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ECOLOGICAL OBJECTIVES AND

THE ENERGY SECTOR

- THE GERMAN RENEWABLE ENERGIES ACT AND THE EUROPEAN EMISSIONS TRADING SYSTEM -

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1 Introduction

The traditional German policy objectives in the energy sector were foreseeable and reliable energy prices and a stable energy supply. Rising industrial competition at the global level increased the importance of energy prices as a locational factor. Therefore not only continuity but also cost effectiveness of energy production is among the objectives of German and European energy policy. The structural change of the former monopolised market towards liberalisation was forced by European legislation in 1998.

Since the end of the 70s the ecological debate entered energy policy. Mainly concerns about the civil use of nuclear technology forced the discussion about the substitution of fossil energy sources by renewable energies. The debate on climate change deepened the concentration on energy-related questions as a focus of ecological concerns.[1] The discussion about sustainability, initiated by the 1987 report of the World Commission on Environment and Development (WCED),[2] better known as the Brundtland-Commission, broadens the debate on energy policy, because ecological, social and economic aspects were subsumed under the term sustainability for the first time. The dimension of social sustainability mainly concentrates on questions of employment and social security. Economic sustainability refers to the necessity of focusing on economic competitiveness and will be subsumed in this paper under "cost effectiveness". Ecological sustainability means the preservation of a functioning ecological system, also for the following generations. Talking about energy policy, ecological sustainability has two focuses: On the one hand the conservation of energy sources and on the other the containment of negative effects of energy consumption, e.g. the global warming and questions of nuclear waste disposal. Beside cost effectiveness and stable energy supply, the issue of ecological soundness and sustainability is now the third pillar of German and European energy policy.

As the different objectives of energy policy may be contradictory and not mutually supportive it is necessary to identify possible conflicts as well as possible concordance. The variety of objectives is also challenging for the adequate use of economic

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1 See Reiche (2002), p. 40.

2 World Commission on Environment and Development (1987).

instruments. The recent German discussion about ecological effects of energy use and ecological regulation also includes possible consequences for the competitiveness of national industries. The discussion about the economic impacts of ecological effective instruments mainly focuses on two instruments: The German Renewable Energies Act "Gesetz für den Vorrang erneuerbarer Energien" (EEG), a law to promote innovation and diffusion of electricity from renewable energy sources and the "European Emissions Trading System" (EETS), a European approach to abate industrial emissions cost-effectively through the installation of a trading system with emission allowances.[3]

First the paper outlines possible relations between ecological objectives and cost effectiveness. After general considerations, possible trade-offs are specified for climate policy and the promotion of renewable energies. The third chapter does the same for security of supply. Concrete objectives and some characteristics of both instruments, the EEG and the EETS, are described in chapter four and five. In chapter six the paper examines to which extent both approaches are able to meet their ecological objectives. Afterwards, it investigates the effects on possible competing objectives. Such objectives are for example the competitiveness of national industries due to cost-effective energy prices and security of supply. After a comparison of the performance of the EEG and the EETS in regard to effectiveness, cost-efficiency and the impacts on innovation the paper contains conclusions. An outlook on some possible future alternatives finishes the paper.

2 Ecological regulation and cost effectiveness

The underlying objective of cost-effective energy production is the maintenance of competitiveness for energy-consuming industries.[4] A competitive production is based on innovative processes, efficient use of resources and on moderate input prices.

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3 This paper will not consider the German ecological tax because it focuses beside the ecological objectives also employment targets, which makes the evaluation considering cost effectiveness and efficiency more difficult.

4 It is assumed, that cost-effective energy production leads to moderate energy prices. Regarding the non-perfect competition on European energy markets, it might be questioned to what extend this assumption is appropriate.

The theoretical explanation of ecological problems and therefore the necessity of ecological regulation lies within the existence of negative external effects. Harmful ecological consequences of energy use are not internalised through the market mechanism. Theoretically, the most elegant solution for internalisation by state regulation is the pricing of negative impacts, by the so called Pigou-tax.[5] Considering long-term ecological problems such as global warming, it is evident that identification and internalisation of external effects are not always possible. Consequently, other instruments like tradable emissions certificates are applied in order to reach a politically determined objective by reducing the external effects. Considering energy policy, ecological regulations raise energy prices by adding social costs or setting emission limits by direct regulation.

Rising energy prices might have negative impacts on the competitiveness of industries. Lobbyists stress the importance of locational factors like moderate energy prices and the absence of costly environmental regulations. If environmental effects are only local or if the assessment of environmental impacts differs strongly across countries, feared negative impacts of environmental regulations impede unilateral actions of national governments.[6] Through the implementation of Multilateral Environmental Agreements (MEA) states try to minimise the risk of loosing comparative advantages.[7]

Considering dynamic aspects of competitiveness, regulation as well might have positive effects. The possibility of enhancing innovation through state-implemented regulations depends strongly on the specific design. Porter/van der Linde (1995a,b) enumerate different principles for regulation, which increase the probability of cost-reducing innovation:

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5 See Hartwig (2003), p. 142.

6 There is no empirical evidence that these fears are necessarily true. For the possible positive effects of unilateral regulation see below and the concept of “lead markets“ e.g. Beise/Rennings (2003).

7 One example for the avoidance of unilateral action is, that the commitment of the German government to reduce greenhouse gas emissions by 40% until 2020 is subject to the commitment of the rest of the European Union to reduce the emissions in the same time about 30%. To avoid distortions of competition it is seen as favourable to apply regulations at European or international level.

1. Crucial is the focus on outcomes. It is not the prescription of certain technologies, but the search for an optimal technology that encourages innovation.
2. Improving existing technologies and not searching for product or process innovations might result more costly. Radical new approaches are encouraged by the setting of strict regulatory objectives.
3. Employment of phase-in periods. Firms have the possibility to develop innovative processes and are not forced to conduct rapid and costly changes.
4. Preserve flexibility and create new technologies through market incentives.
5. Co-ordination of regulation with other countries.

For ecological problems with international scope, where regulation at an international level can be expected, the concept of *first-mover-advantages* aims at generating industrial efficiency through national regulation at an early stage.[8] Forcing innovations by national regulation is the underlying idea of the concept, which is derived from a dynamic view of competition. The subsequent regulation of other countries is a basic condition for successful implementation of first-mover-advantages.

Another possible positive impact of regulation is the creation of so called *win-win-situations*. In a win-win-situation energy-saving activities result in a reduction of harmful emissions and in the same time lead to cost reductions. Win-win-situations are possible, no matter if the environmental effects are local, national or international.

Under idealised conditions, industries would always realise possible cost reductions, but since there is no perfect information, e.g. problems arising of principal-agent constellations, cost reductions are not implemented automatically. Therefore, regulation stimulates in the concept of Porter/van der Linde the necessary investment to realise such cost reductions.

2.1 Climate policy

The climate effect of fossil fuels combustion is an example of incalculable external costs. Global warming is an international problem. Therefore, multilateral regulation might be expected and climate policy would be a case for unilateral regulation, aiming to induce first-mover-advantages. National regulation implemented in a stricter way or even earlier by one trading partner, forces national industries to develop new techniques. As soon as other countries also apply regulations, the ability of national industries to respond to these new international regulations make them more competitive. If this kind of strategic action to induce advantages will be successful depends on the specific design of a regulation and the existence of stringent international arrangements.[9]

If the industrial development of concerned countries varies substantially, greenhouse gases can be abated cost-effectively through simply modernising existing combustion plants in less developed countries. Having the possibility to export existing technologies to other countries, the incentives for further innovation are weaker.

2.2 Promotion of renewable energies

The promotion of renewable energy sources is linked with ecological objectives as sustainable energy supply, the reduction of negative external effects from fossil fuels and the substitution of non-renewable technologies. But in contrast to a direct climate policy, e.g. reducing carbon dioxide (CO_2) emissions by emissions trading, the promotion of renewable energies is not an environmental regulation which forces industries to reorganise their production chain. The objective of ecological soundness and the installation of renewable energies differ because ecological soundness is a general objective whereas the promotion of renewable energy sources focuses on special technologies. The promotion of renewable energies is often justified by the argument that the development of renewable energies needs a long preparation time and that entrepreneurial investments to reduce emissions in the most cost-effective way are not considered as sufficient. The industry is therefore regarded to be unable to meet the underlying ecological objectives directly.

Generally spoken, there is no direct contradiction between the use of renewable energies and cost effectiveness. Large-scale hydropower is used without special promotion in the Scandinavian countries, Austria and southern Germany. If the external costs of fossil energy sources would be internalised, the compared perfor-

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8 See Oetzel (1997), p. 170.

9 Not only the realisation of first-mover-advantages, but also the general costs of emission abatement depend essentially on the design of regulation. Klepper/Peterson (2002) show for the case of

mance of renewable energies would be even better. However, most technologies are promoted by state regulation, especially photovoltaic power plants and wind energy plants, which are not competitive under current conditions. If the contradiction between cost effectiveness and promoting renewable energies is emphasised, the discussion refers to these technologies and current market conditions.

If non-competitive technologies are introduced in the market by regulation, a rise of energy prices is the consequence. Therefore, contradictions between the objective of cost-effective energy input for industry and high feed-in tariffs for the promotion of renewable energies prevail. Moreover, reduced energy prices, e.g. through the 1998 liberalisation of European energy markets, imply a relative rise in the costs of electricity from non-competitive renewable energy sources.

A promotion of renewable energies and resulting higher energy prices might stimulate fossil energy-saving and therefore include positive cost effects for national industries as well. However, the promotion of renewable energies should take place in a cost-effective way. As the competitiveness of photovoltaic and wind energy plants depends highly on the location, the design of promotional regulations should avoid the over-financing of competitive plants and discourage the installation in uneconomical sites.

3 Ecological regulation and security of supply

Regulations to secure a continual energy supply prove the lack of confidence of market mechanisms which guarantee supply by the signalling function of prices. High volatility and energy shortages are feared. The main reasons for these concerns is the geographically uneven distribution of fossil energy sources. As ecological concerns, respectively the attempts to internalise or equilibrate social costs, change the relative prices of energy sources, they might influence the policy to stabilise supply.

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the Kyoto-Protocol that due to different designs of the emission trading, the abatement costs of the Annex-B-countries plus USA might vary from 8$ to 33$ per ton of CO_2-equivalent.

3.1 Climate policy

Climate policy intends to reduce the emissions of greenhouse gases, resulting from fossil energy use. The storage of CO_2 still has to be further developed. Therefore, reducing emissions means beside raising efficiency of energy use a reduced employment of coal, lignite and mineral oil. The problem of securing energy supply in Germany is increased by the planned phasing-out of electricity from nuclear power plants. Substituting nuclear power by imported coal would further increase the trade-off between climate policy and security of supply, because the harmful ecological consequences of the transport add to the effects from combustion.

If climate policy does not focus on different technologies, but also means higher efficiency in energy production and use, the described trade-off can be softened or even reversed. Zero CO_2-emission coal-fired power plants are still not competitive but might be a future alternative of climate-friendly energy production. Nuclear power as an emission-free technology contributes to climate protection and security of supply at the same time.[10]

3.2 Promotion of renewable energies

The promotion of renewable energies broadens the basis of supply. Renewable energies are locally available and therefore diminish the dependency on foreign energy suppliers. Germany and the European Union explicitly aim at reducing the import quota of energy, which amounts to approximately 50% and is expected to reach 70% in 2030. Renewable energy sources should make an important contribution.[11] In order to improve the security of energy supply, it is not important where exactly in Europe the energy from renewable sources is produced, because there are no concerns of strategic action restricting the energy delivery among Member Countries of the EU.

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[10] The ecological objectives contain more than climate policy. Because of incalculable risks and unresolved questions of final storage, nuclear technology does not meet requirements of sustainability. The simultaneous compliance of the ecological objectives reduction of greenhouse gas emissions and general sustainability limits relevant technological possibilities.

4 The German Renewable Energies Act (EEG)

In March 2000 the "Gesetz für den Vorrang erneuerbarer Energien" (EEG) has been adopted. It follows the "Stromeinspeisungsgesetz" from 1990 to promote supply of electricity from renewable energy sources. In December 2003 the German government has proposed an amendment of the EEG,[12] changing especially the minimum feed-in tariffs for renewable energies. The amended form of the EEG is planned to be adopted until July 2004.

4.1 Objectives

The explicit objective of the law is to enable the development of a sustainable power supply and to extend the share of renewable energies remarkably, i.e. to reach the European objective of doubling the percentage of the renewable supply of total energy consumption to 12% until 2010. Generally, the underlying motivation is climate protection and the protection of the ecological system by the introduction of new technologies.

The German quantitative objective to reach a share of 12,5% electricity from renewable energy sources by 2010 is directly taken from the directive for the promotion of renewable energies on the European level[13], which sets for each Member State a specified contribution to the EU-target to reach by 2010 a share of 22,1% of electricity produced from renewable energy sources of total electricity consumption. Moreover, a long term target of the amendment of the EEG[14] is a share of electricity from renewable sources of 20% in 2020.

The draft for the amended EEG specifies not only quantitative objectives: The sustainable development of energy supply based on renewable energies is regarded as necessary for the internalisation of long term social costs of fossil energy use, the

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11 See Commission (2000b).

12 The amendment will be called "Gesetz für den beschleunigten Ausbau der Erneuerbaren Energien im Strombereich" (Erneuerbare-Energien-AusbauG).

13 Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity from renewable energy sources in the internal electricity market. Official Journal L 283 of 27. 10. 2001.

14 See www.bmu.de

avoidance of energy-related conflicts and the further development of technologies to produce power from renewable sources.[15] The last objective is part of a strategic industrial policy. Industrial policy means the attempt to promote a certain industry by using favourable regulations, e.g. tax incentives. The motivation for industrial policy is the political anticipation of possibilities to develop a favourable market position.[16] The objective of the EEG is to develop a national industry of renewable energy plant producers, for national demand and export.

4.2 Design and mechanisms

The EEG is based on guaranteed feed-in prices. The local grid operator is obliged to buy power from renewable energy sources defined by law.[17] The law sets a minimum price for each technology, ranging in the actual legislation from 6.65 Euro-Cent/kWh for middle-size hydro power to 50.62 Euro-Cent/kWh for photovoltaic power. The average feed-in tariff in 2001 amounted to 8.64 Euro-Cent/kWh.[18] Declining feed-in tariffs intend to accelerate competitiveness.

The four German transmission grid operators[19] are obliged to compensate local operators for the EEG-promoted power. With many wind power plants in the north and a lot of hydro plants in the south the feed-in of electrical power from renewable sources varies regionally.[20] Therefore the financial burden is equally distributed annually at the level of the transmission grids. The power supply industries which finally provide the power to the consumers are obliged to take the EEG-power and compensate it with the average rate. That leads to raising consumer prices. There is no limit for the total amount of obligatory payments for renewables.

For energy-intensive industries with an electric power consumption exceeding 100 GWh and electricity costs more than 20% of the gross value added, there is the possi-

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[15] See www.bmu.de

[16] There is no evidence, why political leaders should be in a better position to anticipate future market developments than private market participants. Moreover, the theory of public choice explains decisions to subsidy a certain industry with electoral considerations and massive lobbying.

[17] Included is electricity gained exclusively from photovoltaic, hydro power, wind power, biogas or biomass, except power from hydro power plants with installed capacity exceeding 5 MW, state-owned power plants and photovoltaic plants with installed capacity exceeding 5 MW. See EEG, § 2.

[18] See BMU (2002).

[19] RWE, E.ON, EnBW and Vattenfall Europe.

[20] An extreme example is the region of Papenburg, Germany, with a 54% wind power share.

bility to apply for an exemption. The conditions for the application of the escape clause will be softened in the amendment, but the exact design is not yet determined.

5 The European emissions trading system (EETS)

The EETS is based on the 2001 proposal of the Commission to implement a European System of emissions trading, starting with an initial period from 2005 to 2008 and a second period from 2008-2012. The directive came into force on 25th of October 2003.

The EETS has been designed to reduce the effect of man-made global warming. In order to reach this objective, reducing CO_2-emissions beside other greenhouse gases is the most promising approach.[21] As the greenhouse effect is a global phenomenon, an effective reduction strategy should start on a global level, too.[22] Facing the fact that even the Kyoto-Protocol, which is far from global, will probably not be ratified in near future,[23] a European approach is still better than national tackling. The effectiveness of reducing emissions does not depend on the geographical position. The tradability of emission allowances permits the polluter with the lowest marginal abatement costs to reduce emissions and to sell his emission allowances. Industries with higher abatement costs can buy the tradable emission allowances until the marginal abatement costs and the marginal costs of emission allowances are equal. Consequently, the emission reduction of a politically fixed amount of emissions can take place in a cost-effective way.

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21 Beside CO_2 the greenhouse gases named in the Kyoto-Protocol are Methane (CH_4), Nitrous Oxide (N_2O), Hydroflourocarbons (HFC_S), Perflourocarbons (PFC_S), Sulfor Hexafluoride (SF_6). It is intended to include these gases in the EETS, too. See Directive 2003/87/EC, Annex II.

22 Böringer/Löschel (2002) see a possible reduction from 57 Euro to 31 Euro per ton of CO_2-equivalent, if the emission trading takes place on a global level and not only between Annex-B-Countries.

23 The Kyoto-Protocol will enter into force if 55 countries responsible for 55% of CO_2-emissions caused by listed industrial countries have ratified the Climate Convention. The second condition is difficult to meet as long as the US and Russia do not intend to ratify the Kyoto-Protocol.

5.1 Objectives

The EETS objective is to fulfil the EU obligations within the Kyoto-Protocol: The EU reduction target is to reach a greenhouse gas reduction of 8% within the period of 2008-2012, compared to the base year 1990. Furthermore, each Member State has to fulfil an individual objective due to the inter-European burden-sharing. The German contribution adds up to 21%. The EETS plans the participation of energy-intensive industries, which are responsible for about 46% of the total European CO_2-emissions.[24] The conceded national emissions vary substantially, Portugal for instance is allowed to increase emissions up to 27%, Luxembourg has to reduce its emissions by 28%.[25] Consequently the underlying objective of EETS is not only to avoid the greenhouse effect, it also incorporates objectives concerning industrial policy. The different distribution of abatement obligations has direct impacts on the industrial and economical development of the Member Countries.[26] Differing reduction obligations due to industrial development mean an attempt to equilibrate the welfare of the Member Countries.

5.2 Framework

The directive for the implementation of EETS[27] focuses initially only on the reduction of CO_2-emissions. About 80% of the EU greenhouse gas emissions are CO_2-emissions.[28] The concerned industries are defined by their industrial activities, mainly energy activities, production and processing of ferrous metals and mineral industry. Beside the classification based on this industrial activities, combustion capacity, respectively production capacity, is decisive for the obligation to participate at the EETS.[29] Through the national allocation plans the Member States decide about the quantity of emission allowances and the distribution on the concerned industries.

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24 See Herrmann (2003), p. 368.

25 For the EU burden-sharing see Schafhausen (2002), p. 566. The national abatement obligations of the Kyoto-Protocol differ substantially, too. The EU has to reduce its emissions by 8%, the total reduction objective of the Kyoto-Protocol is 5.2%.

26 See Reuter (2003), p. 262.

27 See for the following remarks the Directive 2003/87/EC.

28 See Hillebrand et.al (2002), p. 10.

29 See Directive 2003/87/EC, Annex 1, for the energy activities the combustion capacity has to exceed 20MW, the capacity limit differs between the concerned industrial branches.

The European Commission has to authorise the national allocation plans. At least 95% emission allowances are initially distributed at no charge. Industries which do not have sufficient allowances by the annual deadline are charged with emission penalties.[30] Nevertheless, the industry has to hand in the missing allowances the following year. Member States are responsible for the enforcement of penalties. The whole system must be transparent, allowing the public to be informed about sales of certificates, compliance with the requirements, etc. It is planned to apply the international flexible mechanisms of the Kyoto-Protocol, which allow to realise emission reductions in other industrialised (Joint Implementation) or development countries (Clear Development Mechanism) at a later point of time. A separate directive will regulate further details.

6 The EEG and the EETS: trade off between ecological objectives and cost effectiveness, innovation and security of supply?

After having described possible trade-offs between ecological regulation, cost effectiveness i.e. competitiveness and security of supply, the next chapter will examine the performance of the EEG and the EETS. In respect to ecological effectiveness, effects on industrial competitiveness and the effects on security of supply, the performance of the instruments is quite different.

6.1 EEG

Ecological effectiveness

Concentrating on climate policy, the ecological effectiveness of the EEG can be measured at the abated emissions due to renewable energy promotion.[31] The use of renewable energies reduced greenhouse gas emissions by about 35 million tons of CO_2-equivalents. If the objective of the EEG, namely to double the renewable ener-

[30] Excess emissions penalties are planned to amount to 40 Euro in the first three years and from 2008 on to 100 Euro for each tonne of CO_2(-equivalent).

[31] Apart from harmful effects on the climate other possible environmental risks like fall-out from nuclear power plants or acid rain as a consequence of burning coal, might be related to the use of fossil energy sources. These risks are difficult to quantify therefore the paper concentrates on ecological effectiveness concerning climate policy.

gies share by 2010, is reached, emission abatement will amount to 70 million tons in 2010.[32]

As the installation of renewable energies plants is considered an ecological objective itself, the EEG can be classified as quite effective. The effectiveness is reached by minimising investors risk through the long-term fixation of feed-in tariffs. Higher compensation in sites with lower profitability encourages to further installations.[33]

The monitoring report of the German government specifies the results of the EEG. The installed capacity reached 17.82 MW in 2001. About 60% of the promoted power came from wind power plants. The accumulated costs rose to 1.54 billion Euro in 2001.[34]

The effectiveness of the installation of power plants has to be assessed in relation to the impacts on cost effectiveness and security of supply.

Cost effectiveness

For the assessment of the claimed cost effectiveness of the EEG, two different aspects have to be taken into account: Firstly, if the massive employment of non-competitive renewable energy sources contributes to a cost-effective energy supply, and secondly, if the EEG is a cost-effective instrument to promote electricity from renewable energy sources.

1. The trade-off between general cost effectiveness and the promotion of renewable energies by means of the EEG is obvious: Through the obligatory feed-in system with fixed minimum prices, an increasing share of renewable energies means at the same time rising electricity prices. The gradual decline in feed-in tariffs does not compensate the strong raise in installed power capacities.[35] While monthly additional costs due to EEG promotion for an average household amount to approximately one Euro,[36] industrial consumers even face serious competition disadvantages due to rising energy prices.

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32 BMU (2002), p. 5.
33 See WWF (2003), p. 15.
34 See BMU (2002), p. 6.
35 The average rise in installed wind power plant amounted for the first nine month of 2003 about 11.8% (see German Wind Energy Institute (2003)), the annual reduction of feed-in tariffs for wind power plants lies by 1.5%.
36 See BMU (2003c).

The promotion of power from renewable energy sources is no strategy to internalise external effects. Not the negative environmental effects of fossil energy sources are priced, but energy consumers have to pay an extra sum for the promotion of certain technologies. If it is not possible to create win-win-situations, the higher share of renewable energies and the resulting higher energy prices worsen the market position of national industries. Theoretically, the considered unjustified low prices for the input factor energy due to subsidies and external effects are partly equilibrated by a higher share of renewable energies.

2. Regarding the efficiency of the underlying feed-in system, the EEG has to be judged critically, too. As the feed-in tariffs are set due to anticipations about investment costs and desirable rates of return for investors in order to create investment incentives, the feed-in tariff is not based on market mechanisms. The instrumental efficiency is subsumed under the direct effectiveness i.e. maximum installation of power plants. Considering wind power, promoting maximum installation means that also very favourable sites which are nearly competitive are promoted as well as installations on unfavourable sites which probably never produce enough power to reach competitiveness.[37] The constant promotion of wind power plants with high rates of return for a long time has been politically accepted, although some resistance arose lately.[38]

On the other hand, reaching the final aim, a competitive cost structure of renewable energies is not encouraged by the promotion of all plants.[39] There is no competition between the operators of renewable energy power plants. Different feed-in tariffs for each technology impede competition among technologies. The declining feed-in tariffs are essential to avoid the development of permanent subsidies. But maybe a sharper decline would further stimulate innovation.[40] On the level of producers of renewable energy power plants market participants compete, stimulating innovations.

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37 The planned amendment of the feed-in tariffs shows that the energy policiy is searching for tariffs, which minimise the efficiency losses.

38 As the promotion of wind power plants accounts for more than two thirds of the EEG-promoted electricity, the question of more or less favourable sites gains importance for the whole promotional system. See BMU (2003a), p. 15.

39 Enhancement of efficiency of already existing and competitive big hydro power plants is not promoted in the current version, although this could rise renewables share essentially. The amended EEG will probably consider this shortcoming. See BMU (2003b).

40 In the revised form of the EEG the annual decline will be increased, e.g. for wind power plants from 1,5% to 2% p.a.

Innovations

The question is in how far the EEG favours the development of innovative solutions for ecological problems. Using the criteria of Porter/van der Linde described in 2.1

1. Industry is not considered to have the ability to find long-term solutions for ecological problems (greenhouse effect) and future challenges (limited resources). The political strategy to enhance specific technologies does not leave much room for the implementation of individual and creative solutions and therefore reduces possible win-win-scenarios.
2. Considering the ambitious targets of the German government, through the strict regulation the concerned industry might recognise that in the long run, energy-saving is the only alternative to unaffordable high energy prices.
3. The long time horizon of regulation and the continuation of the first promotional act gives industries the possibility of long-term adaptation.
4. Constant monitoring and adaptation of the legal framework show flexibility. By the process of trial and error, it is attempted to come closer to optimal regulation. The dimension of regulation in the EEG is not appropriate: By setting minimum prizes and by the feed-in obligation, the market mechanism has been suspended and consumers and producers sovereignty narrowed seriously.
5. The directive for the promotion of renewable energies on the European level[41] sets a specified contribution to the EU-target for each Member State. By 2010 a total share of 22.1% of electricity produced from renewable energy sources has to be achieved. Each Member Country specifies its own promotional regulation, but from the European commitment to promote renewable energies one can expect rising future markets.

Security of supply

The possibility of using national energy sources enhances the security of supply. The actual role of the EEG ensuring a steady supply should not be overestimated. The share of consumed power promoted by the EEG amounts in 2003 to estimated 6.64%.

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[41] Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity from renewable energy sources in the internal electricity market. Official Journal L 283 of 27. 10. 2001.

As the existing promotional framework does not predominantly enhance competitiveness and production under current market conditions, the contribution to security of supply will be related to high costs.

The fast installation of wind energy in Germany challenges the existing grid structure:[42] Unpredictable feed-in caused by seasonal fluctuations and irregularities challenges the existing infrastructure. Grid operators are obliged to hold spare capacity guaranteeing the uninterrupted supply and compensating feed-in fluctuations.
At the same time they have to avoid overloads resulting from an unexpected supply of wind energy. These peculiarities might lead to an interrupted supply through black-outs arising as a consequence of renewable energy feed-in.
Not only the deployment of renewable energy plants, but also the resolution of these technical problems are needed to enhance the security of supply.

Summing up, the EEG is an instrument that sets the method to solve ecological problems in advance. Consequently, private initiative has little scope. The future importance of European markets might lead to strategic advantages.
The possible trade-off between cost effectiveness, security of supply and the fulfilment of ecological objectives has not been resolved through the EEG. Ecological objectives dominate the design.

6.2 EETS

Ecological effectiveness

Generally spoken, the instrument of emissions trading provides a high degree of ecological precision. The political ability to set a certain amount of emission allowances is much more precise than other instruments, e.g. taxation. But the ecological effectiveness depends on the chosen design of the trading system, too. In the EETS the constraint on selected industries undermines the effectiveness. In applying the EETS on the level of energy supply, more emissions could be covered than on the level of energy use. With emission allowances for the initial purchase of fossil energy sour-

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[42] Installations of wind power plants in Germany rose from 529 MW in 1997 to 2627 MW in 2001, see BMU (2002), p. 15.

ces, emissions of households and traffic could be priced and directed, too.[43] But at the same time the incentives to innovate for energy-saving production methods would be weaker if energy supplier would need to keep certificates for the delivered energy.

As the Member States decide about the share of emission reductions realised through the EETS and fix it in their national allocation plan, there is the danger, that national governments try to favour national industries through moderate reduction obligations.[44] The recommendation of the Commission to align the reduction of the concerned industries to their share of total national emissions might not effectively prevent this development. The lack of penalties for Member States not fulfilling their emission reductions implies the possibility of ineffectual penalties to protect national industrial participants.

The aspect of transparency raises ecological effectiveness as national industries probably try to establish a reputation of ecological soundness. Ecological groups differentiate between “honest” national reductions and “cheap”, i.e. less honest reductions through the employment of international mechanisms.[45] If transparent information about sellers and buyers therefore hinders the application of the most cost effective mechanisms, it has to be judged as being ambivalent.

Cost effectiveness

The instrument of emissions trading is in line with the market mechanism. The fixed amount of emission allowances leads to a market-based regulation through the price mechanism. As non-compliance leads to the obligation to hand in certificates one period later, there is no maximum price for certificates.

By involving more industrial sectors and enterprises and including not only CO_2 but also other greenhouse gases, there are further possibilities to reduce the abatement costs. The international flexible mechanisms of Joint Implementation (JI) and Clean Development Mechanism (CDM) would also increase cost effectiveness. A broad inclusion of these mechanisms should be implemented.

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[43] See Herrmann (2003), p. 370.

[44] The danger is not only a theoretical one: The German government already assured the German industry, that required reductions will not exceed the voluntary commitments of 45 tons of CO_2 until 2010 (see BMU (2003d)). This reduction would be less than the 70 tons expected from the EEG-mechanisms until 2010.

Innovations

The possibility of industry to enhance innovations and competitiveness by the EETS depends on the incentives which are set by the framework. Testing again the criteria of Porter/van der Linde, for the EETS result following tendencies:

1. The EETS does not determine technologies in advance, industries are free to develop their own approach to abatement. Therefore innovations are promoted.
2. As the national allocation plans are not set yet, the strictness of regulation still is uncertain. But the commitment of governments not to exceed voluntary promises, raises fears that complying with the reductions will not be very challenging.
3. The three year phase-in period allows institutional changes and industries adoptions to the new directive.
4. Requirements for functioning market mechanisms are largely met.
5. The common European approach leads to efficiency. For innovative industries possible new markets emerge, as they can sell certificates, which are left over. Hesitating behaviour in the process of legislation and the insistence on special regulations such as the possibility to opt-out under certain circumstances or the creation of certification pools show that the German government underestimates market possibilities for national industries to gain competitive advantages through emission reductions.

Generally the design of the EETS enhances innovations and can therefore be judged as positive.

Security of supply

The EETS does not immediately abolish the use of fossil fuels, as it would be ideal for climate policy. Through the pricing of emissions the EETS enhances energy-savings and the application of innovative production methods, which do not rely that much on the traditional energy feedstock. The rising energy prices favour the development of renewable energies, by internalising at least some of the external costs of fossil energy use.

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[45] See Graichen/Requate (2003), p. 8.

6.3 Comparison between the approaches of the EEG and the EETS

One main difference between the EEG and the EETS is the underlying time horizon. The targets of the EETS are specified for the trading periods 2005-2008 and 2008-2012. There are no targets for the time after 2012. The long term objective is the stabilisation of greenhouse gas emissions at an ecologically sustainable level. The underlying time horizon of the EEG is much longer, reaching until 2020.

The official justification for the strictness of regulation and the predefined technology is the disability of private investors to plan for a long time horizon. Beside this fact the installation of renewable energy plants is considered as an unique way to simultaneously reach emission abatement, sustainability and installation of a national power plant industry. Cost effectiveness has no special importance in the design of the EEG.

The EETS is directly addressing the emissions of greenhouse gases, which cause the ecological damage. Through the existence of market incentives, expected harmful effects on industry are moderate. Innovative enterprises can realise additional gains through the possibility of selling emission allowances.[46]

Both the EEG and the EETS follow the "*Polluter-Pays-Principle*". The abatement of emissions is achieved by substitution, respectively the pricing of emissions. There are loopholes in both approaches: The escape clause of the EEG favours energy-intensive industries, which does not reduce the effectiveness of the EEG, because other energy consumers have to bear the additional costs. In Germany for example, the EETS only addresses approximately 2600 producers.[47] Consequently, the instrument only accounts for a certain share of the total emissions, which will be set in the national allocation plan.

Regarding climate policy both approaches follow the "*Precautionary-Principle*", trying to avoid harmful effects on the environment before they are generated. The feed-in obligation of electricity from renewable energy sources avoids emissions by the substitution of fossil energies. By issuing only a limited number of emission cer-

[46] The EU counts with a approximate price of 33 Euro per ton of carbon dioxide, see Commission (2000a), p. 27.

[47] See Süddeutsche Zeitung, 1.2.2004, no. 25, p. 20.

tificates, the EETS would be able to stabilise the emissions of greenhouse gases on a sustainable level.[48]

The performance on stimulating innovations of both instruments is ambivalent. The criteria of Porter/van der Linde show that it is more likely that the EETS may enhance competitiveness of national industries. Contrarily, the regulation of the EEG leaves no room for innovations. Setting a specific technology in advance will not encourage innovation to an optimal extend, because many other possibilities are excluded. Table 1 shows the expected tendencies.

	focus on outcomes	strict regulation	phase-in periods	market mechanism	international co-ordination
EEG	–	+	+	+/–	+
EETS	+	?	+	+	+

Table 1: Performance of the EEG and the EETS regarding the criteria of Porter/van der Linde to reach competitiveness through ecological regulation

Regarding the effects of the EEG and the EETS on security of supply, the comparison is more difficult. The promotion of renewable energies leads to the use of a bigger variety of energy sources. Possible problems such as the unstable availability of wind power and photovoltaic power and challenges for grid operators rise expected costs in order to reach security of supply. The EETS does not contribute directly to security of supply, but stimulates nevertheless technological innovations. Using energy in a more effective way makes future problems of supply less probable.

Both the EEG and the EETS have distributive effects. The allocation of the emission allowances is a very effective instrument of distribution and can either preserve the industrial structure (by means of allocation on the basis of emissions from previous years) or favour newcomers (by means of reservation of an essential share of certificates for newcomers). The distributive effects of the allocation of emission allowances can also have substantial impacts on the different concerned industries. The different reduction shares of European countries also imply a distributive effect.

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48 Uncertainties on the direct relation between greenhouse gas emissions and climate change also

7 Conclusions and outlook

Considering the objectives of the German and European energy policy, possible trade-offs between ecological aspects on the one hand and cost effectiveness and security of supply on the other hand arise. The trade-offs depend on the specific design of the instruments. The EETS is as an instrument using market incentives more likely to fulfil the objective of abating greenhouse gas emissions in a cost-effective way. The EEG does not regard cost effectiveness as a prior objective. It is shown that cost effectiveness and the promotion of renewable energies are not generally contradictory.

The EETS addresses only one objective and the way of reaching this objective is not regulated. In order to change the technology of energy production a specific regulation is necessary. The case of the EEG shows that losses of efficiency might result.

Using market mechanisms the promotion of renewable energies could be more cost effective, e.g. by means of tendering, promoting the industries with the most cost-effective offers concerning the installation of renewable energy plants or by the introduction of tradable green certificates.
Additionally, a future promotion of renewable energies at the European level would be more efficient because renewable energy plants would be installed in the most promising sites, e.g. photovoltaic plants in southern Spain and not in Germany. The political possibility to set renewable energy quotas could preserve the high effectiveness of the EEG.

Beside the (expected) effectiveness of both instruments, there are still possibilities to design these instruments in a way that does not hinder a better compliance with other objectives as cost effectiveness and security of supply.

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imply uncertainties on quantification of a sustainable level of emissions.

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