# Climate change Policy in Europe and US: the role of corporate social responsibility

**Abstract:** *We discuss the natural and societal challenges and drivers in the energy and climate debate and compare the role of Corporate Social Responsibility (CSR) in the US and Europe as an example of soft law. Dramatic CO2 emission reductions are necessary (~95%), but there is no hard law in sight to provide the needed legal framework for such reductions. Surprisingly CSR has begun to play a role in changing both the US and the European energy policies and could become the key future driver. However, on its own CSR is unlikely to achieve the needed scale of reductions.*

**Keywords: Corporate Social Responsibility; climate change; energy policy**

***Diana Mangalagiu***
Reims Management School

## *Background*

In recent years, there has been a growing level of concern that anthropogenic emissions of carbon dioxide ($CO_2$) cause a general warming of the planet. Today the estimated yearly global $CO_2$ emissions from fossil fuel consumption of ~29 billion metric tons (~29 Gt) represents some 80% of the total stemming from human activities and is about 8% of the natural $CO_2$ cycle. This significant amount of $CO_2$ makes it the most important greenhouse gas (GHG) in terms of potential climate change.[1] In 2005, the US accounted for 21%, Europe for 16.5%, and China for 18.8% of the of yearly anthropogenic $CO_2$ emissions (EIA, 2007). In 2006, China's $CO_2$ emissions surpassed those of the US by 8%, topping the list of $CO_2$ emitting countries for the first time (Raupach et al., 2007).

The relative contributions of different fossil fuels to total energy-related anthropogenic $CO_2$ emissions have changed over time, but the total emissions produced by combustion of fossil fuels[2] remained stable at roughly 80% in the last decades (EIA, 2007). To set the scale of these emissions, we note that a billion tons or a gigaton (Gt) is the mass of a cubic kilometer of water. Thus the total yearly global $CO_2$ emissions are equal in mass to 29 cubic km or 7.0 cubic miles of water. The yearly storage volumes required are likely to be somewhat larger. If, for instance, $CO_2$ is injected deep underground to the required storage depths, the combination of the prevailing storage temperatures and allowable pressures, would mean that the $CO_2$ is a super critical fluid whose density is only about 80% than that of liquid water and therefore require 25% more volume. In spite of the huge volumes involved, it is important to keep in mind that these values are very small compared to the crustal volume of the Earth and also that in a single year we already move worldwide several cubic km of oil, as well as coal.

The impact of $CO_2$ is amplified by its long effective residence time in the atmosphere. Thus the cumulative global emissions have led to a significant net increase in atmospheric $CO_2$ concentration approaching 385 parts per million (ppm) today (end 2007), which is 37.5% above the pre-industrial value of about 280 ppm (1 ppm ≈ 7.8 Gt of $CO_2$ ≈ 2.1 Gt of C). There is consensus in the scientific community (IPCC, 2007) that a clear connection exists between rising atmospheric $CO_2$ concentrations and the warmer global climate. However, due to the complexities involved in predicting climate change, the magnitude of the consequences that will result are not well quantified, especially on local levels where there will be a considerably greater number of extremes than for the global average predictions. It is also not yet clear when, or if, a major positive feedback effect will "kick in", although there are a number of predictions of this occurring. Furthermore, these feedbacks also raise the issue of a potential climatic "tipping point" at which time the changes will become essentially irreversible on multi-generational time scales. The fact that $CO_2$ is a GHG is however not in dispute. Prudence would ague it would be best to avoid further change, given that there are far more things that can go wrong than right.

Atmospheric $CO_2$ at about 560 ppm (twice the pre-industrial level) is an operational number that is often used as a reference for climate policy discussions as a number not to exceed. We shall also use this number as a reference because it is a level that we are likely to reach even with significant work to limit $CO_2$ emissions in the near term. In fact, without aggressive policies much higher atmospheric $CO_2$ concentrations will be generated.

An example of a major climatic tipping point would be the cessation of the Gulf Stream due to the disruption of the thermohaline driven ocean circulation. It is the Gulf Stream that provides the relatively balmy climate in the most of Western Europe (Broecker, 1997) and such a cessation would probably turn the Western Europe climate into a Newfoundland like climate within a decade with severe human and economic consequences. Obviously, such localized climate change issues are also a matter of global stability and national security, both important issues that are not yet a central part of the energy debate.

Another infrequently mentioned impact of $CO_2$ is that of ocean acidification. $CO_2$ is an acidic gas, and since it is freely exchanged with the ocean surface waters, increased atmospheric $CO_2$ concentrations results in acidification of the ocean, especially the surface layers where much of its life exists (Davis, 2007; Royal Society, 2005).

Estimates of the economic impacts of climate change and also the costs of climate change mitigation vary considerably. According to the Stern review (Stern, 2006), the expenditure required to mitigate climate change can be limited to 1% of global gross domestic product (GDP) annually if action is taken now. However, if no action is taken, the overall costs and risks associated with climate change could equate to 20% of global GDP annually. According to the IPCC (IPCC, 2007), in 2030 macro-economic costs for GHG mitigation, consistent with emission trajectories towards stabilization between 445 and 710 ppm, are estimated at a 3% decrease of global GDP compared to the baseline scenario, though the regional costs may differ significantly from global averages. The European Community's (EC's) impact assessment (EuropaWorld, 2007) states that taking action to limit climate change is compatible with sustaining global growth. Investment in a low-carbon economy would require around 0.5 % of global GDP over the period 2013-2030.

## *The issue of scale*

Our previous discussion needs to be situated in a broader perspective to realize the scale of the global climate problem we are confronted with. What does the US actually need to do to implement per capita $CO_2$ emissions that stabilize our atmospheric $CO_2$ level at twice the pre-industrial level? To provide an order of magnitude estimate, we note that the standard of living is approximately directly proportional to energy use. We also note that the US per capita $CO_2$ emissions are about 5 times those of the average person on the planet. If the current world's population were to equally share per capita emissions at the US standard of living, the US per capita emissions would have to go down by a factor of 5 just to prevent an increase in the current global emission rate. Furthermore, if the world's population were to still double, another factor of 2 reduction would be required leading to an overall factor of 10 reduction in US per capita emissions. This massive US reduction would however simply maintain current global emission values, which are of course still producing a relatively rapid rise in atmospheric $CO_2$ levels. According to estimates (Wigley, 1995), to actually stabilize atmospheric levels at twice the pre-industrial level would require about a factor of 3 reduction from today's global emission rate. Multiplying the various factors together leads to a required factor of 30 per capita emissions reduction from today's US values. Being roughly only 3% of today's US value, this indicates that our goal needs to be effectively zero emissions from all the major $CO_2$ sources (Ziock and Lackner, 2000). We note in passing that since large efficiency improvements are not business as usual, we have not included them. When/if they are achieved and implemented, they would count as part of the factor of 30 reduction. At the same time we have also not included possible increases in energy use to address likely pressing future problems such as fresh water shortages and their possible solution by energy intensive water desalinization.

## *Hard law versus soft law*

The international community has proven its inability to produce mandatory rules to reduce $CO_2$ emissions. There is no hard law in sight that could provide a legal framework for such reductions. On the soft law front, the Kyoto Protocol is of symbolic importance as an expression of the governments' concern about climate change. However, as an instrument for achieving $CO_2$ emissions reductions, it has failed, achieving no significant reductions in emissions (Prins and Rayner, 2007). It is critical to note the grave discrepancy between the magnitude of the necessary emission reduction needs (about 95% value compared to the 1990 level), and the modest requirements articulated in the Kyoto Protocol (about 5% value compared to the 1990 level and only for the developed nations)[3]. The UN organized Bali Conference (December 2007) on climate change didn't achieve much either. For example, the EU tried to include into the roadmap emissions cuts of 25% to 40% for the developed countries by 2020. However, even these modest cuts could not be approved. Furthermore, both in the US and Europe the most progressive official policy documents only propose $CO_2$ emission reductions by a factor of 2 still far from the necessary cuts by a factor of 30.

Despite the lack of political will to address the $CO_2$ emission reduction issues, the development of clean and carbon neutral energy sources is paramount if the US and Europe are to reduce the release of GHG and prevent major global climate changes. Also, other countries including the emerging powers such as China and India have to address their emission issues, as the problem is global in nature. However, one might hope/expect that the technologically and economically advanced countries would take the lead in developing and implementing the first versions of the needed technical and political solutions.

As we have stated above, by assessing the global scale of the climate problem and discussing the different issues, the total yearly emissions produced by combustion of fossil fuels of 29 Gt of $CO_2$ represent more than 80% of the total anthropogenic $CO_2$ emissions. The US and Europe are, along with China, the main $CO_2$ emitters. It is clear that radical $CO_2$ emission reductions - far beyond anything currently in the public debate - will be necessary within the next generation.

We investigate the way the US and Europe are currently addressing the energy-related emissions issue. They serve of examples of trends in the wealthier global regions that will need to take the lead in addressing the climate change issue. We comparatively study the US and European energy policies and focus on the federal and European level vs. state and national vs. local policies with respect to $CO_2$ emissions and climate change. Our proposition is that while the large companies have no financial interest in tackling greenhouse gasses without significantly greater government and public pressure, Corporate Social Responsibility (CSR) could nonetheless play a key role in changing the US energy policy and bring further changes to European energy policy. We seek to evaluate the role CSR has played in the changes that are taking place today and what likely roles CSR will play in the future initiatives in terms of $CO_2$ emission reductions.

## *Public policy and awareness about energy issues in Europe and US*

### The CO2 issue is different from most other environmental issues

In the Western World, the 20th century has been characterized by a culmination of industrial pollution growth followed by a significant cleanup effort. The process occurred at all levels ranging from soil, water, and air pollution to additives in foods to unhealthy building materials, etc. The 20th century history of water management illustrates this general trend.

In the US and across most of Europe the accumulated pollution of the waterways caused by industrialization was mitigated in the latter part of the last century. During the 60s, a public debate on water quality was prompted by an increasing number of affected citizens supported by scientists as it became clear that the previously utilized "dilution principle" was insufficient. Stakeholder concerns rapidly grew and through the 70s significant legislature was passed in most regions. In the US, the Clean Water Act, 33 U.S.C. § 1251, et seq., started as the Federal Water Pollution Control Amendments of 1972. Amendments added in 1977 commonly became known as the Clean Water Act, which is the primary federal law in the United States governing water pollution. The act established the symbolic goals of eliminating releases to water of harmful amounts of toxic substances, eliminating additional water pollution by 1985, and ensuring that surface waters would meet standards necessary for human sports and recreation. Across the US and Europe the late 70s and early 80s were characterized by major public and private investments in waste-water treatment plants and other cleanup initiatives. The impact of these initiatives became obvious in the 90s and by the turn of the century most streams, beaches, and straits were brought back to a state similar to pre-industrialization. These changes were driven by the obvious effects of water pollution, the fact that a close to reversible cleanup effort was achievable at relatively low cost, and that it could be completed quite rapidly (about 30 years). Similar initiatives to restore clean air were started to mitigate acid rain, particulate emissions, and smog.

For the $CO_2$ issues the situation is different in a critical manner. Once the effects of global warming become clearly visible in for example radical local climate changes and rising ocean levels, both the costs associated with mitigating the effects and the century long timescales associated with a restoration of lower $CO_2$ levels are unacceptable, especially since climate impacts tend to be non-linear. Thus the mitigation of the effects of the rising $CO_2$ levels has to be initiated long before "severe" effects are directly visible.

## *Energy policy and political will to address climate change in US and Europe*

### The US case

The US had in the past abundant energy supplies, including energy self-sufficiency and low energy prices, low population densities, and hence seemingly small environmental impacts. Over the last 35 years, the federal government's interest in promoting renewable energy has often peaked with high oil prices and waned as oil prices fell. Following the 1973 Arab Oil Embargo, the US became the early leader with modern renewable energy development. The 1978 Federal Public Utility Regulatory Policies Act was largely responsible for this development (Haar and Theyel, 2006). The lifting of the oil embargo, the return to low costs for conventional electricity and fossil fuels, and the seeming lack of concern about the issues of energy, environment, and sustainability among the US population were to a large part responsible for the elimination of the subsidies that supported renewables. Moreover, declining oil prices invariably led to increased oil imports and reduced budgets for promoting renewable energy. Since 1980, energy related R&D as a percentage of total US R&D has fallen from 10.0% to 2.0% (Gravitie, 2007). The sharp increase in oil and gas prices since 2005 has ignited fresh interest in alternative energy at the federal level. The US Congress is considering legislation requiring US utilities to generate 20% of their electricity from renewable sources by 2020, as well as legislation on $CO_2$ cap and trade type mechanisms.

With the long-standing policy vacuum of the federal government, states have been increasingly stepping in, pushing the US federalism to its limits. State action is widespread and varies significantly in policy instruments, causing critics to claim a regulatory 'balkanization' of the US (Lewis, 2004). State and local governments have enacted numerous policy measures to control $CO_2$ emissions either directly or indirectly. Since 2002, 28 states have adopted financial incentives and mandatory regulations to promote the use of renewable energy (Jaeger, 2004; Menz, 2005), including the Renewable energy Portfolio Standards (RPS). In states with RPS measures, the utilities and power marketers meet their renewable obligation by buying Renewable Energy Certificates (RECs). Nine Northeastern states[4] already have $CO_2$ cap and trade type mechanisms in place and agreed to initially freeze power plant emissions at their current levels and then reduce them by 10% by 2020. California, Oregon, and Washington are exploring a regional agreement to control GHG emissions (Bang et al, 2007). California established targets for GHG emissions of 11% below 2005 levels over the next 5 years, 25% by 2020, and 80% by 2050.

At a local level, 772 mayors from 50 states, representing a total population of over 77 million citizens (information updated on Jan. 7, 2008) have joined a bipartisan coalition to curb GHG emissions. Their goal is to meet what would have been the US requirements under the Kyoto Protocol (7% below 1990 levels by 2012) through actions including changes in land-use policies, increased use of renewable energy, public information campaigns, and efforts to change state and national policies (http://usmayors.org/climateprotection/listofcities.asp).

**The European case**

The European position changed from the role of a skeptic towards more of a frontrunner in the promotion of renewables through investment and emissions trading systems, as well as the run-up to Kyoto. For example, initially the Kyoto NEPI (new environmental policy instrument), an emissions trading system promoted by the US and introduced based on the US's positive experience with permit trading in the acid rain program was opposed by the EU. After Kyoto, the EU switched from resisting the NEPI to designing a domestic emissions trading system (Damro and Méndez, 2003). Since then, the EU countries are operating under a directive to harmonize their programs. The main instrument for supporting renewables at a EU level is the Directive on the Promotion of Electricity from Renewable Energy Sources in the Internal Electricity Market (2001/77/EC), which follows on from the non-binding White Paper 'Energy for the Future: Renewable Sources of Energy' adopted in 1997 and the Green Paper 'Towards a European strategy for the security of energy supply' adopted in 2000 by the European Commission. Under the Directive, member states are required to double the share of renewable energies in gross domestic energy consumption from 6% in 2005 to 12% by 2010 (Mangalagiu, 2007). Tax incentives for renewables and high $CO_2$ taxes in a few countries have also helped renewable energy development. The higher retail costs of electricity in Europe have assisted in keeping per capita demand at half the US value. Furthermore, motivated by gasoline taxes of 300 to 400%, and high carbon taxes on fossil fuel-derived power production in e.g. Sweden, Europe displays greater fuel efficiency in production and consumption processes than the US does (OECD, 2006). Different European countries have reached very different energy solutions, but what is common for most of them is their high level of public and governmental engagement in the energy debate in contrast to what is seen in the US. However, it seems to be rather doubtful whether the 2012 Kyoto target will be achieved in Europe although the two largest emitters, Germany and UK, have nearly and/or already achieved their national targets (AEC, 2006).

Although the achieved and planned efforts mentioned in the US and in Europe above are a start, they still fall far short of the reductions that are required to actually stabilize atmospheric $CO_2$ levels at 'reasonable' level

**The developing countries case**

The developing nations dominate the world's population and will eventually emit far more $CO_2$ than the currently developed world does. China became the largest emitter of $CO_2$ (Raupach et al., 2007) in 2006. Moreover, the carbon intensity in developing countries is much higher than that of the developed ones: 1007 g $CO_2$/kWh in China, 1653 g $CO_2$/kWh in Russia compared to 349 g $CO_2$/kWh in Europe and 476 g $CO_2$/kWh in North America. The world's average is 540 g $CO_2$/kWh.[5]

Emissions from developing countries are currently unconstrained by the Kyoto Protocol. The developing nations have consistently resisted any form of commitment to reduce GHG emissions (Bodansky, 2001) successfully arguing that in achieving its growth the developed world was responsible for 70% of the integral increase in atmospheric concentrations of $CO_2$ from pre-industrialized levels (Grubb et al., 1999). While certainly being a reasonable argument, it does not address the underlying problem. The Protocol's approach to dealing with developing countries is to encourage the transfer of carbon efficient technology from developed to developing nations through the Clean Development Mechanism and Joint Implementation Initiative. This is very difficult in practice given that the developed world has in fact done very little relative to what is really needed to solve the true scale of the problem.

## *Public opinion and awareness of climate change issue*

For many years, Europe and the US have differed in the strength and the focus of public opinion on environmental issues in general and the climate issue in particular.

Due in part to ambiguities in the detailed scientific climate predictions, a significant part of the US energy industry, with major economic interests in keeping the status quo (e.g. the Global Climate Coalition (GCC)[6]), together with a lack of action by the US government, has in the past successfully publicized in the mainstream media a rebuttal of the predicted human inflicted climate changes. This activity has generated confusion in the US public discourse and thus in the public awareness of the magnitude of the real energy issues and problems (Brechin, 2003).

In Europe, public opinion has generally been strong and has supported an active climate policy, although there are major differences between the countries in terms of "solutions". In the US, there has been much less awareness about climate change and more active opposition to measures that might affect personal finances through the touted increase in the price of energy associated with $CO_2$ controls.

Recent studies on public views of climate change (Lorenzoni and Pidgeon, 2006; TNS Opinion and Social, 2005; Eurobarometer, 2007) indicate that there is now a convergence, although not strictly comparable, among the public in Europe and in the US. However, even if the awareness and concern about climate change is increasing both in Europe and the US, climate change is considered less important than other personal or social issues, especially in the US. For most individuals in the US and in Europe, climate change is a complex and sometimes misunderstood issue. As recent data also show, for many individuals the immediate perceived threat from confronting climate change lies in the potential loss of benefits from current lifestyles, while the long-term threat is not well or crisply defined and is viewed as being potentially unmanageable (Lorenzoni and Pidgeon, 2006).

Media coverage about climate change has multiplied several-fold in recent years with many stories focusing on evidence of retreating glaciers and rising sea levels. The number of stories containing the phrase 'climate change' in major US publications in recent years increased from 2,873 in 2000, to 4,970 in 2004, 18,272 in 2006 and expected to be over 68,000 in 2007 (Gravitie, 2007). These issues demonstrate how rapidly climate change has become a mainstream public concern in the last few years, due to heightened media coverage of the topic. The change in public opinion is expected to spur legislative change at both local and global levels.

## *Consumers' willingness to pay for green energy*

Although surveys suggest that more than 25% (and occasionally as high as 50% or more) of consumers in Western countries claim they are willing to pay a premium for "green power" (Wiser et al., 2001; Batley et al, 2001; Zarnikau, 2003), it remains unclear how consumers perceive clean energy and if they are actually willing to pay a premium or not. For example, when given the opportunity, less than 1% of the US households have chosen to adopt a "green" energy plan (330,000 customers by end 2004) while over 50% of them have access to green power. Today, more than 600 utilities offer green power programs to customers in 34 states, almost always with a price premium. Moreover, any US consumer can purchase green power using RECs (renewable energy certificates) (Bird and Swezey, 2005). In Europe, the most successful green power markets have achieved penetration rates of between 5% and 15%. Consumer demand for green power has been highest in the Netherlands (13% of residential customers) and Sweden (6%) (Bird et al., 2002). The relative success of the Dutch market can be explained by aggressive marketing campaigns by utilities, a restructuring policy that has allowed early access to retail green power suppliers, and tax exemptions for green power purchases. In Sweden, the market has been driven by the availability of large quantities of existing hydropower that can be sold at relatively low prices. The limited consumer response to green energy products is due to higher cost, lack of marketing by the green power suppliers, and a lack of a clear definition of what "green" really means.

## *Growing support on climate change and renewable energy from investors*

There are numerous initiatives towards climate change mitigation by institutional investors. Since 2002, the Carbon Disclosure Project[7] on behalf of a coalition of 315 institutional investors with assets of $41 trillion under management, on a yearly basis has been asking the 2,400 largest companies in the world (based on market capitalization) for disclosure of information concerning the risks and opportunities resulting from climate change. Insight Investment, part of the HBOS Group, which was launched in 2002, is a founding signatory of the UN Principles for Responsible Investment, and is already one of the UK's largest asset managers with $207 billion in assets under management (September 2007). In 2006 Insight Investment set out expectations for disclosures by electric utilities concerning climate change policy and actions and subsequently engaged with a number of electricity companies. Other examples include the Sustainable Asset Management Group (over $8.5 billion under management), the Climate Change Capital Carbon Funds ($1.5 billion), and the European Ethical Funds (over $200 million), which invest a portion of their portfolios in companies that are involved with low-carbon technologies.

Investment in renewable energy and low carbon technology has been rapidly increasing worldwide, rising from $6.5 billion in 1995, to $30 billion in 2004, to $66 billion in 2007, and now making up about 10% of all investment in the energy industry worldwide

(REN21, 2006).

Investment in renewable energy technology is central to reducing the capital and operating cost of these evolving technologies. Furthermore, once carbon neutral energy systems become national priorities for the industrial countries, a combination of more aggressive $CO_2$ taxation, intelligent and stable subsidies, increased cooperate social responsibility (see next section), as well as targeted R&D efforts could significantly accelerate and later transform the long-term evolution of the energy technology sector.

## *Corporations and environmental issues*

### Corporate Social Responsibility

Today CSR is a buzzword. Elkington (1997) formalized this as "the triple bottom line", which combines economic, social, and environmental performance. In other words, companies should operate in ways that secure long-term economic performance by avoiding short-term behavior that is socially detrimental or environmentally wasteful. The result of CSR is a shift from a corporation's immediate obligations to its shareholders to the obligations to its stakeholders, who are affected more by a corporation's longer-term policies and practices. Fulfillment of these obligations is intended to minimize the harm and maximize the long-term beneficial impact of the firm on society. Corporations have an incentive to make social and environmental policy statements as they may positively influence public perceptions of company commitment to environmental protection and sustainable development, possibly resulting in increased market share and improved stakeholder relations (Winn and Angell, 2000).

### Voluntary approach to tackle $CO_2$ emissions

What the $CO_2$ emission legislation at a national and international level will be is currently very uncertain. Corporations, which are major polluters, have an intrinsic interest in shaping future legislation relating to $CO_2$ emissions. Moreover, customers' requirements are becoming more and more complex and difficult to understand and predict. More and more companies are implementing environmental strategies. Shifts in strategy towards voluntary action have been perceived in the energy and automotive industries, the sectors most affected by international current and future GHG regulation. According to Greening and Gray (1994), due to higher risks and unpredictability, higher visibility and higher external scrutiny, the larger the company, the more voluntary environmental strategies are implemented.

Regarding the effectiveness of self-regulation of the private sector, there are contradictory views. Business associations such as the World Business Council for Sustainable Development (WBCSD) and the Chemical Manufacturers Association (CMA) argue for the effectiveness of self-regulation, claiming little need for regulatory intervention. King and Lenox (2000) studying programs such as the Responsible Care program of the CMA argue that there is no evidence that industry self-regulation is effective. Lyon and Maxwell (2002) state that explicit sanctions (and incentives) administrated by informed outsiders may be needed to avoid opportunism within an industry self-regulatory scheme. Environmental self-regulation can be a complement to regulation, but not a substitute as firms commit to different levels of environmental protection. However, the threat of unavoidable future regulation is a significant factor in motivating corporate voluntary actions and the threat of future legal liability may well serve the same function.

In late 1997, BP initiated a series of withdrawal from the Global Climate Change organization, a group that actively worked against Kyoto. In the same year another group, the Pew Center on Global Climate Change was launched. In contrast, this group, in collaboration with more than twenty major corporations, supported the Kyoto Protocal. In 2007 major companies, including Alcoa, Caterpillar, and DuPont asked the US Congress to establish a cap-and-trade system for GHG.

A pro-Kyoto corporate transnational actors coalition established in Europe, as well as the change in public attitude towards climate change partially impacted the US through contagion of corporate policy (Meckling, 2005). Indeed, contrary to the US government policy, corporate strategies on climate change reflect a major shift after Kyoto from aggressive opposition to a more moderate stance (Dunn, 2002; Kolk, 2001). In the pre-Kyoto phase, opponents of domestic and international GHG controls were dominant. Following Kyoto, the US business opposition began to erode, as firms started to accept climate change science and to channel investment flows to lower-emission technologies (Levy and Kolk, 2002).

Throughout the history of climate politics, firms have strongly influenced domestic and foreign policies of the US. Therefore, shifts in corporate strategy on climate change are typically good indicators of domestic political momentum for curbing GHG emissions. However, the question will remain as to whether the approach they favor will be optimal for truly solving the problem in a timely manner or instead simply be a partial concession which doubles as a delaying factor for a true solution.

Clearly, corporations have an incentive to publish environmental policy statements as such statements can positively influence public perceptions of company commitment to environmental protection and sustainable development, possibly even resulting in increased market share and improved stakeholder relations. Furthermore, there is little downside to making a public commitment (independent of intent to implement the policy) because there is no easy mechanism for verification. However, as an ever-increasing number of companies make claims to sustainable development through these policies, skeptics wonder if these policies are just a form of greenwashing (Ramus and Montiel, 2005).

## Conclusions and discussion

### The socio-technical transition to a carbon neutral society

The overarching question is of course how the different parts of the world will be able to transition to a $CO_2$ neutral infrastructure, economy, and life-style, and what will be the nature of this transition. To explore this fundamental question we will discuss the impending transformation in the light of four different types of socio-technical transformations.

(i) A mainly top down reorganization of critical components of society. The industrial transformation in the US during the Second World War is a prime example of such a transformation, where the civilian- to war production transition occurred in only a few years, while still enabling economic growth (Hooks, 1991; Merrill, 1995). Clearly a major socio-technical transition that redirects human activities towards carbon neutrality can occur, but it requires the mobilization of industries, labor, scientific know-how, and public opinion.

(ii) A mainly bottom up societal reorganization characterized in part by its own infrastructure, leading industrial sectors, typical production methods, and main products, often called the Economic Log Wave or the Kondratieff Wave (Kondratieff, 1935; Rasmussen et al., 1989). This transition lasts about half a century, mainly driven by a natural lock-in of innovations and capital investments. Interestingly, the growth pattern for the adoption of a new integrated communication, energy, transportation, housing, production, and social infrastructure does not seem to depend much on the details of any of its components or of which historic period this transition occurs in. Instead, the main time constant for such a transformation is determined by the time lag from initial technology adopters to the time where the socio-technical complex is "taking off" and becomes macroscopic, which typically takes 20-30 years. This rapid initial expansion period is followed by a saturation period of about 20-30 years where the socio-technical niche matures and becomes more saturated.

(iii) Regional and global ecological disaster typically with a breakdown of societal fabric, including hunger, war, terrorism, and fighting within families. Such a transition is characterized by the removal of governments, revolutions, and military coups. The socio-technical transformation after the crisis is often a combined bottom up and top down process, and the time frame can vary from months to many years (Diamond, 2005).

(iv) No specific phase locking or imposed policies between technological infrastructure, economy and society. The transition happens in the shadow of other more dominating socio-technical developments.

## *What is feasible and what is likely? Surprisingly CSR may very well be part of the answer*

Until recently, the mainstream energy policy rhetoric has implicitly assumed a transition of kind (iv), and the actual policy and regulations both in Europe and the US are still assuming such a transition. However, the writing on the wall from all credible scientific sources indicates that radical $CO_2$ reductions will be necessary, which suggests that a type (iv) transition is not a likely reasonable scenario. This is also reflected in the positioning of the energy companies, which can be read as a signal of what kind of futures they are preparing for.

Accelerating awareness of the gravity of the $CO_2$ issue would possibly result in decisive actions long before we will see planetary scale ecological disasters, such that a type (iii) transition would not be the driver for energy policy changes. Such disasters could, however, still occur in the longer term, due to the significant time lags and positive feedback in the climate system (recall our discussion in Section 2 and the positive feedback effects).

Due to the lag of federal policy leadership in the US, a catalyst for progressive changes to the US energy policy may therefore emerge from a surprising stakeholder: the US energy companies. They have recently adopted a corporate social responsibility principle and there is clear evidence for an increasing consumer and stakeholders demand for ethical and responsible behavior of corporations. This recent trend, taken together with the already strong stakeholder involvement in energy issues in Europe, could impact the manner in which the US energy sector operates. However, even in Europe, the current reductions in fossil carbon emissions are far from what is required to have the needed impact, even if applied worldwide. Far greater direct or indirect public pressure will be required on the energy companies (through governmental regulation) to achieve the major reductions in greenhouse gas emissions that are still required. While the energy sector firms have no interest to tackle GHG emissions without significantly greater public and thus governmental pressure, CSR in this sector could nonetheless play a role in steering the energy systems, especially within the US, onto a more sustainable long-term path.

Self-regulation is a complement to imposed regulation, but not a substitute for it. Firms commit to different levels of environmental protection, while the threat of unavoidable future regulation is a significant factor in motivating corporate "voluntary" actions. The threat of future legal liability may well serve the same function. Although there is greater evidence that the European companies may be doing more about $CO_2$ emissions than the US companies, none of them is pushing for a meaningful zero emissions approach. Studies show that without explicit sanctions, self-regulation is not consistent (King and Lenox, 2000). Furthermore, companies will commit to different levels of environmental protection (Sharma, 2000). Coercive, normative, and mimetic pressures from the institutional environment may motivate companies to commit to policies, but it is regulatory requirements coupled with a need to maintain economic advantage that will be the most probable motivator for companies to implement specific environmental policies (Bansal and Roth, 2000). It is therefore clear that CSR alone is not enough to move the business sector to the extent needed. However, CSR can be used to mitigate, delay, or avoid the more threatening prospect for companies of mandatory regulation. The effectiveness of this approach, especially for a time critical problem, remains to be fully understood.

In any event, it is unrealistic to assume that CSR alone could drive the development of future energy systems that result in $CO_2$ footprint reductions down by factors of about 30 in the US, or factors of 10 to 20 for most of the EU countries, which is necessary, as we saw in Section 2. We therefore believe that we most likely will see a type (ii) transition with some overlay of type (i): a transition where a significant part of the socio-technical fabric transforms and is redirected towards a sustainable mode within a generation.

How could the type (i) part of the transition play itself out? If we assume that it is not an eminent climate driven global ecological disaster that forces the transition, one could, as a *gedanken* experiment, imagine a situation along the following lines: Since the US is still the most powerful single economy, a new US administration could decide to take the global lead in developing carbon neural energy systems. This would mean major federal R&D investments in sustainable energy technology coupled with strict regulations, which in a relatively few years both would enable the US both to export carbon neutral energy know-how and technology to most of the world, as well as reorganize its own energy infrastructure. This would mean both economic growth and a revitalization of the innovative components of the economy. Further, this new technological edge would give the US a new morally well-founded foreign policy tool as a promoter of a sustainable planet, which could help the US to regain some of its recently lost international reputation. It is interesting to note that one of the inherent excuses given by companies for not acting is the lack of a viable example that low or zero carbon emission power plants can be affordably built. In fact, a single counterexample might be all that is needed to move things significantly forward. Several such plants are currently in the planning phase such as the partially internationally backed FutureGen plant slated for the US.

## Available technology and political will

Any long-term global solution to climate change mitigation will require carbon emissions be limited through regulation involving taxes, trading, severe penalties, and/or absolute limits. CSR will not generate $CO_2$ emission reductions at the necessary scale, but may aid in getting the needed changes in place, in particular initially as the governments, in particular in the US, are getting organized in this area. It is also the authors' opinion that the main obstacle towards a sustainable energy system is political will and not existing technology, although improved technology could significantly facilitate the transition.

However, efficiency measures, systemic solutions, carbon sequestration, and renewables, together with a different attitude and lifestyle, could bring us a long way towards the necessary emission goals without any decline in the standard of living. The known approaches would also naturally tend to improve and become lower in cost with time. Longer term, however, significant governmental and private investments in R&D, as well as pilot tests will be necessary for new approaches, in particular in both the solar energy and energy storage arenas. The former could well fulfill a significant fraction of future demand, while the latter is particularly important for several of the renewable energy approaches.

## Notes

1 GHG also include: methane; nitrous oxide; chlorofluorocarbons and related compounds; non-methane volatile organic compounds; and water vapor.

2 Pepper et al., (1992, p. 101) provide the following breakdown of 1990 anthropogenic $CO_2$ emissions: fossil fuel combustion - 80%, deforestation - 17%, and cement production - 3%.

3 To convert from percentage reductions to reduction factors the formula is reduction factor = 100% / (100% – percentage reduction). For example a 5% reduction corresponds to a reduction factor or 1.16, while a 95% reduction corresponds to a reduction factor of 22.

4 Connecticut, Delaware, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont.

5 Data derived from "A manual for the preparers of eco-efficiency indicators", United Nations Conference on Trade and Development (UNCTAD), 2001.

6 The Global Climate Coalition was a group of mainly United States businesses opposing immediate action to reduce GHG. The group formed in 1989 as a response to several reports from the Intergovernmental Panel on Climate Change. A major scientific report on the severity of global warming by the IPCC in 2001 led to large-scale membership loss. Since 2002 the GCC has been deactivated.

7 Carbon Disclosure Project is a special project of Rockefeller Philanthropy Advisors in New York

## Bibliography

AEC. 2006. *Annual European Community Greenhouse Gas Inventory Report 1990-2006*, UNFCCC Secretariat.

Bang, G., Froyn, C. B., Hovi, J. and Menz. F. C. 2007. The US and international climate cooperation: International "pull" versus domestic "push", *Energy Policy*, 35(2), 1282-1291.

Bansal, P. and Roth, K. 2000. Why Companies Go Green: A Model of Ecological Responsiveness. *Academy of Management Journal*, 43(4): 717-736.

Batley, S. L., Colbourne, D., Fleming, P. D. and Urwin, P., 2001. Citizen versus consumer: challenges in the UK green power market. *Energy Policy*, 29, pp. 479–487.

Bird, L. and Swezey, B. 2005. Green Power Marketing in the United States: A Status Report. *Technical Report NREL*, October.

Bird, L., Wüstenhagen, R. and Aabakken, J. 2002. A review of international green power markets: recent experience, trends, and market drivers. *Renewable and Sustainable Energy Reviews*, Elsevier, 6 (6), 513-536.

Brechin, S. R. 2003. Comparative public opinion and knowledge on global climatic change and the Kyoto Protocol: The US versus the rest of the World?. *International Journal of Sociology and Social Policy*, 23(10), 106–134.

Broecker, W.S. 1997. Thermohaline Circulation, the Achilles Heel of Our Climate System: Will Man-Made CO2 Upset the Current Balance?. *Science*, 278, 1582-1588.

Damro, C. and Méndez, P. L. 2003. Emissions trading at Kyoto: from EU resistance to Union innovation. *Environmental Politics*, 12 (2), 71-94.

Davis, C. 2007. Ocean Acidification, the Other Threat of Rising CO2 Emissions. http://earthtrends.wri.org/updates/node/245.

Diamond, J. 2005. Collapse: How Societies Choose to Fail or Succeed, *Penguin*.

EIA. 2007. Annual Energy Outlook 2007 with Projections to 2030. *Energy Information Administration*, US Department of Energy.

Eurobarometer. 2007. Attitudes of Europeans towards the Environment", January.

Elkington, J. The Triple Bottom Line of 21st Century Business, *Conscientious Commerce*, 1997.

Gravitie Limited. 2007. Green Energy in the US: Renewable investment, capacity growth and future outlook. *Business Insights Ltd.*

Greening, D. W. and Gray, B. 1994. Testing a Model of Organizational Response to Social and Political Issues. *The Academy of Management Journal*, 37 (3), 467-498.

Haar, N. and Theyel, G. 2006. US electric utilities and renewable energy: drivers for adoption. *International Journal of Green Energy*, 3, 271-281.

Hooks, G. 1991. Forging the Military-Industrial Complex – World War II's Battle of the Potomac. *University of Illinois Press*, Chicago.

IPCC. 2007. Fourth Assessment Report: Climate Change 2007. *The Intergovernmental Panel on Climate Change*. B. Metz et al (eds), Cambridge University Press, Cambridge, UK.

Kok, P., Weile, T., McKenna, R. and Brown, A. 2001. A Corporate Social Responsibility Audit within a Quality Management Framework. *Journal of Business Ethics*, 31(4), 285-297.

Kondratieff, N. D. 1935. The long waves in economic life. *Review of Econ. Statistics*, 17, 105-115.

King, A. A., and Lenox, M. 2000. Industry self-regulation without sanctions: The chemical industry's responsible care program. *Academy of Management Journal*, 43, 698-716.

Levy, D. L. and Kolk, A. 2002. Strategic Responses to Global Climate Change: Conflicting Pressures on Multinationals in the Oil Industry. *Business and Politics*, 4 (3), 1369-5258.

Lorenzoni, I. and Pidgeon, N. F. 2006. Public views on climate change: European and USA perspectives. *Climatic Change*, 77, 73-95.
Lyon, T. P. and Maxwell, J. W. 2003. Self-regulation, taxation and public voluntary environmental agreements. *Journal of Public Economics*, 87: 1453-1486.
Mangalagiu, D. 2007. Regulatory issues and voluntary norms adoption in the US and European electricity markets, *Physical Constrained Electricity Markets as Complex Systems Conference*, Institute for Scientific Interchange Foundation, Turin, Italy, 4-8 December.
Meckling, J. 2005. Transatlantic Interdependence in US Climate Change Policy. Cross-Border State-Business Relations Challenging State Autonomy. *The Global Governance Project*. WP16.
Merrill, D. 1995. Demobilization and Reconversion: Rebuilding a Peacetime Economy following World War II, in *The Documentary History of the Truman Presidency*, Vol. 4.
OECD. 2006. The Political Economy of Environmentally Related Taxes, Paris, June.
Pepper, W. et al. 1992. Emission Scenarios for the IPCC. An Update: Assumptions, Methodology, and Results, *Mimeo*, US Environmental Protection Agency, May.
Prins, G. and Rayner, S. 2007. Time to ditch Kyoto. *Nature*, 449, 973-975, October.
Ramus, C. and Montiel, I. 2005. When are corporate environmental policies a form of greenwashing?. *Business & Society*, 44 (4): 377-414.
Rasmussen, S et al. 1989. Empirical indication of economic long waves in aggregate production. *European Journal of Operational Research*, 42, 279-293.
Raupach, M. R., Marland, G., Ciais, P., Le Quéré, C., Canadell, G. J., Klepper, G. and Field, C. B. 2007. Global and regional drivers of accelerating CO2 emissions. *PNAS*, 104: 10288-10293.
REN21. 2006. Renewables 2006 Global Status Report. *Renewable Energy Policy Network for the 21st Century*, http://www.ren21.net.
Royal Society. 2005. Ocean acidification due to increasing atmospheric carbon dioxide, Science Policy Section, *The Royal Society*, 12/05, ISBN 0 85403 617 2, 30 June, London.
Skodvin, T. and Skjærseth, J. B. 2001. Shell Houston, we have a climate problem!. *Global Environ. Change*, 11, 103-106.
Sharma, S. 2000. Managerial interpretations and organizational context as predictors of corporate choice of environmental strategy. *Academy of Management Journal*, 43, 681-697.
Stern, N. 2006. The Economics of Climate Change: *The Stern Review*. Cambridge Press.
TNS Opinion & Social. 2005. Attitudes of Europeans towards the environment. Special Eurobarometer 127 for the EC, Directorate-General Press and Communication, Opinion Polls. available at: http://europa.eu.int/comm/public opinion/archives/ebs/ebs217en.pdf.
Wigley, T. M. L., Richels, R. and Edmonds, J. A., 1995. Economic and environmental choices in the stabilization of atmospheric $CO_2$ concentrations, *Nature*, 379, 240-243.
Winn, M. I. and Angell, L. C. 2000. Towards a process model of corporate greening. *Organization Studies*, 21, 1119-1147.
Wiser, R., Bolinger, M., Holt, E. and Swezey, B. 2001. Forecasting the growth of green power markets in the United States. TP-620-30101. *NRL Laboratory*, Golden, CO.
Zarnikau, J., 2003. Consumer demand for "Green" power and energy efficiency. *Energy Policy*, 31, pp. 1661–1672.
Ziock, H.-J. and K.S. Lackner. 2000. Zero Emission Coal. *The 5$^{th}$ International Conference on Greenhouse Gas Technologies*, Cairns, Australia, August 14-18.