Constructing Green Markets: Design Challenges and Pioneering Experience

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Introduction

Following deregulation of the principal energy markets, and EU failure to impose harmonised taxation on polluting emissions, some European countries have moved towards market based greening of energy supply. This move is demanding, however, as political authorities thereby engage extensively not only in market regulation, but also in market construction, even to the extent of taking responsibility for creating demand and balancing it with sufficient supply.

Based on experiences from the Swedish electricity certificate market, this paper discusses challenges facing "green" market construction, including such issues as: Static efficiency versus dynamic innovation and the challenge of immature green technologies; market functioning and competition; the challenge of matching commercially based investment with political commitment; the problem of market calibration; effects of the certificate system on the power market; and distributive issues. The paper also explores how these issues and challenges reflect underlying goal conflicts and theoretical assumptions.

Modes of Market Intervention and Design

There is a long tradition of public intervention for in market regulation and market adjustment in modern Western economies. The green electricity- and emissions markets, represent an ambitious extension of the regulatory agenda, where public authorities have moved further into market-based governance by substituting direct administrative intervention by market governance. However, at the same time public authorities are engaging deeply strategically, by taking on over all design of new quasi-markets as a major policy tool.

Contrasting the certificate markets with other market-oriented policy tools may serve as a useful point of departure to highlight the specific regulatory characteristics of this type of policy tool.

Firstly, *market adjustment* constitutes perhaps the least radical form of public intervention. Through government intervention already existing markets are adjusted to function better and/or include new concerns. This adds an administrative restriction to the general exchange regime, but basically leaves the regime intact within this restriction. An example would be environmental taxes to introduce externality costs.

Secondly, *de-regulation* or opening up planned economy/regulated monopoly to competitive market exposure represents a more complex form of public intervention. The assumptions are, however, that there is an underlying interest from both buyers and sellers to trade. The role of government thus is to facilitate organisation of the sector under general market law. An example would be the opening up for competitive energy markets.

Thirdly, competitive market organisation may necessitate that government engages more directly also in *market design for specialised transactions.* Public authorities may then add on to the general exchange regime, a specialised exchange regime, often to supply specialised supplementary facilitation of the primary exchange. An example would be specialised functions in electricity trade: balancing power; grid access etc.

Fourthly and finally, green electricity markets and similar quasi-market constructions represent some of the most ambitious engagements as they include *complete market design, including the constitution of demand and/or supply preferences*. This model of market-intervention thereby includes the fundamental motivation for exchange as an object for strategic public policy design.

The four regulatory approaches are briefly summarised in table 1

Table 1: Typical uses of market mechanisms in current regulatory practice

Regulatory Approach	*Main focus*	*Characteristics*	*Example*
I Market adjustment	existing markets are adjusted to function better/ include new concerns	Administrative restriction added to the general exchange regime. The restriction is set outside of the market system	Environmental taxes
II De-regulation	Opening up for competitive market exposure	New sectors opened up to general market rules	Opening up for competitive energy markets
III Market design for specialised transactions	Institutionalisation of specific elements beyond the standard market rule model	Adds specialised exchange regime,	Specialised functions in electricity trade: balancing power; grid access etc.
IV Market design with constitution of preferences	Institutionalisation of specific elements beyond the standard market rule model Actors and preferences are explicitly constituted by design	Transfers the design element to the fundamental motivation for exchange	Green certificates markets Climate/ emissions markets

When some European governments now recur to the highly ambitious form of policy-intervention by targeted market design, they are embarking on a demanding strategy where the analytical premises are debated. There are at least two dimensions to this debate:

The first dimension concerns the question of the relevant theoretical point of departure. The motivations for green certificate markets are highly complex and cover economic efficiency concerns, innovation concerns, industrial policy issues as well as distributive concerns across regions and technologies. At best, each of these concerns may be handled within consistent analytical frameworks, while a consistent framework for integrated analysis is difficult to find.

The second dimension concerns how strongly the market design can rely on deductive theorising and how much it must rely on experiential learning. The views here range from a strong deductively oriented market-design approach to softer empirically grounded learning.

The two dimensions are interlinked as some theoretical positions are more open to deductive analysis, whereas others are more heuristic and open to supplementary empirical construction.

Competing Theoretical Perspectives

Both the pragmatic and the theoretical literature cites several goals behind green certificates: Reduced pollution, technological development, security of supply, and increased regional employment.

This involves a variety of theoretical perspectives, ranging from static efficiency and resource optimisation and eco-efficiency to innovation theory and industrial policy and to social acceptability and legitimacy issues. These perspectives may easily lead to divergent strategic/policy conclusions.

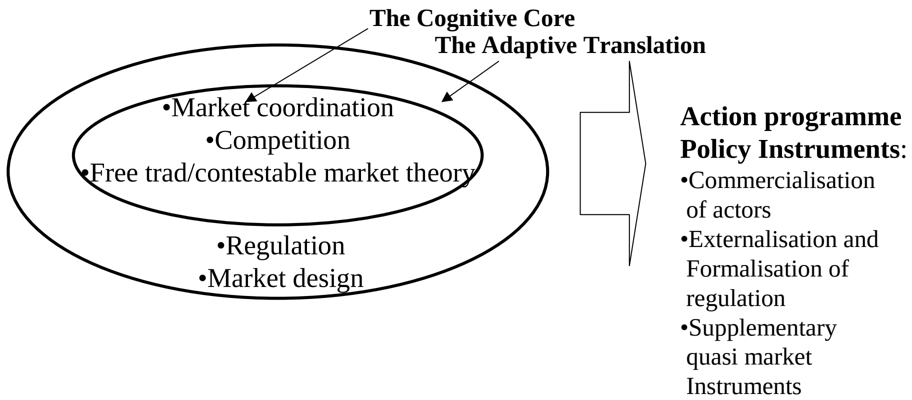
The Market-efficiency Perspective

The core focus of the market efficiency perspective is on efficient allocation of economic resources between alternative deployments in an economy where both economic resources and technologies are given and scarce. The typical method employed is optimisation, and the fundament of an extensive theoretical framework is the welfare theorem postulating that a competitive market based on the free trade solution is Pareto-optimal (Samuelson and Nordhaus 2001).

In organisation theory March’s (1991) concept of exploitation covers a similar cognitive orientation, characterised by a focus on refinement, choice, efficiency, selection, implementation and execution.

The action programme or core policy instruments in this perspective are market exposure, competition policy and regulatory design that foster competitive pressure and cost efficiency. Within organisations this approach fosters combinations of internal competitive incentives and tight programming of efficient routines with a cost minimisation focus (figure 1).

Figure 1: The Market Efficiency Perspective[1]



The innovation/exploration perspective

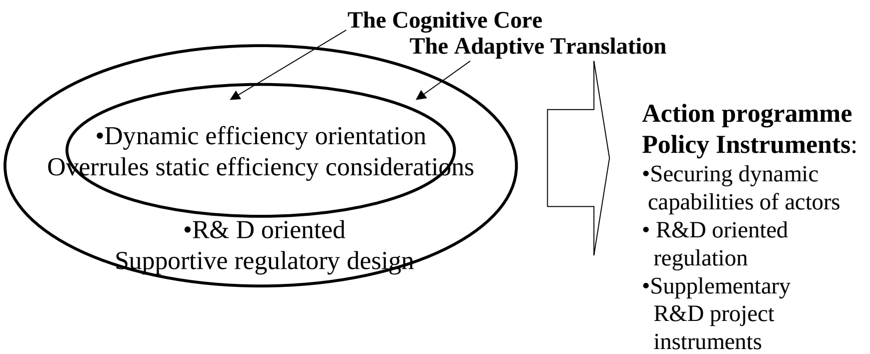
The innovation/exploration perspective sees environmental reorientation of the energy system as a question not only of efficiency, but also of technological change.

The core focus of this model is on development and growth as a function of innovation. Competitive pressure is also here of central importance, but then as a force to stimulate creativity and not cost minimization (Edquist 2001; Lundvall 2002) (figure 2).

In organisation theory March's (1991) concept of exploration covers the orientation characterised by a focus on variation, risk taking, experimentation, flexibility, discovery and innovation.

Core policy instruments within this perspective are support of research and development combined with facilitation of industrial learning environments that support innovation and technological learning. The aim is to elicit new technical solutions and to stimulate promising already operative technologies to cut costs and increase performance through protected niche markets and the associated learning curves (Wene 2000).

Figure 2. The innovation/exploration perspective



[1] Following Lakatosh (ref…..) we distinguish between the cognitive core and the adaptive translation of the core into "realistic" propositions and/or normative policies

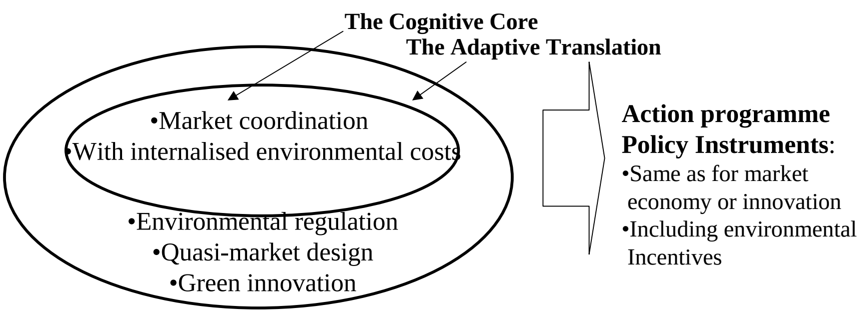
The Eco-efficiency Perspective

The eco-efficiency perspective relates specifically to the environmental policy dimension and focuses on internalisation of environmental damage or negative external effects into the business model and into the regulatory market design. Depending on policy orientation this model may be compatible with either the market-efficiency or the innovation perspectives (figure 3).

Interpreted within the efficiency/ exploitation oriented paradigm, the focus of eco-efficiency is on how economic incentives can be built into and restructures the market, either through taxation or quasi-market designs so as to introduce a trade-off for the firms between net private benefits and marginal environmental costs (Turner & Pearce 1990).

From an organisational point of view eco-efficiency raises a focus on building pollution controls, environmental management and product stewardship into the organisational design of the firm in response to regulatory pressure. The eco-efficiency perspective is often integrated in the market-efficiency approach., but could subsidiarily be interpreted within the innovation/exploration paradigm, where eco-efficiency may be built in as a major innovation/exploration driver through specific orientations of research &development policies and programmes, and/or through privileged resource allocation to ecologically oriented niche markets to drive learning curves (Wene 2000, Kemp, Schot & Hoogma 1998).

Figure 3 The Eco-Efficiency Perspective

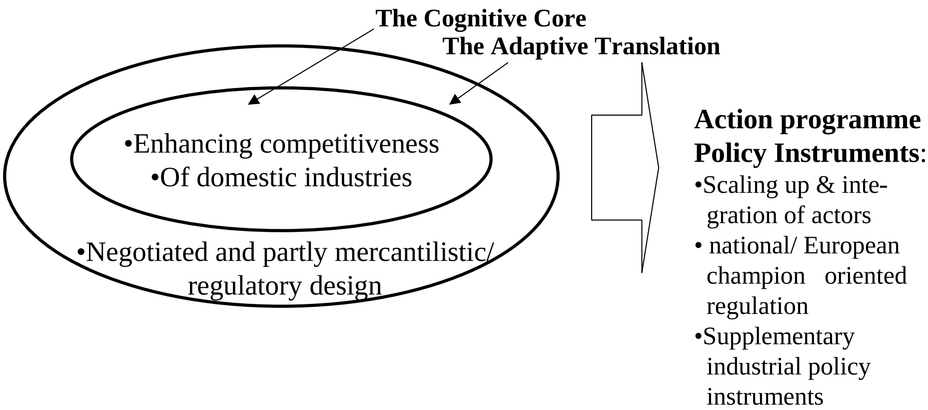


The Industrial Policy Perspective

The core focus of the industrial policy perspective is on building up and maintaining industrial capabilities within the territorial domain in focus. Industrial competition on a global scale is therefore partly defined in mercantilist terms as a race between national/regional champions (whether at a firm or industrial sector level). The role of public policy is to provide the partnership and nurturing context for the national champion.

While the pure market efficiency perspective is neutral to national championship, the industrial policy model is likely to favour the use of market/efficiency pressures as long as strategic domestic industry prospers. The industrial policy perspective may also be linked to the innovation/ exploration perspective, but only to the extent that it stimulates technological development favourable to national/regional industrial development (figure 4).

Figure 4. The industrial policy perspective



The Social Acceptability Perspective

This perspective introduces social acceptability as a major design criterium for policy solution. From this point of view, the concept of social equilibrium is introduced as an additional criterion to the neoclassical concept of economic equilibrium. Successful policies emerge only in those situations where both criteria overlap (figure5)

Some pure economic market solutions with a high degree of economic efficiency may imply socially unacceptable distributive effects and not qualify on the social criteria. On the other hand, solutions where the economic realities are neglected would be examples of unilateral socio-political equilibria where economic efficiency conditions are not met.

Figure 5. The social acceptability perspective[2]

[2] From Finon, Johnsen & Midttun (2004)

Deductive Rationality and Learning in Market Design

In addition to competing theoretical perspectives there is, as already mentioned, also a question of balancing theoretical-deductive and experiential learning in quasi-market design. Just like in financial market analysis, market design can be undertaken under strong, medium or weak deductive theoretical assumptions. In the latter case, theoretical analysis may be strongly supplemented by a more procedural learning approach.

The *strong rationalist position* is characterised by a dominant belief in deductive design. The green certificate market is constructed with a clear theoretical anchoring, which in principle makes it possible to impute strong a priori optimisation logic into the regulatory design. This design thereby also allows clear predictability of outcomes.

It is recognised, however, even within the circle of game theoretical market-designers, that market design entails considerable complexity which makes it necessary to subscribe to a *medium or weak deductive-rationalist position* (Roth 1999, McMillan 2003). Practical design carries with it a responsibility for detail that confounds the simple models and deductive analytical methods that characterise most game-theoretic analysis in the economic literature. Complexity may here refer both to complexity of the strategic environment itself, as well as complexity of participants' behaviour (Roth 1999)

In its medium and weak deductive positions, the rationalist green electricity market design position blends with a competing *learning perspective.* This perspective suggests that rather than being designed up front, markets evolve over time through discovery and creative participating actors.

The learning perspective differs essentially from the rational market design where a chosen course of action is determined by deductive theoretical analysis, even if blended with substantive knowledge. In the market-process world of entrepreneurial discovery, on the other hand, one would expect initial plans to be at least partially flawed. Deficiency in market design would subsequently be adjusted through the responsiveness of alert, imaginative entrepreneurs to the opportunities revealed.

There are some fairly obvious links between the debate over theoretical perspectives and the debate over the relevant mix of deductive and empirical experiential analysis:

When strong rationality is evoked in market design, it is usually done with explicit or implicit reference to the market-efficiency perspective. Based on simplistic behavioural models within a well defined functional scheme, this analysis, in many cases allows clear deduction of optimal policies and strategies.

The weaker rationality assumptions implied in a learning approach to regulation is typically theoretically anchored both in the Austrian tradition in economics and in innovation theory.

The following sections explore the challenges of green certificate market design in the pioneering Swedish elcert case. The Swedish elcert model is, a case of a relatively strong design ambition, and is also reasonably well documented based on 1 1/2 years of experience

The first section provides a general description of the case and its development over the first 1 ½ years, based on evaluation reports and documentation from actors and traders. The second section discusses the case findings in the light of the theoretical issues raised above.

The Swedish Elcert-case[3]

The electricity certificate system was introduced in Sweden in May 2003, to stimulate generation of electricity from renewable energy sources. The goal was to increase the share of new renewable electricity with 10 TWh before 2010, based on the 2002 level. Electricity generation from wind, solar energy, peat and certain bio-fuels, in addition to small scale hydropower projects, may under this scheme attain energy certificates.

The introduction of electricity certificates implied a regime shift in Swedish support policy for renewables, away from fixed subsidies towards market based support.

The Core Model

The Swedish certificate model is based on an obligation for electricity users, with some exceptions, to buy a certain number of certificates, depending on their total consumption, their so-called quota obligation. For ordinary households the electricity retailer handles the obligation. In 2003, the quota obligation was set at 7,4% of electricity consumption. This quota obligation will successively be increased, up to 2010 to 16,9% on a yearly basis.

If the quota obligation is not met, the responsible must pay a levy to the state. The levy is set to 150% of the volume weighted average electricity certificate price under the given certificate period (1. April previous year to the 31. March the year after). For 2004 and 2005, the levy was however fixed at 175 SEK and 240 SEK respectively. The electricity consumption is declared to the energy authorities march 1st evey year. On April 1st, el-certificates corresponding to the quota obligation must be placed on the quota-responsible's certificate account. (Energy Authority I)

Preliminary statistic overviews show that about 7 million elcertificates have been issued under the period May 2003 until March 2004. These certificates came from around 1700 plants. The largest share of certificates came from biofuel electricity production (74%). Hydropower stood for 18% and wind for 8%. (Energy Authority II)

The quota obligation for 2003 amounted to 4.4 million el-certificates. Only 3.5 million certificates were redeemed, which gave a quota fulfilment of about 79%. The average price of certificates in the first period was 216 SEK.

Energimyndigheten (The Swedish Energy Agency), registres eligible generation devices and oversees quota compliance. When a facility is accexpted, a montly certificate is issued, based on the electricity generated in the facility.

Svenska Kraftnät, the TSO/national grid company, registres fulfilled contracts including number of certificates and price. Its main task as far as the certificates are concerned is to develop and run a register of certificates and their owners, to issue certificates, based on the performance measurement of electricity generation that qualifies for certificates.

At the present, the Swedish electricity certificate system only includes generation in Sweden. The Swedish government has, however, expressed an intention to allow international trade in certificates in the future[4]. Norway is presently planning

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[3] Based extensively on information provided in the Overview by the Swedish Energy Authority (2003) and personal communication with a specialised market broker (Greenstream, Arne Jacobsen; and a trader Sydkraft, Stephan Chudi)

[4] prop 2002/2003: 40

to introduce a similar certificate system, and is plans to integrated its system with the Swedish.

Qualifying Generation Potential

The government estimate at the beginning of the elcert system was that the existing generation capacity entitled to certificates was around 6.5 TWh. The future potential for electricity generation qualifying for el-certificates is estimated by Swedish authorities as given in table 2.

Table 2: Estimated reasonable potentials, including existing generation (TWh), (from Swedish Energy Agency 2004)

	2010	2012	2015
Wind power	4.2	9	10
Chp	4.5	5	6
Hydropower	2.25	2.3	2.5
Industrial burners	6	6.4	7
Sun, waves, geothermal	0	0	0
Sum reasonable potential	16.95	22.7	25.5

Wind

The natural potential for onshore wind is by the Swedish government estimated to be between 35 and 70 TWh. The potential for ofshore wind is estimated to be 100TWh, limited only by the sea deph.

According to Swedish energy authorities, the technical limitations to wind power is probably how the rest of the electricity system may be balanced in a cost-efficient manner[5]. The largest practical limitation on wind power, they argue, is probably the licencing procedures, and the resource demand they put on licencing authorities.

Bio-fueld chp

The natural potential for bio-fueled chp in 2010 is estimated by the energy authorities at 60 TWh. The span of chp generation costs is large: between 46 – 61 øre/kWh. These potentials are based on the market managing to establish 20 burners with an average effect of 20 MW with a utilization of 4500 hours.

A central condition for introducing a new burner is probably that there is a need for a new burner in the local system as it is not probable that well functioning burners will be removed.

Hydropower

The natural potential is estimated on the basis of Sweeden’s topography and hydrology. The technical potential has been set to 130 TWh. The technical potential

[5] The energy authorities estimate that the limitation may be around 10-30% wind power share of the total system[5]. The economic potential corresponds to the technical at prices around 45 to 65 øre/kWh.

for increasing generation in existing large scale hydropower facilities, in a recent Government review, has been estimated to 3.1 Twh. The same review has estimated the economic potential for further large scale hydropower development to 5 TWh. The potential for small scale hydro, which is covered by the certificate, according to Government is 1 TWh.

Industrial burners

The Energy authorities have estimated that the renewable generation within industrial boilers can be increased to 7 TWh until 2015. Generation the first 12 months of the certificate system was 4.5 TWh renewable electricity. Based on existing plans, the Energy authorities expect generation in year 2010 to be around 6 TWh.

Solar, Wave and Geothermic Energy

Solar, wave- and geothermic electricity generation are less mature techniques and are likely to find a place within the certificate system only after 2020. However, the potential for solar and wave energy is extensive[6].

There is an estimated potential for commercially exploitable wave energy of 12 TWh in Sweden. At the present, prototypes are being tested, and the Energy authorities explect considerable wave energy to come on stream after 2020.

Biofuel

The increased generation in industrial boilers and in chp that have been commented on earlier, will demand large quantities of biofuel. The potential for ecological, technical and economic exploitation of biofuel, is, by the Energy authorities, estimated to 78TWh, compared to the existing exploitation of 125 TWh/year. It is seen as realistic to increase bio-based power generation by 3 TWh until 2010.

Supply Side Actors

The main actors on the supply side are paper and pulp industry, regional heating industry, wind producers and small scale hydro producers

Paper and Pulp Industry

Swedish paper and pulp industry have traditionally generated electricity from waste products from the paper and pulp production. Particularly chemical processing with black liquor as a waste product, has been used for energy generation, while also utilising the heat for industrial processes. Mechanical processes have to a lesser extent resulted in energy generation.

[6] The cost for electricity generated by solar cells is today estimated by the energy authorities between 3-5 kr per kWh and even if this cost is assume to come down to 2 kr /kWh year 2012 and 1 kr by 2020, the electricity certificate instrument cannot be used to support this development.

While the energy generation from paper and pulp industry has served as part of waste management and self-supply of electricity, the new certificate market has provided a new focus for energy generation as an attractive business area. Paper and pulp industry is therefore gearing up electricity production and is considering building up further capacity.

Regional Heating

Swedish regional heating industry has also been one of the contributors to the elcert supply. The certificate add on to the electricity price makes biofuel an interesting alternative to coal for this industry. We have therefore seen extensive fuel switching to profit from the new certificate market.

Like for the paper and pulp industry, the certificate market may stimulate refocusing and motivate this industry to develop electricity generation as a business area. Some companies may be motivated to install electricity generation capacity in the heating system, and it could also motivate these companies to uphold production for electricity only in periods where heating is not required. In these periods they might develop cooling capacity to match the electricity generation instead.

Wind Generators

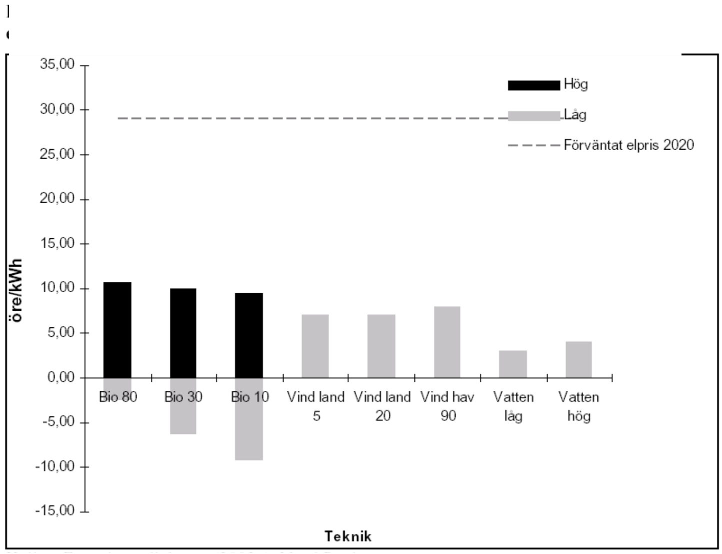
Wind generators have not stood to profit from the Elcert market. Their support under the previous regime included 9 øre kwh + environmental bonus of 8 øre + additional investment support. With the elcert system the environmental bonus and the 9 øre have been taken away?? The elcert regime has therefore not stimulated new windpower in Sweden.

Small hydro, which is also under the Elcert support regime, had less privileges under the old regime (only 9 øre) and may be mored easily accommodated under the Elcert regime.

Generation Costs

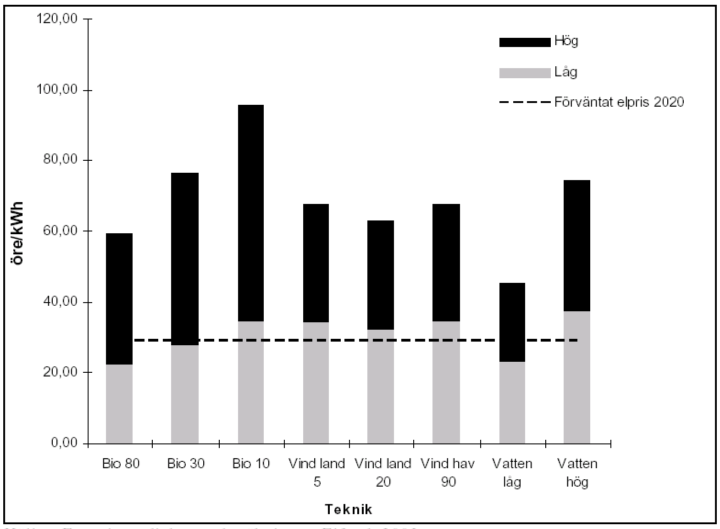
Existing electricity generation qualifying for certificates, and was characterised by fairly low variable generation costs. A number of older plants had their capital costs largely payed back, other plants had investment subsidies from previous support regimes, and a nuber of new facilities still retained capital costs. For some bio-based chp facilities with heat generation the variable costs have been negative.

Figure 6
Variable costs of green el generation



On the other hand, costs for new generation facilities are much higher. The estimates vary extensively between different techniques, based on the time horizon, the discount rate used in the net present value calculus and the contribution given from heat production[7].

Figure 7
Generation costs for existing renewable technologies



Källor: Energimyndighetens beräkningar, Elforsk 2003

[7] The lowest electricity generation costs are the result of the longest depreciation period of 30 years, the lowest discount rate (6%) and the highest heat contribution of 0,21 øre/KWh heat.

Demand Side Actors

The main actors on the demand side are electricity suppliers who are default actors, while some industrial actors have opted for direct demand responsibility. A small minority of households have opted for direct demand responsibility. Heavy industry has been exempted from certificate obligations (0 obligations)

Electricity Auppliers

As default demanders, electricity suppliers have not experienced a strong competitive challenge in attracting customers. The traditionally low customer focus on electricity supply has spilled over to the certificate market and allowed a confortable profit level for this new market segment, with profit rates running up to 50% on the certificate price.

Industrial Actors With Direct Demand Responsibility

As a consequence of the sizeable management costs with the default providers, a number of industrial actors have opted for direct demand responsibility and are managing their obligations themselves.

Households With Direct Demand Responsibility

Very few households have opted for direct demand responsibility. Given the marginal importance in the personal economy, this has been a field for green enthusiasts.

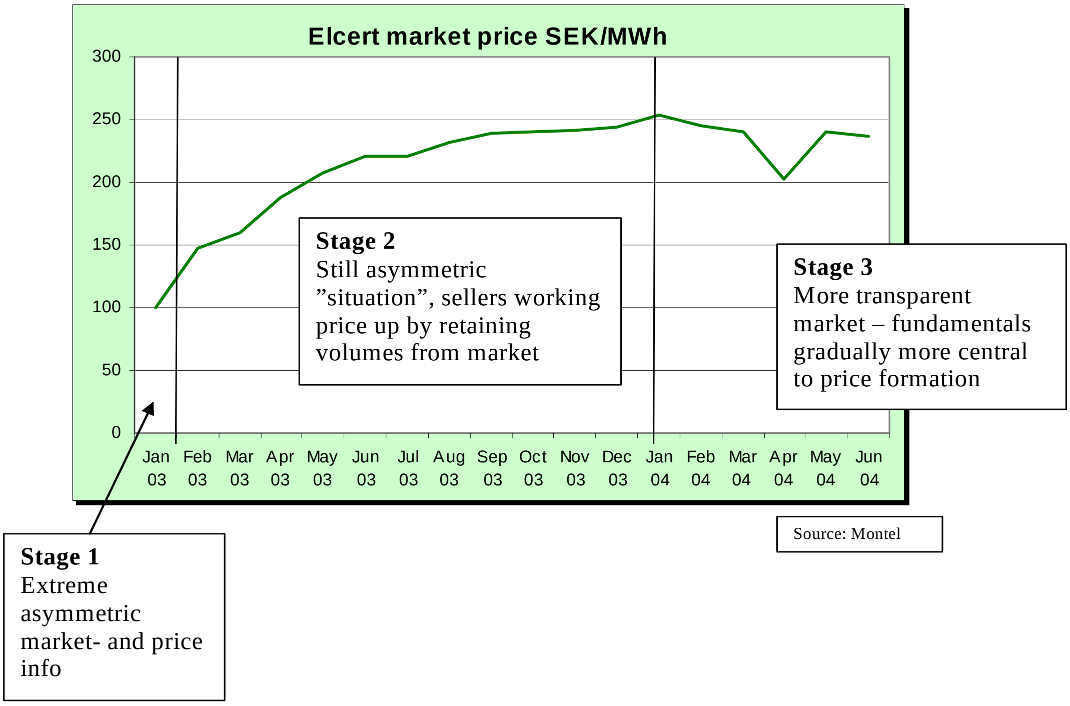
Heavy Industry

Heavy industry has received 0 obligations in the initial round. With extensive gains from their supply side engagements, they have thus had good windfall profits

Market Development

The price expectations in the emerging elcert market was around 100 Kr/MWh, before the system was put into operation. Since then, the prices have risen sharply. For the major part o 2003 and the first months of 2004, the price has been around 240 SEK/MWh. After a brief fall in April, down to 200 SEK/MWh, the price has again been back to 240 SEK again (figure 9).

Figure 9: Price development and stages[8].



Early Stage

The transaction forms in the Swedish market were initially very much modelled on experiences with the Dutch market.

Trade was typically bilateral, between large producers and distributors, often within the same integrated company. However, OTC, or broker-mediated trade also dominated this trade.

Specialised brokers such as Greanstream were initially major intermediaries in this trade, along side specialisation within the large Nordic companies such as Vattenfall, Sydkraft, Fortum, Statkraft and Norsk Hydro

The typical contract would be a forward contract, based on meeting the annual quota obligation. Typically this would entail the producer providing steady generation for a period of ½ to 1 year on a fixed price basis. There are a few long contracts running up to 2010.

Maturing Stage

More recently, brokering has been taken over by large general power brokers like Montel, ICAP and SKM in Norway.

In spring 2004, the Nordic Power Exchange, Nord Pool introduced a spot-product, but this has hardly been traded. The spot orientation replicates the regular power market, and did not meet the forward needs of the elcert market, given by the regulatory design. With an underlying liquid spot-market missing, long term financial derivatives to provide an alternative to forward contracting also lacked.

[8] Source: Arne Joacobsen, Greenstream, Montel

Issues and Challenges

Although the development of the Swedish certificate market is generally judged positively, the case demonstrates that there are considerable tensions between goals and underlying theoretical perspectives as well as between deductive aspirations and inductive adaptation. Drawing on the Swedish experience, and relating it to the introductory theoretical discussion, we shall elaborate on some central themes.

Static Efficiency Versus Dynamic Innovation: The Challenge Immature Green Technologies

The evaluation of the Swedish certificate market, as well as the public debate has highlighted the tension between static efficiency and dynamic innovation as a major challenge to the certificate policy. More specifically, the challenge has been that a certificate system will only stimulate the development of the most mature technologies such as bio-fuel and wind and may not further development of immature renewable energy technologies,.

Different green technologies may be at different stages of development. If the certificate market in line with static efficiency considerations, only supports the most efficient green technologies, in the most efficient locations, this may create a lock-in from an innovation policy point of view. Immature technologies will thereby not achieve adequate financing and promising new technologies with a steep learning curve may never be developed. If, as indicated in numerous studies, including the IEA's study on energy system transformation (Wene 2000) there is a need not only for research and development, but also for actual market application to develop operative technology, then also immature technologies need niche markets to be taken further. New renewables such as wave power or solar cells, would need additional support beyond the certificate price over a considerable period to develop their potential.

In principle, one might consider a segmented green market, with specific price-setting for each technology-segment. However, this would tend to undermine the liquidity of the green certificate market(s) and create competition problems, especially within a limited national market context, where the limited volume of trade in each technology niche would undermine competition. If a common certificate market could be developed at the EU level, there might be more scope for nice market differentiation as each technology segment would be much larger.

Another option might be to supplement the certificate market with research and development support that runs parallel to the certificate market. This could, however, disturb the price formation in the certificate market and thereby undermine its credibility and the actors' willingness to invest.

The Swedish energy agency's second evaluation report, points out that the interplay between the Swedish elcert market and other nations' innovation policies may solve the problem. As long as other countries pursue more innovation-friendly technology policies, through technology investments and niche markets, they may sustain immature technology development, and Sweden may reap the fruits when these technologies mature.

Market Functioning and Competition

Green certificate markets are qua markets vulnerable to the same challenges as other markets including competition issues, transparency and liquidity issues etc. In the Swedish el-certificate case, there have been complaints of limited transparency and strategic behaviour. Large part of the trade is handled bilaterally, or through OTC brokerage, and Nord Pool has not been able to establish a transparent certificate market. As pointed out in the previous section, the price in the certificate market has rapidly risen to the level of the non-compliance fine, in spite of over-supply of certificates. As noted in the latest review by the energy authorities, there are concerns that the paper and pulp industry engages in strategic market behaviour, in a situation with a sizealble over supply of certificates.

Given the small scale and national character of most certificate markets, competition, liquidity and transparency issues are particularly challenging. Even though the fairly broadly dispersed biomass generation, has served to enhance competition in the Swedish elcert market, compared to other certificate markets (Bye et al 2002) there still seems to be considerable concerns.

However, practice from competition authorities so far has been to go soft on green markets as they are in an initial buildup-phase. Nevertheless, there is probably a limit to how long such de-facto amnesty could last without giving rise to serious questioning. Like for the underlying electricity markets, internationalisation might be necessary to cope with the structural challenge.

The Challenge of Matching Commercially Based Investment with Political Commitment

The challenge of adequately predicting market-behaviour in order to calibrate the market design is also illustrated in the Swedish elcert case. A major issue in the evaluation of the first year of the Swedish certificate market has been the lack of investments in new generation capacity within the present certificate framework, with a time horizon only until 2010. A fairly unanimous response from the actors responding to the Energy authority’s enquiry has been that the major weakness of the Swedish certificate system is its limited time horizon. Setting quotas only until 2010 has not given sufficient payback time to undertake major investments.

As shown in the previous section, while large wind- potential exists in Sweden, the main industrial response has been in fuel shift from fossil to non fossil fuels. About 1 TWh extra electricity generation has, according to Kårberger et l (2004), come from generators that have shifted to biofuels from earlier fuel mixes with fossile components. High el- and certificate prices has made chp generation profitable even in periods with low demand for heat.

The need for evaluation and learning, which presumably dictated the relatively limited horizon of the certificate system in the first round, has probably limited its ability to unleash more long term oriented industrial investment. The ability for a certificate market to unleash investment in new “green” technologies, after all, depends on whether the commercial investors see attractive payback opportunities within the time horizon for the green certificate. The licencing period and the payback period for capital costs in capital-intensive technologies, implies that investors will need to have a considerable time-horizon to engage.

Given the low risk/ low cost strategy of fuel conversion, compared to the higher risk strategy of wind power investment, one could argue that the market actors have responded soundly, and that exploitation of the wind power should under any circumstance only have come after saturating the fuel shift potential. Nevertheless, as also argued by the second Swedish elcert-review, a more long term stable framework needs to be put in place for the more long term "next generation" investments to take place.

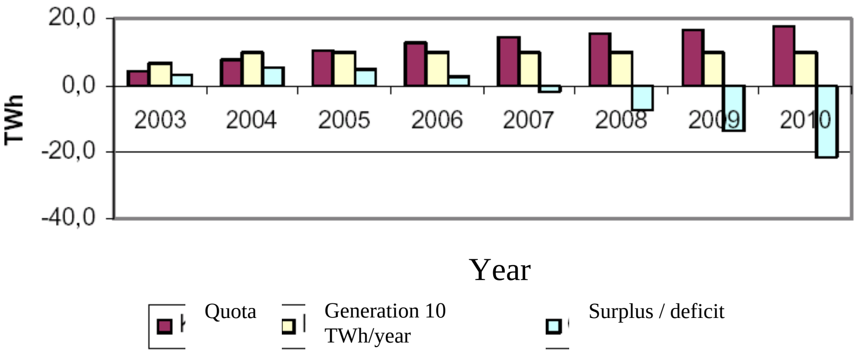
Market Calibration

One of the very challenging sides of orchestrating constructed "quasi-markets" - where public authorities not only set market frameworks, but also artificially specify demand - is the market calibration. The information demand on setting a right policy-target is clearly extensive. Yet adjusting too frequently to updated information, on the other hand, would undermine the credibility of the market.

The government estimate at the beginning of the Swedish elcert-market was that the existing generation capacity entitled to certificates was around 6.5 TWh. After the first year of the certificate system, the total production was 10 TWh. It is primarily bio-fuel based generation that has increased faster than presupposed (ref energy authority II).

The certificate surplus estimated by the energy authorities is presented in figure 8. The surplus for 2005 is likely to be more than 50%, decreasing in 2006 and triggering demand for new certified generation capacity from 2007.

Figure 8: Surplus and Scarcity of Green Generation (from Swedish energy agency 2003)



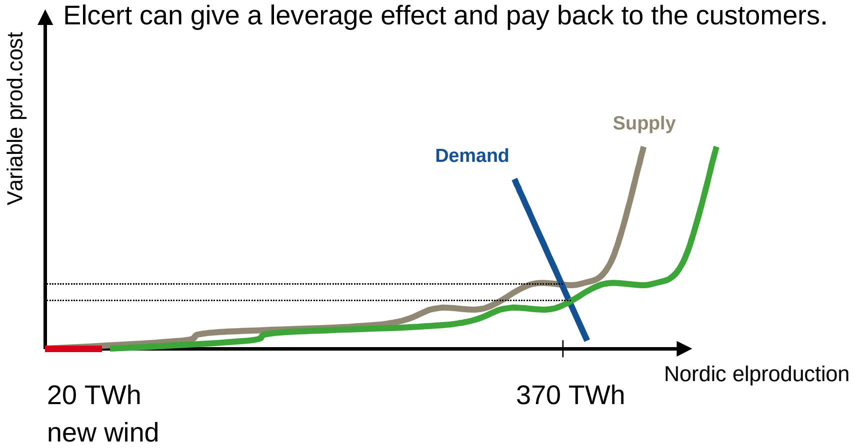
Should the quota obligation increase beyond resources available at reasonable costs, one could risk dramatic price increases, given that the absolute non-compliance fine in the Swedish elcert-arrangement is taken away and substituted by a fine derived from the market price The Swedish government has therefore, as previously presented, taken great care to explore the resource potential for eligible certified generation and the potential for licensing them. All the same, such estimates are ridden with uncertainty, and illustrate the challenging task of taking explicit responsibility for defining market preferences. The fixed price ceiling in the first period proved to be an important balancing factor, yet rather paradoxically, given the large supply surplus.

Effects of the certificate system on the power market

The perhaps greatest challenge to the strong rationalist position in market design is to overview the interaction between the new certificate markets and the underlying electricity markets. Several analyses point out that introduction of green certificates through quotas may have effects on the traditional electricity markets that are not trivial to overview (Tennbakk (2004) Bye et al (2001).

In order for the goals for electricity from renewable sources to be met by 2010, the electricity certificates must trigger considerable investments in new capacity. Such investments increase the total generation which leads to a lower electricity price. A lower electricity price stimulates the demand, which again leads to increased demand for certificates, to a higher certificate price, increased profitability for renewable generation, investments in new generation capacity, and hence lower prices in the regular power market etc. The el-certificate system can be said to have a price-limiting effect on the basic power market, if the renewable electricity displaces expensive marginal electricity generation (figure 9). However, this will have to be balanced off against the increased costs of higher green el quotas, which at a certain point will outweigh the price fall in the regular electricity market

Figure 9[9]



From a security of supply point of view, the increased generation from the green electricity market might have positive effects, although some of the new renewable portfolio might have rather fluctuating input. However, the resulting price fall could also limit investment in traditional technologies, such as gas fuelled cph, that might otherwise have been built.

It appears that the complex interaction effects can only partially be anticipated by deductive analysis. Extensive experiential learning is therefore likely to be necessary to understand this more fully. This indicates that development of new quasi-markets may possibly be just as adequately described as innovation as by rational design.

[9] From Chudi, (2004)

Distributive issues

Given the artificial character of the certificate market, where demand is constructed by specific public intervention, this market is likely to be particularly sensitive to distributive issues. In this respect, the debate over the Swedish elcert model has focused on the fact that the transition to electricity certificates has had relative different effects for different generation technologies. The certificate price of over 200 SEK/MWh has implied more than a doubling of the compesation to bio-fuel and small-scale hydropower (Sandberg 2004). Actors with biofuel and hydropower facilities, such as the paper and pulp industry, have therefore been seen to harvest large windfall profits. Furthermore, critique has been voiced over the fact that the same paper and pulp industry is itself exempted from quota obligations. For wind-power, however, the elcert model has implied a lowering of support and a stronger risk exposure.

The coming integration of the Swedish and Norwegian certificate markets may, however, raise such distributive issues on a Nordic level. Internationalisation potentially implies efficiency gains, as it allows exploitation of comparative advantages. However, this may in turn, create distributive issues, since the allocation of potentially competitive green el generation may not be evenly distributed across the participating countries. As the levy is imposed by national authorities as an extra cost, there may be reactions if the industrial/innovation/ technology returns multiply in one country and are absent in another.

Should the distribution of certificate-financed generation become to biased in favour of one or the other of the two countries, it might provoke reactions. In such cases there would be a conflict between an economic efficiency and industrial policy perspective.

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