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The no cost emission saving policy

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Abstract:
The EU is enthusiastically proposing climate saving policies that place Europe as the innovator in reducing emissions and increasing the share of renewable energy sources (RES). However, the application of suitable instruments appears to create problems with differences between the approaches that seek to achieve the objectives. The European Union Emissions Trading Scheme (EU-ETS) and national support regimes such as renewable energy feed-in tariffs (REFIT) in particular are often not well integrated. Whilst the first aim is to price carbon emissions, the second is to increase the market share of green energy, however coordination of the two is lacking.

This paper analyses literature addressing the two instruments of EU-ETS and REFITs and shows how when jointly applied they can interact with one another. If interaction is possible, what potential to reduce emissions at a faster rate without increasing costs is created? The legal options in addition to economic efficiencies enable a new policy that can faster reach the ambitious climate saving goals of the EU.

Keywords: emission savings, renewable energy sources, feed in tariffs, permit markets, emission trading

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1. Introduction

Time is running and the European Union aims to be a pioneer in climate protection. Ambitious policies agreed in the 2020 by 2020 decree seek to lower carbon emissions to at least 20% below the level of 1990. Further, the share of renewable energies and energy efficiency must increase by up to 20% by 2020. Is achievement of this goal realistic? Most member states decided to adopt the policy of a joint application of two different instruments. At first sight it seems to be absurd not to concentrate on the strength of one policy, but to implement a second cost intensive policy. Nevertheless, the advantages of such a policy mix exceed the application of a single one. It appears to be the measure used to cut emissions radically and provides new opportunities for the no-cost emission saving policy which have not yet been realised.

The instrument chosen to lower carbon exhaust is a cap and trade market of emission permission; one seeks to raise the share of green energy of total energy production through support regimes, which intend to increase the new installations of zero emission power plants. While the application of an emission trading scheme is a cross sector incentive aimed to save emissions at the lowest cost point, subsidies for green energies lead to sector specific and large quantity savings of emissions and thus make a certain amount of conventional production and its permissions redundant. Thus the question arises that if both instruments are jointly implemented, what is the deal that would lower absolute emissions across sectors below the cap set in an emission trading scheme? Research generally focuses on economic and not ecological efficiency, the lowest costs for the permitted (carbon) emissions for example are considered and not what the highest possible carbon saving is that could be obtained for a specific budget.

The EU is primarily pursuing the instrument of a Europe wide CO_2 emission trading scheme, the EU-ETS. This instrument sets a maximum allowance as the limit for the emission of greenhouse gases and thus fulfils the EU climate targets committed to via the Kyoto protocol and the 2020 by 2020 commission decree.

After Phase 1 of EU-ETS (2006-2008) commenced there was an increase in literature about the world's biggest application of a cap and trade market:

Some authors focus on whether the quantity of permissions set are right and what the ecological efficiency is, for example, are the CO_2 savings the maximum that can be derived from the application of such state of the art technology? Schleich and Betz (2005), and Betz and Sato (2006), determine that the initial allocation can already indicate the likelihood of over-allocation or abatement where the potential savings will not occur if allowances are cheaper than the abatement of emissions through technological measures. The same problem is implemented within the regulation of national allocation plans (NAP) for emission permissions. Ellerman and Buchner (2007) argue that such plans are often less ambitious than technological developments and thus the decrease of emission exhaust is not maximised.

Other authors concentrate on how permission trading schemes can be optimised, focussing on the economic efficiency of the costs. For further information refer to the comparative analyse of Tietenberg and Johnstone, 2004. The EU-ETS was the first big scale cap and trade market, an "experiment" as stated by Kruger and Pizer, (2004), with all the early stage problems such as the actual emissions being well below the intended allocation that lead to permission prices at zero, as listed by Schleich, Betz and Rogge (2007). Not contrary to this point, but supplementary, Alberola, Chevallier and Benoît (2008) add that the often missing political volition that forces emitters to accept huge exhaust reductions can lead to higher economic costs. ETS participants anticipate (low) permission prices and become less innovative in light of the problems associated with the higher costs of the long run perspective.

Contemporaneous to the EU-ETS, the member countries are encouraged through national incentives to increase the share of renewable energy sources (RES). The implementation of new technologies often arise through national decrees that guarantee a fixed renewable energy feed-in tariff (REFIT) for every produced kilowatt hour (KWh). The newly installed capacity is (almost) free of CO_2 emissions. Electricity suppliers are obliged to primarily feed-in electricity produced from any renewable energy plants in their service territories. This commitment helps the affected enterprises to reduce total summed emissions without what would otherwise be necessary spending for permissions.

Literature in this stream nearly only quantifies the pure costs of RES support systems, but not the possible substitution effects in the energy mix, or social costs of air pollution. If pollution is free of costs, it prevents carbon savings. The allowances prices have a huge influence on the make-it-or-buy-it-decision for emission reductions and thus lead to fuel switching to energy with the lowest fuel costs, e.g. substitution of natural gas through coals. The contribution of different papers by authors like Bickel, Kelm and Edler (2009), Wenzel and Nitsch (2008) or Senßfuß and Ragwitz (2007) is important when quantifying the spending of support systems for green energies and estimating fuel switches and exhaust quantities. The resulting effects on spot prices of electricity and carbon permits are indicators of targeting the future emission cap. Low costs of spending for RES support regimes and low costs of permits show an over allocation of permits and open the option to cut the set cap more rigorously.

Mennel and Sturm (2008) stress the problem of energy efficiency. The policy maker should always answer with a certain regulation, where it is relevant to the [ETS-] system: e.g. technology specific taxes or a shortage of CO_2 permits. Zenke and Schäfer (2005) concentrate on how to revoke redundant certificates from the market if more savings are generated within the sector or exclusively to large proportions of the sector by the subsidised RES. The Community treaties for the property rights protection therefore highlight the limits and provide the restrictions of a change to the cap once it is set. Magen (2009) critiques the emissions market, stating that it is "not free" but even if it were, the policy maker can at least change the cap *ex post*.

An important characteristic of a REFIT is the priority feed-in of RES into the grid. The consequences are far reaching as it shifts the mix of the remaining required conventional energy sources. Energy utilities will switch off the most expensive power plants, under the logistical condition to ensure the delivery of the base load in the grid. Ecologically this may result in additional or reduced CO2 savings with changes in demand for emission permits. Delarue and D'haeseleer (2008) and Delarue, Voospools and D'haeseleer (2008) explain how short run fuel switches influence the carbon exhaust under the EU-ETS. If emissions have a price, less competitive but ecological advantageous sources will become cheaper. The monitoring of the Phase 1 of EU-ETS shows fuel switching from coal to gas that has already led to emission savings not previously realised. It is important to take into account the effects when support regimes for green energies have an impact on allowances prices and the demanded quantities of permissions in the market.

If ETS and REFIT are jointly applied in one market, will the ecological efficiency vary? If changing significantly, the permissions market should be reorganised and adjusted under the uncertainty of the future realised amount of new RES capacities. Some similarities can be found in literature about the overlapping effects of ETS and the [ETS-] system aside from emission taxes. Not all industries are covered by the EU-ETS, thus taxes can be an instrument to force emission reductions in non-EU-ETS sectors. On-going research in this field of study is rarely conducted. Eichner and Pethig (2010) refer to the unclear effects of different and overlapping instruments, namely ETS and (sector specific) taxes. These authors seek to quantify the economic and ecological efficiency and determine the risk of a "dry up" of permit markets through taxes; the new installation of CO_2 neutral capacities in one sector appear to cause similar "dry up" effects.

This paper is organised as follows. Chapter 2 will firstly explain the theoretical conditions of cap and trade markets and REFIT subsidies, paying attention to the possible contrary effectiveness of both instruments when contemporarily implemented. Secondly, in chapter 3, the question of the interdependencies of the two instruments arises. Do emission reductions through RES lower the absolute amount of carbon permits needed? Will the demand for allowances decrease or is the market inundated with these free certificates? Chapter 4 will discuss solutions for the allocation of problems resulting from new installations and the amount of possible additional, cost free carbon savings. Germany as an innovator of REFIT policies will be the focus. One must refer to the difficulties between economic demands and legal needs which limit the design of trading themes. Chapter 5 will conclude the paper.

2. Theoretical framework

The implementation of a cap and trade systems creates a market for good "emission allowances" under certain regulations. The general approach has to be proofed including and specifically with regard to the conditions imposed by the new instrument of green energy support systems. Are ETS and support regimes two systems interacting or contrary to each other? Are new RES capacities an additional variable of market theory or influencing existing parameters?

Modern economies are based on industrial production and as a negative consequence; the environment is polluted and damaged. The missing price of this impact and the resulting social costs of production can be classified as a market failure. The idea of an ETS is to charge polluters for their emission quantity and reward the injured parties. But how does one price carbon exhaust? The place of the exhaust and its impact is not equivalent and thus a price for the social costs of greenhouse gases is hard to set. It is much easier to enable a system that prices the emissions of the emitter. Emission allowances are a market based instrument that price air pollution and become an additional input factor influencing production processes and the prices of goods. Other measures such as carbon taxes are on option, but not market based and thus less cost effective (see e.g. Parry, 2003).

Coase (1960) initiated the debate on a compensation for ecological damages payable by the emitter to the injured individual. Both parties should thus find the price for damage through negotiations under the condition of perfect information. Due to the asymmetric allocation of information the problem cannot be ideally resolved. Crocker (1966) proposed to link emission allowances to ground as property. The use of air produces a positive output at one place that causes damages at another place. Both parties should have an (financial) incentive to allow a specific amount of exhaust on one side and avoid emissions on the other side. Dales (1968) added that the policy maker must fix the maximum quantity of emissions allowed with an exact description of where and when the exhaust is allowed, while the price of every single permit will be found in a classical market scheme in relation to the number of allowances demanded.

Without restriction, the total pollution is equal to the maximum demanded exhaust e_{max} of CO_2 emissions of N polluters,

(1) $$E=\sum_{n=1}^{N} e_{\max_n}$$

The advantage of the ETS system is the efficiency of permits trading between system participants, emissions savings are found at the minimum cost point, as described by Baumol and Oates (1971). Hence the initial allocation, i.e. grandfathering, auctioning or others, are without influence. Permits are "flowing" to the place where emission saving would cause the highest costs. A single firm will be a seller of permits as long as the permission price is higher than the individual marginal abatement costs curve (MAC) of emissions. The market price for allowances will be equal to the optimum which can be realised by the joint MAC for all market participants (Montgomery, 1972). Tietenberg (2003) verified the theory by evaluating different applications of ETS. He highlighted the importance of the appropriate implementation of financial sanctions for the case where a participant failed to hold enough permissions to equal the exhaust of his emissions. Thus, if sanctions are high enough, the binding cap is met by all parties participating in ETS.

The first climate protection policy of the EU is the European wide emission trading scheme (EU-ETS) that seeks to reduce carbon exhausts by at least 20% below the levels of 1990. The first multi-annual trading period, Phase 1 of the EU-ETS, was based on a grandfathering process where the status quo emission less a compulsory reduction were the benchmark for the initial allocation and setting of the cap. In future periods, the free allocation will be substituted with a certain quota of auctioning while for the long run perspective the full auctioning will become the standard for allocation.

The length of one period of the EU-ETS will be expanded from phase to phase over a few years. Early adoption of energy saving technologies will become more efficient and release redundant certificates for sale on the market.

The second climate protection policy of the EU is the introduction of national support regimes that will push the share of RES of total energy production to at least 20% by 2020. Where new capacity expansions of RES lead to a lower demand in required certificates, the price of allowances will fall. In existing conventional power plants, the realisation of emission savings will occur at a lower cost level. The full technological potential of emission savings through innovations to the production process will not be realised. Emission savings are thus almost exogenously made. Conventional capacities can be shut down, system participants can buy cheaper certificates up to the allowed exhaust quantity of E_{max}.; which was set for the status quo conditions before RES supports. If the permit price p is decreasing, the (retail) price for conventional fuel energies should lower.

The policy maker limits the total emissions allowed to a maximum permissible level under the status quo demand, the cap Φ. System participants must reduce their emissions under the maximum demanded level e_{max} by avoiding the exhaust of a, while participants can choose between avoiding emissions or buying permits under market conditions dependent on their individual MAC. The system costs result from the sum of abatement costs c_a for each emitter N. If new RES installations occur exogenous, the cost effective Lagrange solution is

$$\min \sum_{n=1}^{N} \mathrm{C}_n = c_{a_n}(a_n) + \lambda \left[\sum_{n=1}^{N} (e_{\max_n} - a_n) - \Phi \right] \qquad (2)$$

The optimisation of (2) is achieved by choosing the values of c_a and a that satisfy

$$\frac{\partial c_{a_n}(a_n)}{\partial a_n} - \lambda \geq 0 \quad , \quad n = 1 ,...., N \ ,$$
$$\sum_{n=1}^{N} (e_{\max_n} - a_n) - \Phi = 0 \qquad (3)$$

The emitter participating in the trading scheme is obliged to obtain for each single unit of emission e an allowance for the price p_a. The obligation to acquire allowances can be substituted by an emission reduction. Cost savings realised are equal to redundant fuel costs. The substitution will take place when the cost of saving c_a per saved unit *a* of emissions is lower than the price p_a of the emission allowance. The total costs then consist of the avoidance costs and the costs of allowances for the remaining emitted amount $e_{max}-a$. In addition, the change of the demanded quantity of allowances itself effects the certificate price which is then $p_a(e_n)$.

$$\text{(4)} \qquad C_n = c_{a_n}(a_n) + p_a(e_n) \cdot (e_{\max_n} - a_n)$$

The cost effective optimum is achieved if the marginal costs of emission reduction per unit is equal to the price of the allowance in the market:

$$\text{(5)} \qquad \frac{\partial c_{a_n}}{\partial a_n} = p_a(e_n)$$

Effective cost control and sanctions for the individual failure of participants lead to a system that ensures the exact attainment of the maximum allowed emissions Φ. Further, technically possible reductions of pollution will not occur. They are not cost effective for the individual emitter N who is a price taker.

In the framework of an ETS, the policy maker can chose between three different scenarios. Due to a certain trade-off between the two scopes, cost efficiency or ecological maximisation, it is important to define the initial allocation as the measure that determines the achievement of the objectives:

Firstly, if and only if the optimum amount is set for the supply and demand function will there be no welfare losses, as shown in [image 1] in point A for the combined market $MAC_1 = p$. Secondly, over allocation, i.e. government supply of a permit quantity above market needs, lead to lower prices, as shown in point A in relation to point B with MAC_3, and thirdly, a shortage of allowances lead to higher prices and real savings in exhaust, set point A while C would be needed.[1] Innovation reduces MAC_2 to MAC_1, lowers the price and thus the cap Φ will be reached, as shown above in (5), the price can influence the MAC and thus the amount of carbon emissions and savings.

---- [Image 1] ----

In the short run there are no economic reasons to cut emissions under status quo levels. Thus, if the policy implements a smaller maximum capacity as the cap, it has

[1] Hintermann (2010) mentions that low permit prices are not caused in all cases by over allocation, but also by over abatement and thus result in redundant allowances in the market.

ecological intentions, social costs in future periods through the environmental pollution of today and the security of further supply of resources.

As shown, newly installed RES capacities step into the market without any direct impact on the system participants. Depending on whether conventional production capacity can be substituted, the maximum condition (2) (3) changes for the effected electricity sector and for whole the economy:

- in the case of non-substitution, the total production rises, but total emission avoiding *a* remains the same; or
- in partial or full substitution, the production increases, or decreases less and e_{max} shrinks. Thus, emission savings are smaller than before, relative to each unit of conventional production, or can even increase.

The issue of substitution also affects the price of emission allowances (4), as the demand is dependent on the total emission. Further details will be discussed in the following chapters.

As result of the literature review, theoretical analysis demonstrates that if both measures of EU-ETS and RES support regimes are jointly implemented, the ETS cap set by the policy maker will always be achieved. Feed-in tariffs are not contrary to, but have an impact on the effective achievement of the goal and can contribute a cost shrinking effect to system participants.

3. Interdependencies between EU-ETS and national feed-in tariffs

The European Union's ambitious climate protection plans is based on market instruments for emission trading and support regimes seeking to increase the share of total energy production that is RES. As demonstrated, the EU-ETS ensures the achievement of a pre-defined cap of carbon exhausts. The amount of the cap is set by the policy maker. The second measure, a REFIT, helps to increase the share of RES energies and is a kind of financial promotion of research and development. It is cost intensive and does not bring further benefits of CO_2 savings. What drives the EU to force the joint implementation of these two instruments? Is it simply expensive or is it well thought out with results that can be interpreted as a calculation yielding more than 1+1?

The setting of a cap still has important impacts on energy efficiency and emissions abatement. If firms have to pay for emissions, they raise their efforts in saving carbon exhaust. Innovations in energy saving technologies become a competitive advantage and result in lower production costs. Thus, the permit price has to be higher than the individual MAC if the firm shall abate emissions instead of buying certificates from the market. The EU-ETS and the pertinent NAPs of the member states have to implement a certain shortage in the quantity of allowances in order to secure and hold a specific price level.

The EU-ETS was initially designed as a system with three periods. The length of period one grows from Phase 1 to 3, running from three to seven years. Thus, even if the EU is continuously evaluating their directives for the trading scheme, (policy) scenarios must pay attention to more parameters under the heading of uncertainty. The period length and issue that the cap is set once before the trading phase starts, brings less flexibility during the single phases if market demand and supply do not develop consistently and in relation to one another. As shown for over allocation, i.e. the supply of more permits as demanded by the market leads to zero level prices; this is however not at all a shortcoming of the general ETS design. Concerning the inter-periodical adjustment of the permit amount, the EU member states have a strong instrument, the annual allocation of allowance rights. In Phase 1 in particular, but also in Phase 2, free allocation based on historical emissions, grandfathering (see e.g. Ellermann, Buchner (2007) for detailed processes), caused high *windfall profits* in the power sector. When pricing the initial permit prices in retail prices after the trading period has commenced, energy suppliers are skimming consumers due the price inelasticity of the good "electricity" and market oligopoly. Power producers did not feel the need to seriously save emissions, as determined by Schleich, Betz and Rogge (2009). Further, if permit prices are decreasing, consumers have to pay the initial price. Banking free permits can result in a shortage of markets and carbon prices can even increase if the market power is strong enough. Auctioning cannot solve the problem of over allocation and high prices on consumer bills. Hephurn et al (2006) evaluated the grandfathering process in Phase 1 and estimated auctioning in Phase 2. Auctioning can provide solutions to prevent distortions through banking permits. If market participants do not have incentives to hold free, unused permits, price volatility and high prices due to market domination of single players will not occur or reduce.

Buttermann, Hillebrand and Hillebrand (2009) propose full auctioning in Phase 3 of EU-ETS for energy utilities. Otherwise, the amount of allocated certificates is sufficiently high to use conventional fuels used previously. A slight cut to the cap for example can be compensated by a switch from coal to gas. In this scenario, physical switches to new RES capacities is not an option and too expensive.

Fuel switching is an important issue. If carbon permits will have (high) prices or the cap is significantly cut, the first option for carbon savings is to switch from coal to gas capacities which both exist in the power plant mix of energy utilities. A long run switch to RES would cause higher costs in the short run. The advantage of the implementation of more efficient technology in the energy mix is a disadvantage in the short run and causes higher costs. Delarue, Voorspools and D'haeseleer (2008) investigated scenarios for Phases 1 and 2 of the EU-ETS with the result of course, of a correlation between prices and CO_2 savings. Nevertheless, the overall effect appears to be a positive exhaust reduction and contrary to this the prices in the EU-ETS tend to be low (Delarue, D'haseeleer, 2008). In this case, one can propose that the EU-ETS leads to carbon savings in the existing power plant park. RES are neither needed nor demanded. Innovations in new technologies will occur only where conventional fuel efficiency has the potential to increase and results in additional inter-system savings.

Thus, in terms of general theory, the price should regulate emissions and force carbon savings if MAC is lower than the allowance price. High prices signal that an abatement is needed. It is often not taken into consideration that other factors also play an important role: (i) high market power of a single player or inefficient markets can distort prices when market participants bank free permits. The market will in this scenario have a shortage of tradable permits, resulting in high prices (Hintermann, 2010); or (ii) the simple correlation between economic growth and certificate prices, where there is a gap between economic growth estimated for the set of the cap and the real rate of growth (see Alberola, 2008).

This confirms that the political capacity to act is limited, the policy maker must set a relatively small cap if carbon savings are the main intention of the political framework and this decision cannot be adjusted as the cap can only be set once before the period has started. The EU-ETS directives do not allow adjustments during the on-going period. The EU-ETS and the NAP goals will be met by the economy. Thus, a REFIT does not bring any additional carbon savings additional to the EU-ETS. Why should such a policy be adapted?

National states have good reason to implement RES support regimes: decentralised energy production, security of energy supply, innovations and resource in RES technologies, steeper inclining learning curves and cost shrinking effects in the future (see for example Abrell, Weigt, 2008, or Nicolosi, Fürsch, 2009 . Furthermore, set caps are forecast future power plant generation, the exhausted emissions result from a combination of the state of the art emission amounts with expected scenarios regarding the implementation of new technologies. For example, if RES efficiency becomes higher and / or the share of total production is growing faster, the policy maker can set a lower cap. Technological conditions available on the market allow energy utilities to reach the emission target faster and / or more cheaply. This is the focus of the German government (e.g. Klinski, 2005, and Wenzel, Nitsch, 2008), a line of argument that is supported by different authors as discussed below.

Fischer and Preonas (2010) discuss the two-way influence of ETS and FIT. Lower permit prices can lead to a crowding out of a favourable technology and technology specific FITs can help diminish disadvantages through for example, higher costs of green energy production and push RES into the markets. The cap for the next period can thus have more ambitious targets.

De Jonghe et al. (2009) focus on welfare maximisation through an ETS, but criticise that dependent on the energy mix, especially in countries with a high share of nuclear power plants, new RES technologies will not step into the market nor will fuel switching occur. Thus a FIT for RES is highly recommended in order to step into the market.

The REFIT stimulates RES investments. The FIT, the investment guarantee for the RES is paid by all consumers through a levy on all energy sources whether they are conventional or green. Through the statutorily stipulated priority feed-in of RES, conventional power plant capacities will be shutdown, beginning with the power plant that has the highest marginal costs. The demand quantity for conventionally produced goods is reduced from D_1 to D_2, the merit order effect[2].

---- [Image 2] ----

For Germany, the merit-order effect is calculated to be higher than the annual costs for the consumer through the REFIT levy. The cost effect is positive (see Sensfuß, Ragwitz (2007) and Sensfuß, Ragwitz, Genoese (2007)) for the merit order effect and for the substituted energy sources, see Bickel, Kelm, Edler (2009). Mennel and Sturm (2008) stress the market inundation of permits caused by the additional green energies and the negative associated impacts; it is somewhat harder to obtain higher fuel efficiency if exhaust has a price equal to zero, as shown above. Wissen and Nicolosi (2008) point out the unclear effects in terms of the implications of the EEG

[2] The merit order effect can be observed only if one or more goods (e.g. energy sources) are positively discriminated. As for German electricity from RES, in general it has to be immediately fed into the grid, here the effect is most often described theoretically and in absolute figures, see Sensfuß, Ragwitz, 2007 and further analysis of the authors of the BMU.

and the German REFIT which are already included in a defined quantity in the NAP. Without green energy capacities, the importation of cheaper nuclear power would have been an influence on electricity prices. The authors did not negate the merit-order effect and mention the importance of increasing prices and the price elasticity of energy in the long run demand.

To summarise and conclude, one can state that the EU-ETS as the measure to fulfil government regulations on carbon savings at the lowest cost point and thus welfare maximisation, is given for the on-going period, whereas a REFIT pushing technologies and broadening the possibilities to cut emissions in the future periods of the EU-ETS is faster and cheaper.

4. How to reach the zero cost emission policy

As shown before, retail prices on electricity remain at high levels even if permit prices tend to zero. Energy utilities act in oligopoly markets and can set consumer prices which include allowance prices of the past, which is according the general design of the EU-ETS, often higher than it is in the present. Thus, if allowance prices decrease, energy utilities cash a part of the welfare effect arising as their own rent. These windfall profits are an imbalance at the expense of the consumer.

From a welfare maximising perspective, it is legitimate to cut the recent windfall profits. The question is how to reach lower consumer prices. If single players can dominate the ETS-markets, it is difficult to place pressure on the energy utilities to decrease prices. Is it thus legal to withdraw free, unused certificates and reallocate them to other market participants? Windfall profit problem solving instruments consist of a levy on such profits with the aim of lowering or reallocating windfall profits from private suppliers to the community.

For the system participants, the maximum emission quantity is given exogenously, but as the policy maker sets and controls a further shortage of permits through policy regimes and thus forces additional savings, the cap itself becomes quasi endogenous (see Tietenberg and Johnstone, 2004). The economic efficiency is influenced by the emission target and implementation of technologies. Chosen policies can undermine the achievement and market participants influence the cap. The technological and economic possibilities to save emissions are determined by endogenous changes through the application of environmental changes as well as climate saving polices. Thus the question of what the legal options to withdraw allowances from inside the system are and whether the system conditions change, like they do for example through a REFIT, arises.

Full auctioning is one option. Especially for Germany, Schleich, Betz and Rogge (2007) attest the advantage of full auctioning in order to avoid windfall profits, but also support the simplification of the NAPs to lead to more transparency.

The advantages for the community are that the emitter must buy all allowances in periodical auctions or in inter-periodical trades within the market when participants have free permits for sale. As trades can only occur with the government as the initial seller, financial resources will be relocated from the private sector to the public sector and can fund further research and development of RES or subsidies for new green power plant capacities. If the price increase of allowances does not exceed the value which is still contained in the electricity prices, the costs for the community do not rise, but the rent for energy suppliers shrinks. The social costs of climate change caused by carbon exhaust will be internalised. The allowances price is thus market based and not only a theoretical construct and Emitters have no incentive to bank allowances. Further effects are highly positive and will yield to additional carbon savings at zero cost to the community.

Literature on auctioning generally endorses the practice with the exception of some minor doubts regarding the legal feasibility. If one participator loses his right to pollute the air, is this already a dispossession of a property or common law?

Posser and Altenschmidt (2005) state that the property law governing allowances cannot be clearly defined. If the government cuts allowances to gain a shortage, it is legally questionable and may be contrary to EC treaties on property rights. The energy utility always requires a sufficient amount of allowances in order to operate its production unit, the power plant.

Martini and Gebauer (2007) meet these concerns in terms of the protection for reliance on existing laws, where only a grandfathering allocation can pay attention to the issue of property rights, because it is based on the exhaust experienced in the past. Nevertheless, a certain reduction in the amount of allowances can be realised. It is not discriminating individuals if it is a global percentage cut.

Tietenberg (2003) argues that the ETS as "the system is to protect the economic value of the resource, not the resource itself." Therefore, in American emission trading, the right to emit a unit is not a property right, but remains a collective good. Thus, a future reduction without compensation is possible.

It is important to refer to the EC treaty (96/92/EC and 2003/54/EC) that limits national solo efforts and underlines the importance of European co-ordination if planning is to cut emissions under the pre-period implemented level. A single member state like Germany cannot decide to withdraw certificates if not based on a common agreement with the other member states.

To summarise the literature, one can argue that non-utilisation of permits due to reduced production output, as the substitution of conventional energy through RES, should lead to an adjustment of allowances quantity. The crowding out of conventional energy producing capacities through the new exogenous green capacity renders permits redundant. At least in the next period, a further shortage in the same proportion is recommended and intra-periodic adjustment must be avoided, especially to guarantee the property rights of permit holders.

Magen (2009) supports this argument stating that the trade of emission rights is not and was never completely free, if burning fuel in a power plant, (i) a government authorisation is required and can be refused, and (ii) once in operation, permits for air pollution are essential for energy production. Thus, the plant operator must possess enough permits to fulfil the legal restraints coupled with the authorisation. The government on the other hand, must ensure that it maintains enough permits so that all authorised operators can fire the power as legalised.

The EU-ETS, legally implemented in the German Decree for Emissions Trading (TEHG), is a core environmental regulation like operation authorisations, thus the legislative is legally obligated to protect the collective goods of clean air and the environment. As an implication, it is constituted through German basic constitutional law to utilise every legal option to cut emissions and thus intensify the conservation of the environment.

In the long run at least, the demand for electricity is elastic, thus a higher price is preferred from an ecological point of view. The EU itself, as constituted, must strengthen efforts to establish free markets and competition for different types of energies. Currently, REFITs help non-competitive energies with high emissions to become cheaper than they really are and help to obtain EU-wide free energy markets from different sources (Gunst, 2005). Thus, the EU-ETS alone does not yet have the means to protect the climate. It may however transform into a powerful instrument through the setting of shortage of permits, if REFIT investments allow it.

The national levels, due to the EU-ETS design options, are provided with a certain feasibility that is not yet exploited in terms of shortening the quantity of permits.

Kruger and Pizer (2004) emphasise the three levels of the ETS: first is the European burden-share agreement, followed by the national level and then the emitter level. The last two levels are designed by EU members and the CDM (Clean Development Mechanism) and JI (joint implementation) activities in particular are instruments to reduce greenhouse reduction outside of the national territory and reduce permit prices. The ratio of both instruments at the level of the whole carbon saving liability can vary and is set by each member state on its own, (see e.g. Kruger, Pizer, 2004). On the other hand, the instrument can, but does not have to be used if other policies, like the REFIT for RES, place pressure on prices. Thus, the EU members already have an instrument to regulate their cut in a small range.

The German NAP provides an approach for this purpose. For example, if the energy utility shut down a power plant, it triggers the mandatory duty to withdraw the certificates linked to that specific production capacity. In this case, the new REFIT capacities induce the theoretical shutdown of a percentage of conventional capacities and there should be no reason to not withdraw the certificates as with a full shutdown.

Determining the economic wide quantity of pollution to the right amount can have a purely rational response that corresponds to economic factors. Such an answer is possible but not advisable, because other (ethical) factors must be considered. The legal options that may propose a reduction policy equal to the quantity finally set must be clear. The ETS is the measure to control carbon exhaust through quantification, while the exact amount is a question of scientific and political nature (Rahmeyer, 2007).

As shown in this chapter, a shortage of the good "allowances" will raise the prices up to the ex ante anticipated price which is part of the consumer bill, without incurring any extra costs for the consumer. The policy maker can force additional carbon savings through a further shortage in the quantity of certificates.

5. Conclusions

The design of the EU-ETS makes this an instrument to measure and to control emissions and reduce them to a set cap. Without an over allocation of allowances to market participants, the compliance of the cap is secured. The joint implementation of support regimes for RES and the REFIT for example, does not change the system, but place some pressure on the linked variables.

The cost of an ETS system was described in (2) as a cost maximising Lagrange function where participants seek to reduce their individual costs due their individual MAC, costs were equal to avoiding costs or permit prices. Thus, most research is focused on the ecological efficiency of cost minimisation in order to achieve the cap. If the cap is considered as exogenously given and system participants are forced to attain the objective, the approach makes sense. Optimisation of the system does not change the amount of carbon savings. If the adjustment of the system conditions can reduce the costs without negative impacts on the environment, the saved financial resources can be spent elsewhere and the total economic burden of the instrument can be limited.

In the context of the ETS debate, the fact that that the ETS does not yield to higher the share of RES produced energy at the total production when it is the only policy applied is often ignored. Support regimes can increase investment in RES power plants. If newly installed capacities of green energies and their output are growing faster than total energy consumption and faster than expected when setting the cap, it can lead to displacement in the structure of permit holders. Energy utilities are obligated to feed-in RES produced energy. This does not lead to free emission permits and the total amount of allowances is not affected. Nevertheless, a part of the conventional production output is redundant and a minor per cent reduction of exhaust per produced is necessary if the total cap remains constant, equal to the free certificates. It seems that there is no ecological advantage, but cost shrinking effects for emitters. Through the substitution of conventionally produced energy, market demand losses lead to lower prices of allowances and especially "dirty" technologies or other sectors can even (i) raise percentage of exhaust per unit of output, or (ii) the production output can increase while maintaining the initial planned emission reduction. Economically this effect is desirable and leads to the shown cost shrinking effect or production increase and therefore results in prosperity gains.

The high social costs of air pollution and a possible "role model" to other nations are not taken into account; a faster development of RES provides political leeway to cut emissions faster. The cap is not at all exogenous, but endogenous factors are influencing the cap for the next period. The implementation of additional RES supporting regimes is a difficult policy. The recommendations to the policy maker stemming from the results of this paper are as following:

- The REFIT is part of the EU-ETS parameters, but due to a gap between expectations and real production output, the RES power plant production places pressure on the well-balanced system. REFIT supported RES power plants should be separated from the EU-ETS.
- When this occurs, conventional power plant capacities become redundant. The production authorisation for a disused power plant must be also withdrawn in parts if the plant is not completely shut down. The withdrawal of the authorisation lead must be linked to the withdrawal of emission allowances. Full auctioning can also support the enforcement of a shortage of permits. This results in additional emission savings through intensive use of technological innovations that are above the emission reduction scenario which is anticipated before the period started.
- The cap is exogenous for the system participants, but system conditions have a strong influence. Thus, the setting of a cap is determined endogenously through for example, the intensity of the support for RES and the further application and implementation.
- A side benefit is the cost shrinking effect of the higher demand for RES technologies and the resulting learning curve.
- Benefits gained by Germany through its role as the innovator are yet to be realised. Questions about employment effects, real economics costs estimated in consideration of social costs and competitive advantages also arise.

The named effects could have an enhancing effect if contemporaneous RES support regimes would be accepted not as a cost intensive instrument, but as one that optimise inter-system conditions. The targeted support of selected technologies at selected places or regions would lead to cost-optimising use of spending, higher outputs and lower costs per unit. The quantification of the potential remains open at this point and requires deeper research. What can be mentioned is the missing pragmatism to calculate the full effects through RES capacities. The separation of conventional and RES source grid loads would be the first step for the future accreditation of unrealised intra-system emission reductions. It is an unpopular result for EU-ETS participants, especially from the energy sector, as they would lose their economic advantage, while the community and the environment would profit highly from additional carbon savings at zero costs. Ecologically, it would enable an enormous step forward in European climate saving policies.

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Images

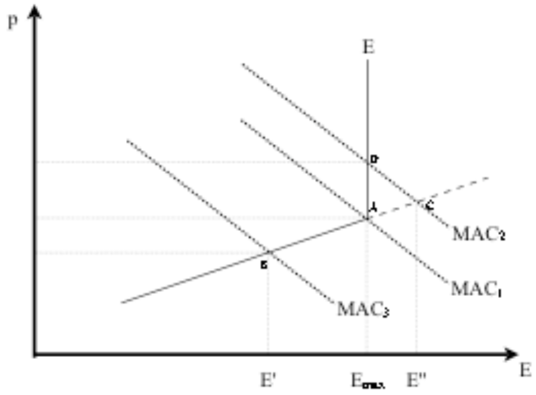

Image 1: carbon savings in different scenarios, own illustration.

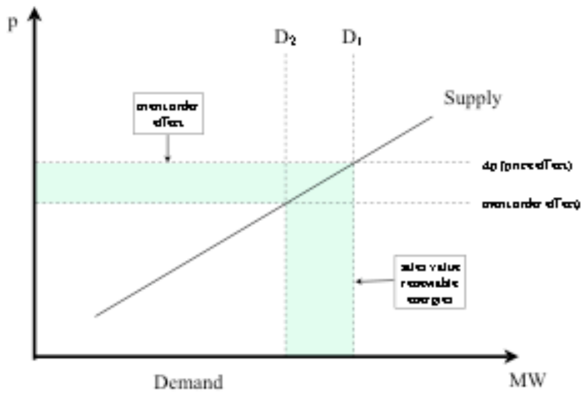

Image 2: merit-order effect, own illustration.