# BUSINESS RESPONSES TO CLIMATE CHANGE: IDENTIFYING EMERGENT STRATEGIES

**Ans Kolk & Jonatan Pinkse**

University of Amsterdam
Amsterdam graduate Business School
The Netherlands

Correspondence:

Prof.dr. Ans Kolk
University of Amsterdam
Amsterdam graduate Business School
Roetersstraat 11
1018 WB Amsterdam
The Netherlands
tel. 31 20 525 4289
fax. 31 20 525 5281
e-mail: akolk@uva.nl

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## ABSTRACT

In the absence of sufficient support for the Kyoto Protocol, the international policy arena on climate change is far removed from being a 'level playing field'. Companies thus face much uncertainty about the competitive effects of the Protocol and (upcoming) regulatory measures. This means that the present context offers considerable managerial discretion, with companies exploring different market strategies to address global warming and reduce greenhouse gas emissions. This article examines the strategic options available to companies, focusing on the market responses, and identifies the actual patterns of market-oriented actions currently being taken, using data from 136 large companies that are part of the Global 500. These climate change strategies consist of different combinations of the market components available to managers. Companies turn out to follow distinctive pathways in addressing climate change; the six different market strategies that have emerged are typified. Under a flexible regulatory regime, managers have the possibility to choose between more emphasis on improvements in their business activities through innovation or on compensatory approaches such as emissions trading; and to do this merely on their own or by interacting with external actors, be it other companies in the supply chain or industry, NGOs or (local) governments.

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In a period of less than a decade, the policy and strategy debate on climate change has changed dramatically. Until the late 1990s, most companies focused more on political, non-market strategies, usually to oppose upcoming regulatory regimes.[1] Currently, however, a range of market responses is emerging to address global warming and reduce emissions through product and process improvements, and emissions trading. These market components are receiving much attention, although political activities continue to play a role as well in companies' overall strategic positioning on climate change. The exact composition of such an integrated strategy is company-specific, depending also on the (perceived) risks and opportunities related to climate change and the type of regulation relevant for the industry and countries in which companies operate.[2]

Companies consider their strategic options in the field of climate change against the background of a diverse policy landscape globally.[3] With the recent ratification of Russia the Kyoto Protocol, adopted in 1997, has received sufficient support to enter into force. Nevertheless, the US in particular still opposes Kyoto's global emission reduction approach, advocating support for the exploration of specific technological options instead. At the same time, however, a considerable number of US states, including California, has passed or proposed emission legislation or developed carbon registration schemes. And those countries that have ratified are starting to take measures. Most notably, the EU emissions trading scheme will take effect in 2005.

Companies face much uncertainty about the competitive effects of the Protocol and (upcoming) regulatory measures.[4] This applies globally, but also within Europe, where

member states' reduction plans exhibit differences. What is clear, however, is that current climate change policies are more flexible than before, and that 'command-and-control' approaches are seen as much less politically feasible. Flexible mechanisms, particularly emissions trading, Joint Implementation and the Clean Development Mechanism, allow companies to achieve reductions of greenhouse gas emissions by interacting with other parties, for example trading emission credits or partnering in offset projects. All this means that the present context offers considerable managerial discretion, with companies exploring different strategies to address global warming and reduce greenhouse gas emissions.

This article examines the strategic options available to companies, focusing on the market responses, which have emerged most recently, and identifies the actual patterns of market-oriented actions currently being taken, using data from 136 large companies that are part of the Global 500. These climate change strategies consist of different combinations of the market components available to managers. Companies turn out to follow distinctive pathways in addressing climate change; the six different market strategies that have emerged are typified.

Under a flexible regulatory regime, managers have the possibility to choose between a greater emphasis on improvements in their business activities through innovation or on compensatory approaches such as buying emission credits. An *innovation* strategy improves a company's assets and competencies as a result of the development of new environmental technologies or services that reduce emissions. *Compensation*, on the other hand, involves the transfer of emissions or emission-generating activities. Companies can follow either approach merely on their own or by interacting with external actors, be it other companies in the supply chain or industry, non-governmental organizations (NGOs) or government agencies.

## STRATEGIC OPTIONS FOR ADDRESSING CLIMATE CHANGE

Emerging climate policies show considerable flexibility as well as differences per sector and location.[5] The approach taken by the EU is the implementation of a 'cap-and-trade system' for energy-intensive industries, in which strict goals are set for the absolute amount of emissions. It is left to industries how to realize this goal, with emissions trading as one option. For industries that are not energy-intensive, the EU approach resembles that of the US, which is based on voluntary participation of industry in emission reduction programs. Unlike previous regulations on emissions, such as the Clean Air Act in the US, no technologies are prescribed when these flexible regulatory measures are implemented.[6] In general, it is expected that flexibility of environmental regulations will be an incentive for companies to reduce emissions in a creative way.[7]

More flexible regulation gives companies the opportunity to comply with the goals set by the government in cooperation with third parties. Cooperative efforts can, for example, take place within a company's own supply chain. Management can tighten the environmental requirements for suppliers with regard to the climate impact of their goods and services.[8] Cooperation can move beyond the supply chain as well. A much-observed phenomenon is the formation of partnerships among competitors, and between companies and NGOs to develop and market low-emission technologies.

In addition, current climate policy developments have been accompanied by the launch of emissions trading schemes. Emissions trading enables companies to buy or sell certified emission reductions (CERs) in the market. It has been argued that trading CERs is more cost-effective for companies than changing their production process or products. Particularly for companies that have a large experience in trading in general, trading CERs may be less complicated and only a small step, compared to large-scale innovations. To some extent, the choice between emissions trading and product- or process-oriented improvements

could be seen as a corporate decision related to 'make' or 'buy' emission reductions.[9] Peculiar to the issue of climate change is, however, that companies can also do both: they can achieve some reductions internally and buy the balance; moreover, it is also possible that companies 'make and sell'. Such a 'make and sell' strategy particularly fits those companies that can reduce emissions at a relatively low cost and sell the ensuing surplus of emission credits at a profit.[10]

Corporate reactions to climate policy can be captured by considering the make and/or buy/sell decision on the one hand, and the degree to which this involves interaction with other companies, on the other. When these two aspects are combined, the strategic options can be set out in a matrix with two dimensions: the main aim (strategic intent) and the form of organization (degree of interaction). In the resulting typology (see figure 1), six strategic options surface that can be part of a more comprehensive strategy for climate change (in which companies combine several options).

**Figure 1. Strategic options for climate change**

| | **Main aim** | |
|---|---|---|
| **Organization** | *Innovation* | *Compensation* |
| *Internal (company)* | Process improvement (1) | Internal transfer of emission reductions (2) |
| *Vertical (supply chain)* | Product development (3) | Supply-chain measures (4) |
| *Horizontal (beyond the supply chain)* | New product/market combinations (5) | Acquisition of emission credits (6) |

The vertical axis of the typology is relatively straightforward, since it differentiates the degree to which companies choose interaction with others to reach their objectives. The typology distinguishes three organizational levels: the individual company (*internal*), companies' own

supply chain (*vertical*), and interaction with companies outside the supply chain (competitors or companies in different sectors - *horizontal*).

The horizontal axis deals with differences regarding the main aim of corporate climate strategies. They can focus merely on *innovation* with regard to their own business activities or on *compensation*. *Innovation* involves the development of new environmental technologies or services to reduce emissions. The main difference with compensation lies in the fact that innovation fundamentally improves a company's technological assets and competencies.[11] For example, oil company Royal Dutch Shell develops solar energy not only to reduce emissions, but also to secure its competitive position in the longer run by acquiring new competencies. *Compensation* leaves a company's own technological assets and competencies merely unaltered; companies use low-emission and emission-reduction technologies developed by others. The process of emissions trading illustrates the distinction and relationship between compensation and innovation. A thriving emission market requires a balance between buyers and sellers of emission credits. A company (compensator) cannot buy emission credits in the market if there is no seller that offers credits acquired by reduction of emissions through innovation.

*Innovation*, a prime orientation on business activities, is directed at the production process (box 1 in figure 1) or at products (box 3).[12] Process improvements frequently encompass energy reduction (and/or higher energy efficiency), but can also involve measures to diminish the use of other gases. In energy-intensive industries such as chemicals, mining, metals, utilities, and oil and gas, for example, new energy-efficient technologies are developed and implemented to achieve reductions. Semiconductor companies take initiatives to optimize their production process in order to reduce the emission of perfluorinated compounds (PFCs), a greenhouse gas with a high climate impact. A supply-chain orientation is frequently taken by companies in automotives, chemicals, mining and electronics, which

focus on realizing emission reduction of existing products and/or developing new (energy-efficient) products.

In addition to these internal and supply-chain approaches, companies may use the option of drawing upon organizational capabilities as well, by exploring new product/market combinations (box 5). A possible way to enter new markets is by becoming involved in a strategic alliance or another form of cooperation with other companies; the cooperation between oil and automobile companies on fuel cells is a case in point. Climate policy may also induce companies to position their products and services outside traditional markets. Companies in insurance and finance can, for example, start to play a role as brokers in the upcoming emission markets, thus helping to arrange the sale of emission credits from companies that have a surplus to those that are short on credits.

Different from innovation, *compensation* includes internal transfer of emissions (box 2), supply chain measures (box 4), and acquisition of emission credits through emissions trading or participation in offset projects (box 6). Compensation means that companies do not primarily aim to reduce greenhouse gas emissions, but merely focus on transferring emissions or emission-generating activities within the company or to other companies. With regard to emission-reducing technologies, companies that pursue compensatory approaches act as a passive, arm's length actor, because they do not participate in the innovation process themselves.

Internally-oriented compensation particularly fits large companies that operate across borders. These companies can alleviate government pressure to mitigate climate change by transferring high-emission activities to locations where stringent reduction plans are not (yet) in place. Companies can use internal or external emission markets to carry out internal trades, transferring emission credits between business units.[13] Integrating targets for emissions into investment decisions for new projects is another form of internal compensation that also fits

companies active in a single country. A first step for internal compensation is usually an inventory of greenhouse gas emissions, followed by target-setting and the monitoring of progress in achieving these targets.

Supply-chain measures for compensation aim to avoid the need for emission cuts within the company. A company then instead seeks to find solutions to ensure that activities and sources of high emissions are carried out elsewhere in the supply chain. The most common supply-chain measure is to replace inputs with a high potential for emissions by those with lower emissions. An example is the recent step by British Telecom to purchase only electricity that is generated by renewable sources and combined heat and power plants.[14] Companies can also subcontract certain high-emission activities (such as transportation) and thus reduce their own emissions while increasing those of their partners.

Finally, companies can also move beyond the supply chain and achieve reductions by interacting with others, either by buying emission credits or by other forms of offsets, for example through the Clean Development Mechanism or Joint Implementation. By acting as a buyer on the emission market, a company can balance its excess emissions. Similarly, offset projects designed under the Kyoto Protocol enable a company to attain and transfer credits by partnering with companies or governments in locations (for example, developing countries) where reductions are achieved with less effort. In the classification of figure 1, offset projects are not considered to be innovative because they merely rely on the transfer of existing technologies instead of the development of new ones. While the number of emission markets and offset projects is currently still limited, many companies follow the developments, exploring the opportunities to become involved at some stage.

A company that takes action with regard to climate change does not necessarily adopt all measures identified in the typology, but it is likely that they will use combinations of the different boxes. Which of the options will become part of a more comprehensive

environmental strategy, is likely to depend on the managerial perception of climate change (opportunity or risk). Managers that perceive climate change as a business risk may have a tendency to rely on compensatory options. Compensation does not require processes of organizational change to the same extent as the implementation of innovative measures because it does not fundamentally change current process and product technology. It may therefore fit companies that want to avert possible risks in a less strenuous way. Focusing on improvements in business activities may be more apt for those companies that have a clearer view of the opportunities of climate policy. These companies are willing to take the risk of large-scale investments for the development of new environmental technologies, partly because they believe that their long-term survival depends on it.

Where companies currently stand as to the precise combinations of strategic options will be analyzed in the next section. It examines empirical data on the climate strategies of large multinational corporations in order to identify 'organizational configurations' of corporate climate change strategies.[15]

## SAMPLE AND RESEARCH METHOD

The study is based on qualitative data that have become available through the Carbon Disclosure Project.[16] In this project, instigated by 35 institutional investors, the 500 largest companies (according to the 2002 Financial Times Global 500 list) were asked to provide information on their policy towards climate change. Of the complete sample, 46% of the companies answered the questionnaire; of the remainder, 27% did not respond at all, 18% declined to participate, and 8% provided only some (limited) information. Of the 227 companies that answered the questionnaire, the responses of 139 companies were made available through the Internet. Three responses turned out to be unusable and were therefore left out, leaving 136 questionnaires suitable for analysis.

In the questionnaire, the companies gave detailed answers to seven questions about emission reduction targets, policies, activities and measurement, and their perceptions of climate change.[17] To explore the market strategies towards climate change a measurement instrument was developed based on the typology described above (see figure 1). This climate change strategy matrix enables the measurement of this construct in a multidimensional way. Companies were rated based on the conceptual definition of each of the six cells of the matrix using their complete questionnaires; the ratings on each individual dimension were not restricted to one question. Thus, climate strategy was measured on a fully anchored 5-point scale, with different anchors per dimension (see appendix 1 for the complete measurement scales). For each of the six dimensions, the anchors were ranked on an increasing scale corresponding to the level of proactivity of the climate strategy option.

A cluster analysis was subsequently carried out to tease out the different 'organizational configurations' of the six climate strategy dimensions (see appendix 2 for more details). Cluster analysis is a statistical technique that classifies companies based on their scores on each of the six dimensions of the matrix, thus creating fairly homogeneous groups. The final clusters have particular profiles derived from the mean value of the cluster centers, which display the loading across the dimensions.

## CLIMATE STRATEGY CONFIGURATIONS

It turns out that six different strategy configurations for climate change can be identified, which consist of combinations of the six boxes as described above (and compiled in figure 1). The results of the analysis are shown in table 1, which summarizes the mean values of the final cluster centers for the following six profiles:

- Cautious Planners (which characterizes 31% of the companies)
- Emergent Planners (36%)

- Internal Explorers (14%)
- Vertical Explorers (10%)
- Horizontal Explorers (5%)
- Emissions Traders (4%)

Below, the different groups will be analyzed in more detail, illustrated with one typical case for each cluster.[18]

**Table 1. Final cluster centers of the six climate strategy configurations**

| | *Cluster* | | | | | |
|---|---|---|---|---|---|---|
| | Cautious Planner | Emergent Planner | Internal Explorer | Vertical Explorer | Horizontal Explorer | Emissions Trader |
| **Process improvement (1)*** | 2.24 | 2.29 | 4.32 | 1.54 | 2.14 | 2.50 |
| **Internal transfer of emission reductions (2)** | 1.19 | 4.78 | 4.42 | 2.77 | 2.57 | 4.83 |
| **Product development (3)** | 1.40 | 2.08 | 2.74 | 4.23 | 2.71 | 3.50 |
| **Supply-chain measures (4)** | 2.00 | 3.53 | 4.11 | 4.23 | 3.71 | 2.33 |
| **Product/market combinations (5)** | 1.19 | 1.10 | 1.47 | 1.15 | 4.29 | 3.83 |
| **Acquisition of emission credits (6)** | 2.12 | 2.22 | 3.79 | 2.85 | 3.00 | 4.33 |
| **Number of cases** | 42 | 49 | 19 | 13 | 7 | 6 |

* Numbers between brackets refer to the cells of figure 1; these are the dimensions that served as input for the cluster analysis

### Cautious Planners

Cautious Planners have relatively low scores on all market-related climate change strategy options. Their posture can be characterized as preparing for action, with not much activity in the different areas. On average, they mention measures to reduce greenhouse emissions only as a possibility in the future without giving any specific details.

FirstEnergy, the US electric utility, seems to exemplify the position of Cautious

Planners. The company reports on its efforts to reduce emissions, resulting from expansion of nuclear and natural gas capacity and of closing down of (some) coal-fired power plants. However, FirstEnergy is unclear about its current position; the company does not mention targets and only sees limited possibilities for process improvements. It stresses the unavailability of commercially viable technologies to reduce emissions from coal-fired plants and considers expansion of natural-gas-fired plants as its only option. It must be noted, however, that the potential of this last option is very limited, because there is almost no infrastructure for natural gas available in the locations where FirstEnergy operates. Participation in the Climate Challenge Program and Power Partners Program of the US government has led to a number of climate change projects, but the company does not report on reductions realized with these projects.[19]

On the whole, FirstEnergy does not provide a clear view of its market-oriented actions in the near future. The company relies heavily on the position of the US government and focuses more on emissions of nitrogen oxides and sulfur dioxide (regulated under the Clean Air Act) than on greenhouse gases.[20] However, recent evidence shows that it will be difficult for electric utilities in the US to maintain this rather cautious attitude towards climate change. American Electric Power and Cinergy, for example, have been put under great pressure by large American institutional investors to be more transparent about their strategy to reduce greenhouse gases and other emissions.[21] This shareholder pressure has led to a remarkable shift in the climate strategies of these companies over the past year.

**Emergent Planners**

The second cluster consists of those companies that have set a process in motion to develop a more comprehensive climate strategy in coming years. So far, the initial step of these Emergent Planners has been to set a target for the reduction of energy consumption and/or

greenhouse gas emissions, but they are only in an early stage with regard to implementing organizational change to realize this objective. They have not yet implemented measures to go beyond the process of target setting and actually reduce emissions.

Bristol-Myers Squibb (BMS), the US pharmaceutical company, is preeminently an Emergent Planner: it has set well-developed targets, but lacks far-stretching business improvements to follow up these goals.[22] It appears that the lack of large-scale innovations is explained by the fact that the products and services of BMS only have a modest impact on climate change. The opportunities that it identifies are not in the redesign of products or processes, but in the stakeholder recognition that the company receives for its environmental initiatives.

BMS has two types of goals directly related to global warming: a goal to reduce energy use and one to reduce GHG emissions by 10 percent with 2001 as baseline year.[23] However, it is notable that BMS as well as other members of this cluster do not restrict the target-setting process to internal business activities, but also include suppliers. It must be noted that goals for suppliers are of a more general nature, not focused particularly on climate change, as illustrated by BMS's effort to improve the overall environment, health, and safety performance of its suppliers.

**Internal Explorers**

This group of companies has a strong internal focus, which involves a combination of targets and improvements in the production process. For most Internal Explorers, the 'low-hanging fruit' has consisted of improvements in the production process in terms of energy efficiency with the intention to reduce $CO_2$ emissions.

An example of a company that already substantially improved its energy efficiency is Nippon Steel. This Japanese steel company set a goal of 20% energy savings by 1990 in

reaction to the oil shocks of the 1970s.[24] In response to the upsurge of climate change as policy issue in the 1990s, however, this early target has been followed by a 10% reduction of energy consumption to be reached by 2010. One consequence of realizing energy-efficient production technologies at a relatively early stage is, however, that it becomes difficult to improve efficiency levels further, thus creating a negative balance of emission credits in subsequent years. This dilemma is currently inciting Internal Explorers to move beyond the borders of their own company and open up other routes to reduce GHG emissions than just focusing on the internal possibilities.

Two options currently available to Internal Explorers are supply-chain measures and carbon offset projects. Within the supply chain, Nippon Steel focuses on measures to reduce emissions related to transportation and distribution, and to the purchase of electricity. With respect to offset projects, the company intends to use the Kyoto Mechanisms (Clean Development Mechanism and Joint Implementation) to earn certified emission reductions by means of technology transfer to other Asian countries that do not have targets for emission reductions. This opportunity emanates from the technological advantage that Nippon Steel has in the development of energy-saving equipment, which can be effectively exploited for the acquisition of emission credits.

**Vertical Explorers**

Vertical Explorers are characterized by a strong focus on measures within the supply chain. Although these companies are also in the process of getting insight in the greenhouse gas emissions resulting from their own activities, they clearly see opportunities for developing more energy-efficient products and for engaging in a dialogue with their suppliers to reduce greenhouse gas emissions. The reason for a company to concentrate on upstream and downstream activities can be twofold: it relies on natural resources that are vulnerable to

extreme weather conditions and/or its manufacturing process has a relatively low climatic impact compared to the consumption of its products (for instance the automotive industry).

Unilever, the British-Dutch food and home products company, is an example in this regard. It is indirectly susceptible to natural disasters such as floods and long-term drought, because most of its supplies are of an agricultural kind.[25] Moreover, the climate impact of its home products strongly depends on household behavior, such as the temperature of laundry washing. Therefore, Unilever pursues a strategy of manufacturing a range of products that diversifies the risks of extreme weather conditions, and it keeps track of emissions related to energy use by taking the type of energy source into account.[26] The company also encourages its suppliers to maintain similar environmental standards and considers joint projects with them. Measures related to downstream activities consist of product design based on life-cycle analysis, which enables a decrease of household energy consumption, and programs to increase consumer awareness.

**Horizontal Explorers**

The companies in the last two clusters (Horizontal Explorers, and Emissions Traders) score moderately on most dimensions, but set themselves to one particular activity. Horizontal Explorers focus on the exploration of opportunities in markets outside the current business scope, sometimes in cooperation with partners.

An exemplary Horizontal Explorer is Stora Enso, a Finnish paper, packaging and forest products company. This company is using the by-products of its core business to enter a new market, for green electricity. In the production process of paper and forest products, Stora Enso also produces large amounts of sawmill and logging residues, which are now being used as a biofuel for the generation of electricity. While these biofuels were initially only used for internal energy consumption, the company has recently set itself the goal of becoming a major

player in the green electricity market, which means that biofuels will be offered to external users as well. In this way, what used to be a waste product is now actively harvested to serve the purpose of entering new markets. In order to improve the harvest of these byproducts for biofuel use, Stora Enso has established a private-public partnership with the Forest University of Freiburg (Germany) to further develop harvesting systems.[27]

### Emissions Traders

Emissions Traders also score moderately on most dimensions except for one, which is the engagement in emission markets and the participation in offset projects. This group of companies directly focuses on the opportunities of emissions trading and combines this option with an internal reduction target that has a global reach and with a favorable position towards new products and markets. Instead of offering products that facilitate emissions trading, these companies are trading certified emission reductions themselves or act as an intermediary for other companies.

Mitsubishi Corporation, a Japanese trading company, follows a dual approach to emissions trading. Together with other companies, it has established Natsource Japan Co., which is devoted to the creation of a greenhouse gas market in Japan.[28] Besides, in anticipation of the introduction of a Japanese trading scheme, Mitsubishi decided to gather certified emission reductions by investing in emission reduction projects and by participating in the UK trading scheme.[29]

## CONCLUSIONS

In the current uncertain policy context after Kyoto, a wide variety of corporate strategic market responses are emerging, which are part of companies' broader strategic positioning that includes both market and non-market components. The introduction of emissions trading

schemes leaves companies the option to compensate for their emissions, instead of reducing them by changing products or processes. Moreover, flexibility in environmental policy induces companies to take a more interactive approach to environmental management, such as a dialogue with members of the supply chain and the formation of partnerships with other companies and NGOs. Nevertheless, looking at the responses to the questionnaire, most companies' market-oriented climate strategies are still in an early phase.

Emergent corporate strategies for climate change can be characterized in six profiles: Cautious Planners; Emergent Planners; Internal Explorers, Vertical Explorers; Horizontal Explorers; and Emissions Traders. The majority of companies falls in the first two clusters. They are still in a preliminary phase regarding the implementation of market strategies for climate change. This implies that the development of climate strategies is to some extent path dependent: taking stock of current greenhouse gas emissions and setting reduction targets is usually the first step towards a more sophisticated strategy. The other four clusters include companies that have a more proactive standpoint and are in a more advanced stage of exploring market opportunities related to climate change. An impediment to a more proactive approach seems to be the anticipated economic burden of climate policy. Even those companies that acknowledge the competitive opportunities in the long run, have to fulfill the obligations set by the government in the short run and therefore tend to implement compensatory measures.

The Horizontal Explorers and Emissions Traders underline that the evolution of environmental strategies is not necessarily path dependent. In configuring their climate strategies, these companies do not follow a pre-specified path that runs from setting targets, to process innovations and subsequently product development. To the contrary, they combine several strategic options that fit their existing competencies, and expect to enhance competitiveness in this way. This focus on the competitive opportunities sets them apart from

the other four, more risk-oriented, strategies. It is notable that most companies that are already (ready to become) engaged in emissions trading have a relatively proactive climate strategy when other dimensions are considered as well, and do not only try to buy off their obligations.

The evidence presented in this article shows that there are various strategic options from which managers can choose in addressing the market components related to the issue of climate change, and that current strategies consist of different combinations of these market possibilities. Existing managerial discretion, resulting from perceptions of the risks and/or opportunities related to climate change, leads companies, also those active in one and the same sector, to choose different approaches. Further development can be expected in the next few years, since ongoing government, stakeholder and shareholder pressure will encourage companies to explore the full range of options, and move to other strategy clusters.

In view of the fact that climate change policies are likely to affect most companies in one way or the other, managers might want to make up their mind about what kind of strategic profile they find most appropriate for their company. Looking at the increasing importance of market responses and instruments, a careful consideration of the options available can assist in arriving at an overall integrated strategic positioning that may also include political, non-market responses in addition to companies' market activities.

## APPENDIX 1

### Measurement scales for climate strategy

Process improvement

1. Do not mention process improvements
2. Mention process improvements as potential measures, without giving any details
3. Mention process improvements that lead to emission reductions, which are not explicitly related to climate change
4. Mention specific process improvements related to climate change that are operational at this moment
5. Mention concrete results of process improvements that have been achieved recently

Internal transfer of emission reductions

1. Do not have internal reduction targets or do not mention it
2. Have the intention to set targets
3. Are running a pilot project to estimate current emissions
4. Have several reduction targets on a local level and/or integration of emission indicators in investment plans
5. Have reduction targets for the whole organization and/or an internal emissions trading scheme

Product development

1. Do not mention product development and/or estimates of product emissions
2. Mention product development and/or estimates as potential measures, without giving any details
3. Estimate product emissions, but do not have any concrete product innovations
4. Have product innovation policy, but do not estimate product emissions
5. Have product innovation policy and/or give concrete examples of product innovation for climate change and estimate product emissions

Supply-chain measures

1. Do not intend to take measures to reduce emissions of suppliers
2. Do not measure emissions of suppliers, but do not give an opinion on the matter
3. Take a favorable stance towards supply chain measures, without giving any details
4. Suppliers' environmental performance is evaluated and/or ISO 14000 certification is required
5. Specific emission evaluation and/or targets are in place for the supply chain

New product/market combinations

1. Do not mention new product/market combinations
2. Mention possibility of partnerships (in the future) and/or entrance of new markets, without giving any details
3. Explore partnerships and/or entrance of new markets
4. Concrete partnerships and/or new market entrance are mentioned, but no actual action yet
5. Refer to real partnerships and/or entrance of new markets

Acquisition of emission credits

1. Oppose market mechanisms and/or do not intend to engage
2. Do not apply market mechanisms, but do not give an opinion on the matter
3. Take a favorable stance towards market mechanisms, without giving any details
4. Take initial action with regard to market mechanisms, such as engagement in design phase of a trading scheme or execution of pilot transactions
5. Take concrete action with regard to market mechanisms

## APPENDIX 2

### Cluster analysis

The cluster analysis was conducted in two steps.[30] First, a hierarchical clustering procedure was applied to determine the appropriate number of clusters and to select the cluster seeds that serve the purpose of initial cluster centers for the nonhierarchical clustering procedure. In the second step, the clusters were regrouped following a nonhierarchical procedure in order to avoid individual cases to persist being part of an early combination with other cases. The advantage of the nonhierarchical procedure is that it allows cases to switch cluster membership in later stages of the analysis, while a hierarchical analysis is unable to do so. For the hierarchical procedure the average linkage method was used with squared Euclidean distance as the distance measure for both the hierarchical and nonhierarchical procedures. Plotting individual company scores on the two dimensions – aim and organization – gives an overview of the dispersion of companies over the complete matrix. With the hierarchical procedure it was empirically found that there are six clusters and the six center points were used as initial seeds for the nonhierarchical procedure.

## NOTES

1. See Ans Kolk and David L. Levy, "Winds of Change: Corporate Strategy, Climate Change and Oil Multinationals," *European Management Journal*, 19/5 (2001): 501-509; Ans Kolk and David Levy, "Multinationals and Global Climate Change: Issues for the Automotive and Oil Industries," in Sarianna M. Lundan ed., *Multinationals, Environment and Global Competition* (Oxford: Elsevier, 2004): 171-193; David L. Levy, "Business and International Environmental Treaties: Ozone Depletion and Climate Change," *California Management Review*, 39/3 (1997): 54-71; David L. Levy and Ans Kolk, "Strategic Responses to Global Climate Change: Conflicting Pressures on Multinationals in the Oil Industry," *Business & Politics*, 4/3 (2002): 275-300; David L. Levy and Daniel Egan, "A Neo-Gramscian Approach to Corporate Political Strategy: Conflict and Accommodation in the Climate Change Negotiations," *Journal of Management Studies*, 40/4 (2003): 803-829; David L. Levy and Sandra Rothenberg, "Heterogeneity and Change in Environmental Strategy: Technological and Political Responses to Climate Change in the Global Automobile Industry," in Andrew J. Hoffman and Marc J. Ventresca eds., *Organizations, policy and the natural environment. Institutional and strategic perspectives* (Stanford: Stanford University Press, 2002): 171-193; Seth Dunn, "Down to Business on Climate Change," *Greener Management International*, 39 (Autumn 2002): 27-41.
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3. Michael Grubb, Christiaan Vrolijk, and Duncan Brack, *The Kyoto Protocol - A guide and assessment* (London: RIIA/Earthscan, 1999).
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5. Grubb et al., op. cit.
6. Alfred Marcus and Donald Geffen, "The Dialectics of Competency Acquisition: Pollution Prevention in Electric Generation," *Strategic Management Journal*, 19/11 (1998): 1145-1168.
7. Dorothy Thornton, Robert A. Kagan, and Neil Gunningham, "Sources of Corporate Environmental Performance," *California Management Review*, 46/1 (2003): p. 127.
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9. Joshua D. Margolis and James P. Walsh, "Misery Loves Companies: Rethinking Social Initiatives by Business," *Administrative Science Quarterly*, 48/2 (2003): p. 289.
10. We are grateful to one of the reviewers for suggesting this to us.
11. Competencies based on innovation in low-emission technologies have the ability to strengthen competitive advantage in the long run. Compensation, however, does not share this ability, because it does not involve the acquisition of new competencies. C.K. Prahalad and Gary Hamel, "The Core Competence of the Corporation," *Harvard Business Review*, 68/3 (1990): p. 79.
12. Compared to other environmental problems, greenhouse gas emission reductions can only

be realized through prevention technologies, because there is a lack of end-of-pipe technologies available to capture these gases during the production process. The only end-of-pipe technology that is currently being explored is the capture of $CO_2$ in underground reservoirs. However, this method is still much disputed and not applied on a large scale. See Vanessa Houlder, "The case for carbon capture and storage," *Financial Times* (London), January 23, 2004, p. 13.

13. Differentiation between locations in the capacity to mitigate climate change does not only depend on the relation between geographical differentiation and regulatory stringency, but also on the specific activities of a business unit.
14. Fiona Harvey, "BT makes renewable energy pledge," *Financial Times* (London), October 13, 2004.
15. Organizational configuration can be defined as "any multidimensional constellation of conceptually distinct characteristics that commonly occur together". Alan D. Meyer, Anne S. Tsui, and C.R. Hinings, "Configurational Approaches to Organizational Analysis," *Academy of Management Journal*, 36/6 (1993): p. 1175.
16. Available at <www.cdproject.net>.
17. It must be noted that the questionnaire has some limitations as a source of information about companies' positions. Because the number of questions was limited, companies' market strategies for climate change might include other activities that they did not mention in their answer to the questions. At the same time, however, it provides valuable information about companies' views on their own actions at a certain point in time.
18. The cluster profiles are based on an interpretation of the values presented in table 1. To correspond with the measurement scales in appendix 1, the values have been interpreted as follows: a value of 4 and higher refers to concrete action that is already in place; a

value between 3 and 4 refers to intended actions that have not been implemented yet; and a value lower than 3 is considered a potential measure only.

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