How much market do market-based instruments create? An analysis for the case of "white" certificates

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Keywords

tradable certificates, market-based instruments, energy efficiency, transaction cost economics

Abstract

Discussions about "green" certificates for renewable energy forms are under way for some time now. In contrast, tradable "white" certificates have only lately been celebrated as a market-based tool to foster energy efficiency.[1] Theoretically, there is little doubt about this. In practice, however, some fundamental problems and doubts about the usefulness of certificates arise: How "competitive" are markets for certificates in reality? Is a "white" certificate scheme only a new name for an old hat rooted in control and command regulation?

With this suspicion, a number of questions and aspects arise:

- *Market mechanism:* Which criteria guarantee that an – artificial – market for certificates really becomes competitive? Will trading be characterized by spot markets or by rather anti-competitive long-term over-the-counter contracts? Which minimum market size is needed, and which are the conditions regarding the tradability of the certificate that have to be met?
- *Target group:* Who should be obliged to purchase certificates? Are electricity suppliers the right target group, or should fuel and heat suppliers be addressed, or the consumer himself?
- *Additionality and measurability:* Which efficiency technologies should be eligible for certificates? What exactly is an efficient technology? A narrow definition might ease measuring problems but at the same time reduce innovation incentives.

We use the theoretical framework of Transaction Cost Economics to discuss these issues. A brief review of the design of tradable certificate schemes in Italy and the UK is given. Lessons can also be learned from renewable portfolio standards recently implemented in a number of countries.

Theoretical Framework

The choice of an appropriate organisation of economic activities (in other words: an appropriate governance structure) is in the focus of Transaction Cost Economics (TCE). TCE start from the observation that information is not complete *per se* and that the human capacity to process information is limited. Improving access to and processing of information is related to costs. In consequence, human behavior is guided by the rule of satisficing rather than optimizing.[2] People intend to act rational but are bounded by their own capacities of thinking. Economic actors hence take their decisions on the basis of imperfect information[3]

1. One exemption are Rader, Norgaard 1996 who adverted to the applicability of the certificate concept to DSM rather early.
2. In this regard, TCE has the same roots like other scholars of the New Institutional Economics.
3. Richter, Furobotn 1999, 510.

and bounded rationality[4]. The pure existence of bounded rationality and imperfect information opens the door for so-called opportunistic behaviour, a rather euphemistic term for dishonesty, fraud and malice.[5] To summarise, any transaction inevitably causes costs, the so-called transaction costs.

In this context, an important concept is the notion of investment specifity. Investments can be *specific*, i.e. related to high sunk cost, or *generic*, i.e. easily transferable to another application. According to TCE, specific investments allow a more efficient production than more generic investments.[6] The higher the specificity of the investment the more will these efficiency gains occur only in the specific transaction. Thus, specific investments are characterised by quasi-rents, which can be derived from this investment in comparison to its next profitable application.[7] For example, once an insulation has been fixed to a certain building, it delivers energy savings to the building user but cannot easily (if at all) be transferred to another building. It thus loses most of its initial market value, and the asset owner depends on sufficient payments by the building user to be able to recover his sunk costs and to realise the quasi-rent of the specific investment. In contrast, a CHP-plant has a more generic character since it is more easily transferable to other applications.

Investments specific to a certain transaction thus open the door for opportunism: The quasi-rent is on risk for opportunistic behaviour by a transaction partner (a customer, a retailer, …): This "partner" may threaten to refrain from buying the output of the investment and thus be able to appropriate at least a part of the quasi-rent. In anticipation of this danger, the asset owner has an incentive to invest in more generic assets with lower quasi-rents on risk but possibly also lower efficiency[8].

Alternatively, an appropriate governance structure may be established to safeguard the quasi-rents of specific investments against opportunistic behaviour.[9] In so doing, efficiency gains due to the specific investment can be realised, which is comparatively profitable for both transaction partners and increases overall social welfare as compared to low-efficiency investments.

To conclude, the extent of specificity of investments is a main determinant for the choice of appropriate governance mechanisms. The *higher* the specificity the more an efficient governance will be characterised by patterns of hierarchies or regulation. Such regulations may still allow for cooperative and intentional adaptations to changes in the environment, but they are connected to stricter accounting and auditing as administrative controls, and hence imply a lower incentive intensity. By contrast, *low* specificity of investments allows for pure governance by markets and thus to benefit from theoretically optimal incentive structures by profit-maximising behaviour. At the same time, the choice for an appropriate governance structure is not a choice exclusively between either markets or hierarchies, but may also lead to a hybrid governance structure with elements from both "sides".

In the case of energy efficiency (EE) investments, an additional opportunity for opportunistic behaviour may exist. As long as EE investments are not fully competitive by themselves, the external benefits of these investments due to reduced environmental impacts and higher security of supply need to be remunerated; otherwise the investments would not take place. Public regulations are a way to internalise these positive externalities, either by means of financial assistance or by compulsory efficiency standards. In the later case, the state may appropriate the extra-rents accruing from the EE investment by altering the regulation. If for example the regulation is phased out untimely or unexpectedly, the EE investments will loose at least some of its value as the investor looses the expected extra-benefits from the regulation. To avoid such a situation or its anticipation (which would be a disincentive for future investments), a reliable 'regulatory contract'[10] is needed as a tool to provide comparable safeguards against opportunistic behaviour from the side of the state.

In the following chapters, we use this theoretical framework to discuss the problems related to establishing and running a tradable certificate scheme for energy efficiency (EE) measures for grid-bounded energy[11]:

- Does the specificity of energy efficiency investments allow for an efficient governance by markets for tradable certificates?
- Which EE investments are suitable to be governed by markets with respect to the measurability of the efficiency improvement through the investment?
- What aspects have to be considered when deciding on the obligated parties?
- What is the minimum market size for tradable certificates?
- And finally, how far are the derived recommendations reflected in existing tradable certificate schemes?

Design of a Tradable Certificate Scheme for Energy Efficiency

A scheme for supporting energy efficiency (EE) with a tradable certificate scheme comprises of several elements. First, a quantitative overall target needs to be set, either in absolute terms or relative to energy consumption. Secondly, a regulation needs to translate this overall target to individual targets for the obliged parties. In a market environment for grid-bound energy like electricity, natural gas and district

4. Simon 1957, 198.
5. Williamson 1987.
6. Williamson 1987.
7. The energy service provider will not be able to use the insulation in any other building once it is fixed; thus the investment is highly specific to the transaction between the energy service provider and the building user.
8. Note that the term "efficiency" is used here in a generic meaning, not exclusively meaning energy efficiency.
9. Williamson 1987.
10. Birkenbach et al. 2001.
11. Even though the concept of tradable certificates has only been applied for grid-bound energy it is *per se* also suitable for non-grid-bound energy.

heating, the obliged parties can be either energy generators, distributors, suppliers, or energy consumers themselves. Thirdly, EE measures eligible to fulfil the respective obligation need to be defined carefully while considering a number of possible restrictions. There are several options for measures eligible to an EE scheme:

- The scheme may admit only certain EE measures (e.g. energy efficient light bulbs) and exclude others.
- The scheme may admit exclusively hardware installations eligible or also software measures such as information campaigns or customer education.
- The scheme may be constrained to EE measures, which economise on the same *energy carrier* the obligated party is supplying.
- Finally, the scheme may be restricted to EE measures related to the customers of the individual obliged party to fulfil its target.

These design options have to be weighed against their respective benefits and disadvantages. Economic theory suggests that the wider the definition of eligibility is and the lesser the restrictions are, the lower are the costs to fulfil an obligation. On the other hand, a lax definition of EE may result in limited comparability and measurability of EE measures and their effects and thus reduce the tradability of the related certificates (see below).

Obliged parties prove the fulfilment of their target by presenting certificates that attest a certain amount of saved energy. These certificates are tradable, which allows obliged parties either to fulfil their obligations by own EE measures or to buy certificates from others. Here, possible restrictions may apply: First, the regulator may control trade by asking for official approval for any transaction. Secondly, certificates bought on the market may only be eligible to cover a certain share of individual obligations, which would force the obligated parties to undertake own EE measures in any case.[12] Here again, transaction costs and the market size are under question; the more complex the administrative procedure for trading is, and the higher the share of the target that is to be covered "at home", the smaller the certificate market will be, and the more the system will resemble a traditional command and control policy.

Finally, a monitoring system needs to be established to issue and track certificates and to impose penalties when an individual obligation is not fulfilled.

Specificity of Energy Efficiency Investments

In this section we investigate the specificity of EE investments. EE investments can be specific or generic. The degree of specificity is determined by the specificity of the investor's entire assets towards his commercial transactions. If for instance a manufacturer is running a factory able to supply goods for many different customers, an enhancement of the factory buildings isolation has the same low specificity as the remaining factory's equipment. Against that, enhancing a factory building, which houses highly specific assets, creates an investment with a higher specificity. Similar conclusions apply to efficiency improvements in production technologies and energy supply technologies.

As already said, TCE assume that the higher the specificity of an asset, the larger are in general opportunities to raise efficiency. The reasoning is that assets, which are adapted to specific purposes, may be driven more efficient. Analogously, this applies to EE: EE potentials can thus be assumed largest with highly specific assets. Also, the higher the targets in reducing energy consumption are, the more specific the EE investments get. Finally, since rents from specific investments are on risk with market governance, less EE investments than efficient will be undertaken as compared to a situation with some sort of regulation for EE.

This TCE reasoning adds an important explanatory (yet similar) aspect to the existing discussion on barriers to EE investments, which focuses on the prohibitive effect of high upfront-investments[13] and on the phenomenon of short payback periods stipulated by investors in energy efficiency measures.[14]

However, so far, the above arguments only apply to commercial energy consumers. Private households do not invest in assets for reasons of transactions. Their investments are targeted on final consumption. Thus, their own EE investments may not be analysed with TCE. This picture changes when energy services rather than purely energy is supplied. Investments in the household sphere will make supply of the energy service more efficient. These investments may also be highly specific or not. Examples for a highly specific investment are installed EE light bulbs. Albeit EE light bulbs themselves can be applied generic (their value is the same in the next best application), the costs of dispensing the bulbs are sunk costs. Thus, this part of the investment is entirely specific. Standardised analysis and proposal formats help to keep investments in consultancy rather generic. However, more ambitious energy savings need individual consultancy raising the specificity of this kind of investments.

Introducing Energy Service Companies (ESCOs) for commercial energy applications may also reduce the specificity of EE investments. Take again the example of consultancy: The costs of gathering information for how to achieve best EE may be highly specific to a single consumer of energy. Against that, an ESCO might use the gathered information also with other customers thus their investment is less specific.[15] There are also technical means to reduce specificity of EE investments e.g. movable CHP plants.

The analysis of specificity of EE investments reveals that the higher the targeted EE is the less appropriate get market governance. More hierarchical governance allows more spe-

12. Such a limit has for example been adopted for sink projects in the case of CDM: For the first commitment period, emission credits from CDM afforestation / reforestation projects shall not exceed 1% of the base year emissions of an Annex I country.
13. Vine et al. 2003.
14. For empirical studies on this phenomenon, see DeCanio 1993; Blumstein et al. 1980; Fisher and Rothkopf 1989; Koomey 1990, Levine et al. 1995, Stern and Aronson 1984, Bhattacharjee 1993 and references therein.
15. Of course the benefits from economies of scale may exceed by far the benefits from reduction of specificity in this case.

cific investments thus more EE is achievable. Hierarchical (and not market) governance is crucial to secure transactions between those parties who are investing in EE and those who are paying for the EE measures in the end. Even when regulation creates a market, the actors on this market will tend to establish forms of hybrid governance with some elements of hierarchy such as long-term contracts. This hybrid governance will soften the ongoing "high-powered incentives"[16] to act efficiently that are constituent for pure markets. ESCOs may reduce the specificity of EE investments into search and information. EE policy should be thus targeted also on establishing ESCOs.

Transactions in EE Tradable Certificate Schemes

The description of design features and particularly of possible restrictions made already clear that a tradable certificate scheme for EE does not allow *per se* for more freedom[17] to obligated parties than conventional command-and-control regulations.[18] So what kind of relations is then established through a certificate scheme? To answer this question with help of the TCE, we need to take a closer look on the additional transactions induced by a tradable certificate scheme for EE (Figure 1). These are:

1. Transactions between obliged parties (i.e. mostly the energy supplier) and users of the EE measures, i.e. the energy service customer.
2. Transactions between obliged parties for the purpose of trading certificates.
3. Transactions of obligated parties with (non-obliged) Energy Service Companies (ESCO), which are independently accomplishing EE measures and marketing EE certificates.
4. Transactions of obligated parties with broking intermediaries.

With transactions of the first type, energy consumers will trade certificates to obliged parties. To generate certificates, the energy consumers need to invest. Thus, these transactions are crucial for achieving EE through a regulation based on tradable certificates. As we have shown, EE investments may be highly specific to this transaction. So, these transactions tend to be governed by hierarchy, for example through long-term contracts, to secure the investments; otherwise, they would not take place. Such long-term contracts, however, limit the freedom of obliged parties once they entered in long-term contracts. The obliged parties may instead choose to invest themselves in EE on the level of the final consumer. In this case, a *contract* needs to fix that certificates arising from the EE investment are to be transferred to the investor. Hence, this option will not change the need to secure specific investments with long-term commitments.

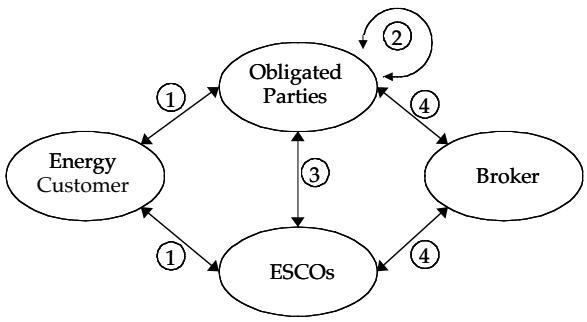

Figure 1: *Transactions induced by tradable certificate schemes.*

Alternatively, a *regulation* may assign the certificates to the investor. In that case, no transaction of certificates needs to take place. This option is equal to a situation where obliged parties fulfil their regulatory obligation by entirely internal business. This type of allocation of certificates seems to be more appropriate to reality: Investments by energy companies or ESCOs are usually regarded as crucial to achieve more EE on the demand side.

The regulation may even allocate the entire energy savings generated prospectively over the lifetime of the EE investment to the investor already at the time of investment. After commissioning of the EE investment neither the energy-consumer nor the obligated party would then need to prove that the energy savings actually took place. This implies a shift of risks from the investor to the regulator. Such an approach is only feasible in the case of measures with proven effectiveness and little opportunities for fraud like building insulation. However, such a scenario is not very realistic, as in both cases, i.e. certificate transactions governed by hierarchy or assigning directly certificates to the investor, the resulting governance does not provide an additional permanent incentive for the efficient use of energy, as pure markets would do.

Trade of certificates between obligated parties will take place as long as marginal costs for EE are different for different obligated parties. Given a functioning market for certificates, such a trade system ensures that marginal costs of the regulation are the same for all obligated parties. Economies of scale may be realised by bundling demand for EE. In this context, it is worth to note that energy suppliers as obligated parties will also incorporate their opportunity cost due to decreased energy sales in their calculus of marginal costs of EE. Thus, acquiring certificates on the certificate market may be more favourable than realising EE with own consumers even if direct costs of EE with own customers are lower than certificate prices on the market.

In the case that no specific assets are involved, i.e. when the generation of EE certificates is based on non-specific investments, trade on markets will be the prevailing and appropriate form of governance. As soon as specific investments are involved, the governance will tend to a more hierarchical form with long-term contracts softening the continuous incentives to act efficient. However, inves-

16. Williamson 1987, 90.
17. We understand that the expected higher degree of freedom in decision combined with prospected makes certificate schemes more appealing to the obligated parties than other types of regulations.
18. However, we do not regard command-control-regulations as the main alternative to certificates in liberalized markets. See below for a discussion of alternatives.

tors ready to take over some risk might still choose to market certificates on the spot market. The same might be true if obligated parties generate certificates exceeding their own obligation to a small amount of their obligation.

Energy service companies (ESCO) are in a similar position as obligated energy suppliers. This is particularly true for their relations towards energy consumers. Specific investments of ESCOs need to be secured by some hierarchical governance or long-term contracts as well. The possibility to trade EE certificates creates an additional income flow. Thus, ESCOs get less dependent on equipment-users' payments. As far as specific investments are involved, certificate transactions tend to hierarchical governance. However, as we discuss below, the often small share of certificate trade may restrict both the benefits from the additional income as well as the need for more hierarchical governance.

Brokers may facilitate trade of certificates and they may act as risk takers as well. Regarding the second issue, the same applies to brokers as was said on obligated parties and ESCOs, depending of course also on the broker's readiness to take risks.

One should be aware that income from certificate sale might only represent a small or even negligible part of the total income from EE investments. As far as energy consumers themselves undertake EE investment, income from reduced energy bills is often sufficient to cover the extra costs of the investment, as many calculations on feasible EE potentials show.[19] But even when energy suppliers as investors are concerned, benefits for example from strengthened customer-relations may entirely offset the costs of EE investment and reduced energy sales. Securing income from selling certificates may be thus less crucial than opening more opportunities for market governance. In these cases, an EE regulation of any kind is rather a means to raise awareness on EE potentials than a costly obligation. Tradable certificate schemes have thereby the advantage that market prices of certificates will reveal the low total costs of EE policy.

Monitoring and verification of energy efficiency efforts

Issuing certificates for energy efficiency efforts presumes that these efforts can be measured. The underlying problem is not trivial, as it implies a number of questions to be answered as precisely as possible:

- In order to measure the actual amount of energy saved, the energy consumption of the more efficient technology has to be compared to the "business as usual" case. But how should the baseline be defined to which the energy consumption of the energy efficiency measure is compared to in order to determine energy savings?
- How should the system boundaries of the baseline and of the energy efficiency measure be defined with respect to the geographical boundary: Local, regional or national? Or international?
- Alternatively, should the energy efficiency measure be compared to the less efficient technology it is supposed to replace, and which reference technology should be accepted? Should the reference technology be restricted to similar technologies, i.e. clean coal should be compared to old, inefficient coal power stations etc., or should it be compared to the existing *mix* of electricity supply respectively to the average heat supply systems? Or should it be compared to alternative investment potentials, i.e. the new high efficient gas turbine would be compared to a new coal-fired power turbine?
- Last but not least: How do we actually evaluate energy efficiency efforts – only in terms of, say, gigawatts saved, or does the measurement also recognize environmental impacts of the energy carrier used: Will a switch from "dirty" and inefficient coal to "cleaner" and high efficient gas-fuelled electricity be honoured in the measurement?

Many of the questions raised above were recently discussed in Germany at the occasion of plans to increase the share of high-efficient cogeneration by a combination of a quota (of eventually approx. 20% of total electricity generation) and a scheme of tradable permits. The ultimate objective of this policy measure was to substantially reduce CO_2 emissions. Discussions about how to define an appropriate baseline were complex, but never reached a consensus, and the quota system was never implemented.[20]

More prominently, the questions have also been discussed in detail in the course of the negotiations for so-called flexible mechanisms in the context of the international climate protection regime, i.e. the Kyoto Protocol.[21] The Kyoto Protocol provides for three instruments that allow fulfilling the emission reduction commitments by generating or trading CO_2 certificates at a location outside of the own national boundaries. CO_2 certificates can be generated through investments in emission reductions:

- Either in developing countries (Non-Annex 1) in the course of the Clean Development Mechanism (CDM), generating certified emission reductions (CER),
- Or in eastern European Annex 1 countries as contribution to Joint Implementation (JI), generating emissions reduction units (ERU),
- Or by purchasing emission reduction units (either CER, ERU or assigned amount units, AAU) on a market for tradable certificates.

In Europe, an emission trading scheme will be implemented by the year 2005, covering about half of the industrial energy consumers. Any plan to introduce efficiency-oriented tradable permits as discussed in this paper has to take into consideration of these real developments, because otherwise a parallel market would be created. This would result

19. See footnote 14.
20. Praetorius, Ziesing 2001.
21. See http://www.ghgprotocol.org/docs/baseline-energy.pdf for interim results of the GHG Protocol Initiative under the roof of OECD. In particular, see Viloette et al. 2000 for baselines in the case of energy efficiency. For baselines in general see Ellis, Bosi 2000; Bosi 2000, Ellis 2001; Bode et al. 2001 and Ellis 2002.

either in double transaction cost for the participating actors when the markets are completely separate, or in a smaller and probably too small market size for one of the two trading mechanisms (see below for some reflections on the issue of market size.

Since the ratification of the Kyoto Protocol, the international parties to the Protocol have been negotiating the details of these mechanisms with respect to measurability, liability and eligibility. In the case of JI and CDM, there is an ongoing, controversial and intense debate about how to define an appropriate baseline over the project lifetime and how and when to issue the certificates. The debate is still under way. First road tests and experience with emission reduction projects and proposals in the context of Activities Implemented Jointly (AIJ) and also with CDM and so-called "early" JI[22] suggest that:

- Energy efficiency measures are much more difficult to be evaluated with respect to their CO_2 savings as compared to renewable energy projects, and that
- Demand-side measures are significantly more difficult than supply-side measures.[23]

The latter can be attributed to the higher transaction cost due to the larger number of actors (in particular in the case of private households) involved in the project.

Standardising baselines and monitoring procedures may achieve some relief of the measurability problem. This option is also under discussion within the international Kyoto negotiations but not yet resolved. So far, the approach is two-pronged: first, to define a set of *principles* to be followed, i.e. the project proposal has to outline the expected emission reductions in a transparent and comprehensible way, and secondly, to allow for simplifications in the case of so-called small-scale projects (so far only made explicit, albeit not yet determined in detail for small-scale CDM projects).

The Netherlands started a national tender for JI and CDM projects already some years ago.[24] The guidebook for applicants offers a large number of simplifications, reaching from standardised analyses for small-scale projects to standardised emission factors for electricity generation for the next 20 years in JI host countries. The calculations are transparent and comprehensible. However, it is not yet guaranteed that international institutions responsible for approval of the generated emission reduction units will accept these simplifications.

In both cases, and also in the case of the German quota for cogeneration, experience shows that there is no "objective" baseline to which energy efficiency can easily be compared. Baselines are a clear-cut case for negotiations of the involved stakeholders, which again results in transaction costs.

To summarise, the combination of theoretical considerations and practical experiences show that the issue of assessing the success of energy efficiency measures in quantitative terms involves high transaction cost. However, there is still some hope for standardised baselines with thereafter reduced transaction cost, once the initial effort to determine these standards was successful.

Who should be obliged?

In this section we will discuss some aspects related to the choice of who should be obliged to fulfil a certain reduction of energy consumption. In a market environment for grid-bound energy like e.g. electricity, natural gas and district heating, the obligated parties can be either energy generators, distributors, suppliers or energy consumers themselves. To date, energy suppliers seem to be the most appropriate choice for some reasons[25]:

- The obligation will support the development of energy suppliers to become providers of genuine energy services.
- This way the incentive structure for suppliers can be changed so that it alters from maximisation of energy sales to maximisation of energy *service* sales.
- Supply companies have direct access to energy consumers so they can build their energy efficiency efforts upon existing customer relations and existing infrastructure.

Against that, energy *generators* have generally only poor knowledge on the demand side. Since distribution remains a natural monopoly even in liberalised markets, distributors do not act under competitive pressure. Incentives to lower costs are thus smaller in comparison with those parties acting under competition. An obligation directly imposed on the final energy consumer would directly motivate changes in consumption patterns. However, energy supply companies can be regarded as a more appropriate addressee, as they experience lower transaction costs both with the regulator and the obligated parties, and also may realise economies of scale with respect to information and specific knowledge on energy efficiency measures as compared to the individual consumer. A synthesis between the options of obligating consumers vs. obligating suppliers is to obligate the customers but relegate the obligation by default to energy suppliers.[26] A right to apply for fulfilling the obligation themselves remains with customers. This will allow particularly large energy customers to realise own EE potentials and benefiting from the regulation.

Regulations tend to focus on grid-bounded energy since these sectors have been regulated traditionally for reasons of natural monopolies. Thus, public influence in this sector has been large. However, there is no reason for not widen the obligation for EE also to non-grid-bounded energy carriers like heating oil or even transport fuels. Particularly concerning the heat market, this would avoid distortion of markets which otherwise occur when solely natural gas or district heating suppliers are obligated.

22. JI measures are only eligible when they start after January 1, 2008. The (unofficial) mechanism of "early" JI allows for JI projects when the host country agrees in a contract to transfer a corresponding amount of AAU to the investor (country).
23. DIW 2003.
24. ERUPT and CERUPT, see information and links at http://www.senter.nl/asp/page.asp?id=i000000&alias=erupt.
25. Adapted from Wuppertal 2002.
26. See the Swedish proposal for a certificate trading scheme for electricity from renewable energy sources (Elcertifikat 2001).

Market Features

Policy instruments with tradable certificates to balance obligations are particularly favourable compared to command-control policies, if large differences exist between individual marginal costs of EE measures of obligated parties. The larger these differences the larger will be the induced trade of certificates. Presumably, differences in marginal costs get larger the wider the scope of the regulation in terms of accepted EE measures and spatially is.

Conventional economic theory suggests that a market will produce the best results:

- When the goods traded are homogenous,
- When information is perfectly transparent to all market actors (buyers, sellers, intermediates), and
- When a certain critical minimum market size is exceed.

These three features are all interlinked: The energy efficiency certificates should best be issued in the same form and size, for example denoting "100 kWh saved" or – in the case of an environmentally focussed certificate – denoting one ton CO_2 saved and so on. The critical market size is the easiest achieved when there are not too many different products and parallel markets. Perfect information allows for access of many buyers and sellers to a market (including international actors), and information (i.e. transaction) costs are minimised when goods are homogenous and when transparency is guaranteed for. It is for these reasons that stock exchanges are usually quoted as the real market that comes closest to a "theoretical optimum".

In the case of energy efficiency certificates, these aspects also have to be considered. First and most importantly, defining and issuing a homogenous certificate is indispensable. This simultaneously eases the information problem and thus the transaction cost involved on the level of the certificate market. Eventually, the market size is also the larger the more energy efficiency measures are included into the trading scheme *or* the larger the obligation (or quota) for the target group is being set.

Hence a unique EE certificate scheme for the entire of the European Union would give the most benefits. All kinds of EE measures with all kind of energy consumers should be awarded with the same type of homogeneous certificate. No different partial obligations for certain technologies should be imposed since this would differentiate markets thus reduce competition. Such an approach would leave decisions for the most cost-efficient energy efficiency to the market for certificates. One may support politically more EE for different reasons like reduced emissions from energy generation, enhanced security of supply and raising the competitiveness of industry. To date, as has been argued above, EE for the most part is being appreciated as a contribution to reducing the environmental impacts of energy use, and more specifically to the reduction of emissions, particularly of green house gas emissions (GHG). Most countries thus see energy efficiency as part of their climate protection strategy.

For these reasons, it seems reasonable to integrate a market for tradable energy efficiency certificates with a future EU emission trading scheme. This would create one homogenous good, and avoid parallel markets and the subsequently relatively higher transaction costs: A separate regulation for EE certificates would otherwise differentiate the GHG certificate market, risk to create a sub-optimal market size, and create higher information costs for participants because they may have to either chose between markets or to deliver to both.

International experiences

This section describes briefly two regulations with trading possibilities recently implemented in Europe.[27] A short overview is given about trends in regulation for promoting renewable energies in Europe and the US.

THE BRITISH ENERGY EFFICIENCY COMMITMENT

The British "Energy Efficiency Commitment" obliges all electricity and gas suppliers to save a total of 62 TWh of fuel-standardised energy by 2005 against 2002.[28] This obligation only covers the energy supply to households. Only suppliers with more than 15 000 customers need to meet the obligation. The total target is broken down into individual obligation in relation to individual market shares. Generally, all EE measures need to get approval by the regulator to achieve eligibility for the regulation scheme. The regulator has defined a number of standard EE measures that he accepts for fulfilling the obligation. The energy savings of these standards measures are quantified, too. Thus, energy savings need not to be metered measure-by-measure, which allows reducing transaction costs quite considerably. New and innovative schemes not contained in the list of standard measures are still possible but require independent verification. Subsidised supply of compact fluorescent lamps is accepted as an eligible measure to a limited extent per served customer.

As another restriction, at least 50% of the EE measures must take place in low-income households. Thus, the market for eligible EE measures is differentiated in low-income households and others. To encourage energy services, they will be rewarded with an additional 50% on top of the sum of energy savings of the single EE measures content of the energy service. Energy services are thereby defined as consisting of at least two different single EE measures with a single customer, and need to incorporate individual customer consultancy. The total energy savings over the lifetime of the EE measure will be awarded to the energy supplier initiating the EE measure. Future savings will be thereby discounted.

The regulation does *not* provide tradable certificates. However, some limited flexibility is provided in two ways:

- Energy savings may be traded. The regulator needs to approve the trade.

27. See other papers in this summer school by Pavan and Pagliano for more details on the Italian system.
28. Obligation 2001.

- Individual obligations may be also traded. Again, this trade needs official approval.

Thus, anonymous trade is not possible but only bilateral over-the-counter trade. Spot trade is not possible either. This trade will thus allow equalising marginal costs to a certain extent but it not provide any public information on prices of EE. In summary, we may characterise this system as a rather conventional command-control policy with some restricted flexibility concerning fulfilment of obligations.

ITALIAN ENERGY EFFICIENCY CERTIFICATE TRADING

In April 2001, two Ministerial Decrees set targets of reducing consumption of electricity by 18.6 TWh/a and of gas by 15.1 TWh/a respectively against a business-as-usual scenario in the period of 2002 to 2006.[29] This relates to between 5 and 15% of the Italian Kyoto target.[30] The national target is apportioned to electricity and gas suppliers with more than 100 000 customers according to their individual market shares. This translates to 22 obligated gas suppliers and 8 obligated electricity suppliers. At least 50% of the individual obligations need to be covered by EE measures in the electricity sector, gas sector respectively whereas the remaining obligation may be covered with any other EE measures. This means that for instance also savings of heating oil are eligible. There exists a comprehensive illustrative list of eligible EE measures. The regulator issues certificates to obligated electricity and gas suppliers as well as ESCOs who have paid for EE measures. Trade of certificate does not need official approval. Trade can take any form from bilateral contracts to transactions on anonymous markets. A penalty is imposed in case of non-compliance.

The success or failure of the trading scheme cannot yet be evaluated. Prospectively, obligated parties will as much as possible try to fulfil their quota with EE measures that do not decrease their individual sales. Due to the rather limited number of market actors we expect bilateral trade rather than anonymous spot market trade with certificates if any at all.

RENEWABLE PORTFOLIO STANDARDS

To increase the market penetration of renewable energies, a range of regulations have been implemented in various European countries in recent years.[31] Mainly, price regulations have been established. However, a number of countries (Italy, Sweden, United Kingdom) have recently turned to quantity regulations with tradable certificates (also called Renewable Portfolio Standards or quotas); others abandoned or postponed such plans (Austria, Denmark, the Netherlands). A tender system can currently only be found in Ireland.

Fifteen U.S. states have recently implemented Renewable Portfolio Standards, often (but not always) as a component of electricity reform: These are Arizona, California, Connecticut, Hawaii, Illinois, Iowa, Maine, Massachusetts, Minnesota, Nevada, New Jersey, New Mexico, Pennsylvania, Texas, and Wisconsin (DSIRE 2002). Some first success stories are beginning to emerge from Arizona, Texas and Wisconsin, and there is much hope for the standards in Massachusetts, Nevada, and New Jersey. However, to date, few of these policies have been operable for more than a year and several have not yet begun. The experiences with the Texan Standard show that certificates are mostly jointly trade in the framework of long-term contracts.[32] The Renewable Portfolio Standards in several of these states do not contain very strong provisions and may do little to instil confidence in the renewable energy industry.

In summary, we see a mixed picture of different renewable energy regulations in the USA and Western and Central Europe. Even though widely discussed, Renewable Portfolio Standards have only been recently implemented in a number of countries and states. It is important to note, that in spite of the broad attention Renewable Portfolio Standards have gathered in the scientific and political discussion no general trend towards Renewable Portfolio Standards can be seen to emerge. Countries are still establishing new price regulations (in Europe e.g. Austria, France) and others have postponed or cancelled plans for Renewable Portfolio Standards (in Europe e.g. Austria, Denmark and the Netherlands). Growth of electricity generating RE has predominantly take place in countries with price regulations. Tender systems have been only established in a few countries and have mostly ended now.

Conclusion

Regulations to promote energy efficiency with certificate trading allow equalising the individual marginal costs of all obligated parties. Moreover, bundling of demand for EE can activate potential economies of scale. This creates also opportunities for Energy Service Companies thus promoting the shift of traditional energy suppliers towards energy service providers. The nature of many EE measures i.e. their transaction and investment specificity will however restrict markets in practise. Long-term contracts rather than spot trade will be the prevailing form of governance. The particular design of regulation may thereby heavily influence the choice of appropriate governance. The definition of eligible EE measures remains a challenge in terms of balancing prospective gains due to a wider, flexible formulation of eligibility and the threat of stimulating hot-air rather than real Energy Efficiency. This is also reflected in two realised regulation on EE comprising also flexible market elements.

Such regulations allow promoting EE without any burden for public budgets. Moreover, the total burden on customers is prospectively minimised to achieve a certain level of EE. Yet, tradable certificate schemes are not the only policy option promising these features. Tenders organised by public authorities and financed out of general surcharges may serve the same purpose as well. Considering transaction costs, such an option might even distort competition between larger and smaller suppliers less than certificate trade.

29. AEEG 2002.
30. Malaman, Pavan 2002.
31. Haas et al. 2003.
32. Langniss, Wiser 2003.

To date, an EE oriented scheme of tradable certificates cannot be discussed without considering the EU emissions trading scheme, which will be introduced by 2005. Within this scheme, energy efficiency will also play an important role. It would not make sense to create two parallel markets for EE certificates on the one, and for CO_2 certificates on the other, because transaction cost involved would be much higher. However, the above reasons for promoting EE should also make clear that the benefits of EE go beyond pure mitigation of GHG. Thus a GHG-policy alone does not provide sufficient incentives to mobilise all the benefits that comes with EE. A specific policy to foster EE is thus grounded in the specific bundle of public benefits, which comes with enhanced EE.[33]

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