How to dismember a potent instrument – the intractability of the emission trade proposal of the European Commission

Juha Honkatukia, Heikki Kemppi, Adriaan Perrels
Goverment Institute of Economic Research VATT
Hämeentie 3, P.O. Box 269, 00531 Helsinki
Juha.honkatukia@vatt.fi
heikki.kemppi@vatt.fi
adriaan.perrels@vatt.fi

Keywords

emission trade, EU emission trade directive, regulatory cost, transaction cost, policy interaction

Abstract

The initiative of the European Commission to start up an emission trade system is fraught with difficulties. In order to be viable it should provide value added to justify the extra efforts it requires.

A review of the draft-directive unveils many critical issues, that undermine the value added. Many proposed measures and conditions increase the cost of participation, and reduce the emission trade market volume, thereby affecting both level and volatility of the permit price. Furthermore, the proposed organisation of the system is unbalanced as it simultaneously leans on (1) a devolution of policy planning tasks, (2) a centralisation of decision rights and, (3) an asymmetry in information levels and deployable specialist knowledge. As a consequence the directive proposals would complicate but not prevent gaming during the establishment and approval phase of the trade system.

The paper discusses (1) the burden sharing between trading and non-trading segments in the member countries, with special reference to Finland (2) the possible responses of companies to increased transaction cost and uncertainty, and (3) the consequences of the permit trade requirements for the earlier devised domestic climate policy and as a consequence for energy efficiency policies. The paper is based on a study conducted for the Ministry for the Environment, involving both an in-depth review of the directive and AGE-E[3] model based calculations. The paper focuses on the analytical-qualitative clarification of effects. Some model results are added to underline the practical relevance of the identified risks and obstacles[1].

Introduction

In December 2002 the European Council of ministers adopted an amended draft proposal of the European Commission concerning the creation of a greenhouse gas emission trade system inside the European Union (Commission of the European Communities, 2001). Even though some further amendments are possible during the second reading of the proposal in the European Parliament during spring of 2003, we assume that an emission trade system will be put in place which by and large encompasses the elements as explained in the draft proposal. The present paper discusses various features of that draft proposal based on a study carried out by VATT (Honkatukia et al, 2002). The study was commissioned by the Finnish Ministry of the Environment[1].

In essence the attractiveness of an international permit trade system depends on the expected cost level of the permits in comparison to the abatement cost levels based on domestic actions. If there are sectors for which the marginal costs clearly exceed the expected permit price, it becomes

1. In the meantime a follow-up study has been commissioned by the Ministry of Trade and Industry, which elaborates further on alternatives how to reshape fiscal energy policy given the existence of European permit trade. In case that study produces still new significant insights, the final version of the paper can be amended accordingly.

worth contemplating taking part in emission trade and thereby achieve the targets partly through purchased emissions and the rest through domestic measures with a low unit cost. Permit trade is also interesting for sectors with very low abatement cost, since they can implement those actions that are cheaper (per ton abated) than the permits, and sell the surplus of emission rights.

In a trade system that includes the so-called accession countries (Poland,Czech Republic, etc.) quite low permit prices may be expected. Therefore, by default Finland can be denoted as a permit buying country. The possibility can however not entirely be excluded that Finland would be (on balance) a small permit seller.

It should not be forgotten that the system generated by means of the EU directive does not preclude the possibility that so-called Annex 1 countries are trading emission rights outside the EU system, but within the guidelines of the Kyoto Protocol. In other words the EU system should provide value added to justify the extra efforts it seems to require.

The trade system will initially only include carbon dioxide. Furthermore, it concerns generic emission trade and not project based emission trade as for example is arranged under Joint Implementation. It is however envisaged that a parallel and linked up system for permits obtained in Joint Implementation will be created before 2008[2]. This is especially important in the view of the EU membership of many Central-European countries as of 2004 (or 2007 in some other cases). Membership would entitle these countries to participation (provided they fulfil administrative prerequisites), but would put them in an awkward position if the generation JI related permits would have a somehow less acknowledged position. In case of too many obstacles and limitations various Central-European candidate countries may decide it does not serve their interests to qualify for the EU trade system, consequently permit prices could be around or above the upper level applied in our simulations.

The EU emission trade system covers the sectors of energy conversion, paper and pulp, iron and steel, building materials (bricks, cement, glass). These sectors cover about 45% of the carbon dioxide emissions for the EU as a whole. In Finland however, these sectors cover 60% of the national carbon dioxide emissions. The trade system does not include energy conversion units that are smaller than 20 MW_{th}. This is a relevant limit in some of the smaller district heating systems in Finland. Energy conversion systems – notably CHP – in other non-trade sectors such as chemicals, could be still included depending on the juridical and technical separability of such units. The trade system also wants to keep rewards from units converting to bio-fuels, inter alia because of the other existing and expected support schemes for bio-fuels (e.g. RECS). We will not discuss the consequences of these limitations in this paper, even though they seem to be very relevant for Finland.

The paper will discuss the subsequent topics in the following sections:

- Initial distribution of permits and the national allocation plan.
- Burden sharing (assigning allowable volume of emissions) between permit trading sectors and other sectors.
- Cost impacts and consequences for energy efficiency efforts.
- Summary and Conclusions.

Inititial distribution of permits and national allocation plan

The draft directive implies that grandfathering will be used for permit distribution in the test period 2005-2007 and mixed grandfathering/auction system with ever larger shares for auctioning for the first commitment period 2008-2012[3]. Grandfathering means handing out free to participating companies up to their initial allotment.

The EU directive obliges participating countries to submit an allocation scheme of envisaged emission quota by sector, encompassing both the sectors – in principle - designated for trade and the other (so called sheltered) sectors. The initial allocation of emissions permits is a crucial part of the scheme, which simultaneously affects the international competitive ranking of national sectors and the macroeconomic cost of every country's overall climate change policy. So, each member state takes part in two interconnected games. For the first period 2005-2007 grandfathering of the allowances is foreseen. For the first commitment period 2008-2012 the choice of the initial allocation system is still open, but in all likelihood involves a gradual change into an auction system. Member states have to announce their decision on the choice of the initial allocation system by July 2006[4]. Furthermore, article 10 section 2 mentions that the Commission will specify a harmonised method of allocation for the five year period starting in 2008. In as far as 'specifying' means carrying out the guidelines as given by the member states and approved by the council(s) of Ministers, it constitutes no problem. However, it would be a novelty if the Commission would be authorised to decide how the system will be.

The allocation of quota by sector and company[5] refers to the entire period 2005-2007, specifying annual amounts. According to the Directive the allocation should be based on a official plan, e.g. in the case of Finland these could be the constituent parts of the National Climate Programme (UEO, ESO, voluntary agreements, etc.).

2. For example, such statements were made by leading representatives of the Commission DG Environment during the ECCP conference in July, 2001.
3. This represents the situation after initial approvals and amendments of the European Council of Ministers and the European Parliament. A second reading during the spring of 2003 can however still result in changes in the directive.
4. Articles 9 and 10 of the Directive mention 18 months prior notice for the overall plan (quota division between trading and non-trading sectors) and the principles of the allocation procedure. A more detailed sector and company overview should be given 12 months prior to the first commitment period. For the test period the prior notice period is 9 months and 3 months. It seems advisable to allow the directive to be still amended in terms of these minimum prior notice periods, 18 and 12 months is quite long.
5. To be precise the Directive (e.g. article 11) refers to operators of installations instead of companies. In case of joint ventures and leased installations the consequences are not entirely clear, as ownership and benefit shares can differ.

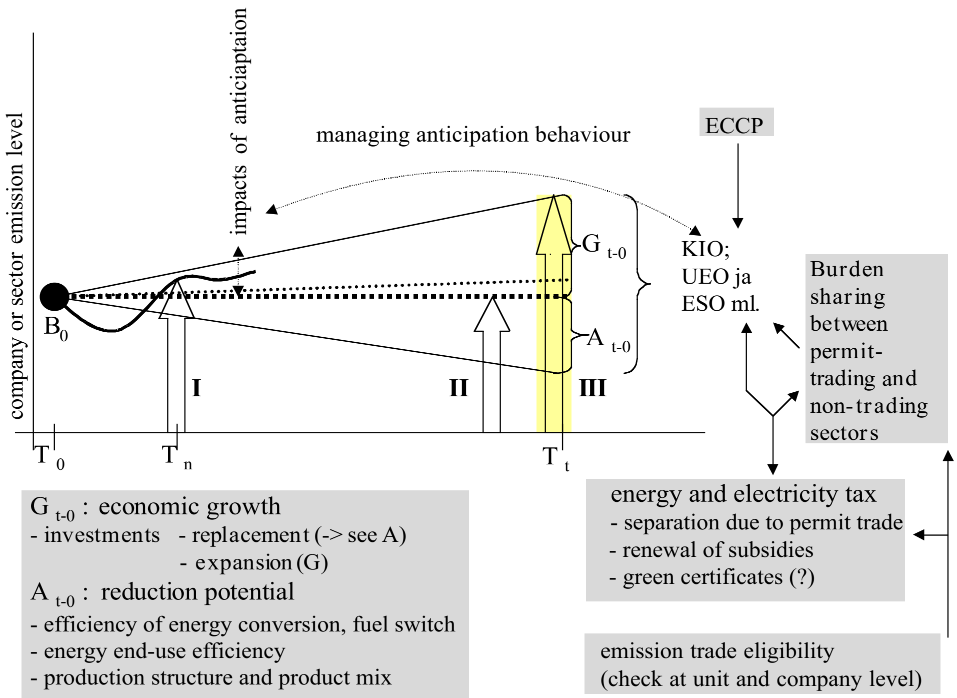

Figure 1. *Preparatory work and effects to be considered when starting emission trade.*

Starting from a purely national economic optimising approach one would like to allocate quota to the trading sectors in such a way that the implied emission reduction efforts in both trading and non-trading sectors arrive at the same marginal cost for the last tons abated in each sector. In absence of sensitive exports, this approach would yield the lowest macro-economic cost. The actual achievement of so-called lowest possible cost depends also on the adaptations in the fiscal system and other upper and lower limits stipulated in energy and climate programmes. The decision on the division of quota between national sectors is the national part of the twin game mentioned before.

All member states have to consider the sensitivity of their export industries and therefore an uncompromising national optimisation approach could lead to significant loss of export volume (and/or increased imports) in the allowance trading sectors. Finland has a relatively energy intensive industrial structure and consequently the export sensitivity of the sectors included in the trade system bears more significance to the entire Finnish economy than is the case in any other EU member country. So, from the original purely closed domestic optimal allocation one has to find a new division between trading and non-trading sectors. The second best solution requires a balancing between two 'bads' in the sense that the best achievable solution is found there where the marginal welfare loss due to decreased export equals the marginal welfare loss due to a sub-optimal allocation of quota between trading and non-trading sectors (sub-optimal meaning not equalising domestic marginal abatement cost across sectors). This is further discussed in the next chapter.

The draft directive indicates that the attribution of emission quota to a sector needs to be based on a justifiable forecast for a baseline development of the emission volume. Main explanatory factors are on the one hand sectoral economic growth (G in Figure 1) and on the other hand the default trends in energy and carbon intensities of sectors (A in Figure 1). The default trends may include impacts of already agreed (irreversible) policies, such as the ACEA agreement with European car-makers.

Depending on whether a tight or spacious provision of allowances is agreed and depending on the way taxes and subsidies are reformed for both trading and non-trading sectors a significant anticipation effect may occur. An abundant allocation of emission allowances may cause a slowdown in abatement efforts, whereas tight provision may cause a speed up of actions, in particular if this coincides with the availability of subsidies.

The degree to which – in general – trading sectors are endowed with ample allowances depends also on the economic and political feasibility to have relatively high or relatively low abatement cost in the non-trading sectors. This is the burden sharing discussion within each member state. Furthermore already committed reduction goals may also curtail the range within which quota for trading and non-trading sectors can be found. In Figure 1 the reduction target is represented by the bold dashed line starting from B_0 (the Finnish target means that 1990 emissions and average 2008-2012 emissions are to be at the same level). In the reduction target there has been taken account of the reduction potential and the economic growth effects (A and G), as well as the difficulties to establish a domestic allocation of the reduction tasks between emission trading sectors and other sectors (domestic burden sharing). The adaptation of the current energy/carbon tax (present in various EU countries) ties in here as well. As the marginal abatement cost tend to be lower than in most other sectors, the reduction target has been put relatively tight in this example, as the target based on just reduction potential and growth would result in a slight relaxation of the target.

Member countries retain the discretion on what base-year to choose for allocation and burden sharing. This is represented in Figure 1 by means of three broad standing arrows. Option 1 represents an allocation on the basis of shares in emissions in a recent year (the dark wavering line represents actual emissions), whereas option 2 is based on the reduction efforts as allotted in the current climate strategy. Option 3 on the other hand is based on the expected emissions in 2010 according to the baseline development. These alternatives are used in the model simulation to assess the macro-economic costs, by comparing the results with the national climate strategy with domestic actions only (see later on in this paper).

It should be realised that grandfathering and auctioning are basically leading to the same trading price of the permits and hence the permits exert the same signal in terms of deciding for reduction (and sales) or purchase in both initial allocation alternatives. The reason for this is that the opportunity cost of the permit are the same. It is true though that grandfathering and auctioning with recycling of the auction revenues will lead to a somewhat different redistribution of resources over companies. This can have consequences for the product markets in which the emission trade companies are working as will be discussed in a later section.

Balancing between permit trade sectors and other sectors

ALLOCATION BETWEEN TRADING AND NON-TRADING SECTORS AND INTERACTION WITH EXISTING TAXES

Implementing emission trading will inevitably involve changes in currently applied climate policies. The politically sensitive question is whether it will be more economical than existing policies. Evidently, this is less of an issue in countries where no extensive (fiscal) climate policies have been used so far.

The costs of economic climate policy measures can broadly be grouped in two categories: *primary costs* and *tax system costs* (Goulder, Parry, Williams & Burtraw 1999). Primary costs consist of, first, the cut in emissions due to economic (fiscal) measures, which leads to a rise in prices of fossil fuel based energy carriers, and second, the costs of substituting other inputs for energy (i.e. more energy efficient machinery) or switching to cleaner fuels. The level of primary cost depends on the status of the economy and of the energy system. So-called accompanying measures that effectively reduce the transaction cost of preparing and implementing measures may help to reduce the primary cost, but *in principle* at the overall macro-economic level primary cost are always positive.

Tax system costs are caused by interaction effects. The economic-fiscal measures mentioned above affect the cost of private consumption and thereby directly or indirectly the cost of labour, whereas in turn both effects affect labour supply, and consequently other tax revenues as well. These effects increase the cost of climate policies. However, assuming that the introduction of an economic-fiscal climate policy leaves otherwise the public budget objectives unaffected, the extra revenues from the climate policy can be recycled in order to reduce the cost of labour and/or capital. The recycling mitigates the original interaction effects of fiscal climate policy[6].

Regarding the structure of macro-economic cost causation, emission taxes and auctioned permits are very closely related. For a given abatement target, they should produce equal revenues and primary costs. Grandfathered permits, on the other hand, do not yield tax revenue. This fact alone aggravates their negative side-effects, since they cause interaction effects just as taxes or auctioned permits do, but do not allow for the mitigation of these effects by recycling the revenue by, say, lowering distorting taxes. The apparent popularity of grandfathering among various EU member states can be largely explained by the fact that it seemingly intrudes less into the pre-climate policy status quo. Initially, grandfathering causes less cash transfers compared to the other options. Whereas this is less relevant for the permit trade as such and usually unfavourable from a (textbook) macro-economic viewpoint, it can be relevant for the product markets in which the permit trading firms operate (see later on).

Many European countries have introduced emission taxes. In most countries, these taxes allow for exemptions for internationally open sectors. Emission trade would change this, as it would impose similar costs to all emissions. This would change the cost structure of energy users significantly, but would probably lower the primary costs of abatement for Europe as a whole, since it would make it easier to take the most economical abatement measures. However, it is not at all evident a priori that emission trade would have a beneficial effect for every trading country. The loss of tax revenue caused by grandfathering is one of the reasons for this: if emission trade is to be introduced in a revenue-neutral fashion, then some other taxes have to be raised to compensate for the lost revenues, and the effects of this depend on the tax structures in the respective countries. The sales revenues from sales of permits may alleviate part of this effect, but not by any means all of it; and given the mixed ownership structure in most of the trading industries, it is hard to say with certainty who, and in which country, actually benefits from these revenues.

An even more serious difficulty arises from the introduction of emission trade in only a part of the economy. While trade allows the equalisation of marginal abatement costs across the trading sectors, it does nothing to increase cost efficiency in the non-trading sectors. Only if marginal costs in the trading and non-trading sectors are equalised, is the efficiency of abatement for the country as a whole increased. But because trading is to be based on the assignment of targets for trading and non-trading sectors prior to trade (see previous section and footnote 1), this can only be achieved

6. A country without full employment and with sizeable fossil fuel imports, could decide to switch to cleaner but more expensive domestic fuels (e.g. biomass). Despite the higher primary cost, the tax interaction effect (less social security cost and more purchasing power from households) could be very favourable and henceforth a positive macro-economic effect might result. However, this beneficial (re)employment effect can be only validly counted for in the short to medium term.

by assigning *exactly the right target* for the non-trading sector prior to trade! Should this fail, costs in non-trading sectors are either excessively high or needlessly low, implying that the economic measures needed in these sectors either cause too high primary costs or involve significant loss of tax revenue with associated problems (necessitating recouping rather than recycling).

In enhancing cost-efficiency, permit trade relies heavily on the markets' ability to find the cheapest abatement investments. Since the form these investments take – energy saving, fuel switching etc. – is not of consequence per se, it is easy to see that – as regards the emission trading sectors – additional targets on efficiency, the use of renewables or the like, could diminish the gains from permit trade. At the least, these other goals may require specific policy tools, such as performance standards, subsidies and so on. But then, subsidies involve tax system costs as well, since they take up revenue that has to be collected with other taxes. However, in as far as these other measures (performance standards, subsidies, etc.) lower transaction cost of the emission reduction measures significantly and consequently enhance the price effect of permit trade, they would fit into the logic of permit trade.

It should be admitted that this is still a challenging research area, as none of the current usual macro-economic models is capable of absorbing these accompanying measures satisfactorily[7]. We neither intend to claim that macroeconomic cost-efficiency as it is represented in the currently prevailing type of AGE-E^3 models deserves a position as an indisputable decision criterion with overruling capabilities with respect to other policy dimensions.

Permit trade does not directly impose changes on the non-trading sectors of the economy. However, since the non-trading sectors are in effect allocated an emission target with the initial allocation scheme, it is clear that some sort of measures need to be taken in these sectors as well. Whether they take the form of applying existing domestic measures is not restricted by the trade proposal. However, since emission trade already sets carbon-penalties on, say, electricity generation, electricity-users in the non.-trading sector are facing indirect control because of emission trade. This may have an affect on the design of policies in the non-trading sectors, if only for its effect on energy tax revenues.

The emission trade proposal requires that the goals of other European directives are not jeopardised by emission trade. The European Climate Change Programme and several current or proposed directives set targets for energy efficiency of appliances and of buildings, uptake of best available technologies in industrial installations, renewable energy use, and openness of energy markets. These requirements and targets may have implications for the initial allocation of quotas, and it is foreseeable that they may also affect the participation of the plants affected by these directives. This is problematic insofar as these directives have other than abatement targets (see also Vasara et al, 2002; …). An unintended but nevertheless possible effect is that the potential conflicting guidelines and criteria may cause an inclination among industries to postpone investments and first to ensure clearer interpretations e.g. through small trial projects. As mentioned earlier another possibly disturbing effect are the uncertainties about the degree of interchangeability with Joint Implementation (JI) based emission permit.

OPTING OUT

A part of the member countries is interested in the possibility to exclude sectors or companies from participation in the trading system. However, voluntary participation has several disadvantages. First, it threatens to reduce trade volumes, which could make permit prices more volatile. Second, since it seems that especially potentially permit buying sectors or companies would withdraw from the system that feel disadvantaged to other buyer (or sellers) from the same sector, it is likely that prices would drop. This would mean however, that the original reason for not participating (namely cost advantages for other buyers form the same sector) would still exist or even get reinforced. Furthermore, the system also stipulates that those sectors or companies that deliberately choose to stay out of the system should be subject to the same reduction requirements as they would have been in case of participation in the trade system.

The desire to opt out seems to be fed by the impression that it could be cheaper to stay out of the emission trade system. If however, the emission trade system seriously tries to prevent national protectionist programmes, the chances that it pays off to stay out diminish significantly, as has been explained above. A reason that might be valid in some cases are transaction cost, especially if it concerns a small company that just passes the eligibility mark. Another related reason might be the complications to assess price risks and to hedge against them. For example, in electricity generation permit price hikes might coincide and even be reinforced by unfortunate weather conditions (Perrels, 2003). On the other hand trade co-operates of smaller firms could reduce these cost and risks. Also the state is allowed to be trading partner and could for example arrange a buffer fund of permits. In this respect smaller countries have an advantage, since what is already a sizeable fund on their domestic markets may still have a negligible size compared to the entire EU permit market.

Another rather down to earth reason why (a part of) a sector in a country may stay out of the trade system is the inadequacy of the emission observation and registration system. In Harrison and Radow (2002) is pointed out that in quite some member states, and even more so in various candidate countries, large sections or even complete layers from which these systems have to be built, are presently non-existent.

IMPACTS IN OLIGOPOLISTIC PRODUCT MARKETS

As mentioned earlier the efficiency of grandfathering and auctioning is the same in terms of their price guidance. However, it depends on the type of product market on which the emission trade participating companies are active, whether differentiation in competitiveness can occur.

Figure 2 gives an example of a product market on which three dominating firms are active. The sector is to take part

7. The 5th framework ACROPOLIS project aims to address some of these matters.

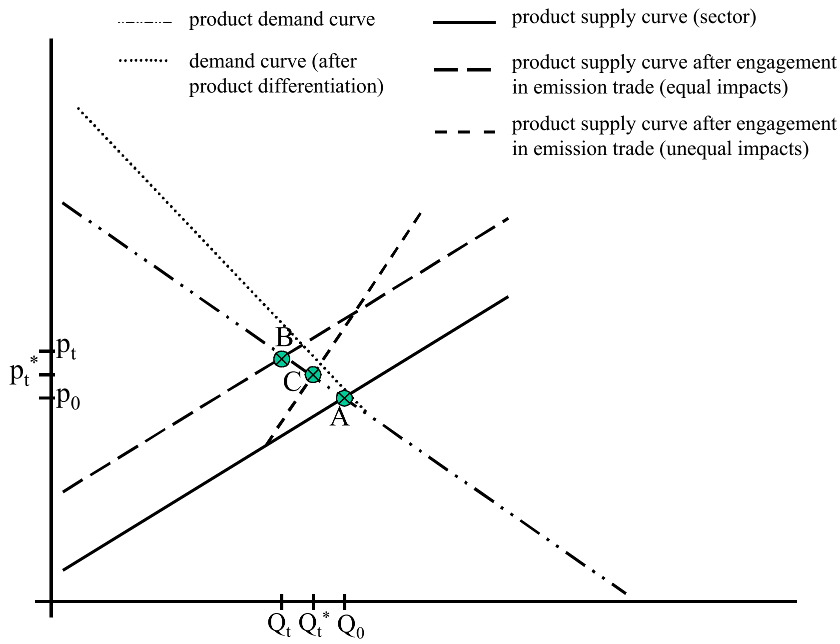

Figure 2. *Consequences of emission trade in an oligopolistic product market.*

in emission trade. Prior to implementation of emission trade the three equally sized firms together sell Q_0 goods against a price p_0. In the figure this is also indicated at the intersection of the original demand and supply curves, point A. If all companies would have the same reduction cost profiles and the companies get indeed similar reduction targets from their respective governments, the supply curve would shift upward and a new equilibrium B would establish. In that case all firms equally reduce output (This is the case which is also explained in Harrison and Radov, 2002).

However, if the companies differ among each other e.g. due to having different vintage mix of machinery and/or due to differences in their respective domestic allocation plans, serious differentiation may occur. If one of the three companies, despite the opportunities of emission trade, ends up with higher cost per unit of output it either has to accept a lower margin on its products (which can never be a lasting strategy) or it sets a slightly higher price to make up for the extra cost. In that case however, that particular company carries the largest burden in terms of demand reduction and hence it has to reduce production much more than its competitors. In Figure 2 this is combination where the price rises to pt, whereas sales settle at Qt* (intersection point C). The new dashed part of the supply curve indicates the changed cost structure of the unfortunate company. As a reaction and as an attempt to get out of a negative spiral it might try to introduce product differentiation, in way that allows for augmented prices (the dashed demand curve). Company C however runs the risk that the competitors try to copy the product. On the other hand the product differentiation may be a benefit to society (and it would lower the GDP/emission intensity).

Simulation results

In this section, we present an analyses of integrating emission trade, as proposed by the European Commission, with the existing National Climate Change Strategy in Finland, based on simulations with an AGE-E^3 model.

Economic measures with climate goals have been applied for some time in Finland. In fact, it was the first country to introduce a CO_2-tax in 1990, and energy taxation has taken emissions into account in some form or other since then. The current tax system sets an emission tax to all fuels and in all other uses except electricity generation. The system includes thresholds for the taxes paid as in most other EU countries. Until 1997, also fuels used in electricity generation had an emission tax, but as this necessitated a tax on imported electricity, it was contestable under EU competition laws and was given up consequently.

The tax system constitutes the basis for the economic measures in the Finnish Climate Change Strategy. The strategy envisages the introduction of subsidies to promote renewable energy, as well as performance standards and subsidies to promote energy saving. The strategy recognises growth in electricity demand by the Kyoto period and considers the alternatives for producing electricity with either current capacity (which means meeting demand mostly by coal-fired capacity) or with increased gas-fired or nuclear generation capacity.

Emission trading would cover about 60% of Finnish CO_2-emissions,more than in any other member country. For this reason, the linking of trade to measures in the non-trading sectors takes careful consideration. It is clear that energy taxes need to be used in the non-trading sectors to ensure their compliance with the target. At the same time, however, it is difficult to see what benefits would arise from raising energy taxes in the trading sectors, since they are already facing the carbon penalty of permit prices. But this approach has inevitably effects on tax revenues, with implications on other taxes.

Emission trade is taken to be initiated by grandfathering permits for the trading sectors. Allocation is assumed to be based on three alternative schemes:

- recent emission history (arrow I in Figure 1),
- baseline emissions (arrow III in Figure 1),
- climate strategy emissions (without trade; arrow II in Figure 1).

Permit prices are not evaluated in this study. Instead simulations with three given price levels were studied, being 5 Euro per ton CO_2, 10 Euro per ton CO_2 and 20 Euro per ton CO_2, respectively.

These prices cover the estimates from several studies concerning likely market price ranges of permits. (Sijm et al, 2002; Klimbie et al, 2000; Forsstöm, Honkatukia and Sulamaa, 2002). While some studies suggest significantly higher prices, most recent studies are nevertheless leaning on lower estimates, particularly after the U.S. withdrawal from Kyoto Protocol, whereas the EU trade system is to include central European countries with excess assigned amounts (see also the provisos made earlier in this paper).

At a theoretical level, emission trade can be expected to change the costs of climate policies, since it allocates abatement to quite different sectors than the domestic climate strategy does. Whether this enhances cost-efficiency (from the Finnish point of view) compared to domestic measures, depends on several factors. We can identify at least:

- the effect on "domestic burden sharing". By allocating quotas to trading and non-trading sectors, the emission trade proposal in effect determines the highest domestic marginal cost; if allocation is generous to trading sectors, it is likely that marginal costs will be high in the non-trading sector, implying that quite high emission taxes are needed to ensure the non-trading sectors meet their target. On the other hand, if allocation is strict to trading sectors, the marginal cost for non-trading sectors is low, but the trading sectors will probably have to rely heavily on the emission markets.
- the effect on tax revenue and tax system costs. In the case of generous allocation for trading sectors, the effect on domestic tax revenues is likely to be smaller than in the case of strict allocation, where the loss of energy tax revenue may necessitate increases in other taxes, thereby aggravating the costs of abatement.

Furthermore, we assume that a maximum of half of the national reduction target can be met by emission trade. This is not necessitated by the emission trade directive, but has been a constant EU view on flexibility mechanisms. The lower the permit price the more likely it is that this is a binding limit. We also assume that when trade starts, the government can act as a buffer and re-evaluate the target for non-trading sectors, depending on whether the national abatement target is met or not.

Table 1 presents the required increases in the CO_2-tax in the non-trading sectors under the different grandfathering schemes. On the basis of the table, it can be seen that the grandfathering schemes differ markedly from each other, with the history based scheme being least favourable to non-trading sectors (requiring the highest taxes to attain) and the climate strategy based generally the most generous (except for the combination of 20 Euro permit price and no extra nuclear). When the initial allocation is based on historical emissions (i.e. average 2000-2002), the trading sector will receive a larger allotment of allowable emissions. In the Baseline alternative (i.e. no extra policy) this situation does not change much compared to the historical basis, whereas in the Climate Strategy based alternative the allotment for the trading sector is smaller, since in the Climate Strategy it is planned that a relatively large share of the reductions are achieved in (what now happens to be) the trading sector.

It can also be seen that in almost none of the trading cases does the price of permits come close to the domestic taxes, which start from 17 Euro/t CO_2. Only the combination 'Gas-History/20 Euro permit price' results in a tax level for the non-trading sectors of about 22 Euro per ton. The other combinations result in taxes varying between 26 Euro and 46 Euro per ton. This means that in many of the cases cost-efficiency does not markedly improve for the economy as a whole, which is not to say that the improvements in the trading sectors might not be significant.

Table 1 also shows that the necessary raises in emission taxes become lower in the non-trading sectors as permit prices get higher. This is due to the increases in energy (end-use) prices caused by permit trade for example in the electricity sector and which as such already invokes reductions in energy demand in the non-trading sectors. Presumably, for a somewhat higher permit price than listed in Table 1 the taxes in the non-trading sectors would start to equal the permit price in some combinations, which would mean that the respective initial allocation appears to be cost-efficient. However, evidently there is absolutely nothing in the trading proposal that would automatically guarantee such an outcome.

Table 2 summarises the aggregate effects of emission trading. From the table, it is clear that emission trading has the greatest effect on overall abatement costs when permit prices are relatively low, which decreases the primary costs most but also does not cause large losses of tax revenue, which is the case with higher permit prices (due to the induced effect on end-use prices and its concomitant decrease of energy use and hence energy tax revenues). In most cases, emission trade lowers the costs of abatement quite clearly, but with high permit prices, this is not always the case. Obviously, this result depends very much on the assumption of a rigid – that is pre-fixed – allocation scheme, which does not attempt to take into account the price level of permit prices. In fact the requirement as formulated in the draft directive that an allocation plan plus overall climate policy package covering the entire 1st commitment period should be submitted in advance by each member country denies some key characteristics of a permit trade, such as limited predictability and volatility of prices. On the other hand it is neither attractive to have a highly unpredictable level of required efforts for the domestic sector as that would just as well affect investment risks and technology choice and development in that part of the economy. There should be somehow a trade-off introduced between allowing for adaptations and the need for (and costs of) hedging against risks due to pre-fixed allocation schemes.

As regards the impacts on energy efficiency it is not easy to draw clear cut and definitive conclusions. In this respect one should also realise that there are several mechanisms at work that complicate a straightforward attribution of

Table 1. Increases in emission taxes in non-trading sectors, % addition on top of *17 Euro/ton CO_2*.

Permit price Euro / tCO2	Climate Strategy (only domestic measures)		Climate Strategy + trade started via grandfathering					
	Natural gas	Nuclear	Gas-History	Nuclear-History	Gas-Baseline	Nuclear-Baseline	Gas-Climate	Nuclear-Climate
5	91	58	170	165	115	162	120	140
10	91	58	82	113	83	109	83	99
20	91	58	31	80	50	82	63	73

Table 2. Aggregate effects of emission trade *(% increase from baseline, 2010).*

	Natural gas (domestic)	Nuclear (domestic)	Natural Gas-History	Nuclear-History	Natural Gas-Baseline	Nuclear-Baseline	Natural Gas-Climate Strat.	Nuclear-Climate Strat.
Permit price Euro 5/tCO2								
GDP	-1.2	-0.9	-0.7	-0.6	-0.7	-0.6	-0.6	-0.6
Consumption	-2.0	-1.5	-1.4	-1.2	-1.2	-1.3	-1.2	-1.2
Investment	-1.1	-0.7	-0.3	-0.1	-0.3	-0.1	-0.3	-0.1
Employment	-1.1	-0.8	-0.3	-0.3	-0.2	-0.3	-0.2	-0.3
Emissions, total	-21.0	-21.0	-21	-21	-21	-21	-21	-21
Emissions, non-trading sectors	-7.4	-5.8	-8	-8	-7	-8	-7	-7
Permit price Euro 10/tCO2								
GDP	-1.2	-0.9	-0.5	-0.5	-0.5	-0.5	-0.4	-0.4
Consumption	-2.0	-1.5	-0.8	-0.9	-0.9	-0.9	-0.8	-0.8
Investment	-1.1	-0.7	-0.4	-0.2	-0.4	-0.2	-0.4	-0.2
Employment	-1.1	-0.8	-0.3	-0.3	-0.2	-0.3	-0.3	-0.3
Emissions, total	-21.0	-21.0	-21	-21	-21	-21	-21	-21
Emissions, non-trading sectors	-7.4	-5.8	-2	-4	-2	-3	-2	-3
Permit price Euro 20/tCO2								
GDP	-1.2	-0.9	-1.1	-1.1	-1.3	-1.2	-1.2	-1.0
Consumption	-2.0	-1.5	-2.1	-2.0	-2.3	-2.2	-2.2	-1.9
Investment	-1.1	-0.7	-0.7	-0.4	-0.7	-0.4	-0.7	-0.4
Employment	-1.1	-0.8	0.0	-0.3	0.0	-0.2	-0.2	-0.3
Emissions, total	-21.0	-21.0	-21	-21	-21	-21	-21	-21
Emissions, non-trading sectors	-7.4	-5.8	-7	-8	-8	-8	-8	-8

achieved reductions to fuel switching, energy efficiency and permit trade. First, in the electricity sector a change in generation technology can involve changes in conversion efficiency or fuel input or both. In addition, space heating and low temperature process heat can be either provided on the basis of localised technologies (boilers using oil or gas or biomass) or through a network (district heat, electricity). All these options exist in Finland and are competing among each other. Changes in relative end-use prices, possibly combined with tighter regulations, can cause switches, including fuel switches as well as switches from self provision (boilers) to networks and vice versa. The latter switch means however that emissions are moved in or out the trading sector, whereas this can be combined with changes in conversion efficiency or fuel switches in the electricity and district heat system.

If the share for the non-trading segment (and hence for the trading segment) remains the same as in the national climate strategy (without trade), than it is save to conclude that domestic efforts have been going down, especially in the trading segment, since a part of its emission reduction task is covered by permit trade instead of physical changes. Most probably this affects energy efficiency as well, though fuel switching and conversion technology choice is often the first to be affected.

If the share for the non-trading segment went up in comparison to the allotment of the reduction task in the climate strategy (without trade,) than it quite possibly means that in (some of) the non-trading sectors energy efficiency has improved somewhat compared to the original scheme without permit trade. Up to 2012 switching to less carbon intensive fuels is not much of an issue for the non-trading segment, which leaves energy efficiency the most important mechanism. However as explained above a kind of hidden fuel switching is possible in the sense that space heating can switch from local heating (oil, wood) to district heat or electricity. The trading sector will buy some amount of permits in all situations considered, and in case of 5 Euro and

10 Euro permit prices the amounts are significant. It means that in most situations the energy efficiency improvement will be somewhat or even appreciably slower than in the original purely domestic climate strategy. Yet, with these opposite effects for trading versus non trading sectors the overall energy efficiency effect of the trading and non-trading sector together is hard to summarise and differs between the situations considered.

If the share for the non-trading segment goes down, it will mean some relaxation of domestic efforts, including energy efficiency improvements. In contrast than, the share of the trading segment goes up, which is largely due to a larger volume of relatively cheap permits, which in turn means that energy efficiency efforts - at best - stay the same in the trading segment, but could diminish also. Consequently, it is likely that in this case the overall picture is a reduction in energy efficiency efforts at the overall level.

Although we cannot draw conclusions on energy efficiency for the entire EU on the basis of this study, the situation in the entire trade area should indeed be considered as well. Since, buying in one country means selling in another country, which – apart from the Central European countries in case of IET only – implies increased abatement efforts in the selling countries. Furthermore, if one would fear that too much 'hot air' from the new member states would mix in the market, it could be attempted to ensure a certain amount of JI based permits. This would not reduce hot air but would spread out its exploitation over a longer period. This approach might even have a somewhat dampening effect on market prices as part of the hot air could be used as buffer in case of unexpected extra demand (so to say 'hot air' to compensate for the effects of cold air).

Summary and Conclusions

The in principle laudable initiative of the European Commission to introduce a new policy instrument based on tradable property rights, in practice turns out to be littered with complications. These complications do not only cause a rise in transaction cost of the instrument for the parties involved, but also constitute the risk that the potential economic benefits of permit trade are jeopardised due to disablement of a flexible management of the climate policy packages in the member states over the course of the first commitment period (and the preceding test period).

The merging of national climate programmes with international permit trade requires more elaborate and more fundamental rethinking than often seems to be anticipated by many public and private parties involved in the various member states. One element is that the risk of very high marginal cost of reduction increases compared to domestic actions such as fuel switching and energy saving. The same applies to the risk of regret of resorting less to permit trade than after all would have been cost-efficient. Both risks can be mitigated to some extent by means of hedging, although these facilities do increase the transaction cost, especially for smaller parties. In addition national public authorities could create buffer funds or buffer repositories of permits (or options).

Yet, the option of national buffer funds (or related measures) would gain a lot of attractiveness, if some degree of adaptation margin was allowed in the initial allocation plans of members states (both for the trade and non-trade sectors). The directive however leans very much to the direction of pre-fixing targets out of fear of giving leeway to cheating and non-level playing fields. Instead of limiting the manoeuvring space of the participants it is probably more effective, with respect to cheating, to install a capable inspection, to impose hefty fines, and to demand an impeccable observation and registration systems as an entry prerequisite. As illustrated above the macro-economic cost of an outright favourable initial allocation for the trade sector easily becomes sizeable, which in practice limits the possibilities of member countries to exploit such tricks.

A third aspect on the other hand points to an upper limit in flexibility. Whereas for the trading sectors flexibility would allow the participating companies to optimise their mix of actions, for the non-trading sector flexibility will one way or another translate itself in less stability in either taxation and subsidy levels or in required levels of standards. This is not an attractive prospect with respect to investment decisions.

All in all it seems that the inclusion of emission trade in the national climate policies requires from national authorities not only a regulatory and planning role, but also a role as active trading intermediate in order to close gaps and to prevent serious cost accumulations. This kind of goal keeper function is in fact consistent with the responsibility that states have assumed by signing the Kyoto Protocol.

Whereas the above issues represent core issues in the European emission trade system there other issues that cause concern as well, such as:

- The still to be clarified relation between permits in the EU trade system (IET) and permits obtained through Joint Implementation projects.
- The proposed exclusion of switching to renewables as a source of sellable permits, without ensuring a level playing field in the renewables development policies throughout the member states; strictly spoken such a exclusion could only be justified if the RECS system would be introduced throughout the EU and otherwise relevant subsidies are granted on a harmonised basis.
- The interaction between the emission trade directive and other directives that imply minimum or maximum levels of fuel use, energy efficiency improvements, emission levels, etc.; many of these directives are directed towards the level of individual energy consuming units, instead of organisations, without a prior understanding on the possible hierarchy or compromises conflicts, litigation and postponed investments may result. Some directives, could be helpful in the blending of permit trade with other climate policies. For example, the impending directive for DSM in liberalised power markets could underscore a wider portfolio of risk mitigation options (Perrels, 2003).
- A further possible complication in the ability to blend permit trade sensibly with a national climate policy is the impending EU agreement on harmonisation of energy taxation; though a good thing in itself it may in fact mean that member state have formulated a large range of inter-

acting objectives whereas they do not dispose of such a large range of – allowable – instruments.

Last but not least it seems that in the short run and without sufficient complementary policies some weakening of energy efficiency improvements could occur in a EU 25 trade system. Yet, the eventual impact depends on many regulations inside and outside the trade system. Furthermore, for the EU as a whole is presumably less dramatic than it could be in some permit buying countries.

Glossary of abbreviations

AAUAssigned Amount Units, created on the basis of the allotted (assigned) amount of emissions for each country subject to a reduction target under the Kyoto Protocol; in IET (and in the EU trade system) countries or trading entities in countries are trading AAU's, in practice 1AAU represents 1 ton CO_2 equivalent (reduced)

AGE	Applied general equilibrium model
AGE-E³	Applied general equilibrium model notably meant for Energy-Environment-Economy interactions
CDM	Clean Development Mechanism, a system to earn emission reduction credits (CER) for Annex 1 countries under the Kyoto Protocol by means of investing in emission reduction in non-Annex 1 countries (i.e. developing countries)
CER	Certified Emission Reduction, an emission reduction credit earned through a CDM project
CHP	Combined Heat and Power (instead of wasting away cooling water, the heat generated in generation is used in industrial processes or for district heating)
ECCP	European Climate Policy Programme (framework programme for EU climate measures)
ERU	Emission Reduction Units, an emission reduction credit earned through a JI project
ESO	Finnish national energy saving programme (Energiasäästöohjelma)
IET	International Emission Trade (see also AAU, JI and CDM), this is the default non-project based trade of emission rights (AAU's), the European Emission Trade programme is an example
JI	Joint Implementation, a system to earn emission reduction credits (ERU) for Annex 1 countries under the Kyoto Protocol by means of investing in emission reduction in other Annex 1 countries (i.e. economies in transition, such as Central and Eastern Europe)
KIO	Finnish national climate change programme (Kansallinen Ilmastoohjelma)
RECS	Renewable Energy Certificate System, system of tradable credits created by generation of electricity from certified renewable sources and technologies; electricity suppliers that need to ensure that a minimum share of their sales is from renewable origin, can buy these credits from renewable abundant areas/generators in case the suppliers do not dispose of sufficient (cheap) renewable generation sources themselves; participation of power units in RECS and European ET is mutually exclusive
RMU	Removal Unit, an emission reduction unit earned through enhancement of carbon sinks
UEO	Finnish national renewable energy (promotion) programme (Uusiutuvan energian edistämisohjelma)

References

Commission of the European Communities (2001), *Proposal for a Directive of the European Parliament and of the Council establishing a framework for greenhouse gas emissions trading within the European Community and amending Council directive 96/61/EC, Brussels*, COM(2001)581, 23-10-2001.

Forsström J., J. Honkatukia, Sulamaa (2002): *Energiaverotuksen kehittämistarpeet Kioton pöytäkirjan toteuttamiseksi (The needs for adaptation in energy taxes with the aim to fulfil the commitments of the Kyoto Protocol).* Discussion paper 800, ETLA, Helsinki, 2002.

Goulder, L.H., I.W.H. Parry, R.C. Williams, D. Burtraw (1999), The Cost effectiveness of alternative instruments for environmental protection in a second-best setting, *Journal of Public Economics*, pp.

Harrison, D., D.B. Radov (2002), *Evaluation of Alternative Initial Allocation Mechanisms in a European Union Greenhouse Gas Emissions Allowance Trading Scheme*, Study for the European Commission, National Economic Research Associates.

Honkatukia, J., E. Joutsenvirta, H. Kemppi, A. Perrels (2002), *EU:n laajuisen päästökaupan toteuttamis-vaihtoehdot ja vaikutukset Suomen kannalta (The implementation alternatives for EU wide emission trade and the impacts for Finland)*, VATT Discussion paper 282.

Klimbie B., B. Leurs, T. van der Werff (2000), *De internationale prijs van CO_2 – determinanten en schattingen (The international price of CO_2 – determinants and estimations)*, CE.

Perrels, A. (2003), *Liberalisation of Electricity Markets – strengths and weaknesses in Finland and Nordpool*, VATT report.

Sijm , J., F. Ormel, J Martens, S. van Rooijen, M. Voogt, M. van Wees, C. de Zoeten-Dartenset (2000), *Kyoto Mechanisms – the role of Joint Implementation, the Clean Development Mechanism and Emissions Trading in Reducing Greenhouse Gas Emissions*, ECN C-00-026.

Vasara, P., K. Silvo, P. Nilsson, L. Peuhkuri, A. Perrels (2001), *Evaluation of Environmental Cross-media and Economic Aspects in Industry – Finnish BAT Expert Case Study*, Finnish Environment Series no. 528. Finnish Environmental Institute.