates) the latter being a much narrower concept representing just a tradable commodity. This differentiation is not so important in the context of the present paper and in the text we refer to complex policy tools/portfolios that include trading of financial commodities (such as certificates or allowances) as ***market-based instruments*** (MBIs).

under the activities specified in Annex I of the Directive: practically all energy intensive sectors (apart from the chemical sector). Each installation gets emission allowances for the whole period: allowances are allocated to installations covered by the scheme by the Member States of the EU by means of a national allocation plan (NAP) and according to defined criteria. For the first period emission allowances are free of charge and allocation is based on the grandfathering method[2]; for the second period (2008-2012) Member States can auction up to 10 % of their total emission allowances.

In the US, the Regional Greenhouse Gas Initiative (*RGGI* or "*ReGGIe*") is a cooperative effort by nine Northeast and Mid-Atlantic states to discuss the design of a regional cap-and-trade program initially covering CO_2 emissions from power plants in the region[3]. In the future, RGGI may be extended to include other sources of GHG emissions, and GHGs other than CO_2[4]. Meanwhile, states are taking action to solidify their climate policy and require mandatory reporting of GHGs – a first step towards emissions trading. Private initiatives have also emerged to allow for voluntary target setting by firms, reporting of GHG emissions, and trading[5].

Caveats of Emissions Trading

There a number of reasons why emission trading by itself, especially as currently applied in the EU ETS, is insufficient to stimulate EUEE and RES[6].

First, emissions trading will stimulate RES and EUEE *only after all cheaper options are taken up by the market*. We expect that direct 'competition' of EUEE and RES projects against other carbon saving options in the EU ETS will result in the additional deployment of a limited number of EUEE and RES projects. For renewables this is because:

(1) Renewables may have higher marginal abatement costs than other carbon mitigation options;
(2) So far the allowance prices in the EU ETS are anticipated to be low and the carbon price is very much fluctuating[7];
(3) Markets are indifferent towards the direction of technological change[8] (this is valid for MBIs in general rather than for EU ETS solely).

[2] Grandfathering is a method of distributing emissions allowances for free using only historical data. This method has been provided for by the Directive and taken as the basis for preparation of the national allocation plan. Projections of emissions for the three-year trading period of 2005-2007 are calculated from previous periods.

[3] See: www.rggi.org/about.htm

[4] Currently, Connecticut, Delaware, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island and Vermont are participating in the RGGI effort. In addition, Maryland, the District of Columbia, Pennsylvania, the Eastern Canadian Provinces and New Brunswick are observers in the process.

[5] See: http://www.chicagoclimatex.com/about/

[6] We recognize that there is a profound difference between emission trading as defined in UNFCCC and the EU ETS and the latter is much more limited. Here we describe the practical concerns related to the EU ETS. We refer to energy efficiency and RE projects that are not covered by the ETS, i.e. **not undertaken by operators under the CO_2 cap** in EU ETS.

[7] Following a bearish start in early Jan 2005, seeing allowance prices drop to Euro 6.35/t for delivery in 2005 (EUA 2005), prices in the EU ETS have since climbed steadily. Late April 2005 saw allowance prices for delivery in 2005 reaching a preliminary all-time high of Euro 17.90/t (www.pointcarbon.com). Some attribute these price increases to the gas-coal spread, cold weather across Europe and discussion on cuts of emission allowances in i.e. the UK, the Czech Republic and Poland insisted by the European Commission. The price of the EU allowance has also been said to track German power price spikes in recent months.

On the other hand, EUEE is a low-cost carbon mitigation option. However, there is the risk that not many EUEE projects will enter the ETS because:

(1) EUEE is 'invisible': businesses may not recognize it as an energy source, business opportunity and a way to improve competitiveness and comfort; and
(2) Power generators obliged under the EU ETS are more likely to take measures at the supply side where their area of expertise is. In this sense an indicative gradation of their preferences would be to first improve the efficiency of plants (rehabilitation and/or fuel switch), then to install renewable electricity generation capacity, and only last to look beyond the consumer's meter.

Second, *the direct (upstream) approach*[9] *applied in the EU ETS only indirectly gives a minor incentive to energy savings and RES* as a means to consume less carbon intensive products. This has a double negative impact. Principally because only direct emissions are accounted for, an industrial user with an emission cap under EU ETS may not get any carbon benefit for reducing electricity consumption on-site, which may give a wrong incentive to electricity end-use options (motors/drives, lighting) and may result in a shift from thermal energy to electricity. In addition, while under the direct approach the cost of the permits will be accounted for in the price of the products sold by emitters – products with high carbon content will become more expensive and buyers may respond by consuming less or switching to an alternative with a less significant price rise (which presumably, but not certainly, is also less carbon intensive) – price differences between product alternatives are not only caused by carbon intensity[10].

A recent report to the UK Department of Trade and Industry has estimated the *potential impact of the first phase of the EU ETS on electricity prices* in ten European countries. The report states "full marginal cost pass-through of carbon into electricity prices equates to an increase of **0.33 to 0.64 p/kWh**[11] depending on the country and year[12]. However the direct generation market cost – incurred by generators having to purchase extra allowances – will be less than one tenth as much on average, i.e. well below **0.1 p/kWh**" (ILEX/Electrowatt-Ekono 2004). This will not make renewable electricity projects much more attractive. The report concludes that the introduction of the EU ETS will "put upward pressure on wholesale electricity

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[8] Emission trading will only evoke innovations when these bring extra rent to the obliged parties.

[9] The direct (upstream) approach is based on the physical source ('the pipe'), whereby the actual emitters are obliged to purchase sufficient emission permits. In contrast, the indirect (downstream) approach is based on the idea that the final users, who are causing the whole production chain, should see more precisely what the carbon intensity is, and get allotted emission quota based on a baseline. The EU ETS follows the direct system, among other things because of the monitoring and inspection complications inherent to the indirect scheme, especially at an international scale.

[10] The method of allowance allocation, the allowance price in the EU ETS, the extent to which additional costs are passed on to consumers rather than to, say, shareholders, the carbon intensity of the electricity generation system as a whole, all have an impact on the price of electricity (Sorrell 2003). In addition elasticities that operate on behavior (in relation to price, substitution, and income) also influence the degree to which customers will re-orient their consumption to less carbon intensive products.

[11] 0.63 to 1.2 USD/kWh

[12] Key elements as far as electricity prices are concerned are: 1) the overall stringency of the EU ETS and the resulting value of carbon that emerges from trading, 2) the level of pass through of the marginal cost of emission allowances into electricity prices, both at the wholesale and retail level, and 3) the rules surrounding closure and new entrants (ILEX/Electrowatt-Ekono 2004).

prices (…). The ETS will affect the relative output of different types of plants (…) and in the medium to long term, the ETS will affect new entry decisions(…)". However, new entry decisions are not likely to lead to more RES because of the EU ETS, unless new entrant allocation methodologies are specifically built to favor them[13]. Furthermore, price increases per se are an inadequate approach to inducing EUEE and delivering savings because the demand side of the energy sector is rarely as responsive to price incentives as economic theory predicts due to insufficient information, externalities and a large number of other barriers to energy efficiency.

Third, *price increases are expected to be insufficient to stimulate RES deployment* – in fact according to German carbon trader Syneco's calculations CO_2 prices need to rise to a level of approximately 20 Euro/ton if they are to induce a significant fuel change in Germany (Point Carbon 2005a). This calculation refers barely to fuel switch from coal to natural gas! The price levels necessary to induce RES deployment are much greater. In addition, carbon prices are only one factor influencing the fuel mix, other important variables including taxes, subsidies and the prices of natural gas and coal. Finally, methodologies to allocate free emission allowances under the EU ETS, including new entrant rules for some countries and EU ETS covered sectors, may do little to encourage even fuel switching, depending on the methodology applied. At its best, the EU ETS may only serve to encourage the relatively cleaner but non-renewable forms of production (such as natural gas over coal). But current high prices of oil and gas along with over-allocation of allowances to the energy sector[14] will probably result in firing more coal.

Fourth, *already current evidence shows that under the Clean Development Mechanism (CDM), supply side projects and methane emission reductions are the preferred option* for investors[15]. Most energy efficiency-related projects will generate only a *small stream of carbon credits* and consequently fall under the small project stream of the CDM. Even though this stream is designed for easier flow through the CDM project cycle, one study shows that energy efficiency projects are under-represented relative to their estimated potential, which suggests the existence of factors and flaws, such as high administrative costs or other barriers that are not fully reflected in analyses of the achievable potential for these projects (Wang et al 2003). On the other hand, projects that involve non-CO_2 gases, such as methane, are over-represented[16] because the higher global warming potential values of non-CO_2 projects improve their project economics (Haites 2004). With the exception of technologies that are already fully or close to competitive (wind, hydro in some countries), renewables are not likely to attract so much the investors' attention. Nevertheless, several efforts are underway around the world to improve the CDM, including policies and strategies to promote investment in small-scale CDM energy projects and assistance for key participants in the process of developing, financing and implementing small-scale CDM project activities.

Finally, *over-allocation of permits to large industry players, which is highly possible, will make direct policies in downstream sectors even more critical*. Depending on the extent that allowances may be over-allocated, the obliged parties under the cap-and-trade system might be required to make relatively little effort towards contributing to a national target, compared to

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[13] New entrant methodologies vary by country but in some cases may use methodologies that do little to stimulate clean fuel procurement, while methodologies exist which could do so.

[14] See a discussion on the German and the Czech National Allocation Plans in Point Carbon (2005b).

[15] Emission reductions from the project-based flexible mechanisms joint implementation (JI) and clean development mechanism (CDM) can be used by the companies to fulfill their emission reduction targets under the EU ETS.

[16] See: http://cdm.unfccc.int/Projects/registered.html (for the limited list of CDM projects that are registered as of May 4th, 2005.

uncovered sectors. This would result in downstream sectors (residential and tertiary sectors, transport that are not easily or efficiently covered by emission trading) paying disproportionately for reductions to ensure that a given emission reduction target is attained[17]. However, even when a tax is applied to downstream sectors for energy use, because the price elasticity of electricity (and petroleum) demand is low and barriers to EUEE persist, a situation like this – that may normally be perceived as stimulating EUEE outside the ETS sectors – is likely to have a limited effect on EUEE unless additional measures are applied.

Inertia in the energy system and in the climate system calls for significant investment in low-carbon energy systems today, such as RES and EUEE, in order to reach and maintain climate stabilisation levels. Stabilizing CO_2 concentrations would require substantial reductions of emissions below current levels and would slow the rate of warming (IPCC 2001). These are levels such as 500+/- 50 parts per million (ppm). 450 ppm stabilization would require GHG emissions to drop below 1990 levels within a few decades. This is possible, but only by investing in low-carbon energy technology starting today. The IPCC (2001) has stated that "technologies that exist in operation or pilot stage today" are sufficient to follow a less-than-doubling trajectory "over the next hundred years or more".

Carbon trading in itself as currently applied in EU ETS is unlikely to stimulate investments in RES or EUEE projects, unless targets are set more ambitiously causing the price of carbon to rise, and the flaws outlined above are addressed. On the one hand *prices are not expected to increase sufficiently to foster takeoff of RES projects*; on the other hand *solely price increases cannot be relied on to foster EUEE project deployment*. These are just a few of our observations and provide the reasoning for our answer to the primary question in this paper: emissions trading, as applied in the EU ETS, and when considered for its own effect alone, can not be depended on to meet stabilisation goals[18] in a dynamically efficient manner, nor is it a strategy that can provide sufficient assurance against possible irreversible climate change. Nevertheless, there are several reasons for keeping an emissions trading as part of a wider energy policy, such as cost efficiency of meeting global emission reduction targets and providing an incentive for overachievement. This is why the Kyoto Protocol includes flexible mechanisms and many European countries and U.S. states are introducing emissions trading. However, if support for RES and EUEE is not provided today, knowledge may be lost, carbon-intensive demand patterns and technology may lock-in, and low-carbon infrastructure will be much more difficult to implement widely and quickly at a later stage.

Options to Support RES and EUEE Deployment with Emissions Trading

Emission trading could be applied in a way that makes further EUEE and RES investments (beyond a certain RES or EUEE target) attractive.

The allowance *allocation scheme* applied can favour RES or EUEE technologies to a certain extent. An alternative to relying on historical emissions is to assign a certain number of allowances for each unit of actual heat input or to electricity production ("output") going forward ("earn as you burn" or "forward looking"). An <u>input-based allocation</u> gives allowances to sources based on emissions per unit of boiler heat input (measured in Btus). An <u>output-based</u>

[17] This will possibly be the case for Germany, given its current national allocation plan (NAP) under the EU ETS.
[18] The uncertainty about climate sensitivity yields a range of estimates of temperature change that would result from emissions corresponding to a selected concentration level.

allocation provides greater incentives to reduce emissions through plant operational efficiency. Alternative allocation schemes such as these should also be used for new entrants. Distributing emission allowances to new entrants for free based on methodologies representing more or less the business-as-usual scenario may *discourage* the wider introduction of low-carbon fuels like cleaner natural gas.

There are at least four other ways to allocate emission allowances to favor in particular renewable energy sources. The first method awards allowances on the same basis as other electric generation resources: a regulator may set a cap on total emissions from the non-nuclear and non-hydro electric generators, and then allocate allowances to new and existing generators by dividing the cap by the *total amount of expected generation* (e.g. a certain number of allowances would be awarded for each MWh of electricity produced). The second way is to assign an *avoided emission value* for each unit of green electric power produced or based on consumption avoided. A third way renewables may gain emission allowances is through a *set-aside*. In the acid rain program in the US, the Congress set aside allowances for RES and EUEE measures directly in the statute. In other cases, renewables set-aside in an allowance allocation will occur administratively, often at the state level. Set-aside systems can be amended by tightening the cap, allowing non-utilities to earn credits from the set-aside, extending the life of the special allowance pool and the period in which credits can be earned, eliminating the income neutrality and integrated resource planning eligibility requirements, and increasing the rate at which renewable generators can earn credits (higher allowance/MWh ratio). A final approach could be to change the whole program in favor of a *generation performance standard*, with a direct allocation of GHG credits to RES generation. These can be applied in different ways to stimulate EUEE investments.

Otherwise governments may choose to ensure energy policies such as standards (i.e. RPS, CO_2 standards for vehicles or building codes) exist alongside emissions trading to ensure the deployment of energy efficient, and/or low-carbon technologies, bring down the cost of such technologies and support them across the technology "valley of death" of the innovation chain. There is a wide array of options and the choice must be made taking into consideration country or region specific conditions, such as existing policy mix.

Market-Based Instruments for the Promotion of End-Use Energy Efficiency and Renewable Energy Sources

The policy goals under which different MBIs are introduced in the energy sector partially overlap. The goal of ETS is cost-efficient CO_2 reduction. RES and energy efficiency also work in the direction of this goal, but have important co-benefits such as improved security of supply, local/regional environmental benefits, trade balance, innovation, and employment. Interactions of policy instruments may arise from overlaps in objectives, target groups, or the design and implementation rules. Important issues to consider include overlaps in target setting, double counting as well as double regulation of electricity and the fungibility of tradable commodities; Sorrell (2003) has examined these and other interaction issues related to the scope, timing, objectives and operation of different schemes.

Quota Systems with Tradable Green Certificates

This policy portfolio involves a quantified obligation (a.k.a. quota, or Renewable Portfolio Standard, RPS) imposed on one category of electricity system "operators" (generators, producers, distributors, retailers, or consumers) to cover a certain percentage of electricity from RES. On a settlement date, the operators must submit the required number of certificates to demonstrate compliance. Certificates can be obtained in one of the following ways. First, operators can own their own RES generation, and each defined amount of energy produced by these would represent a certificate. Second, operators can purchase electricity and associated certificates from eligible renewable electricity (RES-E) generators. Third, operators can purchase certificates without purchasing the actual power from a generator or trader or via a broker. Because of supply-side competition, a TGC system leads, under *perfect* market conditions, to minimal generation costs for renewable energy sources, but only if there is surplus renewable generation beyond the demand for certificates.

In October 2001 the EU adopted the so-called renewable electricity Directive (2001/77/EC), aiming to increase the share of green electricity from 14 to 22 percent of gross electricity consumption by 2010. It establishes non-mandatory national targets for the portion of electricity consumption to be met by RES. During the past few years, interest in tradable green certificates has increased markedly in Europe and elsewhere, and renewable quota obligations coupled with tradable green certificates have been established in a number of EU member states, including Italy, Belgium, Sweden and the UK. Bertoldi et al (2005) provide a review of European experiences with green certificate systems.

While TGCs are not widely used in the US, fourteen states[19] have RPS ranging from 4% to 30%, which typically mandate that retail electricity suppliers obtain a certain percentage of their sales from renewable sources. Four of these (Connecticut, Maine, Massachusetts and Texas) allow renewable energy certificates (RECs, a.k.a. TGC) to be traded independently of the underlying electricity.

Tradable Certificate Schemes for Energy Savings

A tradable certificate for energy savings (TCES, a.k.a. white certificates) portfolio involves four large elements (see Pavan 2002, Bertoldi & Huld 2004, Bertoldi & Rezessy 2004): (a) The creation and framing of the demand: tradable certificates represent a meaningful option only if there is interest in buying/selling them, (b) The tradable property right representing the savings, and the rules for trading, (c) The cost recovery mechanism[20], and (d) Institutional infrastructure and processes (such as measurement and verification, M&V) to support the scheme.

Variations of this policy mix have been recently introduced in Italy and the UK; in France a similar scheme is under preparation. In Italy energy-savings targets for electricity and

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[19] Arizona, California, Connecticut, Iowa, Maine, Massachusetts, Minnesota, Nevada, New Jersey, New Mexico, Pennsylvania, Texas, Wisconsin and New York.

[20] The rationale for providing cost recovery for end-use energy efficiency is that end-use energy efficiency represents a public good, which markets cannot be expected to provide. It should be pointed out that while M&V is a key tool to prove the value and results of energy savings, cost recovery is the instrument through which compensation is given to distributors for the activities undertaken so that the ultimately the final user – at whose premises the measures are implemented – will pay for them.

gas distributors (expressed in primary energy) are combined with tradable energy-efficiency certificates issued both to distributors and energy service companies, as well as with elements of tariff regulation (cost recovery mechanism via electricity and gas tariffs and multiple driver tariff schemes to avoid profit losses) or dedicated funds in some circumstances. At least half of the target set for each single year will have to be achieved via a reduction of electricity and gas end-uses (referred to as the "50% constraint" to which each distributor is subject). The remaining share can be achieved via primary energy savings in other sectors. In the UK, the Energy Efficiency Commitment 1 (EEC) program required that all electricity and gas suppliers with 15,000 or more domestic customers must encourage or assist those customers to take energy-efficiency measures in their homes (EEC 2 lifts the threshold to 50,000 domestic customers): suppliers must achieve at least half of their energy savings in households on income-related benefits and tax credits.

Integration of Market-Based Instruments for Sustainability in the Energy Sector: Advantages and Challenges

With three MBIs that can be and already are introduced in the energy sector in parallel in (e.g. Italy and the UK), the policy space is getting crammed. Naturally one can ask – how these MBIs interact with one another, is it both possible and desirable from environmental and economic point of view to integrate them and, if yes, what would be a environmentally sound and economically efficient way to do it. The following sections attempt to give an answer to this question. It should be noted that because these MBIs have been operational for only short periods of time and market experience is still limited, this is an academic discussion based on the design of MBIs in the energy sector.

We have the following starting premises. First, a special emphasis is placed on integrating green and white certificates in emissions trading as a way to make emissions trading more supportive towards RES and EUEE. Second, from a cost efficiency perspective, integration of supply and demand options should result in the lowest cost for society. Conversely applying different instruments to different parts of the sector increases the risk of undertaking high-cost measures at one part, while ignoring lower cost options in the other. Third, purely operational matters, like registries, can be managed in an integrated way; double counting can be avoided by using a database and again in the principle of redemption. A final point is the issue of fairness: integration of permit and certificate systems would make it possible to credit the party that has actually undertaken measures that have resulted in carbon savings. Avoided electricity consumption due to improved end-use equipment can be certified via white certificates that in this case should be granted to the *equipment manufacturers*. It is logical that these white certificates can enter the carbon market in order to ensure that the carbon credit from reduced electricity use of more efficient equipment will be given to the party who is directly responsible for it and there is no double counting. Under the EU ETS as it stands at present generators will receive the carbon credit from somebody else's efforts (in the above example: the equipment manufacturers). If carbon credits and white certificates exist in parallel but are not linked, then the same effort will be accounted for twice.

White and Green Certificates for EUEE and RES

It is possible to combine domestic green and white certificate schemes in a single common system, where both RES and EUEE measures contribute to meeting a specific obligation. Energy savings may contribute to meeting an overall RES target by reducing the overall consumption. In effect Directive 2001/77/EC on the promotion of electricity produced from renewable energy sources in the internal electricity market encourages such an integration by establishing the *RES-E target* as a share of *final consumption.* The key common characteristic of green and white certificates is that both allow for the separation of the physical flow of electricity from, respectively, the "greenness" of electricity and the energy savings. It should be noted that green and white certificate schemes are asymmetric in the sense that the former at present apply to renewable electricity only, whereas the latter in principle can be applied to all fuels, energy carriers and sectors (although it may be decided to limit white certificate schemes to electricity and gas only, as is in Italy)[21].

Nevertheless, integration must be approached with caution since white certificate trading is more challenging than green certificate trading especially in terms of measuring and verifying savings. Some specific double counting challenges emerge in relation with project types that have multiple values: e.g. how to treat a project, such as CHP on biomass that may receive emission allowances, and may turn out to be eligible for both green and white certificates.

Emission Trading, White and Green Certificates

Both EUEE and RES projects result in CO_2 emission reductions, and these can be calculated (even in a more sophisticated way than national or, say, EU averages)[22]: the carbon value could be included in a certificate. One should keep in mind that the carbon value of EUEE and RES projects varies in accordance with factors such as the local electricity mix and the time of the day when energy is saved or green electricity is generated. In any case calculating the exact value of the carbon displaced is a technically solvable issue: in the NO_x set-asides in the United States there are software programs that calculate the real time power generation displaced by savings taking into account factors such as time of the day and exact generation mix.

The total value of certificates (both white and green) may be viewed as constituted of two separate items: an energy benefit and a carbon benefit. The energy value is limited to a certain country or region and hence purely domestic and unsuitable for trade in an international carbon scheme; conversely the benefits from carbon mitigation are global, i.e. internationally valid. Oikonomou (2004) points this out about TGC[23]. There may be a few interaction options of operating separately with these two values.

First, there may be *no interaction*, whereby the only energy value is certified via green or white certificates for energy efficiency and RES projects not converted in CO_2 and not covered by emission trading.

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[21] In Italy there may be a window of opportunity for integration of renewables in the white certificate scheme because solar heaters and small PV installations are eligible for white certificates. But at present small PV and solar heaters are in practice excluded from the TGC system as green certificates have values corresponding to 100 MWh.

[22] Note that here we refer to energy efficiency and RE projects that are not covered by emission trading, i.e. not directly undertaken by operators under CO_2 emission cap.

[23] The difficulty here, as pointed by Sorrell (2003), is that with EU ETS in place the CO2 value of renewables and energy efficiency has been partly reflected in the allowances 'freed up' by displaced fossil fuel emissions.

Then, there may be a *one-way fungibility* whereby separate carbon and energy values are assigned to energy efficiency and RES projects not converted in CO_2 and not covered by emission trading. The term one-way refers to the fact that green and white certificates may be used to comply with emission caps and in effect will be allowed to enter the carbon markets; in contrast carbon credits cannot be used to meet green electricity or energy saving targets. The three possible routes of one-way fungibility are:

(1) Both energy and carbon are utilized: carbon value (the value of carbon displaced by the projects) is accounted for in the ETS; energy benefits go to green/white certification schemes;

(2) Either energy or carbon is utilized[24] and there are two possibilities:
   - If only the carbon value is utilized, then the carbon value of a project (the value of carbon displaced by the projects) is accounted for in the ETS, but the energy value is not accounted for in a green/white certification scheme, and
   - If only energy value is utilized, then energy value is accounted for in a green/white certification schemes, but no carbon value is accounted for (= no integration).

(3) Both energy and carbon values are utilized but only a portion of carbon benefit: energy value is accounted for in a green/white certification scheme; carbon value is accounted for in ETS but only for portion of energy value over and above the energy-related obligation (i.e. once the green electricity or savings obligation is met[25])

Finally, there may be *two-way (full) fungibility* among the three schemes, whereby green and white certificates can be used to show compliance with the carbon target and also carbon credits can be used to show compliance with green electricity or savings target. However, two-way fungibility may compromise the environmental soundness especially of certificate systems: while green electricity and EUEE have a carbon component/value, not all carbon projects have an energy component.

Set-Asides for Renewables and Energy Efficiency As a Way to Foster RES and EUEE Deployment in Emissions Trading

While one-way fungibility with both energy and carbon values utilized seems to be the best option, in effect it creates three separate markets – there will probably be profound influences across markets, but no real linkage. All these options however imply direct competition of RES and EUEE projects against other carbon mitigation options. This is a situation that – as has been discussed earlier in the paper – is unlikely to encourage the deployment of RES and EUEE projects. An alternative can be to seek integration of RES- and EUEE-based project credits (i.e. green and white certificates) with ETS via a dedicated link.

A possible approach to integration via a dedicated link is through a *set-aside quota* in the ETS[26]. A set-aside is a pool of allowances that are kept by the program administrator and used to

[24] The project developers' choice of which value to account for will depend on the relative prices across markets. The other benefits of energy efficiency and renewables will be ignored

[25] This is used in the UK EEC, whereby savings can be one-way traded in the UK emission trading scheme.

[26] Efficiency/renewables set-aside quotas have been developed and introduced by 6 states in the NO_x Allowance Trading Program in the USA.

reward energy efficiency and renewable energy projects; this will influence the market towards more such projects. In effect a set-aside can either function by individual emission caps designed so that obliged partied under ETS can emit, say 90 emission units *plus* 10 more that can be accounted via RES and EUEE projects (respectively green and white certificates); if obliged parties choose not implement RES and EUEE projects or purchase green or white certificates, they 'loose' the option for the extra 10 units and are therefore subject to a 90-unit cap. Alternatively, obliged parties can be allowed to *exceed* their emission caps provided that they submit sufficient green and/or white certificates to cover these surplus emissions. This latter option will not compromise the environmental integrity of the emission cap because RES and EUEE projects have a carbon component. Set-asides for renewables have been considered under the RGGI effort.

How do set-asides function? Set-asides can take different shapes. If an historical or heat-input model for allowance allocations is used, it can "set aside" some percentage of the total allowances for certain qualifying technologies. There can be *output-based set-aside*, whereby states would set aside some 'public purpose' allowances to allocate to owners of renewable generation facilities on an output basis, using an emissions rate calculation that will be worked out in the process. Another option is to use *output-based standards* whereby the regulator allocates emissions allowances on an output-basis. Finally *"offset" programs* allow participants outside of formal emissions markets to participate by allowing certain types of activities to be recognized for the emissions reductions these projects provide: RES facilities generate emissions offsets that regulated utilities can purchase to meet their targets. RES should receive full value in offset credits on an output basis.

Conclusion: Will Emissions Trading Promote EUEE and RES?

From our preliminary analysis emissions trading and the way it has been introduced in the EU we draw the conclusion that emissions trading alone will not stimulate significant investment in RES, nor in EUEE. Therefore implementation of strategic deployment policy for RES and EUEE is needed to stimulate investments along with the implementation of an emissions trading scheme. We relate our suggestions only policy tools that harness market forces to promote EUEE and RES and provide a brief overview of experiences to date with green and white certificates. In this paper we have presented MBIs applied in the energy sector in particular to foster RES and EUEE deployment, as these are based on the same underlying economic principles as emissions trading. We have discussed possible ways to increase the uptake of EUEE and RES projects in the framework of emissions trading, summarized the arguments in favor of integrating tradable green and white certificate schemes with emissions trading and outlined possible ways to achieve such integration, placing a special focus on the issue of set-asides for RES and EUEE in emissions trading. We have explained how set-asides can function, why they are preferable to other integration options, and how they can be designed. Further work may consider the possibilities to improve the co-existence of both market and non-market mechanisms[27] to increase the sustainability of the energy sector.

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[27] By focussing on MBI interaction, we in no way imply that MBIs are the preferred policy choice, as opposed to performance standards without trading flexibility. The choice of policy instrument depends on the region's particular market circumstances and feasibility of implementation. Trading schemes can be very complex and costly to properly manage.

References

Bertoldi, P. and T. Huld. 2004. "Tradable certificates for renewable electricity and energy savings". In: *Energy Policy,* article in press.

Bertoldi, P. and S. Rezessy. 2004. "Tradable Certificates for Energy Efficiency: the Dawn of a New Trend in Energy Policy?". In: *Proceedings of the American Council for Energy Efficient Economy 2004 summer study on energy efficiency in buildings.* Washington, D.C.: ACEEE.

Bertoldi, P, S. Rezessy, O. Langniss and M. Voogt. 2005. "White, Green & Brown Certificates: How to make the most of them?". Paper to be published in *Proceedings of the European Council for Energy Efficient Economy (ECEEE) summer study.* Stockholm: ECEEE.

Haites, E. 2004. "Estimating the Market Potential for the Clean Development Mechanism: Review of Models and Lessons Learned". Prepared for World Bank Carbon Finance Business PCF*plus* Research program, the International Energy Agency and the International Emissions Trading Association.

ILEX/Electrowatt-Ekono. 2004. *"Impact of the EU ETS on European Electricity Prices".* A report to the UK Department of Trade and Industry.

IPCC, International Panel on Climate Change. 2001. *Climate Change 2001. Mitigation*. Geneva: IPCC.

Oikonomou, V. 2004. "A qualitative analysis of white, green certificates and EU CO2 allowances". White and Green project, draft report. Utrecht: Utrecht University.

Pavan, M. 2002. "What's up in Italy? Market liberalization, tariff regulation and incentives to promote energy efficiency in end-use sectors". In: *Proceedings of the American Council for Energy Efficient Economy summer study.* Washington, D.C.: ACEEE.

Point Carbon 2005a. Carbon Markets Europe, 11 Feb. 2005. Available at www.pointcarbon.com

Point Carbon. 2005b. Carbon Markets Europe, 22 Apr. 2005. Available at www.pointcarbon.com

Schafhausen, F. 2004. "The Implementation of the EU-Directive in Germany" at *Climate Change Policy, National Allocation Plans and Emissions Trading in comparison*. Schloss Leopoldskron, September 26 – October 1, 2004.

Sorell, S. 2003. "Who owns the carbon? Interactions between the EU Emission Trading Scheme and the UK Renewables Obligation and Energy Efficiency Commitment". SPRU Electronic Working Paper Series. Paper No. 100. Brighton: SPRU.

Wang, Y.-D., J. Byrne, W.-J. Chung, A. Zhou, J. Kulkarni, H. Yamaguchi, and K. Takahashi. 2003. "Potential of the Clean Development Mechanism on Residential Energy Efficiency Upgrades in Developing Countries: A Regional Perspective on the Case of Selected Asian Countries". In: *Proceedings of the Third Conference on Energy Efficiency in Domestic Appliances and Lighting (EEDAL)*, 1273-1289. Turin: JRC and Softech.