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Corporate Greenhouse Gas Reduction targets

Michael Margolick

Doug Russell

Global Change Strategies International, Inc.

Pew Center on Global Climate Change

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Doug Russell
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Foreword *Eileen Claussen, President, Pew Center on Global Climate Change*

In the United States and around the world, many businesses are demonstrating their commitment to solving the problem of climate change. Not only are companies speaking out on the severity of the problem, they are setting and meeting corporate targets to reduce greenhouse gas (GHG) emissions from their businesses.

DuPont has committed to reduce its GHG emissions by 65 percent from 1990 levels by 2010. Shell will reduce its GHG emissions 10 percent from 1990 levels by 2002. And earlier this year, Alcoa announced it would reduce its GHG emissions by 25 to 50 percent by 2010.

In this Pew Center report, authors Michael Margolick and Doug Russell of Global Change Strategies International, Inc. provide guidance to companies contemplating targets. Based on in-depth case studies of six diverse members of the Pew Center's Business Environmental Leadership Council—ABB, Entergy, IBM, Shell, Toyota, and United Technologies Corporation—the authors trace the corporate target-setting process from the point of deciding to act on climate change, to the factors involved in setting a target, to management and employee engagement, and to evaluating, monitoring, and performance review.

A number of underlying themes emerged regarding companies' motivations for setting targets. Among the most salient are these: companies that set GHG reduction and energy efficiency targets do so because they believe that setting and meeting the targets will improve their bottom line and drive innovation. They believe that over the long term, the world will have to deal with climate change, so their climate-friendly investments will pay off. They also believe that by taking the initiative, they can help the government to create a climate change policy regime that works well for business. It is one thing to advocate policies such as reasonable targets and timetables and flexibility for businesses to use various means (such as emissions trading) to implement clearly defined goals. It is another thing to actually demonstrate via corporate action that these measures work.

However, in taking these actions, these leading businesses are taking risks. They are betting that there will ultimately be government policy on climate change, that it will allow companies flexibility, and that it will reward and not punish early movers. If they turn out to be wrong, these companies could be disadvantaged relative to their less proactive competitors.

As climate policy continues to develop, we should keep the following lessons in mind. First, it is clear that GHG emissions can be substantially reduced, and that there are many approaches that can be employed to meet this objective. Second, emissions can be reduced in ways that are cost-effective, and that generate ancillary benefits that improve companies' competitive positions. Finally, the diversity in the type and scope of targets and implementation activities that companies have taken on voluntarily indicates that policies to reduce emissions should be as flexible as possible. Flexibility not only allows for more cost-effective reductions, but also ensures that companies can focus their limited resources on achieving the greatest reductions. Companies and countries have only so much money to invest in addressing climate change. The more flexibility we allow, the more economically efficient our response will be, and thus the more environmental progress we will achieve.

The authors and the Pew Center would like to thank the companies featured in this report for sharing their experiences and perspectives, and acknowledge the members of the Center's Business Environmental Leadership Council, as well as Jennifer Nash of the John F. Kennedy School of Government and Sarah Wade of Environmental Defense for their review and advice on a previous draft of this report, and Matt Jones and Bob Masterson for their valuable contributions.

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Executive Summary

A growing number of companies have voluntarily adopted climate-related targets—numerical performance objectives for indicators related to climate change, such as energy efficiency and greenhouse gas (GHG) emissions. This report explores companies' reasons for adopting targets, their choices of target types and levels, their plans for meeting the targets, and their progress to date. It also provides guidance, based on their experiences, to other companies that are considering climate-related targets.

The report is based on in-depth case studies of six members of the Business Environmental Leadership Council (BELC) of the Pew Center on Global Climate Change, supplemented by surveys and a workshop with additional BELC members. The case study companies are ABB, Entergy, IBM, Shell, Toyota Motor Manufacturing North America (TMMNA), and United Technologies Corporation. These particular companies were chosen to reflect a diversity of industries, target types, and headquarters locations.

The companies in this study vary widely in their reasons for adopting climate-related targets, and most have done so for several reasons. All of the companies see targets as improving their competitive market position by reducing production costs and enhancing product sales today, and in anticipation of regulatory and market environments of the future. Other reasons for setting climate-related targets include: to prepare for future regulation by investing in GHG emissions reductions now, to contribute to the design of efficient and equitable international and domestic GHG policies and programs, and to enhance corporate reputation via environmental leadership. However, voluntary targets can present risks to shareholders. Like the motivations for setting a target, the risks of doing so also vary by company. Risks include the following possibilities: governments will not recognize early action; governments will select a late baseline, rendering early reductions less valuable; and governments will not regulate at all, essentially punishing companies with targets for their good deeds because they, but not their competitors, will have incurred costs of making emissions reductions.

Companies have adopted several different kinds of targets. Some targets apply to purchases, others to companies' own energy use or emissions, and others to products; some focus on greenhouse gases, and others on energy use; some serve as absolute limits, and others are relative to indicators such as production levels and revenues. Which type of target an individual company chooses depends on its products and production methods, policy environment, and business models. The target's effect on emissions reductions, the existence of uncontrollable factors relating to emissions or energy use, the opportunity for cost-effective emissions or energy reductions, and the potential impact on company growth are four general considerations that influence a company's choice of target type.

Companies also have different methods for setting the target level. A "top-down" target-setting process sets the level for the whole corporation at once, without a plant-by-plant analysis. Under a "bottom-up" process, the corporate target level is based on analysis of potential reductions by individual plants.

Top-down and bottom-up elements occur within each company's target-setting process, but in widely varying proportions. Common steps in setting the target level include an emissions or energy use inventory, choice of target year, projection of business-as-usual emissions, and an iterative process that weighs potential target levels against the feasibility and costs of prospective action plans. It is beneficial to involve those who will be responsible for implementing the action plan in this process, in order both to ensure a reasonable target, and to put the organizational elements of the action plan into place. The case studies suggest that an environmental management system is a valuable tool for these purposes.

Naturally, the specific components of action plans to achieve climate-related targets depend on the target type and the products and production methods of each company. However, every company must make several general design decisions, including whether the plan will be designed through a "top-down" or "bottom-up" process, how the target will fit in with other environmental management activities, to what extent the plan will feature market mechanisms such as internal emissions trading and external offsets, and how to use research and development (R&D) resources and other means to drive technology innovation. Emissions trading may be useful for companies that wish to drive down costs by using market competition to encourage efforts to discover least-cost reductions. Internal emissions trading is especially useful for companies that are uncertain as to whether their allocation of the target among business units is least-cost, that are uncertain as to how their target will be achieved, and that have low trading transaction costs. Offsets may be valuable where the cost of emissions reductions within a company's own operations is high. The action plan may also need to respond to external risks imposed by markets, technological change, and regulation. An assessment of these factors may be useful in explaining the target results, both internally and externally, should emissions or energy use trend off-target.

The companies studied found that incentive systems for specific ideas and initiatives, as well as reinforcement of commitment by senior management, motivated employees and managers throughout the company. Many managers indicated that targets drive innovation within the company. Sometimes the mere existence of emissions or energy use data generates interest in, and ideas for, improvements that turn out to be profitable on their own. Companies also found that climate-related targets have a positive influence on employee morale. Internal communications are important in all cases — increasing employee understanding of climate change helps gain buy–in to the target, and generates new ideas on how to improve environmental performance.

Communications efforts and styles also vary by company. Typically, firms with relatively high direct emissions and top-down target-setting processes have higher-profile climate change communications efforts, including speeches and public presentations by the CEO. Companies with lower direct emissions, that have had environmental management systems in place for a number of years, and that have bottom-up target-setting processes, tend to take a more low-key approach to communications. Several companies have benefited from collaboration with third parties, such as environmental non-governmental organizations, to help get the message across. Partnerships with non-governmental organizations can build credibility and provide useful services.

Finally, all the companies studied are committed to reach their targets systematically, at low cost, and according to conditions in their particular businesses. The companies consider the achievement of climate-related targets to be as important as other critical indicators of the health of the business.

I. Introduction

Corporations around the world are grappling with how to reduce their greenhouse gas (GHG) emissions. One way to do this is to set and work towards a climate-related target — a numerical performance objective for an indicator of significance, such as energy efficiency or GHG emissions. For example, a company might set a target to improve its energy efficiency by 10 percent, relative to 1998, by the year 2002, or it might cap its total GHG emissions at the 1995 level.

Companies consider many factors regarding whether to set a climate-related target, what such a target might be, how to meet the target, how to engage managers and employees in implementation, how to evaluate results, and how and to whom to communicate performance.

This paper provides guidance to those companies contemplating adopting targets related to global climate change. It follows the corporate process from the point of making the initial decision to do something about climate change, through the factors involved in setting a target, through management and employee engagement, and through evaluation, monitoring, and performance review.

A. Methodology

The paper is based on in-depth case studies of six members of the Business Environmental Leadership Council (BELC) of the Pew Center on Global Climate Change[1] — ABB Asea Brown Boveri (ABB), Entergy, International Business Machines (IBM), Shell, Toyota Motor Manufacturing North America (TMMNA), and United Technologies Corporation (UTC). Each of these corporations has committed to a target related to its contribution to climate change. These particular companies were chosen to reflect the diversity of industries, target types, and headquarters locations (North America and Europe) represented by target-setting companies.

The authors conducted a series of face-to-face and telephone interviews with the key executives and managers involved in deciding to adopt a target, implementing the programs required to meet the target, and communicating the initiative to stakeholders and to the public. Typical interviewees included the vice president of environment, health, and safety; operations managers; research and development personnel;

and senior managers in governmental affairs and communications. Interview questions were standardized to allow for comparison.

To augment the case studies, 11 BELC member companies completed a survey on climate-related targets, and representatives from 21 BELC member companies participated in a June 2001 targets workshop.

B. Overview

The paper consists of four sections and two annexes. Each section concludes with lessons learned concerning the following key elements associated with target setting and global climate change:

- *Reasons for setting the target.* This section explores the motivations of companies that set climate-related targets, including environmental impact, economic competitiveness, corporate culture, public profile considerations, and the political environment in which the corporations operate.

- *Choice of target type and level.* Once a company is considering a climate-related target, it must determine what type of target, and what level, are right for its own particular circumstances. This section discusses various types of climate-related targets, and explores the reasoning behind the choices made by the case-study companies.

- *The action plan to achieve the target.* This section delves into the types of management decisions involved in designing action plans to achieve climate-related targets. These include deciding on the types of analysis and data that are required, what the mix of specific activities might be, how the action plan fits with the normal business planning cycle, ways to motivate employees and managers, and the requirements for monitoring and reporting systems.

- *Communications.* A key element of corporate target-setting deals with the profile and messages that corporations want to convey to the public, their employees, their investors, and the governments of the countries in which they operate. This section of the paper deals with the strategic and tactical questions that arise in communicating action on climate change.

Annex 1 includes details of how the six case-study corporations have approached the issue of global climate change, what their targets are, how they went about setting them and why, and the broad elements of their strategies to achieve their targets and to tell people about the results. Annex 2 lists the types and levels of publicly announced targets for selected major corporations.

Taken in its entirety, the report provides concrete evidence that many of the world's largest corporations are responding to climate change by setting and achieving climate-related targets. Companies have done so not just to be good environmental citizens, but because their Boards of Directors and senior management are convinced of the sound business reasons for a proactive corporate stance on global climate change. Box 1 summarizes the climate-related targets set by BELC member companies.

Box 1

BELC Company Targets

ABB
Reduce GHG emissions by 1 percent each year from fiscal year 1998 through fiscal year 2005.

Develop Environmental Product Declarations for every product produced.

Meet plant-specific energy targets.

Alcoa
Reduce GHG emissions by 25 percent from 1990 levels by 2010, and by 50 percent from 1990 levels over the same period if their inert anode technology succeeds.

Baxter International
Reduce energy use and associated GHG emissions by 30 percent per unit of product value from 1996 levels by 2005.

BP
Reduce GHG emissions by 10 percent from 1990 levels by 2010.

CH2M Hill
Source 5 percent of electricity from renewables by 2000.

Deutsche Telekom
Reduce energy use by 15 percent from 1995 levels by 2000.

DuPont
Reduce GHG emissions by 65 percent from 1990 levels by 2010, hold total energy use flat using 1990 as a base year, and source 10 percent of the company's global energy use from renewable resources by 2010.

Entergy
Stabilize carbon dioxide (CO_2) emissions from U.S. generating facilities at 2000 levels through 2005.

IBM
Conserve, in each year, 4 percent of the energy that would otherwise have been consumed.

Reduce CO_2 emissions associated with IBM's fuel use and electricity consumption by an average annual 4 percent of what would otherwise have been emitted, over the period 1998 – 2004.

Have 90 percent to 100 percent of the new models introduced during the year meet the Energy Star® criteria.

Reduce perfluorocarbon (PFC) emissions from semiconductor manufacturing worldwide by 40 percent from 1995 levels by 2002 (indexed to production).

Reduce PFC emissions by 10 percent from 1995 levels by 2010.

Intel
Reduce PFC emissions by 10 percent from 1995 levels by 2010.

Interface Inc.
Reduce non-renewable energy use per unit of production by 15 percent from 1996 levels, and increase renewable energy use to 10 percent of total energy use, by 2005.

Ontario Power Generation
Stabilize CO_2 emissions at 1990 levels through 2000 and beyond.

Rio Tinto
Reduce on-site GHG emissions per unit of production by 5 percent from 1990 levels by 2001.

Rohm and Hass
Reduce energy consumption by 5 percent per pound of product from mid-1999 levels by year-end 2001, and establish further firm five-year reduction goals at year-end 2001, targeted at an additional 10 percent reduction per pound of product for a total reduction of roughly 15 percent per pound of product by 2006.

Shell
Reduce GHG emissions by 10 percent from 1990 levels by 2002.

Meet energy targets per tonne of product for global business units.

Toyota Motor Manufacturing North America
Reduce energy consumption per unit of production by 15 percent from 2000 levels by 2005.

TransAlta Corporation
Return GHG emissions to 1990 levels by 2000.

Achieve zero net GHG emissions from the company's Canadian operations by 2024.

United Technologies Corporation
Reduce energy consumption as a percentage of sales by 25 percent from 1997 levels by 2007.

II. Reasons Companies Adopt Climate-Related Targets

This section explores the rationale behind setting climate-related targets. It describes recent trends in corporate target-setting and sustainable development,[2] related issues in the decision-making process, and the reasons for the climate-related targets in place today.

At a session in the Davos World Economic Forum in February, 2000, business and government leaders said, "The greatest challenge facing the world at the beginning of the century…is climate change." This surprise verdict was reached after five of the world's leading thinkers presented their visions for the future and the participants present voted electronically to support or reject their scenarios. Not only did the audience choose climate change as the world's most pressing problem, they also voted it as the issue where business could most effectively adopt a leadership role.

A. Drivers of Corporate Environmental Performance

Forward-looking Investment Strategies

A forward-looking investment strategy lies at the heart of corporate environmental engagement during a period of rapid social change. Energy sector and manufacturing investments have long economic lives. This requires firms in these sectors to assess business risks and opportunities well into the future and to consider the long-term societal repercussions of investment decisions made today. In so doing, many corporations have concluded that the environment will play an increasingly important role in corporate decision-making.

This conclusion drives plant operations and product development. For example, large R&D efforts are underway in vehicle motors and renewable energy. Climate considerations, specifically, have spurred industries to develop methods for controlling powerful greenhouse gases such as perfluorocarbons (PFCs), sulfur hexafluoride (SF_6) and halogenated fluorocarbons (HFCs). Industrial energy efficiency also continues to be improved through cost-effective automated process controls, new materials, and better equipment design.

Changes in the Regulatory Environment

Governments have introduced regulations to deal with the environment on both the international and domestic front, beginning with those issues for which the science is sound, the public is engaged, and there is a clear and present threat to human health. Some of the highest-profile environmental regulations are North American and European policies to deal with air quality, with a particular focus on the electricity and transportation sectors. These sectors are subject to regulations controlling ground-level ozone, acid rain, particulate matter, and air toxics. Stricter regulations for both sectors are being considered in many developed countries. Owners of coal-fired power plants, in particular, face a multiplicity of difficult investment decisions. Regulatory risks with respect to any or all of nitrogen oxides (NO_x), sulfur dioxide (SO_2), particulate matter, and mercury, in addition to greenhouse gases, are being factored into choices of fuel and generation technology.

Among the most significant changes in the approach to environmental governance has been an increased reliance on market-based approaches and voluntary agreements. European governments have introduced emissions taxes and industry covenants, while North American governments have established emissions trading regimes to control SO_2 and other pollutants. The use of market-based approaches to environmental protection is consistent with the global trend toward more competitive energy markets. By providing flexibility and choice, market-based approaches allow industry to achieve environmental objectives at a reduced cost to industry, the public sector, and the consumer.[3]

The Triple Bottom Line

Over the past decade, sustainable development and corporate citizenship on environmental issues increasingly have become part of the business and political mainstream. Increased global trading and the voices of civil society have pressured business to factor environmental and social responsibility into its daily operations. In particular, customers and companies in the developed world, and their governments, increasingly want to know that imports have been produced according to appropriate environmental and social standards.

The philosophy of the "triple bottom line" — accounting for economic, environmental, and social factors — has emerged and in some companies is replacing the approach of simply following regulations and avoiding fines. Many forward-looking firms have found it economically advantageous to stay ahead of

the regulatory curve. Pressure to deliver outstanding commercial performance has been coupled with pressure to lead on social and environmental issues. For example, a survey of 100 leading business analysts and decision-makers from France, Germany, and the United Kingdom found that 64 percent "agree strongly" that corporate social and environmental responsibility will affect their own decisions, and that 42 percent "agree strongly" that corporate responsibility will affect share price.[4]

"Entergy's program will demonstrate that companies can do the right thing while remaining competitive and profitable." - *J. Wayne Leonard, CEO,* ***Entergy***

"The bottom line is a small footprint on a big planet." - *George David, CEO,* ***United Technologies Corporation***

"Any credible response to climate change - especially that of an energy company - must start with real cuts in our own greenhouse gas emissions." - *Mark Moody-Stuart, Chairman of the Committee of Managing Directors,* ***Shell***

"Environmentally friendly cars will soon cease to be an option, they will become a necessity." - *Fujio Cho, CEO,* ***Toyota***

"Our corporate responsibility does not end at the factory gate - it covers our activities and products from cradle to grave." - *Goran Lindhal, CEO,* ***ABB***

"Companies like ours must continue to address our planet's pressing environmental problems and help the world develop in a more sustainable manner. Through our operations, products and services, we intend to do just that." - *Louis V. Gerstner Jr., CEO,* ***IBM***

Environmental targets are an effective way to demonstrate leadership. Managers and employees work by numbers — philosophical commitments are not easily translated into action in the production-oriented, engineering cultures of manufacturing and energy companies. Setting a numerical target tends to trigger an immediate focus on addressing the problem. Reaching the target provides a demonstration of commitment as well as a tangible result.

Environmental stewardship is a natural by-product of operating in a corporate culture with strong social and ethical values. In companies with wide-ranging environmental stewardship programs, managers and employees feel a responsibility for, and take pride in, doing the right thing. Environmental targets, including those related to climate, are accepted as an inherent part of business, just like financial targets.

Energy Market Reforms

Energy market reforms have given companies greater choice and control over decisions regarding electricity and other energy supplies. Until recently, corporations had relatively limited choice regarding electricity and energy supply. Industry was also restricted in its ability to contribute electricity into utility grids. With market reforms underway, however, energy supply decisions can be used to demonstrate corporate environmental stewardship. Technological advances, particularly in the areas of co-generation and small-scale power generation, have helped turn

former power consumers into net power generators. Markets have also begun to open up for direct sales to customers of environmentally friendly "green" power.

B. Drivers of Companies' Climate-Related Targets

An increasing number and variety of companies have taken on targets that will result in reductions of their GHG emissions. The first companies to take on climate-related targets included mostly large multinationals in the energy sector and energy-intensive industries. However, recent additions to the list include companies that supply floor coverings, health care and nutrition products, computers, cameras and digital imaging, supermarkets, pharmaceuticals, and hotel accommodation.

> "The choices we make today about how to generate electricity will depend on whether we take into account the true costs of new generation. These include external environmental costs and the uncertain costs from small changes in CO_2 levels that may produce substantial effects on the climate." - *J. Wayne Leonard, CEO,* ***Entergy***

There is no single reason why companies have decided to adopt climate-related targets — a combination of factors provides the motivation for action. These factors include a need to manage risk associated with possible future regulations, recognition that taking climate change considerations into account can improve competitive positioning, and recognition of the validity of climate change science. Typically, several of the reasons described below apply to any given company.

Managing Regulatory Risk

Regulatory risk is a strong driver for companies with high exposure to the costs of meeting any future regulations on GHG emissions. Some companies are expecting future regulations to impose serious financial costs related to GHG emissions. Companies that make lower-emissions investments today are therefore acting to increase their profits in a future climate-constrained economy, even if emissions are not regulated today. This expectation applies particularly to the energy industry, where investments last for many decades. Shell's use of carbon "shadow pricing"[5] is an example of this reasoning. In addition, taking on a voluntary climate-related target provides corporations the opportunity to establish internal systems and procedures and to "learn by doing" in order to avoid, or prepare for, future regulation of GHG emissions.

Companies are also motivated to set voluntary targets and to take action on greenhouse gases as a means to demonstrate the value and effectiveness of flexible approaches to climate change policy. These

activities send a clear message to governments: "Tell us what you want to achieve, but allow us the flexibility to find the least-cost means of getting there." Industries that operate in a competitive global environment can minimize the costs of emissions reductions across operations in many plants and jurisdictions if granted flexibility. In the case of climate change, such flexibility is both environmentally sound, because climate impacts are independent of the location of the emissions source, and economically advantageous, because the options for reduction are geographically widespread and highly variable in cost. The experiences of companies with internal emissions trading systems, and those developing GHG emissions offsets, are informing government officials charged with designing national and international policies.

> "For the energy industry, the central message to take on board is that carbon emissions should no longer be viewed as free. They are clearly a potential cost and they have to be accounted for as such." - *Mark Moody-Stuart, Chairman of the Committee of Managing Directors,* ***Shell***

In many cases, climate-related targets are components of extensive environmental stewardship programs established partly in response to regulatory risk. For some companies, climate-related targets exist within a framework of environmental performance indicators that is managed throughout the company. These companies have allocated a great deal of time, staff, and money to make environmental stewardship effective. For example, ABB, by implementing the International Organization for Standardization's 14001 standard (ISO 14001), has installed an environmental management system, including site-specific management systems at 535 facilities worldwide, detailing objectives for 39 indicators.

Other Competitiveness Considerations

Leading corporations have concluded that they can benefit financially by addressing the climate change issue. By using energy and other resources more efficiently, corporations can reduce production costs and become more competitive. At the same time, by creating products that use less energy and produce lower GHG emissions, corporations can differentiate their products in an increasingly environmentally conscious marketplace.

Decreased Production Costs: Efficient Use of Resources

Some companies have had long-standing energy efficiency targets as part of an overall environmental management strategy. Energy targets are often one of a portfolio of environment, health, and safety (EHS) commitments that pre-date the climate issue. For example, IBM's energy program, which dates back to the 1970s, has had energy efficiency targets for

over 15 years. Within the portfolio, energy is viewed as a natural resource to be conserved along with other natural resources such as water and forests. Since the emergence of the climate issue, some companies with energy targets have additionally taken on GHG emissions targets, especially for non-energy-related greenhouse gases.

Conserving energy is sometimes a more practical goal than reducing GHG emissions, for two reasons.

• First, energy efficiency investments result directly in operating cost reductions. Using less energy often means higher profits through lower energy bills. By contrast, GHG emissions reduction investments do not necessarily reduce, and may increase, operating costs with no direct benefit such as reduced energy bills.

• Second, the great majority of GHG emissions associated with many manufacturing companies come from power plants, as a result of the manufacturing companies' electricity purchases. The greatest emissions impact such a company can have is to conserve electricity or to switch electricity supplier. However, many jurisdictions do not offer a choice of supplier. In these cases, electricity-related GHG emissions can only be reduced by saving electricity. In jurisdictions where customers can choose their electricity supplier, some goods manufacturing companies with energy targets are also purchasing power from renewable or other low-emission sources.

Increased Market Share: Helping Customers Reduce Emissions and Save Energy

Companies with climate-related targets for their products are seeking to serve and create demand in product markets. The products of certain manufacturing companies, including TMMNA, UTC and ABB, generate more emissions from their use than from their manufacture. Product energy efficiency represents a double benefit in attracting both cost-conscious and environmentally aware customers.

Of the case study companies, only ABB and IBM have targets relating to product use. In IBM's case, the target relates to meeting certain energy efficiency standards, while in ABB's case, it relates to the provision of information on GHG emissions, as well as on other environmental indicators. However, UTC and TMMNA also incorporate energy efficiency into their product planning — such as TMMNA's production of the fuel-efficient Prius hybrid automobile. In Shell's case, the company is also shifting its product mix towards low-emission fuels and renewable energy.

Climate Science

A company's views about climate science are central to any decision to take on a climate-related target. Climate science is a key driver of commitments to GHG emissions reductions. This holds for companies that adopted targets early on, based on the precautionary principle, as well as the increasing number of recent adopters driven by rising scientific certainty. The significance of climate change as a business issue has grown in the last five years and there is increasing support for the view that human-induced climate change is a serious problem. For example, a November 2000 poll of Fortune 500 business executives conducted for the National Environmental Trust in the United Kingdom found that 75 percent of those polled believed that global warming was a serious problem, and that 55 percent agreed that the majority of the evidence supported the existence of global warming or that it was an established scientific fact.[6]

C. Drivers of Case Study Companies' Climate-Related Targets

The case study companies all have a mix of reasons for adopting targets. Choosing which to emphasize is a subjective judgment. Most of the companies that have targets also incorporate environmental performance, including performance related to climate change, into their business practices in other ways. For example, ABB has shifted its product line towards low-emission and renewable energy technologies. The companies' targets are shown in detail in Section III.B.

- **ABB:** ABB's corporate target on emissions from its own plants was adopted to signal encouragement to the international process around the Kyoto Protocol.[7] ABB's target is based on its environmental management system, which was already in place and includes a variety of environmental targets for plant operations. ABB also has a product target — the company intends to produce Environmental Product Declarations for all major product lines. These will help customers make informed choices that reduce their emissions, save energy, and help reduce operating costs.

- **Entergy:** Entergy's target is part of a corporate strategy to raise the company's formerly low profile on social and environmental issues, so that other companies in the electricity sector might be encouraged to follow Entergy's lead and begin taking positive steps to deal with climate change. Entergy is a relatively low-emission company in a high-emission industry. Environmental stewardship, a corporate view that climate change science provides sufficient evidence to warrant response actions, and managing regulatory risk are Entergy's key reasons for adopting a GHG target.

• **IBM:** IBM's energy efficiency and GHG targets are related to its environmental management system, which dates from the 1970s. IBM's environmental targets are based on stewardship and resource efficiency. IBM's product targets help customers save energy. However, the energy efficiency of IBM's products is not considered to be a major decision factor in consumer purchases.

• **Shell:** Shell's target demonstrates its triple-bottom-line approach to business. The target seeks to establish the company as an international leader in the long-term transition of the energy industry to more sustainable energy supply. Management of regulatory risk, relating both to domestic government policies and to international agreements on climate change, is also a key factor.

• **TMMNA:** TMMNA's energy efficiency target is part of its environmental management system. Its environmental targets are based on stewardship and resource efficiency. They are also tied to the five-year environmental strategy of its parent company, Toyota Motor Corporation of Japan.

• **UTC:** Efficient use of natural resources, specifically energy resources, is the key driver for UTC's target. UTC's target is part of a package of environment, health, and safety targets that the company is implementing as part of its corporate citizenship policy.

D. Lessons Learned

Despite the diversity of industries and targets in the six case studies and among the survey responses, three themes occur throughout.

An underlying stimulus for adopting a target is an improved position in the market. Corporate action on climate change and energy efficiency is not solely altruistic — in one way or another, all companies believe their targets will enhance their ability to compete. For some companies, energy efficiency has proven to be good business, independent of environmental benefits. Others see government regulation of GHG emissions as inevitable and are positioning themselves "ahead of the curve." Still others see climate change as one of several factors driving their development of new technologies.

Adopting a voluntary target carries a risk to shareholders, related to the uncertainty of future government policy. Reaching a target costs money and may carry risks associated with new technologies. The leaders in a voluntary system may be taking a competitive risk by adopting a target that forces them beyond "no-regrets"[8] measures. Mandatory emissions reductions level the playing field by spreading costs and technology risks across an industry.

If government fails to provide credit for early action under a future regulatory regime, it can expect companies to be "once bitten, twice shy." This uncertainty surrounding governments' intentions to provide regulatory back-up has given some companies pause to reflect on how far they should be moving ahead of the regulatory curve. DuPont, for example, set its first climate-related target in 1991 and has invested in a decade's worth of initiatives to reach that target. To date, no clear policy picture has emerged for governmental recognition of pre-compliance action in a number of key countries in which DuPont operates. This has not stopped DuPont from working towards an aggressive target; nonetheless, a lack of credit for early action will send a clear message to businesses that "doing the right thing for the environment" could come at a competitive cost.

Corporate culture plays an important role in how companies respond to political circumstances. The process of continuous improvement through targets is engrained in companies with well-established environmental management systems. In these companies, GHG emissions or energy targets are more independent of political circumstances. By contrast, other companies treat targets as "big picture" policy matters and are more sensitive, strategically, to the politics of climate change.

III. Choice of Target Type and Level

Once a corporation has made the decision to adopt a climate-related target, it needs to consider what type and level of target best match its individual circumstances. This section outlines the case study companies' targets, and describes key elements of target type and level, as well as the target-setting processes undertaken by some companies.

A. Types of Targets

Two decisions are required before a target can be adopted: its type and its level. The decision on what type of target to adopt can be determined by addressing three questions:

- **Target placement:** where in the product life cycle (from "cradle" to "grave") should the target be applied? In practice, the question is whether the target applies directly, to plant operations, or indirectly, to supplies or products.

- **Target coverage or focus:** should the target focus on GHG emissions or on energy consumption?

- **Nature of the target:** is the target expressed in absolute terms (such as a limit on total emissions or energy consumption), or relative to other factors (such as units of products or sales)?

Many types of targets can result from selecting different answers to the three questions. Each target type brings with it relative strengths and weaknesses, depending on the specific circumstances of a given company. For example:

- A target to reduce carbon dioxide (CO_2) emissions from the combustion of fossil fuel at a company's plants by 5 percent below the 1990 level is an absolute target for one of the major GHG emissions from plant operations. This particular target is similar to the Kyoto Protocol in that it is a GHG target[9] with a base year of 1990. The adoption of an absolute cap on emissions from plant operations, however, creates an element of risk in the form of emissions due to increased production.

• By comparison, a target to reduce purchased electricity per unit of production to 1 megawatt-hour per unit is a relative target on energy supply. The extent to which energy targets mitigate climate change depends on the extent to which a firm's energy supply is dominated by fossil fuels.

Annex 2 lists the types and levels of publicly announced targets for selected major corporations, illustrating the diversity of target types and levels that have been chosen to match the individual circumstances of each corporation.

ABB and Life-Cycle Assessment

Life-Cycle Assessment (LCA) is a method to describe and quantify the environmental impact of a product from "cradle to grave," i.e. from raw material extraction, through production, use, and disposal. LCA is an important and highly developed tool in ABB's product design, strategic planning, and marketing functions.

ABB's involvement in LCA started in 1992 with joint projects with Chalmers University, which in 1996 founded a Competence Center in Environmental Assessment of Products and Materials Systems (CPM). LCA studies of switchgear, motors, and other equipment started in 1992. In 1995 LCA was introduced into ABB's environmental management program. Model and data development followed from 1995 to 1999, when the first Environmental Product Declarations (EPDs) were published. Current work includes further applications to product development and EPDs, as well as company-wide web-based learning and assessment tools.

ABB's LCA framework is supported by extensive data from ten years of collaboration with Chalmers University/CPM. For example, the framework allows specification of details such as the country of origin of raw materials and their mode(s) of transportation to the manufacturing site. The model estimates a variety of material flows, such as emissions, resource use, and hazardous and landfill waste and water, across all phases of the product life cycle. These flows are translated into nine types of impacts, including global warming potential, abiotic (resource) depletion, acidification, aquatic ecotoxicity, human toxicity for air and for water, ozone depletion, photochemical oxidants, and nutrification.

B. BELC Companies' Targets

The climate-related targets of the case study firms are as follows:

ABB: ABB has three targets related to climate change. ABB's overarching corporate GHG emissions reduction target is to reduce total emissions by 1 percent each year during fiscal years 1998 through 2005. ABB also has individual energy conservation targets for each of its plants, as implemented through its environmental management system. Since significantly greater GHG emissions result from the use of its products than from their manufacture, ABB has also targeted the energy efficiency of its products, including turbines and electrical machines. ABB uses Environmental Product Declarations to support low-emissions

product designs and sales. An Environmental Product Declaration describes the environmental performance of a product, system, or service over its entire life cycle. ABB's goal for 2001 is to produce Environmental Product Declarations for all major product lines.

Entergy: Entergy's target is to stabilize CO_2 emissions from its domestic power plants at year-2000 levels, through 2005. This target applies to Entergy's utility and independent power plants operating in the United States. The target is an interim target, and a longer-term reduction target will be established by 2005.

IBM has several targets. Its first target is to conserve, in each year, 4 percent of the energy that would otherwise have been consumed. For example, if energy consumption in 2002 were expected to be 100 units in the absence of energy conservation efforts, IBM's target would be to consume only 96 units. IBM's second target is to reduce CO_2 emissions associated with IBM's fuel use and electricity consumption by an average annual 4 percent of what would otherwise have been emitted, over the period 1998 to 2004. IBM also has product targets. These vary by product line. For those products covered by Energy Star® (a joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy), IBM aims to have 90 to 100 percent of the new models introduced during the year meet Energy Star® criteria. For servers and storage devices, the goal is to decrease operating power consumption per unit of work or unit of storage compared with previous-generation products. IBM's fourth target relates to PFCs, long-lived greenhouse gases emitted in the production of semiconductors. IBM has pledged to reduce PFC emissions by 40 percent from 1995 levels by 2002 (indexed to production). Finally, as part of a semiconductor industry-wide initiative, IBM has committed to reduce PFC emissions from semiconductor manufacturing processes by an absolute 10 percent between the base year 1995 and 2010.

Shell: Shell's overall corporate target is an absolute target to reduce its GHG emissions to 90 percent of 1990 levels by 2002 (a 10 percent reduction below 1990 levels). This target of approximately 104 MT includes all greenhouse gases covered by the Kyoto Protocol. Shell also has annual targets in energy use per tonne of product for global business units. For 2000, these were 0.7 GJ/tonne of throughput for Exploration and Production, 2.9 GJ/tonne for Oil Products, and 7.0 GJ/tonne for Chemicals.

TMMNA: TMMNA's target is to reduce energy consumption per unit of production by 2005 to 15 percent below 2000 levels, an average of 3 percent per year. Adopting a target indexed to production is consistent with TMMNA's corporate goals of increasing efficiency and reducing production costs.

UTC: UTC's target is to reduce energy consumption per dollar of revenue by 25 percent from 1997 levels by 2007.

Table 1 classifies the BELC companies' climate-related targets.[10] All companies in Table 1 have targets on in-plant emissions or energy use. This stems from the fact that internally generated emissions are those for which firms are most directly responsible and over which firms have the most control.

Table 1

BELC Members' **Target Classifications**

Company	Revenue 2000 ($US billion)	GHG Emissions 2000 (million tons)	Target Description	Placement of Target in Product Cycle			Focus of Target		Nature of Target	
				In-plant	Purchased Electricity[11]	Product Use	GHG	Energy	Absolute	Relative
ABB	23	1.1	Energy	•	•			•		•
			GHG	•	•		•		•	
			EPDs[12]			•	•	•		•
Alcoa	23	38	GHG	•			•		•	
Baxter	6.9	.72	Energy Efficiency/GHG	•	•		•	•		•
BP	148	72.2	GHG	•			•		•	
CH2M Hill	1.7	N/A	Energy		•			•		•
Deutsche Telekom	10	N/A	Energy	•	•			•	•	
DuPont	28	49	GHG	•			•		•	
		(1999)	Energy Use	•				•	•	
			Renewable Energy		•			•		•
Entergy	10.0	53.2	GHG	•			•		•	
IBM	88	3.4	Energy Efficiency[13]	•				•		•
			Climate Savers[14]	•	•		•			•
			Energy Star®			•		•		•
			PFC (to 2002)	•			•			•
			PFC (in 2010)	•			•		•	
Intel	33.7	N/A	PFC	•			•		•	
Interface Inc.	1.3	N/A	Energy	•	•			•		•
Ontario Power Generation	6	42.7	CO_2	•			•		•	
Rio Tinto	10	10.1	GHG	•			•			•
Rohm and Haas	6.9	N/A	Energy	•				•		•
Shell	192	111.0	GHG	•			•		•	
			Energy	•				•		•
TMMNA	N/A	1.2	Energy	•				•		•
TransAlta	1.5	42.4	GHG	•			•		•	
UTC	25	1.9	Energy	•	•			•		•

C. Choosing a Target Type

Companies' choices among potential target types depend on the specifics of their products and production methods, their policy environments, and their business models. Four general considerations regarding choice of target type emerged from the

analysis: the scale of potential emissions reductions, the existence of uncontrollable factors relating to emissions or energy use, the opportunity for cost-effective emissions or energy reductions, and the potential impact on company growth.

The scale of the impact on emissions reductions depends on a company's position in the product life cycle and is therefore related to the issue of "placement." For example, over 99 percent of the energy consumed during the life cycle of an electric motor occurs during its use, as opposed to during its manufacture or during the production of its component raw materials. This has influenced ABB and IBM to set targets related to the emissions associated with the use of their products, in addition to targets on in-plant emissions. By contrast, the majority of emissions from electricity production result from fossil fuel combustion at electric generation stations, while substantially less come from the production of those fuels, and none from the use of electricity. Therefore Entergy, which produces electricity, chose to cap emissions from its own operations.

Uncontrollable factors may diminish the practicality of setting an indirect target, i.e. a target related to supplies or to products. Direct GHG emissions and energy use are controlled by in-plant efforts, while indirect emissions and energy use depend on other plants and consumers, and are therefore less controllable. For example, a computer manufacturer typically has no control over the "carbon content" of electricity used by the computers it produces, nor over their hours of operation. Therefore, it would be difficult for IBM to set a meaningful cap on emissions from the use of its products. IBM has addressed this problem by committing instead to produce more energy-efficient computers.

The opportunity to achieve cost-effective emissions reductions helps drive the choice between targeting energy and targeting GHG emissions. For example, Entergy has a greater opportunity to reduce emissions by shifting its fuel mix than by improving its energy efficiency. An emissions target can therefore provide more opportunity for Entergy. By contrast, the manufacturing companies — IBM, UTC, TMMNA, and ABB — use relatively little fuel directly. Their emissions are mostly indirect, from electricity supply. It makes more sense for these companies to target energy efficiency than GHG emissions because (a) they can realize cost savings through improved energy efficiency, and (b) they cannot readily control the carbon content of their electricity (although the advent of green power purchasing options may change this).

A relative target allows emissions or energy use to grow, as long as emissions or energy use per unit of production does not. For example, UTC is a conglomerate of different manufacturing interests.

It plans to continue to increase both the quantity and variety of its products, and does not wish to constrain that growth by imposing an absolute target. On the other hand, Shell has chosen to adopt an absolute target on its GHG emissions. Shell has the opportunity to reduce its emissions through substantial changes in its production methods, such as increased methane capture, while it continues to grow as a diversified energy company.

Absolute targets have the advantage of being consistent with international commitments under the Kyoto Protocol, as well as with many countries' domestic policies. Absolute targets also limit total environmental impact. This appeals to the public because of environmental certainty.

D. Setting the Target Level

Once the target type has been selected, it remains for the company to set the target level. To do so, a company needs to know its current GHG emissions and/or energy use, and have an idea of what it would be emitting or using under business as usual in potential target years. It also needs a broad knowledge of actions that could meet the target, and the costs and emissions reductions or energy savings associated with those actions. A useful process is an iterative exercise in which the estimated effects of potential "test" actions are compared to a "test target." The process can be repeated until a target is found that is significant and achievable at reasonable cost, but would not be achieved under business as usual.

The process of setting the target level can be either "top-down" or "bottom-up." This categorization applies to the method by which the numerical value of the target level is derived, rather than to where in the company that value is approved, or to whether the target exists only at the corporate level or also as a set of plant-level targets. In a top-down target-setting process, the level is initially derived for the whole corporation at once. The target may then be allocated to the operating units in various ways, so that the sum of the "sub-targets" equals the corporate target. Under a "bottom-up" process, the corporate target level is based on analysis of potential reductions by individual operating units. Top-down and bottom-up elements occur within each company's target-setting process. For the case study companies, the processes of Shell, UTC and Entergy may be characterized as primarily top-down, whereas those of ABB, IBM and TMMNA may be characterized as primarily bottom-up.

Whether the target-setting process is top-down or bottom-up will be determined by a number of factors, including the company's corporate culture. For example, one might expect that TMMNA's process would be

bottom-up, consistent with the concept of "Kaizen" — employee-led initiatives to achieve continual small improvements — that permeates its culture.

Normally, the first step in determining the appropriate target level is to develop an emissions or energy use inventory.[15] An inventory is a formal system for measuring, aggregating, and reporting emissions or energy use on a regular basis. The inventory process may involve hundreds of employees dispersed among the company's plants. An inventory is used in setting the target, developing the plan to meet it, and tracking progress towards achieving it.

Companies must decide early on how far back in history the inventory should reach. It is often difficult to estimate emissions or energy use for past years — the further back, the more difficult it is. Depending on how future compliance and early crediting regimes are specified, there may be limited value in attempting to recreate 1990 data solely for the purpose of choosing the same base year as the Kyoto Protocol. For example, an emissions cap of 10 percent below the 1990 level is also a cap of some percentage of the 1995 or 2000 level, which may be easier to estimate.

The inventory may need to account for acquisitions and divestitures, which most companies adjust their targets to accommodate. For example, a cap of 10 percent below 1990 levels requires increasing the 1990 inventory by the 1990 emissions of acquired companies and decreasing the 1990 inventory by the 1990 emissions of divested companies. Choosing a more recent base year simplifies the data adjustment if historic emissions data are difficult to find.[16]

The second step is choosing a target achievement year. Should the company go for less reduction sooner or more reduction later? Balancing the target level with the target year is a risk management exercise. A more distant target is not necessarily more or less difficult to achieve than a short-term target, but carries greater risks associated with changes in technology and markets.

The third step is to project baseline emissions under a business-as-usual scenario. The baseline projection is based on the company's investment and operations plan, and follows from assumptions regarding future technologies and their emissions rates or energy use in the target year. Developing the baseline projection on a decentralized, plant-by-plant basis works well if no major corporate decisions that shift supplies, products, or production methods are anticipated. Otherwise, the business-as-usual projection depends on the expectations of those making the major decisions.

The fourth step is to assess how reasonable the target is, via a broad "test" action plan. Companies with a history of continuous improvement targets often use performance of past action plans as the basis for an assessment. However, if the target is a company's first, it is useful to examine specific options for future action, using the expertise of engineers, economists, and managers. The "test" action plan should consider costs, as well as technical feasibility.

An iterative process foreshadows the action plan and the organizational elements necessary to implement it. Setting the target by using the four steps iteratively brings together the operations managers who need to implement energy use or emissions reductions, the business planners whose ideas drive the underlying emissions-producing or energy-using activities, the technology specialists who study what is possible, and the executives who are accountable for the company's success.

E. Lessons Learned

Companies' choice of target type depends on the specific characteristics of their products and production methods, their policy environments, and their business models. Four general considerations that emerge from the case studies are: the scale of a target's potential emissions reductions, the existence of uncontrollable factors relating to emissions or energy use, the opportunity for cost-effective emissions or energy reductions, and the potential impact on company growth.

When setting a target level, it is beneficial to involve those who will be responsible for implementing the action plan. This involvement is more than a solidarity-building exercise; it helps quantify a reasonable target. The target-setting process also benefits from the input of those making core investment and operations decisions if significant shifts in production technologies, products, or sources of energy supply are planned.

The information generated by an environmental management system is valuable for setting a target. Emissions and energy targets are business-as-usual for companies with established environmental management systems. The combination of the inventory process and the continuous improvement principle provides a basis for learning what is achievable, and suggests how it may be achieved.

IV. The Action Plan

An action plan is a roadmap for achieving a target in the most productive way. Although the chosen target type and the overall business climate of the corporation will dictate the specific measures in the action plan, there are, nonetheless, some "macro" decisions that will shape the overall plan. This section describes these decisions, examines the action plans of the six case study corporations, and discusses common implementation and assessment issues.

A. Macro Design Decisions

Top-Down Versus Bottom-Up

How an action plan is designed – from the top down or from the bottom up – is normally determined by the method by which the target level is set in the first place. In the case of targets set via a bottom-up process, employees in the operating units determine plant-scale actions, and the corporate plan is the "roll-up" of these actions. Targets set via a top-down process are set at the corporate level, and may either be allocated among operating units, or not. If allocated, each unit will develop its own action plan. The corporate action plan will then be based on the ideas that each operating unit has for achieving its target. If not allocated, the action plan is determined at the corporate level, but with advice and technical assistance from the managers of operating units.

"Bottom-up" action plan designs tend to dominate in companies with environmental management systems, which feature continuous improvement through plant-level targets. In these companies, each plant can be expected to have a good idea of what measures can be implemented

Shell Tradable Emissions Permits System (STEPS)

An important aspect of Shell's international climate change strategy is a voluntary "cap and trade" system for GHG emissions. Shell launched the pilot phase in 2000. Permits equivalent to 98 percent of GHG emissions in 1998 have been allocated to certain business units operating in the developed world, representing 30 percent of the company's total emissions. The rest of the target will be achieved through other means.

Shell uses emissions trading to motivate the development of cost-effective emissions reductions, improve the company's understanding of the costs and actions necessary to reach a target, and to gain experience in trading for the future.

within its operations, what impact the measures might have on emissions, and how much it will cost to implement them. Corporate staff may then review the history of achievements and the current plans to develop a comprehensive plan with a high degree of confidence.

Relationship with Other Sustainable Development Activities

Decisions to emphasize certain activities in the target action plan, or to exclude others, may be linked to a company's overall sustainable development policy. Most large companies already manage GHG emissions and energy use within a larger sustainable development framework, but introducing a numerical target may bring about a need for additional criteria, such as those related to the acceptability of low-emissions but controversial technologies. These policy issues are usually decided at the senior management or the Board of Directors level.

Other broad sustainable development priorities may also shape a corporation's plan. For example, many companies are certified under ISO 14001, a program that has prescribed components for assessment, reporting, and continual performance improvement. Other companies require their suppliers to meet certain environmental standards, which may open up additional options for the corporation to meet its targets in partnership with suppliers.

Internal Trading and Offsets

A number of large corporations have decided to embrace the marketplace in their action plan, recognizing that for their operations, internal trading and/or offsets

Kaizen: Machinery Optimization and a New Painting Process

"Kaizen" refers to employee-led initiatives to achieve continual small improvements. Toyota's corporate culture encourages kaizen through suggestions from employees. For example, TMMNA was able to eliminate the use of one of its injection molding machines by consolidating the use of other underutilized machines. Toyota estimates that the change will achieve energy savings worth $27,000 a year, resulting in a payback period of one year, with no capital cost expenditure.

Alcoa: Reducing Emissions Through Technological Innovation

Alcoa expects to achieve its GHG emissions reduction target of 25 percent below 1990 levels by 2010 through technological advancements in the aluminum production process. Alcoa has a long tradition of continuously improving its energy efficiency, having reduced the electricity required to produce a ton of aluminum by 20 percent over the last 20 years. The company's PFC emissions also decreased by one third between 1990 and 1995.

Alcoa is developing an inert anode technology that could reduce its GHG emissions by 50 percent from 1990 levels by 2010. The successful development of this technology would eliminate the need to use carbon in one step in the production process.

may increase the economic efficiency of the action plan. Trading can apply to emissions rights or, in principle, to energy consumption rights, although the latter has not yet been applied in practice. In principle, trading redistributes activity among operating units in such a way that the total cost of meeting a corporate target is minimized. A trading system may also be used to find low-cost reductions. For example, in Shell's case, emissions reduction costs vary widely between largely autonomous core businesses, and between operations in different countries. Shell's Tradable Emission Permits System (STEPS) is expected to find cost efficiencies in a way that a top-down action plan might not. This will help the company better define future emissions reduction measures and plans.

Emissions Offsets: Ontario Power Generation

Ontario Power Generation (OPG) has committed to stabilize its net GHG emissions at 1990 levels in 2000 and beyond. To meet this target, OPG has programs in five areas: nuclear generation performance improvement, in-house energy efficiency, emissions trading, green energy, and carbon sequestration. As an active participant in the emerging carbon market, one of the key elements of OPG's strategy has been to develop and purchase external offsets. In 2000, OPG achieved its target by applying 12.5 million metric tons of GHG emissions reductions. Ten million metric tons of these were purchased from sources in North America and internationally, and the remaining 2.5 million were generated through internal energy efficiency.

Cost-effective allocation of targets is difficult when costs of emissions or energy use reduction are not well known. An internal trading system is therefore of greatest value in two cases: when the initial allocation may not be least-cost, and when there is no other set plan for achieving the target. For example, some top-down targets have been allocated as equal proportional reductions for all operating units. There may be another outcome in which some plants reduce proportionally more, and some less, that achieves the same total reduction at lower total cost. The less costly allocation could be realized through an internal trading system. The value of internal trading is higher when the costs of creating the system and transacting trades is relatively low.

Offsets, or investments in emissions reductions outside the company, may be valuable when the cost of internal reductions is high. In energy-intensive industries, fuel choice and energy efficiency are fundamental drivers of both competitiveness and emissions. For some companies, these drivers are already optimized, leaving relatively little room for further low-cost adjustment under a target. In these cases it is natural to expect the company to "look outside." Many companies have not entertained the use of offsets, while others rely on them a great deal. Participation in the offset market gives companies practical experience with emissions trading. It also demonstrates to governments the feasibility and merit of this approach.

Research and Development

New technology is likely to be the most powerful tool at a company's disposal. An energy or emissions target provides a challenge to technology developers. In the absence of a target, plant equipment and product designs may account for energy costs, but not necessarily for energy quantities or GHG emissions. A target may affect technology development priorities and lead to innovation that makes it easier to reach the target. The more rigorous the target, the greater is the incentive to develop and apply innovative technologies. A few examples of innovation are shown in Table 2.

B. Case Study Company Action Plans

The action plans of the case study companies encompass a large variety of broad strategies and specific activities. The general approach of each company follows:

ABB: ABB addresses emissions from its operations using its environmental management system. Responsibility for meeting the target rests with the more than 500 local sustainability officers around the world. Each local sustainability officer is held accountable for the annual contribution he or she pledges in the context of the environmental management plan. ISO 14001 has been implemented at 97 percent of its sites, corresponding to 535 sites worldwide. ABB also uses Environmental Product Declarations to inform its customers of the life-cycle impact of its products. The corporation spends a high percentage of revenue on R&D, much of which goes to the development of climate-friendly technologies.

Entergy: Entergy has established an internal corporate CO_2 emissions reduction fund that will provide $5 million in each of five years to finance emissions reduction projects and activities. It is expected that a substantial majority of reductions will occur at Entergy's plants, rather than as offsets. Entergy's approach to achieving emissions reductions includes "learning by doing." Therefore, emissions reduction proposals will be screened for their potential to improve future emissions reduction efforts. Proposals will also be evaluated on the basis of their potential to further other corporate objectives, such as regional employment and poverty alleviation. The specific details of the CO_2 reduction plan have yet to be announced. The plan will be integrated with Entergy's U.S. environmental management system.

IBM: IBM's energy and CO_2 targets are governed by a directive that covers the company's worldwide operations. However, energy management is implemented on a decentralized basis. Each major location and business unit prioritizes and allocates capital to energy conservation projects based on the

same financial criteria as for other investments. Recently, IBM began using alternative financing, including performance-based contracting, for energy management. Each major location's performance is tracked and reported through IBM's Environmental Master Plan.

Shell: Following two senior management workshops and a presentation of recommendations to the Committee of Managing Directors, Shell created the position of Vice President of Global Climate Change to oversee corporate implementation, developed an internal emissions trading system, established the Clean Development Mechanism (CDM)[17] Demonstration Program, and embraced carbon "shadow pricing" — the requirement to include "shadow" prices of GHG emissions of $5 and $20 per tonne of carbon-equivalent in the investment analysis of all projects over a certain size—as a fundamental strategy in its corporate action plan.

TMMNA: Each TMMNA plant develops its own energy management plans and each has the same energy target per unit of production as does TMMNA as a whole. It is anticipated that the target will be achieved through "kaizen," which is at the core of Toyota's production system. Improved energy efficiency is supported by extensive collection and monitoring of energy use data as part of Toyota's environmental management system.

UTC: UTC intends to reach its target through the commitment of the senior managers of each of its member companies. Implementation is coordinated through a network of experts within the operating businesses and at corporate headquarters. The network provides technical assistance in energy management, gathers and analyzes energy consumption data, develops benchmarks, and coordinates the sharing of best practices. UTC has developed internal guidelines for use across the companies in common energy applications such as compressed air and lighting, and has set non-published interim targets that are used to evaluate progress and to spur innovation. UTC's resource efficiency targets in non-energy sectors also contribute to its energy target. For example, measures to reduce water consumption often additionally reduce the energy needed for heating and pumping. UTC has also benefited from conservation program contributions from the Connecticut government and is actively looking at using energy services companies to assist in finding and implementing energy conservation measures.

Within these overall strategies, there are a number of specific measures being pursued by the case study companies. Table 2 provides an overview of some of the actions underway or planned.

Table 2

Examples of **Activities in the Action Plans** of the Six Case Study Companies

Company	Target	Examples of Activities in the Action Plan
ABB	Energy	Install timers on rooftop extraction fans
	GHG	Recycle heat from process water
	Environmental Product Declarations	Provide life-cycle environmental impact information on products
Entergy	GHG	Increase new gas-fired generation; increase power plant operational efficiency; external offset projects
IBM	Energy Efficiency	New filter fan unit design for clean room
	Climate Savers	Upgrade IT equipment at IBM's own sites
	PFC	Process optimization, emissions recovery research
	Energy Star®	Product technological advancements, lower power use design such as advanced "sleep mode"
Shell	GHG	GHG recovery; natural gas cogeneration; elimination of flaring
	Energy	Refinery and natural gas processing plant efficiency improvements
TMMNA	Energy	Recovery and reuse of waste heat form painting booth ventilation systems; conversion of electric ovens to gas ovens
UTC	Energy	Energy efficiency guidelines for common applications such as lighting and compressed air

C. Implementation

Implementing an action plan in a large corporation requires coordination at all levels of the organization. A key to success is to motivate managers and employees to contribute ideas and enthusiasm. Some general observations related to implementation follow.

An environmental management system is a valuable tool for all action plans, but relying on it exclusively may not be sufficient to meet an ambitious target. Plans should also be responsive to external risks imposed by markets, technological change, and regulation. The feedback loops built into environmental management systems provide good early warning systems in terms of progress towards a target. However, future emissions and energy use depend on markets, technological change, and regulations, each of which is a strategic, forward-looking, risk management issue. For more ambitious targets, action plans may need to incorporate such risks. For example, Shell missed an interim energy efficiency target for oil products because more stringent quality standards were introduced, requiring more energy to be used in refining. Similarly, Entergy might need to take additional actions to meet its cap if, for some reason, its nuclear operating rates fall substantially below expectations and fossil fuels are used to compensate for the deficiency, and TMMNA's manufacturing energy consumption per vehicle could rise if market demand for bigger vehicles, which take more energy to make, exceeds expectations.

Incentive systems for specific ideas and initiatives appear to work in all cases. However, care is needed in the design of the incentive system since directly linking compensation to target achievement may not always be considered equitable. Some companies include achievement of, or progress towards, the target as a factor in managerial pay and performance review. This may be seen as equitable only when there are relatively few uncontrollable factors relating to the objective. However, in all cases, positive incentives for new ideas and initiatives, including awards and recognition, appear to be productive.

Reinforcement of commitment by senior management motivates employees and managers throughout the company. The case studies emphasize the need for senior management, especially the CEO, to reaffirm frequently what the company is doing and why. Senior and operating-level managers indicate that people enjoy working for good corporate citizens and will stay with, or be attracted to work for a company, based on its values. Reinforcement also appears to lead to greater effort with respect to achievement of the target itself.

Partnerships with non-government organizations can build credibility and provide useful services. Some environmental non-government organizations, especially in North America, promote public-private partnerships on climate change and provide information and networking services. The partnerships reflect a school of thought that encourages progressive businesses, rather than criticizing those with contrary views. IBM, for example, has developed its GHG target as the central feature of its participation in the World Wildlife Fund's Climate Savers program. Two case-study companies, Entergy and Shell, are members of the Partnership for Climate Action, a cooperative organization involving Environmental Defense.[18]

D. Assessment of Results

Measuring progress includes verifying the results, re-evaluating uncontrollable factors, considering setting a new target, conducting cost analysis, and considering the relationship of the plan to the company's long-term vision. The research for this study leads to the following observations.

External verification may enhance the credibility of a company's reported progress toward its target. In external verification, a third party assesses the completeness and accuracy of reported GHG emissions or emissions reductions, as well as their conformance with pre-established criteria. Among the case study companies, Shell and ABB retain independent verifiers.

An assessment of uncontrollable factors may be useful in developing a robust action plan and in explaining, both internally and externally, why emissions or energy use are trending off-target. In the case of a trend towards failure, understanding and communicating how much of the shortfall is due to uncontrollable factors improves the company's credibility and informs future target-setting. Alternatively, if the target is met very early, or greatly exceeded, such an analysis may help defend the company against the claim that the target was merely for appearance's sake, and may also contribute to setting a more appropriate subsequent target. In UTC's case, for example, the target was set nine years in advance and is expressed per unit of revenue. Revenue is a function of product prices, which are set in competitive markets and are therefore uncontrollable. Unexpectedly low product prices would slow progress to the target, and vice-versa, even if the rate of improvement in energy efficiency per physical unit of production is as expected.

Companies may benefit from a systematic analysis of the costs of emissions or energy use reduction. Anecdotal reports may not be sufficient to justify any particular plan. A plan assessment may include determining whether the results to date have been cost-effective, and if not what can be done to force costs down. It may be impractical to compare the costs of every possible path to a target, but there have been some innovative methods of forcing rigorous analysis. For example, Shell's carbon shadow pricing assigns a range of dollar costs per tonne to GHG emissions. The shadow prices must be incorporated in investment analysis of all substantial emitting projects. Standard capital allocation procedures, based on maximizing investment return, are then used to force down the cost of reducing emissions.

The target and the plan may be assessed against the long-term vision of the company. In the fifteen years since the United Nations report, *Our Common Future*, defined "sustainable development," the term has evolved from an abstract concept to daily business for some corporations.[19] Ideas about commerce, society, and environment are likely to continue to evolve in the future. The role of voluntary environmental targets can be expected to change as well. An assessment of a target and the ways to meet it may therefore also look forward in time as well as back, in order to support a company's evolving interpretation of corporate citizenship.

E. Summary of Results Achieved to Date

The case study companies are at different stages of implementing their action plans. Shell, for example, set its targets in 1998 and has since advanced to the point where it has implemented an internal emissions trading system. By contrast, Entergy announced its target in May 2001. To the extent that time has elapsed since the announcement of targets, each of the firms is on track to achieve its target(s). Many of the case study firms indicated that emission reductions have been achieved at a lower cost than originally forecast. Each of the firms also indicated its intent to review and adjust its target(s) as required.

F. Lessons Learned

What gets measured gets managed. Many managers indicated that the existence of data in itself generates interest in, and ideas for, improvement. Curiosity leads to investigation, which leads to investment. Benchmarking against other companies or against plants within the same company generates a healthy competitive mindset.

Targets drive innovation. The research conducted for this project provides many examples of innovation that can be attributed, at least in part, to climate-related targets. These range from simple changes in "housekeeping" procedures, such as lighting retrofits, to brand new technologies, for example in the manufacture of computer components. In most cases, the innovation turned out to be profitable in its own right.

Companies are committed to reach their targets. Case study companies are intent on progressing toward their targets systematically, at low cost, and according to conditions in their particular businesses. Achievement of these targets is as important to the companies as other critical indicators of the health of the business.

V. Communications

A variety of audiences need to be considered in communications surrounding climate-related targets: the general public, employees, government regulators, and investors. Different messages and modes of communications are being used for each audience. This section describes how companies are communicating their climate change activities, and in particular, the approaches they are taking with respect to their targets.

A. Communicating with the Public

Increasingly, corporations answer not only to investors, but also to the general public and to the communities where they do business. Clear and widespread communication of social and environmental commitments and regular, comprehensive updates on results have become standard procedure in progressive corporations. Annual EHS reports augment traditional annual reports in all of the companies studied, and in some the reporting has been extended to societal commitments.[20]

Public communications are tied to how companies perceive the opportunity or threat posed to them by climate change mitigation. Typically, firms with rela-

Shell Canada's Climate Change Advisory Panel

Shell Canada is 60-percent owner of the Athabasca Oil Sands Project. The project consists of an oil sands (bitumen) mine, a 500-kilometer pipeline, and a major refinery upgrade to convert the bitumen into light crude oil. It will produce over 155,000 barrels of oil per day.

In 1999, Shell Canada had extensive consultations with affected communities in the region. In June 2000, Shell established a Climate Change Advisory Panel to assist in GHG management planning. The Panel includes Shell Canada's president, a Shell International representative, representatives of local communities and representatives of national and international environmental organizations.

Through consultation with the panel, Shell Canada tightened an existing target to reduce GHG emissions from the Athabasca Oil Sands Project. The new target means that emissions will be 6 percent less than those associated with imported light crude oil, a similar product. The Panel is also considering Shell Canada's long-term growth strategy in relation to climate change.

The company sees the Panel as an important mechanism to challenge and assist Shell Canada's thinking on GHG management, and to hold the company accountable for its commitments.

tively high direct emissions tend to have higher-profile climate change communications efforts, including CEO involvement through speeches and public presentations.

Climate change tends not to be a sufficient motivator on its own to warrant separate communications campaigns; rather, the issue tends to be dealt with as part of overall corporate communications efforts on the environment. Climate change as an issue in the minds of consumers and the public is country- or region-specific. Typically, in Europe, where there is a higher awareness of climate change among the general public, the communications efforts stress the environmental side of the climate change target. In North America, communications tend to center around energy efficiency and conservation.

BP: Communicating Goals and Progress

BP has found that the key to healthy relationships with stakeholders is to communicate in a clear and transparent manner. BP has made a commitment to state corporate climate change goals clearly and report results, whether good or bad, in an easily accessible manner. Internal communication has also been prioritized as an important means of promoting engagement within the company. BP has launched a best practices web site to facilitate the reproduction of successful initiatives throughout the company. The company's internal emissions trading system has also served as an engagement tool that has been essential in transferring corporate goals to individual business units and across geographic lines. Bid and offer prices within the corporate trading system are publicly available through the company's website.

Climate-related targets are viewed as part of an overall green image. Adoption of a climate-related target is not seen as directly influencing consumers' purchases. Rather, an overall message of corporate responsibility is being communicated, in part to create market differentiation, and in part to avoid being labeled as environmentally or socially irresponsible.

Corporate communications on climate change and on the environment in general sometimes rely on third parties to get the message across. Environmental non-governmental organizations, such as the World Wildlife Fund, Environmental Defense, the Sierra Club, and Greenpeace, are backed by credible analytic capabilities and have sophisticated ties to the media. These "environmental watchdogs" are influential in shaping public and consumer reactions and can make or break corporate environmental initiatives.

Effective communication of environmental commitments and achievements is characterized by openness, thoroughness, and honesty. When a company

makes its target public, it takes on the responsibility to report on progress towards achieving it. Companies stress the importance of clear and complete public reporting.

The most common communication vehicles for climate-related targets are the annual corporate report and the EHS report. Other means include speeches by CEOs, editorial comments in newspapers, participation in high-profile environmental fora, partnerships with environmental non-government organizations, participation in environmentally progressive business groups such as the BELC and the World Business Council on Sustainable Development, and independent third-party verification of results.

Most of the case study companies make little use of the general media, beyond their corporate web pages, to communicate their targets on climate change. The exception is Shell, which has taken out high-profile ads in international newspapers, such as the *Financial Times*. Such ads are timed to coincide with major international meetings where climate change issues are being discussed at senior political levels.

B. Communicating with Employees

Increasing employee understanding of climate change is important to gaining buy-in to the target, and to generating new ideas on how to improve environmental performance. All of the case study companies communicate internally on the existence of the climate-related target, on the overall plan to achieve it, and on the role employees can play in helping to meet it. Face-to-face meetings are the most effective method to gain buy-in from employees. Managers have traveled extensively to make presentations to employee groups in all of the countries in which the companies operate. Most of the case study companies make extensive use of their Intranet to share best practices and to communicate progress towards achieving the target.

Corporate performance on environmental and social issues is a factor in employee recruitment and retention. Commitments on climate change and the environment as a whole are part of maintaining a good corporate image in the

Raising Environmental Awareness

Toyota Motor Manufacturing North America has produced an energy management reference guide called "Why Energy Now" for its 25,000 employees. The reference guide was designed to explain why and how energy use can be reduced within Toyota's plants. The guide describes the issue of global warming and its ties to energy use. Six broad means of reducing energy use are presented and illustrated with parallels to energy use in homes.

eyes of employees. Many of the managers interviewed for this study remarked that EHS reports are avidly scrutinized by employees throughout the corporation, and noted that employees are often the most valued proponents of progress towards meeting targets.

C. Communicating with Governments

The primary reason why companies communicate to governments the existence of climate-related targets, and progress toward meeting them, is to influence the domestic and international policy agenda. Most of the early movers on climate change are keeping policy-makers informed of their climate change initiatives as a means to shape future legislation. The message is that governments should set clear and stable goals on climate change and then allow companies sufficient time and flexibility to achieve these goals. A complementary message is that the design of any mandatory regulation should encourage, or at least not discourage, prior voluntary action. For example, crediting companies for actions taken voluntarily prior to regulation encourages voluntary targets, while the absence of a policy that protects companies' allocation of emission rights under an emissions trading system ("baseline protection") may discourage voluntary targets. Some companies with voluntary targets are regularly consulted by governments. For example, Shell and BP have been influential in shaping the design of the U.K. domestic emissions trading regime and advising governments on specific elements of international climate change negotiations.

D. Communicating with the Investment Community

There is an emerging need to communicate environmental performance on climate change to the investment community. Most companies with climate-related targets do not formally brief their investor relations group regarding climate change. However, the companies recognize that investors increasingly need to be informed and to see good environmental performance. This trend is escalating with the introduction of "ethical" mutual funds and indices on financial markets that rate corporate sustainability performance (e.g. Dow Jones Sustainability Index). Also, as a market emerges for GHG emissions, the financial community will be interested in learning the GHG profiles of major corporations.

E. Lessons Learned

From the case studies, there emerged the following themes related to communications:

In no case are targets motivated solely by public relations.

Companies that have relatively high direct emissions and are seeking to differentiate themselves from their competitors, such as Shell and Entergy, tend to have higher-profile communications efforts. Those with lower direct emissions (e.g. most manufacturing corporations) tend to be more low-key.

The primary reason why companies communicate the existence of climate-related targets to governments is to influence the domestic and international policy agenda.

VI. CONCLUSIONS

At the outset of the research, it was expected that the companies and target types chosen for the case studies would result in a very diverse set of drivers and action plans, and this did turn out to be the case. However, a number of common underlying themes also emerged.

Corporate culture concerning environmental citizenship plays an essential role both in setting the target and in developing the action plan. This applies to companies with well-established environmental management systems, as well as to those adopting an environmental target for the first time. A closely associated driver, consistent with "triple bottom line" thinking, is competitive positioning. Up to a point, companies see their adoption of targets as helping both the environment and their businesses, rather than as a compromise or trade-off. However, some companies also see risks associated with voluntary targets. These include the possibilities that governments will not recognize early action, or will select a late base-line that reduces the value of early initiatives, or will not set mandatory GHG limits at all, essentially punishing companies that are incurring the costs of reducing emissions by failing to require that their competitors do the same.

The case study companies were selected for their wide variety of target types. The range reflects the diversity of products, production processes, and business models of the six corporations. In determining what type of target to adopt, it appears that answering three questions will help narrow the choices considerably: whether to set a target on suppliers, on in-plant operations, or on products; whether to target GHG emissions or energy use; and whether to set a target as an absolute limit or as a limit indexed to some factor such as production. The target's potential emissions reductions, the existence of uncontrollable factors relating to emissions or energy use, the opportunity for cost-effective emissions or energy reductions, and the potential impact on company growth are all considerations to be factored into the target type and level decision.

Some of the case study firms set their target levels via a top-down process, while others built the target from the bottom up. In choosing an approach, it is clearly beneficial to involve those who will be

responsible for implementing the action plan. This involvement not only builds shared objectives, it also helps quantify a reasonable target. An environmental management system is a valuable tool in this regard.

Development of the action plan follows directly from the process of setting the target level. Key management issues include the use of internal trading or offsets, the relationship of the target to other sustainable development activities, and the role of R&D. One common theme was that "what gets measured gets managed," i.e. the development of emissions or energy data in itself generates interest in, and ideas for, improvement. While data help to "push" the action plan, targets themselves drive innovation — ideas and technologies, usually profitable, that would not likely have come to mind without the initiative that a target provides. The case studies emphasize the need for senior management, especially the CEO, to reaffirm frequently what the company is doing and why.

Companies display a wide range of approaches to communications around their targets. All stress the importance of internal communications; however, there are differences regarding external communications. Companies with relatively high direct emissions and that are seeking to differentiate themselves from their competitors tend towards higher-profile communications efforts, while those with lower direct emissions tend to be more low-key. However, in no case is the target motivated solely by public relations.

In summary, many of the world's corporations are responding to climate change by reducing GHG emissions from their operations, by closely examining the life-cycle emissions of the products they make, and by investing in future technologies and projects designed to reduce emissions. Companies that have taken on climate-related targets have done so not just to be good environmental citizens, but because their Boards of Directors and senior management are convinced that a proactive corporate stance on global climate change makes good business sense.

ANNEX 1: CASE STUDIES

ABB Asea Brown Boveri (ABB)

Profile

The ABB Group is a global technology company serving customers in power, gas, and water utilities; process industries; manufacturing and consumer industries; automation technology products; power technology products; oil, gas, and petrochemicals; and financial services. It was formed in 1988 by the merger of ASEA AB of Sweden and BBC Brown Boveri Ltd. of Switzerland. The company headquarters are in Switzerland. ABB employs about 160,000 people in more than 100 countries. Revenues in 2000 were $23 billion. Total GHG emissions in 2000 were approximately 1.1 million U.S. tons CO_2-equivalent, almost entirely in the form of CO_2.

In 2000, ABB completed three major corporate changes that shifted its core business, internal organization, and approach to sustainable development.

First, ABB completed divestment of its traditional large-scale power generation businesses, including fossil fuels, nuclear, and hydropower. ABB's new thrust includes small-scale decentralized or "distributed" energy technologies, such as microturbines, fuel cells, combined heat and power, and wind power plants, with supporting technologies in automation controls, power electronics, and distribution.

Second, ABB reorganized from a product basis to a customer basis. New Customer Segments serve specific groups directly, with support from power and automation technology divisions. The reorganization will enable ABB to provide integrated packages of services and equipment suited to customers' specific needs.

Third, ABB began to develop a formal management system for societal performance. The new Sustainability Affairs department incorporates these activities as well as the expanding efforts in environmental affairs.

Climate-Related Targets

ABB's target is to reduce GHG emissions by 1 percent each year from fiscal 1998 through fiscal 2005. The baseline is adjusted for acquisitions and divestitures. However, this target is a relatively minor component of ABB's climate change strategy, for several reasons. First, the "eco-efficiency" of ABB's operations, including GHG emissions, is controlled and continuously improved through the company's environmental management system. To date, the total effect of CO_2 emissions reductions reported under the ISO system is substantially greater than 1 percent per year.

Second, ABB is itself a relatively minor producer of greenhouse gases. The company can be much more effective in reducing emissions by increasing the efficiency of its products. For example, an electric motor typically emits one hundred times as much greenhouse gases in operation as in manufacture.[21] ABB uses Environmental Product Declarations to support low-emissions product designs and sales. An Environmental Product Declaration describes the environmental performance of a product, system, or service over its entire life cycle.

Third, ABB's shift to distributed generation took it out of the most emissions-intensive segments of the electricity industry, i.e. large-scale fossil fuel-fired plants, and into high-efficiency natural gas-fired generation and renewable energy. The shift will greatly reduce the emissions of ABB's customers. ABB sees environmental impact as a strong influence in electricity markets, as well as a reason to act in itself, but climate change is not the primary driver for this fundamental decision. The primary drivers are expectations of customers' energy service needs, and the emergence of new technologies to serve them profitably. These technologies include small electricity generators and innovations in cabling, power semiconductors, automated controls, and information technology.

Target History

ABB's GHG and energy targets are, like IBM's and Toyota's, an integral part of the company's ISO 14001-certified environmental management system. Also like IBM, ABB was an early adopter of ISO 14001 throughout its operations.

ABB's involvement with environmental management systems dates from 1992 when it signed the 16-point International Chamber of Commerce Business Charter for Sustainable Development. In the same year ABB established an Environmental Advisory Board and Corporate Staff for Environmental Affairs. The

next year saw the introduction of environmental controller positions and environmental reviews at manufacturing sites in 38 countries. In 1996 the ISO 14001 environmental management system was published. In 1997, 123 ABB sites were certified and external auditing began. By 2000, the system was in place in 535 ABB facilities, representing 97 percent of sites.

ABB's target of 1 percent per year reduction in GHG emissions was first announced in 1997. At the time the company wanted to provide a quick sign of encouragement to the Kyoto Protocol process. ABB expects that the target will continue to be easily surpassed through the ISO process.

On the product side, the first Environmental Product Declaration was issued in 1999. ABB's objective for 2001 is to produce Environmental Product Declarations for all major product lines.

Implementation

Emissions from operations

ABB has a matrix corporate structure. Organization along both business and country lines means that products and methods are managed on both technology-oriented and national bases. Environmental impacts are managed through a network of 20 Business Area Sustainability Controllers, 44 Country Sustainability Controllers, approximately 500 Local Sustainability Officers and a Corporate Staff of four. ABB also relies on an Environmental Advisory Board of independent experts.

ABB's environmental management system requires identification on a site-by-site basis of Operational Performance Indicators that reflect impacts of significance. Each of these is monitored and managed at the site, with an objective of continuous improvement through target-setting. In the year 2000, ABB used 39 Operational Performance Indicators throughout its operations, although only ten to twenty might be relevant to any given site.

Circular Transport Saves Emissions and Money

ABB has found numerous instances where emissions and costs can be reduced simultaneously. Under the company's continuous improvement program, ABB in Finland found that ten suppliers were making independent deliveries. The ten partially filled trucks were replaced with one ABB truck that picked up supplies and returned packaging materials for re-use. The new system provided smoother, more reliable flow of components; a reduction in packaging waste; and 500 kilometers less travel, with its associated savings in fuel, time, and environmental cost.

Each year, the corporate staff establishes a generic report format, including definitions and methods for reported items. At the site level, Local Sustainability Officers are responsible for filling in the report. Country Sustainability Controllers are responsible for all reports within the country. The corporate staff consolidates the local reports and performs an internal audit for accuracy and consistency with reporting requirements. The consolidation is then reviewed by an external verification agency. The corporate staff has also made a substantial effort to provide on-site training and program development.

> "In ABB, we have identified 25 operating performance indicators relevant to our activities. Steps to improve these indicators have resulted in a total of three to four thousand on-going improvement programs on ABB's 600 sites worldwide, that is five to ten improvement programs per site." - *Goran Lindhal, CEO,* ***ABB***

GHG emissions are not an Operational Performance Indicator, except for flows of sulfur hexafluoride (SF_6). However, emissions of other greenhouse gases result entirely from energy consumption, which is an Operational Performance Indicator. Energy use is converted to GHG emissions, using average fuel mix, average conversion efficiencies for heating and power plants, and standard carbon content coefficients for fossil fuels.

With 97 percent of its sites ISO 14001-certified, ABB is now turning its attention to suppliers. Preference will be given to suppliers that have implemented environmental management programs, and especially those that are ISO 14001-certified. Any other suppliers of manufacturing materials and services must, at a minimum, have an environmental management policy, identify significant environmental impacts in production of goods supplied to ABB, ensure compliance with all relevant standards and legislation, and have in place the basic elements for continuous improvement of environmental performance.

Environmental Product Declarations

Development of an Environmental Product Declaration starts with Product Specific Requirements that are prepared in cooperation with other manufacturers, industry organizations, environmental agencies, and independent experts. Product Specific Requirements are sets of rules to ensure that environmental impacts are evaluated in the same way by different manufacturers. The rules include standardized assumptions on, for example, units of measurement, equipment life, disposal methods, allocation of impacts (among products from the same plant), and environmental parameters to be measured.

The Product Specific Requirement and knowledge of manufacturing processes are then used in a life-cycle assessment, which provides the impact numbers that are the basis of the Environmental

Product Declaration. Declarations conform to ISO standards for environmental declarations and may be verified by an independent agency. The process is managed within Sustainability Affairs.

Research and Development

ABB spends a large portion of its revenues on R&D. Climate-relevant R&D includes methanol fuel cells, gas micro-turbines, and high-efficiency transmission systems. ABB also uses innovations in materials and automation technology to develop radical new system designs. For example, ABB's Windformer™ system is a new wind power design that changes everything from the turbine to the utility grid connection. It is expected to improve power output significantly and to reduce maintenance costs by half, relative to today's machines.

ABB is also undertaking long-term research on recycling greenhouse gases into methanol fuel. Part of the work is in collaboration with universities in China.

Supporting Activities

The Energy and Global Change Program monitors energy and GHG control technology for ABB, and sponsors and participates in international social and technical research programs. These programs include research collaboration on ocean sequestration of CO_2 in Hawaii, the International Energy Agency Greenhouse Gas Program, and the China Energy Technology Program. The China Energy Technology Program is developing economic and environmental assessment tools, and strategies for electric power in Shandong Province, China.

ABB plays a key role in a World Energy Council program to identify real, practical projects that would reduce GHG emissions by 1 gigatonne (GT), or about 3 percent, per year, by 2005. This target has recently been surpassed and has now been reset to 2 GT per year by 2005. The World Energy Council program was proposed by ABB's CEO in 1998. ABB also supports the Massachusetts Institute of Technology Global Change Program and the Alliance for Global Sustainability.

Results to Date

About fifteen Environmental Product Declarations have been completed, of which at least four have been externally verified.

ABB's total CO_2 emissions from operations fell from 1445 kilotonnes (kT) to 964 kT between 1998 and 2000, in part because of the divestiture of the large-scale generation industry. Sulfur hexafluoride (SF_6) emissions fell from 4 tonnes in 1999 to 3 tonnes in 2000, equivalent to a reduction of 24 kT of CO_2. Results from the environmental management system show that the 1 percent per year target, which assumes baseline adjustment, has been met with ease.

ABB is not highly focused on the 1 percent target, because it has given itself much greater environmental challenges. Future market shares of climate-friendly electricity technologies are not known. However, illustrative estimates of the GHG emissions reduction potential of the distributed technologies ABB is developing are typically orders of magnitude greater than ABB's total emissions from operations.[22]

Communications

ABB publishes an annual Sustainability Report covering the full range of its environmental and societal performance activities. The report includes policy and program descriptions, reviews of events and outcomes, Operational Performance Indicators, case studies, verification reports, and plans for the future.

Additional ABB brochures such as Alternative Energy Solutions and Natural Power blend technical information with marketing material and discussion of environmental principles.

Lessons Learned

ABB has found significant opportunities for cost savings in waste and energy management, with payback times on the order of one year. Energy performance improvement has usually come from a relatively large number of small projects. Employees have become engaged in identifying environmental aspects and formulating objectives. They tend to want to know more about the effects of environmental matters on their daily activities.

Customers may find Environmental Product Declarations difficult to use when there is no comparable information on competitors' environmental performance. The Declarations could be more useful if an industry-wide practice were in place. A level playing field could be encouraged if ABB offered to share a common life-cycle analysis framework with other companies. (See Box, Section III.A.)

Outlook

ABB will continue to be driven by technology and markets. However, environmental responsibility is also engrained throughout the corporate culture. Environmental concerns, including climate change, will continue to have a large effect on how the company thinks about products and services.

ABB will continue to emphasize life-cycle assessment as a tool to support its move into climate-friendly technology and to reduce its own environmental impact. In particular, the company intends to produce Environmental Product Declarations for its core products in all segments.

ABB is also developing its societal performance policy. For ABB, societal performance includes helping to provide reliable electricity to the 750 million households in the world that do not presently have it. Therefore, ABB may find a dual role — social and environmental — in marketing its climate-friendly distributed technologies in the developing world.

Entergy

Profile

Entergy Corporation is the fifth largest power producer in the United States. It owns, manages, and invests in approximately 30,000 megawatts of generating capacity and has an annual revenue of more than $10 billion. It is headquartered in New Orleans, Louisiana and employs approximately 14,000 people. Although Entergy has significant operations outside of the United States, its domestic utility operations account for three-quarters of its operating revenue. These operations deliver electricity to over 2.5 million customers in portions of Arkansas, Louisiana, Mississippi, and Texas.

In 2000, Entergy emitted approximately 53.2 million tons of CO_2. Entergy is the largest operator of natural gas-fired power plants in the United States, and one of the largest nuclear generators. With 81 percent of its electric generation provided by these two sources, Entergy ranks ninth lowest among the 100 largest electric generators in terms of CO_2 emissions per kilowatt-hour produced. Its CO_2 emissions per kilowatt-hour are approximately 50 percent of the average among the 100 largest U.S. utilities.[23]

Climate-Related Target

On May 3, 2000, Entergy announced its intent to stabilize CO_2 emissions from its domestic power plants at year-2000 levels, through 2005. This stabilization target applies to Entergy's utility and independent power plants operating in the United States. The cap covers plant-based or "stack" emissions of CO_2 only, which are the great majority of GHG emissions. The target includes proportional responsibilities for Entergy's shared investments in power plants not under its operational control.

Entergy also owns and operates plants outside of the United States. However, for the present, the company prefers to work within the domestic climate change programs of the respective host countries with respect to emissions from these facilities.

Entergy has also embarked on a broad renewal of its corporate environmental strategy. The strategy for 2001–05 will reduce emissions per kilowatt-hour for a range of emissions, in addition to CO_2. Entergy's long-term goal is to have the most emissions-efficient power plant fleet of all the major U.S. utilities.

Target Development

The current target expands upon Entergy's efforts, since 1991, to reduce its GHG emissions. In 1995, Entergy joined the U.S. Department of Energy's Climate Challenge Program and pledged to reduce 27 million tons of CO_2 emissions by the year 2000. (Over 28 million tons were reduced under this program through 1999.) Entergy is also a founding member of the BELC.

Climate policy is led directly by the CEO. Responsibility for the development and realization of Entergy's environmental strategy, including its emissions reduction targets, resides with the corporate Environmental Forum, which is composed of senior corporate officers.

In November 2000, the company approved three climate initiatives: the CO_2 target, a $25 million Environmental Initiatives Fund for emissions reduction projects and activities, and membership in the Partnership for Climate Action. Entergy is the first U.S. utility to join the Partnership, which is sponsored by Environmental Defense.

Entergy's low emissions rates are a strategic asset. However, the company chose a target based on total emissions, rather than on emissions rates, since the total emissions level is the ultimate concern in terms of impact on the climate and is also the measurement most readily understood by the public.

Electricity demand has been growing 10 percent faster than the national average in Entergy's utility service area, and the company also plans to increase its fleet of independent power plants. Entergy recognizes that such growth can result in increased public scrutiny of environmental performance and increased public focus on the corresponding growth in total emissions.

Entergy selected 2000 as its base year in part because it would be difficult to reconstruct data from an earlier year, such as 1990, and in part because the U.S. electricity industry, including Entergy, has undergone major changes in ownership structure over the past decade. At the time the target was set, it was also thought that 2000 might be the base year for new federal GHG emissions regulations.

The target was set through a top-down process led by the CEO and supported by the company's environmental staff. The company estimates it will need to reduce emissions by 2.5 million tons below business as usual in 2005, or a cumulative 5.5 million tons over the 2000-2005 period.

Implementation

Entergy's new CO_2 emissions reduction fund (the Environmental Initiatives Fund) will provide $5 million in each of five years to finance emissions reduction projects and activities. The fund is held in a corporate account, and will be paid by shareholders to the extent that utility regulators judge that the benefits do not accrue directly to customers. Entergy expects that a substantial majority of reductions will occur at its plants, rather than as offsets.

Entergy's approach to achieving emissions reductions includes "learning by doing." Therefore, emissions reduction proposals will be screened for their potential to improve the emissions reduction plan itself. Proposals will also be evaluated on the basis of their potential to further other corporate objectives, such as regional employment and poverty alleviation.

The details of the CO_2 reduction plan have yet to be announced, but it is known that the plan will be integrated with Entergy's U.S. environmental management system. The system has been reviewed by independent consultants. Entergy has been tracking project- and entity-level emissions for many years under the U.S. Energy Information Administration's Voluntary Reporting of Greenhouse Gases Program, and will be seeking third-party verification of emissions reductions achieved through its Environmental Initiatives Fund.

Results to Date

Insufficient time has passed to be able to assess Entergy's progress towards the 2005 cap. However, under its 1995 commitment to the U.S. Department of Energy's Climate Challenge Program, Entergy has implemented 27 projects, resulting in cumulative emissions avoidance through 1999 of 28.1 million tons of CO_2. Most significant reductions were achieved through increasing capacity and plant availability within Entergy's nuclear generating fleet, improving efficiency within the fossil fuel generating fleet and transmission and distribution systems, and providing energy efficiency services to residential and industrial customers. Entergy has also reduced net CO_2 emissions through its $100,000 investment in the UtiliTree Carbon Company, which funds carbon sequestration projects throughout the world.

The UtiliTree Carbon Company

The non-profit UtiliTree Carbon Company consists of 41 utilities sponsoring a portfolio of forestry projects that manage CO_2. These projects consist of a mix of rural tree planting, forest preservation, forest management, and research efforts at both U.S. and international sites.

UtiliTree projects are identified by the Utility Forest Carbon Management Program (UFCMP). This program is an initiative developed by the Edison Electric Institute — with support from 55 electric utilities, including Entergy — to expand electric utility industry efforts to manage CO_2 via forestry projects. The goals of the project are to advance the state of knowledge regarding options for managing greenhouse gases via forestry, to establish low-cost forestry options, to implement projects, and to promote environmental stewardship by the electric utility industry.

By March 2000, the UtiliTree Carbon Company had committed more than $2.5 million to reduce more than 2 million tons of CO_2 through these projects.

These voluntary efforts led to avoidance of over 7.7 million tons of CO_2 in 1998, the seventh-largest reported reduction of all U.S. utilities participating in the Climate Challenge.[24]

Communications

The electric utility industry has experienced a high degree of volatility during recent years, from ongoing deregulation initiatives and associated mergers within the industry, and from cost-reduction pressures due to stricter environmental regulations. As a result, utility employees are sensitive to any changes in corporate operations that could affect their jobs. This applies to Entergy's GHG target, given that 60 percent of the generating fleet is fossil fuel-based. Management is developing an internal communications plan that will explain and provide perspective on the target and the company's plans to achieve it.

The new GHG emissions cap is one consequence of a conscious management decision to go from being quiet on environmental issues to publicly "putting Entergy on the map." The first report on environ-

mental policy and performance was issued in April 2000. Entergy Senior Management, and the CEO in particular, have been commenting publicly on the challenges of climate change, the electric utility industry's role in contributing to those challenges, and Entergy's efforts at addressing them.

Lessons Learned

The company already has gained considerable experience through previous emissions reduction initiatives, including offsets and in-plant activities. Above all, it has learned that a CEO-led target is necessary to motivate action. Since its November 2000 decision, the company has seen benefits in sharing information with other "climate-progressive" companies through the Partnership for Climate Action and the BELC.

In its current plan, the company has identified customer communications as a priority. Another priority is to link emissions performance to an existing employee environmental award program.

Outlook

The current target is considered interim, but does not depend on government policy. Entergy will continue to evaluate future targets for beyond 2005, consulting with Environmental Defense, and taking progress on domestic and international policy into account.

Plant operating rates, fuel choice, and fuel conversion efficiency are all important determinants of Entergy's bottom line, as well as of its GHG emissions. The greatest challenge in meeting the target will occur if, in the absence of the target, the company would have favored higher fossil fuel operating rates, more coal and oil and less gas and nuclear, and lower fuel conversion efficiency.

International Business Machines (IBM)

Profile

IBM creates, develops, and manufactures advanced information technologies that include computer and networking systems, storage devices, microelectronics, and software. IBM also provides services and business solutions for customers worldwide. IBM ranked as number 16 of the Fortune 500 Companies in 1999. Its total revenue in 2000 was $88 billion. IBM operates in over 160 countries and has approximately 316,000 employees. Its headquarters are in Armonk, New York. IBM has a long-standing tradition of excellence on employee well being, environmental management, and social philanthropy.

Its 1999 GHG emissions were approximately 4 million tons. These derive mostly from electricity consumption, which constitutes more than 85 percent of IBM's energy use. The bulk of the remaining energy-related emissions from IBM's operations are from the use of natural gas and fuel oils in boiler plants. IBM also uses PFCs in semiconductor manufacture.

Climate-Related Targets

IBM has the following targets:

- **Energy conservation:** Conserve, in each year, 4 percent of the energy that would otherwise have been consumed. For example, if energy consumption in 2002 were expected to be 100 units in the absence of energy conservation effort, IBM's target would be 96 units.

- **CO_2:** Reduce CO_2 emissions associated with IBM's fuel use and electricity consumption by an average annual 4 percent of what would otherwise have been emitted, over the period 1998–2004.

- **Products:** For products covered by Energy Star®, the targets range from having 90 to 100 percent of the new models introduced during the year meet the Energy Star® criteria. For servers and storage devices, the goal is to decrease operating power consumption per unit of work or unit of storage compared with previous-generation products.

- **PFCs:** Reduce emissions of PFCs from semiconductor manufacturing worldwide by 40 percent from 1995 levels by 2002 (indexed to production). In addition, as part of a semiconductor industry-wide initiative, reduce PFC emissions from semiconductor manufacturing processes by an absolute 10 percent between the base year 1995 and 2010.

Target Development

Though the information technology industry is not as energy-intensive as many other industries, IBM has a long-standing commitment to energy conservation. IBM's first formal policy on energy conservation was developed in 1974 partially in response to the global oil crisis.

In the early 1970's IBM also formalized its environmental management system and energy targets have been a fundamental element of that system for more than 15 years.

IBM was one of the first three companies to voluntarily report GHG emissions to the U.S. Department of Energy and the U.S. Environmental Protection Agency (EPA). IBM joined EPA's Climate Wise program in 1996 and the Energy Star Buildings® program in 1999.[25] IBM joined the World Wildlife Fund's (WWF) Climate Savers Program as one of the two charter members in March 2000.[26] IBM's CO_2 emissions target derives from its participation in Climate Savers.

In October 1998, IBM became the first semiconductor manufacturer to set a specific emissions reduction target for PFCs. That goal is to reduce PFC emissions from semiconductor manufacturing processes by 40 percent worldwide by the end of 2002, indexed to production against a base year of 1995. In addition, as part of an initiative by the U.S. semiconductor industry, IBM has committed to achieve an absolute reduction in PFC emissions of 10 percent from 1995 levels by 2010.

IBM's Environmentally Conscious Products (ECP) Program was established in 1991. Its objectives are to develop products with consideration for their upgradability to extend product life and for reuse and recyclability, and to develop products that consume less energy. IBM was instrumental in working with the EPA to initiate the Energy Star® program.[27] The PS/2E, introduced in 1993, was the first personal computer to be marketed with the Energy Star® logo. Since then, voluntary initiatives in energy efficiency have spanned IBM's product lines, including servers, personal computers, data storage devices and printing systems.

Energy conservation targets are proposed by the corporate environmental staff based on evaluation of performance of IBM's facilities in locations worldwide. The corporate staff seeks and reviews input from personnel at these locations, and then recommends the target levels to the Director of Corporate Environmental Affairs, who reviews and approves them.

The energy conservation target is a reduction from the current year baseline energy use. Baseline energy use equals actual consumption plus energy savings from all identified energy conservation projects. Conservation projects typically use more energy-efficient technologies than those in the baseline scenario. Baseline technologies are standard technologies determined by IBM's prevailing construction and operation practices. The current year baseline includes consumption at all manufacturing, hardware development, and research sites, and at IBM's major administrative facilities.

The CO_2 emissions reduction target was established for a seven-year period and was based on energy conservation assessments made by energy managers at each of over 40 major sites. This energy use reduction assessment was then "translated" to a CO_2 emissions reduction target by the corporate environment team.

Implementation

> "Consuming less and less energy for the same activity is one of the most effective ways IBM contributes to environmental protection. The results of IBM's longstanding efforts clearly demonstrate that aggressive energy conservation makes good environmental sense as well as good business sense." - *Wayne Balta, Director of Corporate Environmental Affairs,* ***IBM***

IBM's energy and CO_2 targets are governed by a corporate directive that covers the company's worldwide operations. However, energy management is implemented on a decentralized basis. Each major location and business unit prioritizes and allocates capital to energy conservation projects based on the same internal requirements as for other investments. Recently, IBM began using alternative financing, including performance-based contracting, for energy management.

Each major location's energy performance is tracked and reported through IBM's Environmental Master Plan. All major IBM locations are required to:

- Designate an individual to oversee energy management;
- Develop an energy master plan that:
  - records the prior year's energy performance,
  - states the location's key strategies and goals,
  - provides energy demand and use forecasts,
  - identifies projects that contribute to the current year conservation target, and
  - documents any other unique location-specific energy programs;
- Monitor progress against the energy master plan;
- Include participation from all major players at the location and ensure employee awareness;
- Ensure major construction projects consider energy efficiency features in construction design documents;

• Ensure timely submission of quarterly or semi-annual energy reports; and

• Include cost-effective energy efficiency features in engineering design for all construction projects with combined capital and expense costs exceeding either $500,000 or 5 percent of the location's estimated annual energy cost, whichever is greater.

Energy conservation is managed through three types of action: conservation, cost avoidance, and consolidation. Only the conservation actions are counted toward IBM's energy conservation goal. Typical conservation actions include design for energy efficiency in products and facilities, installing efficient lighting, motors, and variable frequency drives; reducing reheat energy or exhaust; varying humidity and temperature; and utilizing free cooling. Consolidation actions such as elimination of vacant space, or cost-avoidance actions such as negotiation of energy contracts, peak-shaving, pursuing wholesale procurement options, and purchasing electricity at higher voltages, are not counted towards the energy target.

Increased energy efficiency is also part of the company's Integrated Product Design process. One internal tool used to track product energy efficiency is the product environmental profile (PEP). PEPs document key environmental characteristics of all major IBM products.

IBM has also committed to promoting the development of cost-effective clean and renewable energy sources. IBM is working with the World Resources Institute, Business for Social Responsibility, and nine other major U.S. firms to develop corporate markets for 1,000 megawatts of new "green" energy capacity over ten years as part of the Green Power Market Development Group.

Also, IBM has established two internal rewards to recognize environmental leadership among the staff. The IBM Corporate Environmental Affairs Excellence Award provides upwards of $50,000 to individuals and teams of employees for innovations that contribute to energy, safety, and environmental objectives. Since its inception, over 250 employees have been recognized with over $1.8 million in awards. The Chairman's Environmental Affairs Citation recognizes IBM sites and organizations for their environmental leadership and achievement.

Emissions Reductions Save Money at IBM

A team from IBM Burlington in Vermont contributed to emissions reductions by optimizing the cycle time and reducing chemical use in two processes used in semiconductor manufacturing. Three different technological innovations in the processes reduced the sites' global warming gases by 5 percent, reduced the use of toxic chemicals by 14 percent, and reduced manufacturing costs by $600,000 per year. The team received a 1999 Environmental Affairs award for its achievement.

Results to Date

For 2000, IBM's worldwide energy conservation actions alone reduced IBM's energy use by 4.85 percent and reduced energy-related GHG emissions by 4.74 percent.

From 1990 through 2000, IBM worldwide conserved an estimated 8.9 billion kilowatt-hours of electricity, and, as a result, avoided an estimated 5.6 million tons of CO_2 emissions while saving $527 million.

Communications

IBM has produced its eleventh annual Environment and Well Being Progress Report, available on the web and in printed form. The report is aimed at employees, customers, investors, regulators, and other stakeholders. The report is written in accordance with the Public Environment Reporting Initiative to ensure transparency and completeness.

Regarding government relations, IBM has had a longstanding belief in the value of voluntary approaches to environmental issues and has cooperated closely with the U.S. EPA and other environment agencies. IBM prefers to lead by example and has not been active in lobbying on energy issues.

Lessons Learned

IBM's energy conservation experience confirms its view that taking action on all environmental issues in advance of regulation makes good business sense. IBM claims to have saved approximately $50 million each year through conservation actions alone during the 1990s. Saving energy can also lead to technological breakthroughs and competitive advantage.

"What gets measured gets managed." IBM's success on environmental matters depends to a large extent on its longstanding commitment to detailed measurement and reporting, and its objectives for continuous measurable improvement. IBM's sophisticated environmental management system provided the data required to make an informed decision on the level and nature of its climate-related targets.

Outlook

IBM expects to continue to minimize its direct emissions of greenhouse gases and to pursue energy efficiency in both its plants and products, particularly in conjunction with any expansions that may occur. It is expected that new targets for energy efficiency and CO_2 emissions reductions will be established in 2002 and beyond as part of IBM's continuous improvement objective.

Shell

Profile

The Royal Dutch/Shell Group of Companies ("Shell") consists of companies operating in more than 135 countries, in the core businesses of oil and gas exploration and production, oil products, downstream gas and power, and chemicals. Shell employed 102,000 people and had revenues of $192 billion in 2000, up from $105 billion in 1999 when it was ranked eleventh of the Fortune 500 Companies. GHG emissions from Shell's global operations were 111 million tons in 2000, placing it among the largest industrial emitters. CO_2 and methane comprise approximately 99 percent of Shell's total GHG emissions.

The Group and its companies are organized along both national and business dimensions. In general, EHS targets are set and monitored through an iterative process that links the Committee of Managing Directors (CMD), the managers of the global business units (Exploration and Production, Oil Products, Chemicals, and Downstream Gas and Power), the managers of operations in each country, and the Country Chairmen. The Country Chairmen are designated representatives of the Group in each country.

Climate-Related Target

Shell's target is to reduce GHG emissions to 90 percent of 1990 levels by 2002. The target of approximately 104 MT includes all greenhouse gases covered by the Kyoto Protocol, but CO_2 and methane comprise nearly all of Shell's GHG emissions. Shell also has annual targets in energy use per tonne of product for global business units. For 2000, these were 0.7 GJ/tonne of throughput for Exploration and Production, 2.9 GJ/tonne for Oil Products, and 7.0 GJ/tonne for Chemicals.

Target Development

The management of each operating company within the Group is responsible for the performance and long-term viability of its own operations. However, the Corporate Centre management of the Royal Dutch/Shell Group of Companies develops, on a global basis, many overall policies and performance criteria, including policies on EHS. EHS policies include one- and/or five-year targets for key indicators whose values are externally verified. Key indicators include CO_2 and methane emissions, and energy consumption per tonne of production or feedstock. Over 90 percent of Shell's major installations have achieved ISO 14001 certification.

Shell's GHG emissions strategy is best understood in the context of a series of fundamental changes that occurred during the mid-1990's in the company's approach to its worldwide operations. These included:

- Adoption of the view that sustainable development encompasses financial, social, and environmental aspects, and is an integral part of all business decisions. In particular, Shell does not consider social and environmental aspects as "afterthoughts" to be traded off against profitability. This view is based in part on the recognition that credibility with the public on sustainability issues is essential to preserving share value and sales.

- A revision in business principles towards openness and transparency. This included a decision in 1997 to monitor and report 24 EHS parameters, of which 12 are verified by an independent agency.

- The conviction of key senior managers that the company has a moral responsibility to act on the climate issue, based on the Intergovernmental Panel on Climate Change (IPCC) Second Assessment Report and the precautionary principle.

The first public recognition of the need to act was contained in a speech by the Chairman in 1996. Following the signing of the Kyoto Protocol in December 1997, the Committee of Managing Directors (CMD) decided to apply an innovative approach, the Value Creation Process (VCP), to the Royal Dutch/Shell Group of Companies' climate change strategy. The VCP had been designed to provide new perspectives on pressing issues common to the Group. The process involved the selection by the CMD of a team of talented employees from different companies within the Shell Group and with different areas of expertise, not necessarily related to the issue at hand. The team was tasked to provide recommendations on climate change strategy directly to the CMD in six months.

Implementation

Key decisions followed two senior management workshops and the presentation of the team's recommendations to the Committee of Managing Directors. These decisions include:

- A commitment to a GHG emissions target for all six gases covered by the Kyoto Protocol of 90 percent of 1990 emissions levels by 2002. The cap is seen by Shell to establish a bond of trust between the company and stakeholders and reflects the CMD's intent to 'do better than Kyoto.'

• The creation of the position of Vice President of Global Climate Change. The position reports to the CMD.

> "In reality, there is no price — as yet. So, at the moment, we are applying a system we call 'carbon shadow pricing.' Applied as a cost — or a benefit — to a project carbon pricing will affect the ranking of our investment options. Any project that comes to the Shell board with emissions above 100,000 tonnes of carbon per annum must carry a sensitivity for a variety of carbon cost levels — 5, 20 and 40 dollars per tonne." - *Mark Moody-Stuart, Chairman of the Committee of Managing Directors,* ***Shell***

• The creation of an internal emissions trading system, the Shell Tradable Emission Permit System (STEPS). (See box on p. 21.) STEPS is designed to: demonstrate the feasibility and merit of emissions trading; gain practical experience with emissions trading, spread best practices within the company, lead to price discovery for emissions rights, identify least-cost opportunities for emissions reductions, and encourage innovation.

• The establishment of the Clean Development Mechanism (CDM) Demonstration Program, which, like STEPS, is designed to gain experience. So far, three projects have been selected from an initial list of 21.[28] Shell is also developing a 'CDM Toolkit' or guide based on these experiences.

• A requirement to include a "shadow" price of GHG emissions of $5, $20 and $40 per tonne of carbon-equivalent in the investment analysis of all projects over a certain size. For projects in the chemicals sector, the threshold is a $10 million capital cost. For all other projects, the threshold is 100,000 tonnes of CO_2-equivalent emissions annually. The shadow price applies to life-cycle emissions of all fossil fuels, including those from combustion of products and from alternative types of supply. The investment analysis must therefore also include any effect on project revenue of carbon pricing throughout the competitive market.

• Estimation of marginal cost curves for emissions reductions. These curves show where and how much emissions reduction is available over a wide range of emissions prices. The curves are considered an essential analytical tool for the development of emissions reduction targets and plans, including participation in emissions trading under an international framework agreement.

The emissions cap is seen as the key commitment of significance to external stakeholders. Marginal cost curve estimation, STEPS, and emissions shadow pricing translate that commitment into an internal initiative to reveal, monetize, and act on the price of carbon. The internal initiative is designed to work in such a way that operations managers can incorporate emissions reductions directly into regular

business practices. Shadow pricing, in particular, is seen by Shell as key. Shadow pricing directly introduces emissions reductions into the financial analysis of investments, and anticipates cost and price conditions that the company expects to be in effect during the lifetimes of those investments.

Results to Date

Shell's 2000 GHG emissions were less than the target level for 2002 but approximately 2 MT more than in 1999. Emissions in 2000 were 11 percent below the 1990 level.

Shell is achieving its emissions reductions primarily through the reduction of venting and flaring of natural gas associated with oil production. Continuous venting will be phased out by 2003, while disposal of gas by continuous flaring will cease by 2008. The largest emissions reductions are from reduced flaring in Nigeria. Technical challenges in gathering and economically using the relatively small quantities of captured natural gas are being met, at considerable expense.

Another source of internal emissions reductions has been increased energy efficiency. In 2000, Shell met its targets for energy consumption per GJ of product or crude oil in its exploration and production business, and in chemicals, but missed the target in oil products by 14 percent. The shortfall is due to quality improvements in refinery products, which require more energy.

Communications

The annual *Shell Report: People, Planet and Profits* is the principal vehicle for setting out the company's views and plans on sustainability, including climate change. The report reinforces Shell's commitment to address climate change, including its internal emissions reduction target, and describes the progress that the company has made over the past year. Key data include GHG emissions, which are externally verified, and the number of tonnes of CO_2 traded under STEPS. Related environmental issues,

Shell and the Icelandic Hydrogen Economy

In 1999, Shell Hydrogen signed a Co-operation Agreement with Norsk Hydro, Daimler Chrysler, and an Icelandic consortium, Vistorka (EcoEnergy), to investigate replacing fossil fuels in Iceland with hydrogen-based fuels and, by 2040, create the world's first "hydrogen economy." Iceland has a head start in this regard. Sixty-seven percent of its primary energy consumption, and all electricity and residential heating, is supplied by hydro and geothermal resources — the highest percentage share among OECD countries. Iceland also has abundant untapped sources of renewable energy.

The Agreement aims to convert the whole transportation sector, including fishing vessels, to hydrogen-based fuel cell technologies. Work will also be carried out in production, storage, and distribution of hydrogen and hydrogen carriers. The hydrogen will be produced from renewable electricity in a climate-neutral fashion.

For Shell Hydrogen "there is no doubt…that hydrogen is the future, the only real question is when."[29]

such as those surrounding the venting and flaring of gas, are also described in the report. The report is printed and publicly available on the company's web site.

An important part of Shell's approach to sustainability is engagement of stakeholders. In 1999 Shell adopted a guiding principle to communications that encourages stakeholders to provide feedback on any aspect of the company's operations. Shell's website includes an open forum for comments and questions. The forum has led to productive online dialogs among stakeholders and company representatives.

Lessons Learned

Shell's GHG inventory had been estimated at the time the target was set. It was also known that elimination of venting and flaring would comprise the majority of emissions reductions. However, achievement of the target was not a foregone conclusion. Shell's GHG emissions depend on production levels, which in turn depend on energy prices, especially the world oil price. The volatility of this price created significant uncertainty as to whether the target would be met through the planned measures.

Outlook

Shell aims to continue to do better than the Kyoto target by 2010. Setting any new emissions reduction target, and developing the plan to achieve it, will require careful analysis of amounts and costs — including oil price volatility. Shell will continue to push the frontiers in climate-friendly technology, shift to gas and renewables, and explore emissions trading.

Toyota Motor Manufacturing North America (TMMNA)

Profile

> "Our society has become accustomed to believing that we have to sacrifice something to obtain products that are environmentally friendly. At Toyota, we are in a strong position to challenge that notion." - *Teruyuki Minoura, President,* ***TMMNA***

The Toyota Motor Corporation was ranked eighth among the Fortune 500 companies in 1999, with total revenue of $116 billion in that year. Toyota's North American manufacturing operations started in 1986. The target discussed here applies to Toyota Motor Manufacturing North America (TMMNA), which in 2000 produced approximately 1.1 million cars and light trucks, as well as millions of auto parts, at ten facilities in the U.S and Canada. TMMNA employs approximately 25,000 people. The manufacturing corporate office is in Erlanger, Kentucky. GHG

emissions from TMMNA's operations were 331,000 tons of CO_2 in 2000, including plant operations and emissions from the generation of purchased electricity. TMMNA has annual energy costs of approximately $60 million.

TMMNA follows the fundamental environmental policies and practices of its parent, the Toyota Motor Corporation, which is headquartered in Japan. Although the target discussed here applies only to TMMNA, the principles and design of the target, and the plan to meet it, are based on those of the parent company.

Climate-Related Target

TMMNA will reduce energy consumption per unit of production by 2005 to 15 percent below the level of 2000, an average of 3 percent per year. "Production" in the target refers to factory output, including vehicles and parts, and is based on physical units, not sales revenue.

TMMNA's target is distinct from the CO_2 emissions targets of the Toyota Motor Corporation's Japanese operations. These latter targets are to reduce total CO_2 emissions to 5 percent below 1990 levels by 2005 and to 10 percent below 1990 levels by 2010.

Target Development

In 1992, Toyota Motor Corporation established a list of Guiding Principles and the "Toyota Earth Charter," which lays out environmental goals and policies. The Earth Charter is supported by five-year Environmental Action Plans. The third Environmental Action Plan covers the period of 2001-2005.

Following the adoption of the Kyoto Protocol, 25 Toyota group companies and affiliates formed the All-Toyota Global Warming Prevention Council. Activities include confirming the development of energy measurement management structures, and conducting monthly on-site tours to monitor the status of goal achievement and the implementation of energy conservation measures. The Council was renamed the "All-Toyota Production Environment Council" in July 2000 and the scope of its activities expanded to include all the environmental concerns related to production in the All-Toyota Group.

TMMNA has also established an environment committee called the North American Manufacturing Environmental Committee, which is made up of the presidents of each of TMMNA's facilities and is chaired by the president of TMMNA. The North American Manufacturing Environmental Committee reports to the All-Toyota Production Environment Council.

TMMNA's target is on energy, not GHG emissions as in the case of its parent company, in part because of different policy environments in the United States and Japan. However, in practice the difference is relatively small because electricity accounts for the majority of energy used in vehicle manufacture, and saving 15 percent of electricity is equivalent to saving 15 percent of greenhouse gases unless the carbon content of purchased electricity is also changed.[30]

TMMNA engaged in an extensive, nine-month information gathering and consultation process in order to select the most appropriate energy efficiency target and to ensure the full support of all of the North American facilities. Energy use data were gathered from all North American facilities for the purpose of comparison against Toyota's Japanese facilities and, to the extent possible, against the performance of competitors. Operations managers provided input on what level of energy savings they felt could reasonably be achieved.

At the completion of this process, an energy savings target of 3 percent per year, per unit of output, over five years was established by consensus. This target was endorsed by the North American Manufacturing Environmental Committee as a key component of the environmental action plan of TMMNA. The structure of the target (i.e. per unit of production) conforms to other corporate environmental targets of TMMNA and the Toyota Motor Corporation, which are also specified per unit of production.

Implementation

Each TMMNA plant develops its own energy management plans and each has the same energy target per unit of production as does TMMNA as a whole. Reductions toward each plant's target must come from within the plant; there is no trading of energy conservation savings among plants.

It is anticipated that the target will be achieved through "kaizen," which is at the core of Toyota's production system.

TMMNA continues to monitor investment criteria in order to promote the application of energy-efficient technologies. It normally requires a one- to two-year payback period, which is the amount of time before the value of energy savings exceeds the initial investment.

Improved energy efficiency is supported by extensive energy use data monitoring and collection under Toyota's environmental management system. Energy use at all facilities is monitored and reported

to TMMNA Headquarters on a monthly basis. These data are then reported to Toyota headquarters in Japan.

All of Toyota's facilities in North America are ISO 14001-certified. Toyota has also taken steps to expand the benefits of environmental management throughout the supply chain by requiring that suppliers be ISO 14001-certified (see box).

Greening the Supply Chain

As part of the Third Environmental Action Plan, Toyota introduced Suppliers' Environmental Guidelines. The Guidelines require that suppliers respect Toyota's list of substances of environmental concern. The Guidelines also require suppliers to be ISO 14001-compliant by 2003. Toyota has also produced similar guidelines for Toyota dealers in Japan. These guidelines are scheduled to be expanded worldwide by 2005.

"Yokoten," or sharing of lessons learned, is another important feature of Toyota's corporate culture that applies to energy efficiency as well as other aspects of production. As a result, it is expected that progress toward the target will be aided by energy efficiency gains throughout Toyota's plants, outside of North America as well as within. An internal website has been established for this purpose.

Results to Date

It is too early to have a clear picture of the progress towards the target. However, the proportion of "kaizens" that are related to energy use has increased considerably since the target was set. Substantial energy savings have been achieved at facilities where equipment and operations have been "kaizened."

TMMNA expects that close monitoring will prevent energy use from deviating from the target path. The presidents of all the North American facilities meet twice a year to review performance and share experiences. The performance review has led to healthy competition between facilities, which has served as a powerful motivator for managers.

Communications

TMMNA stakeholders have made the environment central to their evaluation of the company's corporate citizenship. TMMNA has responded by making a considerable amount of environmental performance information available. Both Toyota Motor Corporation and TMMNA have placed Toyota's Guiding Principles, the Earth Charter, their Environmental Action Plans, and their EHS reports on their corporate web sites.

In August 1999, Toyota Motor Corporation began including environmental specifications in brochures for all new product models. Toyota has also actively promoted the environmental benefits of the new, very fuel-efficient Prius.

TMMNA has also produced materials designed to raise employees' environmental awareness and promote best practices in manufacturing. However, Toyota does not actively promote its in-plant environmental initiatives to its customers.

Lessons Learned

Setting and achieving a target depends on the development of reliable data and on an assumption of responsibility "on the shop floor." Teamwork and sharing of best practices have been particularly effective aspects of the corporate culture. Leadership of the senior executive is an essential motivating factor.

Human resources managers have found that environmental performance has become increasingly important to prospective employees.

Outlook

The "Toyota approach" to efficiency has demonstrated its ability to meet substantial energy efficiency targets in the past and will likely continue to do so. However, two relatively uncontrollable factors may affect TMMNA's progress. First, like all automotive manufacturers, Toyota has experienced a slowdown in sales in 2001. Since some energy use in manufacturing plants is relatively independent of production, the slowdown could adversely affect energy per unit of production in the short term. Second, looking further forward, the composition of TMMNA's production might change if North American demand for larger vehicles continues to increase. Since with all else held equal, energy used in manufacture increases with the size of vehicle, energy use per vehicle shipped would increase.

United Technologies Corporation (UTC)

Profile

United Technologies Corporation (UTC) provides a broad range of high-technology products and services to the aerospace and building systems industries. Its best-known products are Pratt and Whitney aircraft engines, Carrier heating and air conditioning, Otis elevators and escalators, Sikorsky helicopters

and Hamilton Sundstrand aerospace systems. UTC has production, R&D, testing, engineering, overhaul, and repair facilities in 36 countries and conducts business in 183 countries. In 1999 UTC employed approximately 141,000 people worldwide and generated over $25 billion in revenue. UTC's headquarters and almost half of its sales are in the United States.

UTC's total CO_2 emissions were approximately 1.9 million tons in 2000, approximately half of which were from the generation of purchased electricity. Fourteen factories, mostly in aerospace, are responsible for about half of UTC's energy consumption.

Climate-Related Target

UTC's target is to reduce its energy consumption per dollar of revenue to 25 percent below the 1997 level by 2007. The amount was recommended by the senior environmental officer, based on plant assessments and research by an energy council representing the top 20 UTC manufacturing plants in the United States. The target year 2007 was chosen to be consistent with other EHS target years already in place. The figure is seen as attainable, but beyond "business as usual."

Target Development

In 1996, UTC issued a revised EHS policy that included significant commitments to natural resource conservation. Specific targets were set at that time for the year 2007, including air emissions (excluding greenhouse gases), non-recycled wastes, the recycling rate, and water and energy use. UTC's energy target is therefore one of a portfolio of objectives set out to reduce the company's environmental impacts and improve resource efficiency.

Company-wide collection of energy consumption data began in 1995, when a cross-functional team, including EHS and energy professionals, began determining what types of information should be gathered and what tools should be used. After a pilot phase, a standard reporting procedure was developed. It is required for all manufacturing operations and all other sites that have an annual energy and water cost of over $100,000. Reporting is also required of all joint ventures where UTC ownership is 50 percent or more — close to 250 reporting sites worldwide. UTC publicly reports energy consumption and GHG emissions by fuel type at the corporate level.

UTC also reviewed over 100 EHS annual progress reports of other companies for energy data and reporting methods, and benchmarked against certain peer companies to see how energy efficiency goals were structured, which energy sources were included, and how the information was interpreted and tracked.

Other key characteristics of UTC's target, besides the amount and the year, were to target energy rather than GHG emissions, and to index the target to revenue. Energy was chosen on the premise that the reduction should be a preventive, "front of the pipeline" solution (energy efficiency), as opposed to an "end of pipe" (GHG emissions) solution. This is consistent with UTC's other resource conservation goals that focus on prevention.

The target was indexed to revenue in order to conform to UTC's business model. UTC is a highly diverse group of businesses. The company expects to move into new markets, open new facilities, and acquire other businesses. UTC's view is that an absolute cap would not be realistic under these circumstances. The indexed target also allows incorporation of organizational changes without the need for complicated revisions to the baseline or target.

Indexing may initially appear to allow UTC to "grow" its way to the target by acquiring less energy-intensive businesses, but with no effect on absolute energy use. However, when UTC, or any company, acquires a business with no energy–related target, and brings it under the growth cap, the activities of the latter business becomes subject to an energy constraint that was not previously there.

Revenue was chosen as the denominator of the energy consumption index, expressed in constant 1997 U.S. dollars. The alternative, creating a blended index of the quantities of UTC's products and activities, would not have been practical due to lack of data and the diversity of goods and services.

Other decisions on inventory and target include:

- Emissions from purchased electricity are included in inventory and target amounts, at the average emissions intensity of the utility providing the electricity.

- Energy consumption from employee travel (except commuting) is tracked or estimated and included in inventory and target amount.

• Energy use of UTC's products is not estimated or included in inventory or target amounts. UTC sees the energy efficiency of its products as a competitive, or marketing issue, covered under other UTC initiatives such as Design for the Environment.

• Each UTC company has the same 25-percent target.

Implementation

UTC intends to meet its goal through the commitment of the senior managers of each company. To date, the company is well on track to meet the goal. The target has generated a network of experts within the firm and corporate headquarters provides technical assistance in energy management. However, attracting and maintaining the attention of the manufacturing plants has its challenges. Energy is less than 2 percent of production costs, there is no direct linkage of pay to energy efficiency performance, and energy efficiency investments are subject to the same required rates of return as other investments.

Results to Date

UTC is on target to meet the goal for 2007. Energy consumption per dollar of revenue fell by about 22 percent from 1997 to 2000. Changes in indexed energy consumption have come from many sources, including changes in ownership, increases in sales, consolidation of facilities, and energy efficiency measures throughout the company. For example, changes in ownership may reduce indexed energy consumption if acquired companies have a low energy index. Consolidating facilities also saves energy by reducing commercial floor space requirements.

UTC's total energy consumption has fallen by about 15 percent from 1997 to 2000. Total GHG emissions have also been reduced, by approximately 13 percent. The greatest reductions in GHG emissions have come from electricity and jet fuel.

Communications

UTC's efforts in communicating its energy efficiency commitment have been fairly modest. The principal vehicles have been speeches by the CEO, including one in 1998 setting out the target and the CEO's views on climate and the role of government R&D in developing solutions. UTC also decided early to affiliate itself with the BELC.

Lessons Learned

UTC's lessons learned in developing the emissions and energy consumption inventories, setting the energy target, taking action and tracking progress include:

- It takes hard work to build the program from the bottom up, but buy-in from across the business units and "into the ranks" is essential;
- The program has to be simple; and
- There has to be an internal vehicle for recognition and a network for sharing information and experiences.

Outlook

UTC management has established non-published interim energy efficiency goals to evaluate progress towards the publicly-announced goal and to spur the identification of energy reduction opportunities. A continuous improvement process will be used to evaluate additional opportunities and to determine whether the program's boundaries or other features should be modified. If appropriate, additional elements may be added to the program to ensure that all worthwhile opportunities to increase energy efficiency are considered.

UTC recognizes that its energy management program is a work in progress. As experience with various elements of the program is gained, refinements and enhancements are anticipated. The company expects to re-examine the goals of the program on a continuing basis to ensure that targets are realistic yet aggressive.

Annex 2

Selected Companies with Climate-Related Targets[1]

Company Name	Business	Headquarters	# of Countries	# of Employees	Revenue	Ranking		CEO	Target Description	Baseline Year	Placement of Target in the Production Cycle			Focus of Target		Type of Target	
						Fortune 500	Global 500				In-plant	Purchased electricity[2]	Product use	Greenhouse gas	Energy	Absolute	Relative
ABB	Electricity generation and trans-mission equipment	Zurich, Switzerland	103	164,154	$24.7 billion	N/A	160	Jorgen Centerman	Plant-specific energy efficiency targets		•	•			•		•
									Reduce GHG emissions by 1% per year between 1998 and 2005	Annual	•	•		•		•	
									Develop EPDs[3] for every product produced				•	•	•		•
Alcoa	Production of aluminum and packaging materials	Pittsburgh, Pennsylvania	37	142,000	$23 billion	77	278	Alain J.P. Belda	Reduce direct GHG emissions by 25% by 2010	1990	•			•		•	
BASF	Chemicals	Lundwigshafen, Germany	40	100,000	$31.4 billion	N/A	108	Jurgen F. Strube	Reduce CO_2 emissions from a German plant from 4.7 million tons to 3.6 million tons by 2000	1999	•			•		•	
Baxter International	Medical supplies	Deerfield, Illinois	110	45,000	$6.9 billion	258	N/A	Harry M. Jansen Kraemer Jr.	Reduce energy use and associated GHG emissions by 30% per unit of production value by 2005	1996	•	•		•	•		•
BP[4]	Petroleum exploration, refining and distribution and renewable energy systems	London, United Kingdom	91	107,000	$148 billion	N/A	17	John Browne	Reduce GHG emissions by 10% by 2010	1990	•			•		•	
CH2M Hill	Project management	Denver, Colorado		9,000	$1.7 billion	798	N/A	Ralph Petersen	Source 5% of electricity from renewables by 2000			•			•		•
Deutsche Telekom	Telecommu-nications	Berlin, Germany	16	179,000	$10 billion	N/A	94	Ron Sommer	Reduce energy use by 15% by 2000	1995	•	•			•	•	

Dow Chemical	Chemicals	Midland, Michigan	170	50,000	$23 billion	78	231	Michael D. Parker	Reduce energy use per pound of production by 20% by 2005	2000	•				•		•	
Dupont	Chemicals	Wilmington, Delaware	70	94,000	$28 billion	N/A	123	Charles O. Holliday	Reduce GHG emissions by 65% by 2010	1990	•			•		•		
									Hold energy use constant	1990	•				•	•		
									Source 10% of electricity from renewables by 2010			•			•		•	
Eastman Kodak	Photographic imaging	Rochester, New York	29	78,400	$14.1 billion	141	342	Daniel Carp	Reduce energy use by 15% by 2004	2000	•				•	•		
									Reduce GHG emissions from electricity by 20% by 2004	2000	•	•		•		•		
Entergy	Electricity generation and natural gas distribution	New Orleans, Louisiana	2	14,000	$10 billion	187	N/A	J. Wayne Leonard	Stabilize CO_2 emissions through 2005	2000	•			•		•		
Ford Motor Company	Automotive manufacturing	Dearborn, Michigan	30	340,000	$180.6 billion	4	4	Jac Nasser	Improve fuel efficiency of SUVs by 25% by 2005	2001			•		•		•	
									Reduce GHG emissions from European fleet by 25% by 2005	2001			•	•			•	

(continued on next page)

Selected Companies with Climate-Related Targets (continued)

Company Name	Business	Headquarters	# of Countries	# of Employees	Revenue	Ranking		CEO	Target Description	Baseline Year	Placement of Target in the Production Cycle			Focus of Target		Type of Target	
						Fortune 500	Global 500				In-plant	Purchased electricity	Product use	Greenhouse gas	Energy	Absolute	Relative
IBM	Computers and semi-conductors	Armonk, New York	61	299,200	$88.4 billion	8	16	Louis V. Gestner Jr.	Improve energy efficiency[5] by 4% annually	Annual	•				•		•
									Reduce CO_2 emissions by 4% annually[6]	Annual	•	•		•			•
									Have 90-100% of new models Energy Star compliant each year	Annual			•		•		•
									Reduce PFC emissions by 40% per unit of production by 2002	1995	•			•			•
									Reduce PFC emissions by 10% by 2010	1995	•			•		•	
Intel	Micro-processors	Santa Clara, California	45	45,000	$33.7 billion	41	116	Craig Barrett	Reduce PFC emissions by 10% by 2001	1995	•			•		•	
Interface Inc.	Floor coverings	Atlanta, Georgia	6	7,500	$1.3 billion	N/A	N/A	Dan Hendrix	Reduce non-renewable energy use per unit of production by 15% by 2005 and increase renewable energy use to 10% by 2005	1996	•	•			•		•
Johnson & Johnson	Hygiene and health products	New Brunswick, New Jersey	51	98,500	$29.2 billion	57	126	Ralph Larsen	Reduce GHG emissions by 7% by 2010, with an interim goal of 4% by 2005	1990	•			•		•	

J Sainbury	Food processing	London, United Kingdom	3	170,000	$26 billion	N/A	139	Sir George Bull	Increase the use of renewable energy to 10% by 2010		•	•		•		•
Nike	Footwear and accessories	Beaverton, Oregon	N/A	22,700	$9 billion	212	N/A	Philip H. Knight	Reduce CO_2 emissions by 13% by 2005	1998	•	•	•		•	
Ontario Power Generation	Electricity generation	Toronto, Ontario, Canada	1	15,000	$6 billion	N/A	N/A	Ron Osborne	Stabilize CO_2 emissions through 2000 and beyond	1990	•		•		•	
Polaroid	Photographic cameras and films	Cambridge, Massachusetts	18	8,000	$1.9 billion	742	N/A	Gary DiCamillo	Reduce energy use by 3-5% by 2001	1996	•			•	•	
Rio Tinto	Mining and mineral processing	London, United Kingdom	20	34,000	$10 billion	N/A	N/A	Sir Robert Wilson	Reduce GHG emissions per unit of production by 5% by 2001	1990	•		•			•
Rohm and Haas	Chemicals	Philadelphia, Pennsylvania	27	20,000	$6.9 billion	273	N/A	Raj Gupta	Reduce energy use per pound of output by 5% by 2001 and 5% by 2006	1999	•			•		•
Shell	Petroleum exploration, refining and distribution and renewable energy systems	The Hague, Netherlands	135	96,000	$149 billion	N/A	11	Philip Watts	Reduce GHG emissions by 10% by 2002	1990	•		•		•	
									Meet energy targets per tonne of product for global business units	Annual	•			•		•
Siemens	Engineering, design, and manufacturing	Munich, Germany	190	460,000	$75.4 billion	N/A	21	Dr. Heinrich v. Pierer	Reduce energy use in German facilities by 10% by 2001	2000	•			•	•	
ST Micro-Electronics	Semi-conductors	Geneva, Switzerland	27	43,000	$7.8 billion	N/A	N/A	Pasquale Pistorio	Reduce energy use per million dollars of production by 5% a year	Annual	•			•		•
Suncor	Petroleum production, refining, distribution	Calgary, Alberta, Canada	1	2,700	$2 billion	N/A	N/A	Rick George	Reduce GHG emissions by 6% by 2010	1990	•		•		•	
Toyota	Motor vehicles and parts	Toyota City, Japan	65	215,000	$115.8 billion	N/A	8	Fuijio Cho	Reduce CO_2 emissions by 5% by 2005 and by 10% by 2010	1990	•	•	•		•	
Toyota Motor Manufac-turing North America	Motor vehicles and parts	Erlanger, Kentucky	3	25,000	N/A	N/A	N/A	Teruyuki Minoura	Reduce energy use per unit of production by 15% by 2005	2000	•			•		•

Annex 2

Selected Companies with Climate-Related Targets (continued)

Company Name	Business	Headquarters	# of Countries	# of Employees	Revenue	Ranking		CEO	Target Description	Baseline Year	Placement of Target in the Production Cycle			Focus of Target		Type of Target	
						Fortune 500	Global 500				In-plant	Purchased electricity[2]	Product use	Greenhouse gas	Energy	Absolute	Relative
Trans Alta	Electricity generation and marketing	Calgary, Alberta, Canada	3	2500	$1.5 billion	N/A	N/A	Stephen Synder	Return GHG emissions to 1990 levels by 2000	1990	•			•		•	
									Achieve zero net GHG emissions from company's Canadian operations by 2024		•			•		•	
UTC	Aerospace and defense	Hartford, Connecticut	183	141,400	$26.6 billion	57	155	George David	Reduce energy consumption per dollar of revenue by 25% by 2007	1997	•	•			•		•
Participants in the Chicago Climate Exchange[7]									Reduce GHG emissions by 2% below 1999 levels by 2002 and a further 1% reduction per year for an indefinite period after 2002	1999	•	•		•		•	

[1] This list was compiled through an analysis of press releases, corporate web sites, and organizations dedicated to addressing climate change. The table distinguishes between companies who have set a "goal" of reducing GHG emissions and those that have set a firm target by which they intend to reduce their emissions. Only firms that have set a numerical target for a specific reduction from a given base amount, by a specified deadline, are included in the table. Several additional firms have reportedly developed targets but no information on the nature of the targets was publicly available at the time of this writing.

[2] The only supply that any of these companies target is electricity supply.

[3] Environmental Product Declarations

[4] BP is one of seven firms including Shell, Dupont, Alcan, Suncor Energy, Ontario Power Generation and Pechiney that have joined with the environmental advocacy group Environmental Defense in a joint emissions trading program called Partnership for Climate Action. Each of the firms participating in the program has adopted some form of emissions reduction target. Pechiney and Alcan are omitted from the table because insufficient information is available.

[5] IBM's 4% energy conservation target is a percentage, not of the energy use of a fixed year, nor of the previous year, but of business-as-usual energy use in the current year. Business-as-usual energy use tends to vary with production. Therefore, IBM's energy target may be characterized as relative.

[6] IBM's 4% CO_2 emission reduction target is a percentage, not of the CO_2 emissions from a fixed year, nor of the previous year, but of business-as-usual emissions in the current year. Business-as-usual CO_2 emissions tend to vary with production. Therefore, IBM's CO_2 target may be characterized as relative.

[7] The Chicago Climate Exchange is a large-scale emissions trading pilot program that has a large and growing number of participants, many of which are listed above. The following firms and organizations were involved in the design phase of the project: Agriliance, LLC, Alliant Energy, BP, Calpine, Carr Futures/Credit Agricole, Cinergy Corp., CMS Generation, Detroit Energy, DuPont, Exelon Corp., Ford Motor Company, Growmark Inc., IGFInsurance, Interface, International Paper, Iowa Farm Bureau Federation, IT Group, Manitoba Hydro, Mead Corporation, Midwest Generation EME, LLC, National Council of Farmer Cooperatives, Nisource, NUON, Ormat, Pinnacle West Capital Corp., PG&E National Energy Group, ST Microelectronics, Suncor Energy, Swiss Re New Markets, Temple-Inland, The Nature Conservancy, Waste Management, Wisconsin Energy Corporation, Zahren Alternative Power Corporation. Once trading commences, all participating companies would take on the targets listed above.

Endnotes

1. The Business Environmental Leadership Council (BELC) of the Pew Center on Global Climate Change is a group of 36 leading companies worldwide that are responding to the challenges posed by climate change. In addition to agreeing to a Joint Statement of Principles, the members of the BELC serve in an advisory role, offering suggestions and input regarding the Center's activities. The BELC companies do not contribute financially to the Center.

2. According to *Our Common Future*, the report of the Brundtland Commission to the World Commission on Environment and Development (United Nations, 1988), sustainable development is "development seeking to meet the needs of the present generation without compromising the ability of future generations to meet their own needs."

3. According to a study by Environmental Defense, the U.S. acid rain reduction program, which uses emissions trading together with an absolute cap on emissions, has resulted in 30 percent less pollution than the law allows at a fraction of the projected price, despite strong growth in both the U.S. economy and electricity generation. (Environmental Defense 2000: *From Obstacle to Opportunity: How acid rain emissions trading is delivering cleaner air*; www.environmentaldefense.org/pubs/reports/SO_2.)

4. The research was conducted for the communications firm Burson-Marsteller by Research International in 2000. http://www.enn.com/enn-news-archive/2000/06/06272000/envirosurvey_14227.asp.

5. Shadow pricing refers to the practice of including an assumed cost for an input or byproduct such as CO_2 that currently has no real cost associated with it. By using shadow pricing, Shell has created conditions in which it makes corporate decisions, including investment allocations, as if CO_2 emissions constituted a cost to the company.

6. http://environet.policy.net/warming/newsroom/businessmedia/bmpkeyfindings.vtml.

7. The Kyoto Protocol is an as-yet-unratified international agreement that establishes GHG reduction requirements for developed countries. It was negotiated in 1997.

8. A "no regrets" measure is one that is profitable even in the absence of regulations to limit emissions of greenhouse gases.

9. The Kyoto Protocol addresses the emissions of six greenhouse gases, of which CO_2 is the most prevalent. In many cases the other greenhouse gases are denoted in terms of CO_2-equivalent. CO_2-equivalent is a measure used to compare the emissions from various greenhouse gases based on their global warming potentials. Global warming potential is an expression of the warming effectiveness of a gas over a given period — usually 100 years — as compared to CO_2. For example, one metric ton of methane is equivalent to 21 tons of CO_2 over 100 years in terms of heat-trapping capability.

10. In some cases, targets are expressed publicly in terms of CO_2, but are applied internally, and shown in Table 1, as energy targets. In these cases there is little practical difference between energy and GHG targets because most of the relevant emissions come from purchased electricity for which the average carbon content is unlikely to vary significantly over time. For example, a 10 percent reduction in electricity consumption will result in approximately a 10 percent reduction in GHG emissions associated with that consumption.

11. The only supply that any of these companies target is electricity supply.

12. Environmental Product Declarations

13. IBM's 4 percent energy conservation target is a percentage, not of the energy use of a fixed year, nor of the previous year, but of business-as-usual energy use in the current year. Business-as-usual energy use tends to vary with production. Therefore, IBM's energy target may be characterized as relative.

14. IBM's 4 percent CO_2 emission reduction target is a percentage, not of the CO_2 emissions from a fixed year, nor of the previous year, but of business-as-usual emissions in the current year. Business-as-usual CO_2 emissions tend to vary with production. Therefore, IBM's CO_2 target may be characterized as relative.

15. For more information on inventory development see Loreti et al., *Overview of Greenhouse Gas Emissions Inventories Issues*, Pew Center on Global Climate Change, August, 2000.

16. Caps are frequently expressed as percentage reductions below a base year amount. However, the key parameters in any cap are the target amount and the target year. Suppose, for example, that emissions were 100 tons in 1990 and 120 tons in 2000. Then a target of 90 tons is both 10 percent below 1990's level and 25 percent below 2000's level.

17. Article 12 of the Kyoto Protocol establishes a Clean Development Mechanism which permits Annex I countries to receive credit for emissions reduction projects executed within non-Annex I countries.

18. Other members of the Partnership for Climate Action include: Dupont, BP, Alcan, Pechiney, Suncor and Ontario Power Generation.

19. See note 2.

20. Shell, ABB, and IBM all embrace the so-called "triple bottom line" and report on the actions they have taken to improve the society in which they operate.

21. For example, see AC Machine 1278 kW Environmental Product Declaration, p. 3, available at http://www.abb.com.

22. For example, ABB estimates that Europe now generates about 9 percent of its electricity from combined heat and power (CHP) plants. If all of Europe generated 30 percent of electricity from CHP, as in Denmark, Finland and The Netherlands today, emissions would be reduced by 46 percent of the EU Kyoto target, or 220 megatonnes (MT) of CO_2.

23. Natural Resources Defense Council, 1998: Benchmarking Air Emissions of Electricity Generators in the United States.

24. The Climate Challenge is a voluntary program developed by the U.S. Department of Energy to encourage voluntary GHG emissions reductions. The program calls on U.S. electric utilities to commit to reducing GHG emissions and to report on their progress.

25. The Climate Wise program is a voluntary initiative launched by the EPA and DOE that works in partnership with firms to reduce energy GHG emission levels to 1990 levels or below.

26. The Climate Savers Program was launched by the World Wildlife Fund and the U.S.-based Center for Energy and Climate Solutions. The program seeks to facilitate the achievement of energy and GHG emissions reduction goals of participating firms, who commit to specific goals and agree to have their progress independently verified.

27. In order to be labeled as Energy Star compliant, computers and monitors must meet a series of energy efficiency criteria including automatic switching into energy-saving sleep modes after set periods of inactivity and specific energy use for both operating and sleep modes.

28. The three projects are solar homes (South Africa), biomass energy (The Philippines), and pyrite replacement (China). The pyrite replacement project uses sulfur instead of pyrite as the feedstock to make sulfuric acid for farm fertilizer, and avoids combustion of the carbon present in pyrites.

29. McKay, N. 2000: "Can Iceland run on hydrogen?" in Red Herring Magazine. July 1, quoting Don Huberts, CEO, Shell Hydrogen.

30. Typically, two-thirds of the energy used in making an automobile is electricity [Source: http://www.global.toyota.com. Environmental Actions and Results in 1999. p. 44 (data for Toyota in Japan)]. Note that in May 2000, Toyota Motor Sales signed an agreement to purchase 40 million kilowatt-hours of "emission-free" electricity from Green Mountain Power in California. This reduces global warming but has no effect on energy consumption.

notes

This report provides guidance to companies contemplating adopting greenhouse gas reduction targets, based on the experiences of members of the Pew Center's Business Environmental Leadership Council. The Pew Center was established by the Pew Charitable Trusts to bring a new cooperative approach and critical scientific, economic, and technological expertise to the global climate change debate. We intend to inform this debate through wide-ranging analyses that will add new facts and perspectives in four areas: policy (domestic and international), economics, environment, and solutions.

Pew Center on Global Climate Change
2101 Wilson Boulevard
Suite 550
Arlington, VA 22201
Phone (703) 516-4146
www.pewclimate.org