Firms, the Framework Convention on Climate Change & the EU Emissions Trading System

Corporate Energy Management Strategies to address Climate Change and GHG Emmissions in the European Union

Centre for Sustainability Management

Marcus Wagner

Lehrstuhl für Umweltmanagement
Universität Lüneburg
Scharnhorststr. 1
D-21335 Lüneburg

Fax: +49-4131-78-2186
csm@uni-lueneburg.de
www.uni-lueneburg.de/csm/

Juni 2004

Centre for Sustainability Management

University of Lueneburg
Scharnhorststr. 1
D-21335 Lueneburg

Centrum für Nachhaltigkeitsmanagement

Universität Lüneburg
Scharnhorststr. 1
D-21335 Lüneburg

Fax. +49-4131-78-2186
E-mail: mwagner@uni-lueneburg.de
www.uni-lueneburg.de/umanagement

ISBN 3–935630–47–6

1 Introduction and global climate change

Today's environmental issues are very complex and often have a global dimension. Global environmental change concerns such diverse areas as acid rain, biodiversity, climate change, depletion of stratospheric ozone, hydrological processes and global fisheries and is underpinned by anthropogenic processes as for example demographic change, urbanisation, economic development and growth, industrialisation, expansion of the global tourism industry or changes in land use. Often there are complex interrelationships between the key drivers of these changes in which business plays a role both influencing and being influenced these processes and their outcomes. Therefore, the corporate sector (and in the remits of this paper in particular European firms) is pivotal in many ways for sustainable development and there is considerable agreement, even between business and governments that global co-operation across nations is required in order to implement effective policies towards sustainable development (e.g. WBCSD 2002). Some of the processes of change have been tackled early as for example acid rain (which was for example the focus of government measures in Germany in the 1970s and indeed marked the birth of German environmental policy) or ozone depletion which was addressed by the Montreal Protocols and where there is evidence that firms with a proactive stance on the issue even benefited economically (Albrecht 1998a, b). However other issues, and especially global climate change still remain largely unsolved, mainly due to the fact that policy making has only very limited experience in dealing with long run environmental problems under a high degree of uncertainty.

One of the most important global environmental issues is global climate change due to anthropogenic greenhouse gas emissions from various sources. The atmospheric concentration of warming gases, so-called greenhouse gases (GHGs)[1] increased by 30 per cent since the industrial revolution started (Mabey et al. 1998). This is suspected to be due to human activities and might cause an environmental problem that is global in scope and will have impacts that stretch over centuries and because of this sometimes is seen as a man-made global geophysical experiment. Considerable damage could be caused by the potential indirect impacts of global warming as for example changes in precipitation, in vegetation cover or in soil moisture and the consequent effects on agriculture or possible increases in tropical storms and a rise in sea level (Mabey et al. 1998).

The major anthropogenic sources of the GHGs at the root of the problem are on the one

[1] The most important GHGs are carbon dioxide, methane, nitrous oxide and CFCs.

hand coal, oil and gas combustion and on the other hand deforestation and land use changes. The equivalent carbon dioxide concentration today is twice the level of pre-industrial times. In early simulations using General Circulation Models (GCM) a doubling of the carbon dioxide equivalent concentrations of GHGs resulted in an increase of the global mean surface air temperature of 1.5 to 4.5 °C, with a best guess estimate of 2.5 °C (IPCC 1992). Under these scenarios, a doubling of carbon dioxide concentrations was predicted to occur between 2030 and 2040 and the Intergovernmental Panel on Climate Change (IPCC) had recommended a stabilisation of carbon dioxide at a concentration of 450 ppm to avoid further global warming (IPCC 1992)[2].

The Third Assessment Report of the IPCC has meanwhile concluded that global emissions could be reduced below year 2000 levels by 3.6-5.5 bn tonnes by 2020 and that half of these reductions are achievable cost-effectively, due to the considerable technological progress achieved in the last decade with regard to GHG-relevant technologies (Metz et al. 2001). Based on these updated parameters, modelling predicts for carbon dioxide concentration to stabilise at 450-550 ppm until the end of this century (Metz et al. 2001). Achieving this target however requires significant societal changes worldwide, which also imply significant changes in the corporate sector in Europe, particular with regard to firms' energy management strategies.

Due to its large emission levels and a long lifetime in the atmosphere, carbon dioxide still contributes most to the greenhouse effect. The main source of global GHG, and in particular carbon dioxide emissions is the combustion of fossil fuels to generate energy. Currently international co-operation to influence and stabilise global climate change is on its way to being institutionalised within the Framework Convention for Climate Change. After an introduction to the FCCC and a discussion of the different strategic options for business responses of European industry (in terms of corporate energy management strategies) to address climate change, the paper outlines the economic issues surrounding TEP systems and the structure of the European emission trading system and analyses likely implications of the system on European industry. It then discusses implications of a generally positive view of TEPs from a theoretical perspective and a rather critical assessment by industry of the recent EU emissions trading directive. The paper concludes with general observations on the economic aspects of international co-operation and optimal climate policies.

[2] Nierenberg (1995) provides a review of the science of global warming with special emphasis on those aspects that have critical policy implications.

2 The UN Framework Convention for Climate Change (FCCC)

To date, the FCCC is the only multilateral agreement on GHG and especially carbon dioxide reduction that has been both, agreed and enforced. The major aim of the FCCC, according to its Article 2 is "to achieve (…) stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system" (UNEP 1992). Therefore it obliges the countries listed in Annex I of the convention[3] in Article 4.2.b to start controlling their GHG emissions "with the aim of returning individually or jointly to their 1990 levels these anthropogenic emissions of carbon dioxide and other greenhouse gases (…)" (UNEP 1992). Due to the voting rules of the Global Environmental Facility[4] a group of 24 countries, amongst them the G7 economies, will determine the amount of GHG abatement in the short and medium term. This especially concerns the money transferred to developing countries and any further binding targets for these 24 countries themselves (Mabey et al. 1997). These 24 nations account for 43 per cent of the global fossil fuel derived carbon emissions. Within this so-called 'Annex II group', the G7 economies account for approx. 38 per cent of these emissions. All countries that belong to the Annex I group produce 66 per cent of the global fossil fuel based carbon emissions.

According to Greene (1993) the transition of the FCCC to a treaty with significant targets will take some time and is likely to be based on consensus rather than on legal obligation. On the other hand, to develop the FCCC into a true global treaty is a prerequisite to overcome the problem of carbon leakage that is caused by energy market responses and industrial relocation and which hinders for example the implementation of tradable emission permits (*Mabey* et al. 1997). The Berlin meeting of the Conference of Parties (CoP) in 1995 resulted in the 'Berlin Mandate', a declaration of intent that set a deadline of 1997 for negotiating a protocol or other binding legal instrument to cover the commitments of the developed countries after 2000 (Jepma and Munashinge 1998). It also set up a Subsidiary Body for Scientific and Technical Advice to provide scientific and technical information and made the Convention Secretariat permanent on January 1st, 1996 in Bonn. From the point of real-world progress the most important result of the Bonn meeting probably was the agreement on a pilot phase for joint implementation until 2000. After a second CoP-meeting in Geneva in 1996, at the third Conference of Parties (CoP 3) to the FCCC in Kyoto in 1997 the Kyoto Protocol was adopted, agreeing to include three

[3] These are the developed countries, especially the G7 and the economies in transition

[4] The Global Environmental Facility (GEF) is a source of funding for global environmental actions.

flexibility mechanisms (Joint implementation (JI), the Clean Development Mechanism (CDM) nad emissions trading between countries) in the Protocol to the FCCC (Joint Implementation Network 1998). Article 3 enacts this in allowing Annex I Parties to subtract certified emission reductions or emission reduction units from their assigned amount of emission reductions during the commitment period. Joint Implementation (JI) is allowed for co-operation between Annex I Parties and between Annex I and non-Annex I Parties. In this, Article 6 of the FCCC covers this first type of JI whereas the second type is covered in Article 12 of the Protocol, which defines the Clean Development Mechanism (Joint Implementation Network 1998).[5] Whilst CoP 4 and CoP 5 in Buenos Aires and Bonn, respectively were mainly focussed on procedural aspects, CoP 6a/b in 2000/2001 in Den Haag and Bonn arrived at a number of decisions with particular relevance to the corporate sector. These included agreements on the role of carbon sinks in the framework of CDM, limitations to ‘hot air’ GHG reductions, compatibility of different types of emission certificates and credits as well as on details of emissions monitoring and reporting. At the CoP 7 meeting in Marrakesh many of these agreements were finalised and operationalised and also it was agreed on including emissions from air and naval traffic which again is of relevance to the corporate sector (BMU 2001; 2003). One main objective resulting from CoP 7, the ratification of the Kyoto Protocol until the CoP 8 meeting at the Rio+10 conference in Johannesburg was however not achieved. Also, it seems unlikely that, after the recent CoP 9, held in December 2003 in Milan, Russia as the most important state for the Kyoto Protocol will change its position, and in doing so would enable quick ratification (also see Grubb and Safonov (2003) for a more detailed analysis of why this will likely be the case).[6]

[5] The purpose of this CDM is to support non-Annex I countries through projects set up in co-operation with Annex I Parties. The latter may use certified emission reductions from such projects to meet their targets. Emission reductions are measured by novel entities set up by the CoP. Credits are allocated for reductions achieved during the period between 2000 and 2012 (Joint Implementation Network 1998). Next to JI and CDM, emission trading is the third Kyoto mechanism to be discussed in detail later.

[6] The Kyoto Protocol which would require industrial states to reduce their GHG emissions by 5.2% (relative to 1990) between 2008 and 2012 would come into force globally with its ratification by Russia.

3 The success of the FCCC to date

According to Mabey et al. (1997), one precondition for global sustainability (i.e. preservation of ecosystem stability) are nearly constant atmospheric concentrations of GHGs. The IPCC (1992) estimated that a 50 – 70 percent reduction of GHG emissions (based on 1990 emission levels) would be necessary to stabilise the carbon dioxide concentration at 450 ppm. However, none of the cost benefit analyses on climate change carried out to date have concluded that it would be possible to economically reduce emissions more than 20 percent (Mabey et al. 1997). Therefore, carrying out only cost-efficient counteraction and abatement measures will likely not achieve the aforementioned stable concentration levels. Although the FCCC contains a precautionary principle in Article 3.3, it also stipulates that any policy measures to halt global climate change must be cost-effective and take into account economic issues, which points to a trade-off between the ecological and economic efficiency of the convention. Partly as a result of this, most GHG emission reductions to date did not directly attribute to the FCCC. Any reductions in the former-Socialist economies of transition in Central and Eastern Europe are mainly due to the rapid decrease in industrial production in these countries. Similarly, German compliance with the FCCC to date is to a large degree caused by the German unification and the subsequent breakdown of large parts of the industrial base in the former German Democratic Republic (Bergius 2003). In the United Kingdom (UK), a large part of emission reductions can be attributed to the fuel-switching processes (from coal to gas) that resulted from the deregulation of the British energy sector. Therefore only a small part of the reductions to date can be related directly to the FCCC. Also, recent analyses of progress towards their Kyoto targets in the most important member countries of the FCCC reveal that often GHG emission in several countries do not even move in direction of their Kyoto targets (BMU 2003, p. 413). For example, emissions in the U.S., Japan and Canada have grown, instead of falling, and within the EU, only the UK, France, Sweden, Finland and Luxemburg have reached their reduction targets but, as the example of the UK shows this may only partially be a result of the FCCC. From these results the notion may arise that the FCCC is rather to confirm the global recognition of the importance of climate change issues but not an effective instrument, for which one precondition would be ratification of the Kyoto Protocol.[7] This should not be regarded as a failure though, since

[7] Mabey et al. (1997) therefore state that the FCCC has only produced co-operation in so far that it discouraged free-riding, encouraged co-operation on abatement projects by joint implementation and in doing so laid the foundations for further co-operation.

long-run GHG emission levels depend as much on the final atmospheric GHG concentrations achieved, as on the choice of the emissions time-path (Richels and Edmonds 1995). Given that both together determine the ultimate costs of stabilisation the results of the FCCC to date probably indicate that more attention needs to be paid to identifying those paths that minimise the costs of achieving a specific target as the specific design of any stabilisation agreement can greatly influence the potential acceptability and stability of that agreement. However, slow progress on the ratification of the Kyoto Protocol (and the global emission trading systems proposed to become active between countries under the Kyoto Protocol from 2008 onwards) has led the European Union (EU) as early as March 2000 to propose a closed European emission trading (ET) system that shall also form the basis for Kyoto-based inter-country ET from 2008 onwards (EC 2000; Klinski 2002). This was detailed in a draft EU directive on GHG emissions trading between firms in October 2001 (EC 2003) which was ratified by the European Parliament in late summer 2003 after the second reading of the directive in the parliament. This means, that at the beginning of 2005, a tradable emission permit system will be in place in the EU which permits trading between firms. This of course raises the issue of how emission trading affects the corporate sector in particular in the EU which is the focus of the remainder of the paper. Any analysis here needs to start with the broader strategic frame for energy management strategies.

4 Corporate energy management strategies to address climate change

Generally, there are three strategies for the corporate sector to address climate change by means of energy management whilst at the same time not jeopardizing other central business objectives (such as earnings satisfizing or profit maximization). These are: improvement of energy efficiency, an increased use of renewable energies, fuel switching and the use of flexible mechanisms (such as JI, CDM or ET).[8]

The first of these strategies, improvement of energy efficiency, has been on the agenda for quite some time, initially triggered by the 1970s oil crises and recently predominantly because of increasing energy taxes. Unfortunately two factors limit the scope of this strategy. Firstly this is that because of its considerable history, energy efficiency improvements through direct measures (such as process integration, combined heat and power, heat and steam recovery) at plants or sites have often reached a level that leaves limited scope for cost-efficient improvement, since frequently the process-related limits are very close. Secondly, market imperfections such as lack of information hinder even cost-efficient investments in energy efficiency (Jaffe and Stavins 1994a, b; Sanstad and Howarth 1994; Sutherland 1996). Hence the potential for energy management-based GHG reductions by means of increased energy efficiency seems to be most viable in countries with low efficiency levels in energy generation and utilisation such as India, the U.S. and the post-socialist economies of Central and Eastern Europe or China rather than in the EU. Despite of this, new technologies bear some additional potential in the EU as well. For example, the specific energy consumption of thermal processes is expected to decrease by 30% due to novel membrane technology to replace thermal processes. Especially in the consumer market segment of the electricity industry considerable potential also exists for demand-side based energy management strategies such as Demand Side Management (DSM) or Least-Cost Planning (LCP) which were also found not to penalize energy suppliers pursuing them in financial terms (Greening 1995).

For the second of the strategies mentioned earlier, increased use of renewable energy technologies and sources, or more generally for fuel switching, the longer-term potential is high, since it leads to direct GHG emission reductions. Particular potential here exists for countries with a fossil-fuel intensive energy mix and for renewable energy technologies. One example of a technology with significant potential are solar cells.

[8] These three strategies are basically input-oriented but the various emissions-oriented approaches such as GHG inventory and management systems or reduction targets commonly depend on them.

Solar cells are increasingly used, but substantial progress with multi-layer solar cells is expected only between 2013-2023, when cell efficiencies in excess of 50% (resulting in an increase of module efficiencies from 14-17% to over 20%) and a share of renewable energies of around 10% are forecasted (Butz 2002). Firms such as BP Solar and Shell Solar have already vertically integrated solar cell manufacturing operations. However, at the moment, Japanese firms such as Sharp or Kyocera pursue the most aggressive market expansion strategies which may however be slowed down due to a lower level of vertical integration. This shows, that currently activities in the EU in the field of solar cells are mainly driven by large multinational energy companies, renewable energy-focussed companies and EC research programs. However even conservative market forecasts (Butz 2002) predict a market of approx. 600 MWp of solar cell production (with optimistic predictions expecting more than 1000MWp) at least part of which will also be a promising field of activity for SMEs within the EU as is shown by companies such as Enercon, Repower or Vestas. As can be seen from Table 1, market forecasts imply considerable growth rates and at the same time an increased technological diversity (e.g. in terms of a significantly reduced market share of mono-crystalline solar cells which today dominate the market) which also requires novel forms of cooperation within industry. This development is already spearheaded by the recent joint ventures such as the one of German firms SolarWorld and Degussa who intend to jointly set up a pilot plant for the production of solar cell silicon in Antwerpen by 2005 (Anon 2003; Iken 2002).

Table 1: Market forecasts for the world solar cell market

Year	World market solar cells (in MWp)	Market share mono-crystalline solar cells	World market CAGR (cumulative annual growth rate) 1999-20xy
1999	201	35% (1997: 49%)	0%
2001	390-400	30%	25%-26% (calculated)
2010 conservative	600	15-20%	2.5%-9.5% (estimated)
2010 optimistic	1450	15-20%	12%-18% (estimated)

(Source: Butz 2002; SAM 2002; Franken 2003)

For companies in the EU corporate sector, renewable energies will only be a viable energy or fuel source (and thus an element of their corporate energy management strategies), if they can compete on price with fossil fuel-based technologies. This would require prices to fall from currently around 3-4$/Wp to around 1.5$/Wp by 2010, which can only be achieved by means of significant innovation efforts not only of cell and module technology but also associated manufacturing processes. As a note of caution and a remainder that such radical innovation is not a 'free lunch', Grubb (1997) points to the relevance of early (government supported) PV innovation activities and associated induced innovation benefits which may require more systematic market support in order for renewable energy technologies to become a competitive energy source in the soon-to-be fully liberalized and deregulated EU energy markets.

Finally, a third general strategy for corporate energy management to address climate change-induced demands is the use of flexible mechanisms such as JI, CDM and ET which are the mechanisms of the Kyoto Protocol and which have been introduced in Section 2. Whilst CDM and JI enable European industry to exploit marginal abatement cost differences between countries, its incentives for early action are comparatively low. There is for example uncertainty regarding the use of emission reduction units or emission credits from JI/CDM in the EU emissions trading system with the current status being that such use is possible from 2008 onwards, provided the Kyoto Protocol will be ratified until then. Hence, whilst early JI/CDM projects may have positive reputation effects for firms, they run the risk of gaining only limited economic benefits. At the same time such projects, usually requiring multi-partite partnerships have internal risks due to their complexity. Limiting these also increases costs. For example, De Gouvello et al. (2003) show in their analysis of the Tahumanu Project in Bolivia, that it is an important success criterion to analye the incentive situation of all participants in a CDM project.

As another option, a combination of any two basic energy management strategies discussed so far is perceivable, e.g. joint use of renewable energies and JI/CDM. Here, it would be possible for EU companies to use renewable energies at sites which are eligible for JI/CDM, e.g. in Asia, Africa or India with the possibility for gaining credits or reduction units from GHG reductions. This seems to be of particular interest given the current focus of EU firms on expanding business in Non-Annex I countries. For example, new plant construction in Asia could focus on integrating CDM activities already during the planning stage which may reduce the construction costs or offset increased emissions in the EU. With the imminent accession of several Central and Eastern Europe states to the

EU such a scenario would also be possible on the basis of JI for business expansion in Eastern Europe. Several renewable energy technologies can be a pillar for such projects, but in particular in Africa, the potential of PV is significant. This example also shows, that joint strategies based on renewables and JI/CDM are also able to integrate economic, social and ecological demands into business activities and is hence highly suitable for increasing sustainability amongst European industry.

Next to JI and CDM, ET is a third flexible mechanism. Prior to describing the EU sys-tem and discussing its practical implications of for EU firms and its energy management strategies, the theoretical basis for such a system shall be recapitulated briefly.

5 An economic assessment of tradable emission permit systems as a basis for ET

Climate change is a problem to be solved between nation states, therefore it lacks an existing legal framework within which property rights and contractual enforcement allow classically defined actions to take place (Mabey et al. 1997). The atmosphere has no owner and therefore no ownership rights are defined. In this case property rights are not complete and external costs and benefits may not be internalised. The atmosphere will therefore not be used at socially optimal levels which equates to market failure. In order to correct market failure, access rights have to be defined through collective agreements. Otherwise, the fate of such an open access resource is likely to be degraded due to ‘free-riding’ (Hardin 1968), despite of the fact that perfect co-operation could avoid this, since it is a stable outcome (i.e. a Nash equilibrium) of the open access management game provided a number of assumptions are fulfilled (Mabey et al. 1997).

The economic rationale that underpins tradable emissions permits (TEPs) is that by creating markets for environmental goods, property rights can be defined and the negative externality of carbon emissions becomes a ‘normal’ market good. Whereas with carbon or energy taxes the price is controlled directly, with TEPs the amount of GHG emissions is controlled directly, but prices only indirectly (Endres 1994). Therefore permit systems offer more security in reaching pre-defined environmental targets and provide a safer route to securing the corresponding benefits. At the international level TEPs would be a way to avoid international carbon taxes which is seen as their major political advantage (Eyre 1997). As well the U.S., who strongly reject carbon taxes, have already implemented permit systems for sulphur dioxide emissions in some states, and may be more open to tradable permits for carbon emissions despite the fact of the current government opposing to the FCCC and Kyoto Protocol in general. Unfortunately, TEPs are to some degree hindered by several theoretical issues, as for example the problem of how to setting the overall emission cap, whether initial allocation of permits should be based on ‘grandfathering’ or if a TEP system should include a ‘borrowing’ clause (Endres 1994).[9] With the TEP system recently adopted by the EU (hereafter referred to as the EU emissions trading (ET) system), a first system is currently implemented for inter-firm (as opposed to intra-firm) trading of carbon dioxide emissions. This system shall be introduced in the following and its implications for European industry and its energy management activities shall be discussed.

[9] As will be seen later, this is also an issue for the EU emissions trading system.

6 The EU emissions trading system and its implications for the European industry and corporate energy management activities

The EU ET system applies only to combustion installations with a net heat supply in excess of 20 MW, such as industrial power stations, furnaces and other plant in the chemical industry, the energy generation industry, oil refineries, steel smeltering in the manufacturing industry, the ceramics industry and the cellulose, paper and board manufacturing industries. In total, the 4500 installations that are in the scope of the ET legislation emit ca. 46 % of the EU's total CO_2 emissions (Bergius 2003; Klinski 2002).

According to the EU ET directive, only carbon dioxide emissions are affected, but no other GHG emissions. For the former, inter-firm trading is possible, with the system boundary being the individual installations of a firm which are within the scope of the directive. The directive defines initially two trading periods, the first from the beginning of 2005 to 2007 and the second from 2008 to 2012. The national implementations of the directive are subject to approval by the EU. Industry in Europe was initially very critical of the proposed directive and was favoring, next to demanding a number of amendments, voluntary agreements between government and industry as an alternative to any TEP (see BDI (2001) for a critical position typical for German industry). The EU ET directive was amended to make a number of concessions to these criticisms which included voluntary pooling of credits in the first trading period as well as the possibility of an opt-out (non-participation in the ET system) during the first trading period.[10] Over the period until final adoption of the directive, the position of the corporate sector towards the ET directive has become more diverse in that some firms have taken a more proactive stance and acknowledged the possibility of benefits through trading as well as limited competitive disadvantages from the system (Döhmel 2003). Whilst general agreement on the EU ET system was (despite of initial reservations of EU industry, a relatively easy task) a tight timeline now complicates implementation of the system in the EU member states.

For example, in Germany alone 2500 to 3000 installations are affected by the new EU directive. In Germany, initially, emissions data of the relevant installations for 1990, 1998, 2001 and 2002 was collected in late 2003 and early 2004. Then, the national allocation

[10] Whilst the concessions were at the forefront geared towards addressing criticisms by European industry, they at the same time included requirements which made it very unlikely that industry would make use of them. Limitations existed in that reporting duties of firms still (even with pooling or opting-out) referred to individual installations which threatened cooperation within individual industries as well as any incentives for voluntary agreements since these would relief firms of their monitoring and reporting duties. Also, firms can still be sanctioned even when pooling or opting out of the system.

plan was developed by the German Federal Ministry for the Environment based on a top-down allocation of emission allowances to macro-level economic sectors. This macro-level allocation was combined with the aforementioned bottom-up analysis of the current emission data for the affected firms at the end of 2003 and in the beginning of 2004. The final national allocation plan for Germany was then submitted to the European Commission (EC) in March 2004 for approval of the national implementation of the directive based on the national allocation plan and then became binding law in Germany. This last step again required several administrative adjustments concerning legal clarification of key terms (such as 'installation' for which in Germany already precise legal definitions exist which need to be harmonized with the requirements of the EU ET directive), as well as clarification of how an emission permit for an installation relates to existing operating permits for installation and which authorities (e.g. federal or state-level ones) are to administer the new laws. These issues implied that national legalization of the directive was a demanding process in Germany and that the additional structures may result in inefficient administration.

Country-level issues are further aggravated by general problems due to e.g. an unspecific definition in the EU ET directive of what an installation is.[11] At the EU level an issue of particular relevance for the directive is to which degree the novel Accession Countries will participate in the system. The current trend is that except for Hungary and Poland all other Accession Countries will participate from 2005 onwards in the EU ET system. Given that these countries will most likely be strong sellers in the system, the issue is to which degree insufficient EU-wide harmonisation will distort competition in the EU and whether this would constitute a breach of other EU legislation, requiring the EC to take action.

EU industry is mainly affected by five issues resulting predominantly from the tight implementation schedule of the directive. Firstly this is the fact, that the guidelines for formulating the national allocation plans and for monitoring are to be published (according to a schedule suggested by the EC) shortly before the national plans have to be submitted to the EC. This means that firms will not have much chance for a response to the guidelines so that the national plans will likely go unaltered to the EC.

Secondly, the limited data base for derivation of the national allocation plans could easily lead to a misguided allocation of emission credits to the different macro-sectors This may

[11] The problems concerning how an installation is defined refer mainly to the degree to which specific combustions plants are affected which burn waste air, solid or liquid waste but are in parallel fuelled with fossil fuels (coal, gas or oil) as a combustion catalyst.

put EU industry at a disadvantage since they likely have more comprehensive and more reliable data available than e.g. the transport sector where difficulties arise in data gathering due to the non-point source characteristics of most emitters.

Thirdly, the degree to which early actions are taken into account in the allocation of carbon dioxide emission certificates under the EU directive is a critical factor. If early actions are only taken into account to a very limited degree, then the burden will be put to a larger degree on environmentally proactive firms, which carried out emission-reducing activities early since for them, it will be more costly to reduce emissions further. This essentially represents a double burden for such firms, since also their early emission-reducing activities may have put them at a cost disadvantage compared to competitors.

As a forth aspect, the current approaches to allocation are not very well-structured, which may result in cross-subsidiaries from the industry macro-sector to other macro-sectors (traffic, households, or in the case of Germany an emission credit ‘reserve’ for replacing nuclear fuel-based power stations with gas- or oil-based ones as part of the current government’s energy policy). Building such ‘reserves’ as a result of a complex allocation process will reduce the emission reserves of the corporate sector for increasing industrial production and may essentially limit economic growth or introduce competitive disadvantages compared to unaffected world regions. As addressed in Section 5, allocation procedures are also pivotal to the overall efficiency of the ET system.[12]

Fifth and finally, the corporate sector may be faced with increased administrative costs for certification, monitoring, reporting, permit processing and trading of certificates, depending how efficient the directive is implemented by the member states.[13]

Next to tradable emission permit systems such as the EU ET system, voluntary or negotiated agreements are discussed or applied as alternatives or complements.[14] A particular case in question here is Germany. Trautwein (2002) names as one reason why in Germany tradable emission permit systems are not much developed the voluntary agreements of the corporate sector with the government on carbon dioxide and GHG emission reduction targets (Buttermann and Hillebrand 2002; Buttermann et al. 1999). Based on these targets, specific industries such as e.g. the German chemical industry have set their own targets. For the German chemical industry, this requires a reduction of their GHG emissions by 45-50% until 2012 on the basis of 1990 emission levels which equals a reduction of 41 million

[12] Buttermann and Hillebrand (2003) discuss this in more detail.
[13] Gouldson and Murphy (1998) analyse in detail efficiency aspects of implementing regulation.
[14] Wu and Babcock (1999) provide a very detailed discussion of various aspects of voluntary programs.

tonnes of carbon dioxide equivalents, of which until 1990 21 million tonnes have been realized (VCI 2001). Based on specific industry targets, in turn individual companies have often set their own targets. It needs to noted, that voluntary or negotiated agreements between industry and government are partly put under pressure by the EU ET system. Business associations (such as e.g. the German BDI) argue that the EU ET system is to be viewed as a substitute system to any voluntary or negotiated agreement. This argument is frequently picked up by member firms so that there is a risk that voluntary or negotiated agreements are not considered to be binding anymore when the EU ET trading system comes into operation. Whilst initially this may be considered as a drawback in countries where voluntary agreements are in place between the corporate sector or specific industries and the government (such as Germany or the Netherlands), it should not be an issue in the long-term, since TEPs in general are designed to achieve defined environmental targets and, if executed properly, should therefore achieve emission reductions with more certainty. However, as Buttermann and Hillebrand (2003) warn, there is no absolute certainty about the reductions achieved, since macroeconomic factors which are difficult to predict (such as currency exchange rates or unexpectedly warm or cold years) may have a significant effect. They therefore suggest parallel use of CDM and JI as specified in the Kyoto Protocol in order to ensure sufficient flexibility of the EU ET system.

What becomes apparent from the theoretical analysis of TEPs in general and the development of the EU ET system to date is that the rather positive assessment of TEPs from a theoretical perspective is complemented by a rather critical assessment of industry of the recent EU emissions trading directive. This is despite of the considerable potential for firms in particular in the industrial to utilize emissions trading as part of their corporate energy management strategy and strategic responses towards climate change. In particular once the Kyoto Protocol comes into force, a number of novel strategy options open up for EU industry e.g. in combining business strategy-based market expansion plans with JI or CDM activities to be used within the EU ET system. Next to these direct win-win relations between economic [illegible] l enable the EU industry to address the challenge of sustainability in a more integrated way whilst at the same time creating a more positive link between the environmental and economic performance of individual firms, there are also important secondary effects which are not yet fully understood yet. For example, as Rennings (2003) points out, emissions trading is likely to become a key instrument in the future co-ordination of environmental and innovation policy in the EU and expects strong innovation impacts from the application of this novel instrument which according to him however depend much on the chosen environmental targets. Given this expanded relevance of ET beyond its direct role in the energy management strategies of industry, the final section of this paper shall therefore put the instrument in the broader context of optimal climate policies.

7 An outlook on economic issues of international co-operation: ET in the context of optimal climate policies as a basis for global environmental policy-making

In the field of climate policy, one has to distinguish economic factors that drive international negotiations to limit GHG emissions and the process of legal and institutional regime building that takes place for example within the UN Framework Convention. Economic research to date (and the mere existence of the FCCC) show that co-operation can yield large global benefits (Clarke et al. 1993). Following Mabey et al.. (1997), co-operation shall be defined as a solution between countries that includes a negotiated agreement, which is codified in a treaty that is valid under international law. It is well-known from economic theory that perfect co-operation will always maximise the sum of global welfare[15], in other words, full collaborative effectiveness of negotiations to control climate change maximises global welfare into the future. However, a workable concept of global welfare is difficult to derive because of the non-comparability of preference choices, the disparities of income between different countries and the unknowable preferences of future generations. For example, as climate change might have a non-marginal impact on critical environmental goods, although the willingness-to-pay (WTP) of future generations to avoid this change is unknown, it is possible that it will be higher than the WTP of current generations to prevent such damages. Also many costs of climate change are not priced in the market and in this case substitutability cannot be derived from economic analyses but is left to public choice (Mabey et al. 1997). This difficulty in determining the substitutability between man-made and natural capital leads to significant problems in determining discount rates and future prices. An issue at the micro-level is that perfect co-operation would imply that each country internalises the full external costs of climate change. In this case, a country would reduce its emissions to the level, where its marginal cost of abatement equals the marginal global benefits of these emission reductions. Due to the aforementioned fundamental problems in economic analysis it is however very difficult to determine correct values for these marginal costs and benefits, which is probably one of the reasons why international co-operation has not developed as far as it could have in theory. To overcome all these difficulties and to improve co-operation, Mabey et al. (1997) suggest the application of the two supplementary ethical criteria of intra-generational equity and inter-generational equity which would transform the problem from one of full welfare optimisation into one of constrained optimisation and would also bring it more in

[15] Assuming, amonst other things, that no country involved has decreasing marginal utility of income.

line with sustainability objectives (such as proposed in Pearce et al. 1989). In this extended perspective, ET is assigned an important role in increasing flexibility of any institutional arrangements, as well as enabling a better integration of (economic, social and environmental) sustainability aspects at the firm level.

According to Jepma and Munasinghe (1998) a flexible climate change response strategy should include a portfolio of mitigation, adoption and other options, based on the co-ordinated application of a variety of market-based, regulatory and other instruments, as e.g. carbon/energy taxes or TEP systems. Currently tradable emission permit systems seem to be a more suitable instrument to extend the current state of joint implementation in the FCCC than carbon or energy taxes. Attention should be paid to technology development and dissemination, which should as well form part of a climate policy portfolio. A crucial issue in this regard is the timing of abatement. This concerns technology and systems availability and development and the wide spectrum of technologies both currently and potentially available and the spectrum of processes by which such technologies may be developed and incorporated in energy systems. Grubb (1997) stresses, that this is a complex issue with some factors favouring deferral and others favouring early reductions in emissions. However, he makes the point for approaches that favour steady abatement efforts exploiting low cost measures to deter new carbon intensive investments and to stimulate development and diffusion of low carbon technologies and infrastructure through market incentives. He stresses that these might well have the same (or even lower) overall costs as strategies, which first concentrate on research and then achieve much abatement in very short time. Rennings (2003) expects strong innovation impacts from the application of ET, which according to him however depend much on the chosen environmental targets. He stresses the pivotal role of targets in any TEP or ET system, in particular with regard to any innovation-inducing effects of ET. Naoki (1997) in this respect proposes the inclusion of past policy-based efforts and to this end suggests the rate of change of carbon dioxide emissions per GDP since 1973 as one of the indicators for targets in future protocols and agreements. He points out that any new protocols should provide a framework for substantial progress in the real world today, which seems to be a suitable benchmark for evaluating future climate policy. Overall, the conclusion of this paper is that ET systems are potentially suitable instrument for meeting this benchmark and should thus feature prominently in corporate energy management strategies. In the EU, the first steps for achieving this are now made with the new ET system.

References

Albrecht, J.: 1998a, *Environmental Regulation, Comparative Advantage and the Porter Hypothesis*, Working Paper, Faculty of Economics and Applied Economics, University of Ghent.

Albrecht, J.: 1998b *Environmental Costs and Competitiveness. A Product-Specific Test of the Porter Hypothesis*. Working Paper, Faculty of Economics and Applied Economics, University of Ghent.

Anon: 2003, 'Freiberg erlebt den Solar-Aufschwung Ost', *Freie Presse*, 14 February 2003.

Bergius, S: 2003, 'Handeln für die Umwelt', *Handelsblatt*, 23 April 2003.

BDI: 2001 *Marktwirtschaftliche Instrumente in der Umweltpolitik – Freiwillige Vereinbarungen, Steuern und Zertifikate im Vergleich,* Berlin, Bundesverband der Deutschen Industrie e.V.

BMU: 2001, 'Ergebnisse der Klimakonferenz von Marrakesch: Kyoto-Protokoll kann in Kraft treten', *Umwelt* **12**, 832-835.

BMU: 2003, 'Klimakonferenz in Bonn', *Umwelt* **7-8**, 412-413.

Buttermann, H.G. and Hillebrand, B.: 2002, *Die Klimaschutzerklärung der deutschen Industrie vom März 1996 – eine abschließende Bilanz (Monitoring-Bericht 2000),* Essen, Rheinisch-Westfälisches Institut für Wirtschaftsforschung (RWI).

Buttermann, H.G. and Hillebrand, B.: 2003, *Klimagasemissionen in Deutschland in den Jahren 2005/7 und 2008/12 (RWI-Materialien, Heft 2),* Essen, Rheinisch Westfälisches Institut für Wirtschaftsforschung (RWI).

Buttermann, H.G., Hillebrand, B. and Lehr, U.: 1999, *Second Monitoring Report: CO2 Emissions in German Industry 1996-1997*, Essen, Rheinisch-Westfälisches Institut für Wirtschaftsforschung (RWI).

Butz, C.: 2002, *PV 2002 - Markets, Actors and Forecasts*, Basle, Bank Sarasin.

Clarke, R., Boero, G. and Winters, L.A.: 1993, *Controlling greenhouse gases: a survey of global macroeconomic studies (University of Birmingham Discussion Paper 93 18)*, Birmingham, University of Birmingham.

De Gouvello, C.C., Mollon, P. and Mathy, S.: 2003, 'Rent Sharing in the Clean Development Mechanism: The Case of the Tahumanu Hydroelectric Project in Bolivia', *Greener Management International* **39**, 109-119.

Döhmel, K.: 2003, 'Niemand kann sich heraushalten (Interview by S. Bergius with K. Döhmel, CEO of Shell Deutschland Holding GmbH)', *Handelsblatt*, 23 April 2003.

EC: 2000, *Grünbuch zum Handel mit Treibhausgasemissionen in der EU (COM (2000) 81* *final of 8th March 2000)*, Brussels, European Commission (EC).

EC: 2003, *Directive 2003/87/EC of the European Parliament and of the Council of 13 Oct. 2003 establishing a Scheme for Greenhouse Gas Emission Allowance Trading within the Community and Amending Council Directive 96/61/EC*, Brussels, EC.

Endres, A.: 1994, *Umweltökonomie*, Tübingen, Cansier.

Eyre, N.: 1997, 'External costs. What do they mean for energy policy?', *Energy Policy* **25**(1), 84-95.

Franken, M.: 2003, 'Sonnige Visionen', *VDI nachrichten*, 25 July 2003.

Gouldson, A. and Murphy, J.: 1998, *Regulatory Realities*, London, Earthscan.

Greene, O.: 1993, 'International environmental regimes: verification and implementation review', *Environmental Politics* **2**(4), 56-73.

Greening, D.W.: 1995, 'Conservation Strategies, Firm Performance, and Corporate Reputation in the U.S. Electric Utility Industry', *Research in Corporate Social Performance and Policy* **Supplement 1**, 345-368.

Grubb, M.: 1997, 'Technologies, energy systems and the timing of CO2 emission abatement: An overview of economic issues', *Energy Policy* **25**(2), 159-172.

Grubb, M. and Safonov, Y.: 2003: 'Why Russia is dragging its feet on Kyoto?', *Financial Times*, 14 July 2003.

Hardin G.: 1968. 'The Tragedy of the Commons', *Science* **162**(3859), 1243-1248.

Iken, J.: 2002 'Ende der Abhängigkeit in Sicht', *Sonne, Wind & Wärme* **7**, 46-47.

Jaffe, A.B. and Stavins, R.N.: 1994a, 'Energy-efficiency investments and public policy', *The Energy Journal* **15**(2), 1-23

Jaffe, A.B. and Stavins, R.N.: 1994b, 'The energy efficiency gap: what does it mean?', *Energy Policy* **22**(10), 804-811.

Jepma, C.J. and Munasinghe, M.: 1998, *Climate change policy. Facts, issues and analyses*, Cambridge, Cambridge University Press.

Joint Implementation Network: 1998, *Joint Implementation Network website*, accessed 2nd April 1998 under http://www.northsea.nl/jig/Backgr.htm.

Klinski, S.: 2002, 'Handeln mit CO_2', *UmweltMagazin*, **March**, 72-73.

Mabey, N., Hall, S., Smith, C. and Gupta, S.: 1997, *Argument in the Greenhouse. The International Economics of Controlling Global Warming*, London, Routledge.

Matsuo, N.: 1997, 'A proposal for Protocol(s) on climate change. For the innovative and substantial quantified objectives', *Energy Policy* **25**(2), 173-184.

Nierenberg, W.A.: 1995, 'Looking back 10 years', *Energy Policy* **23**(4/5), 283-288.

O'Riordan, T. and Jaeger, J.: 1996, *Politics of climate change: A European perspective*, London, Routledge.

Pearce, D.W., Markandya, A. and Barbier, E.B.: 1989, *Blueprint for a green economy*, London, Earthscan.

Rennings, K.: 2003, *Blueprints for an Integration of Science, Technology and Environmental Policy*, Presentation at the Final BLUEPRINT Conference, Brussels, 25-26 September 2003.

Richels, R. and Edmonds, J.: 1995, 'The economics of stabilising atmospheric CO_2 concentrations', *Energy Policy* **23**(4/5), 373-378.

SAM: 2002, *Klimawandel im Energiesektor*, Zurich, Sustainable Asset Management (SAM).

Sanstad, A.H. and Howarth, R.B.: 1994, '`Normal` markets, market imperfections and energy efficiency', *Energy Policy* **22**(10), 811-818.

Sutherland, R.J.: 1996, The economics of energy conservation policy, *Energy Policy* **24**(4), 361-370.

Trautwein, S.: 2002, *Chancen und Probleme des betriebsinternen CO_2-Zertifikatehandels – am Beispiel des Otto Versand, Hamburg*, Lüneburg, Centre for Sustainability Management (CSM).

UNEP (United Nations Environment Programme): 1992, *United Nations Framework Convention on Climate Change*, Geneva, United Nations.

VCI: 2001, *Chemie setzt beim Klimaschutz weiter auf freiwillige Vereinbarungen statt auf Handel mit Emissionsrechten. Selbstverpflichtung der Branche zur CO2-Reduzierung bis 2012 festgelegt*, accessed 31 July 2003 under www.vci.de/showdoc/ testOpen.asp?Portal=2&DokNr=64397.

Wu, J. and Babcock, B.A.: 1999, 'The Relative Efficiency of Voluntary vs Mandatory Environmental Regulations', *Journal of Environmental Economics and Management*, **38**, 158-175.

WBCSD: 2002, *Innovation, technology, sustainability and society*, Geneva, World Business Council for Sustainable Development (WBCSD).