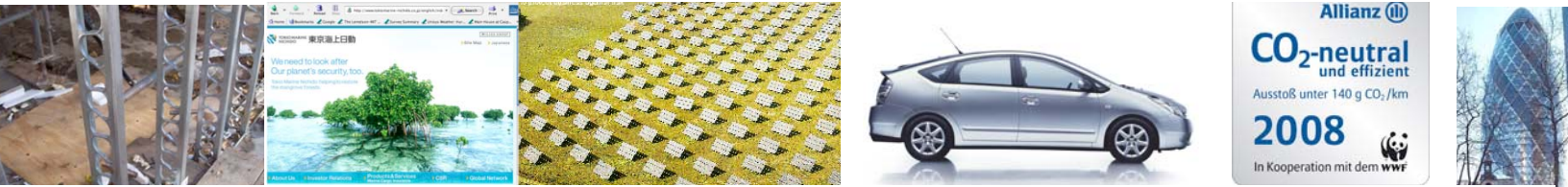




From Risk to Opportunity: 2007



Insurer Responses to Climate Change

Evan Mills

October 2007



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This periodically updated report was commissioned by Ceres, a national coalition of investors, environmental groups, and other public interest organizations working with companies to address sustainability challenges such as climate change. Ceres also directs the Investor Network on Climate Risk, a group of 60 institutional investors from the U.S., Europe, and Canada who collectively manage over \$4 trillion in assets. This project was sponsored by grants from the Pew Charitable Trusts, the Blue Moon Fund, the Energy Foundation, and Rockefeller Brothers Fund, and the Surdna Foundation. The original compilation of case studies, upon which this study expands considerably, was sponsored by the U.S. Department of Energy and U.S. Environmental Protection Agency. The views expressed in this report are those of the author and do not necessarily reflect those of the sponsors.

<http://www.ceres.org>

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For a downloadable version of this report and the most current repository of information on insurance company activities in response to climate change, see:

<http://insurance.lbl.gov/opportunities>

Foreword

Global warming and the growing incidence of extreme weather events pose an enormous challenge to the insurance industry. This summer's devastating floods in Europe and wildfires in the West are only the latest reminder of why investors and consumers are concerned about the impacts of climate change on insurers.

But while climate change poses potential threats, it also creates vast new business opportunities. Just as the industry historically asserted its leadership to minimize risks from building fires and earthquakes, insurers have a huge opportunity today to develop creative loss-prevention solutions and products that will reduce climate-related losses for consumers, governments and insurers, and lower the emissions causing global warming.

This report focuses on the significant progress made by insurers to develop these new products and services. It identifies 422 real-world examples from 190 insurers, reinsurers, brokers and insurance organizations from 26 countries. That's more than double the 192 products and services that we identified in a similar report done by Ceres in August 2006.

Nearly half of the products come from U.S. companies, covering such services as green building design, hurricane-resistant construction, carbon emissions trading, sustainable driving practices and renewable energy such as wind power and biofuels.

Many of these activities have the potential to dramatically reduce greenhouse gas emissions in some of the most energy intensive parts of the economy. For instance, motor vehicles account for more than 25 percent of all U.S. greenhouse gas (GHG) emissions, and insurance policies such as pay-as-you-drive and incentives for hybrid vehicles could reduce that amount by 10 percent or more if broadly implemented. Buildings account for more than a third of U.S. GHG emissions. Green building practices can reduce energy use, and emissions, by 50 percent or more and to zero when coupled with increasingly popular purchases of renewable power and carbon offsets.

Among the recent offerings that show promise for customers and insurers alike:

- Renewable energy-related insurance products are allowing more companies and investors to participate in renewable energy and energy efficiency projects and fast-growing carbon emissions trading programs. London-based Willis Holdings has launched a new product to cover potential underproduction of power from wind farms. AXA provides comprehensive insurance coverage for wind farms, which generated \$14 million in premium revenue for the company in 2006.
- Lexington Insurance Company, a member company of American International Group, Inc., is introducing the first-ever green-buildings product for homes, and simultaneously offering a product for commercial buildings.
- Japan's Sompo insurance has given premium discounts to 3.25 million policyholders that drive low-emitting cars, and Tokio Marine and Nichido has signed up 6.23 million policyholders, representing 48% of its total auto policy customer base.

- Pay-as-you-drive insurance products are now being offered by 19 insurers worldwide, who recognize that reduced driving means reduced accident risk, as well as energy use. Tests have shown that PAYD products can reduce overall miles driven by 10-15 percent or more. About 20 percent of new customers of the French insurer AGF have elected the PAYD option, with 250,000 such policies in force. Progressive and GMAC offer PAYD policies in parts of the U.S.
- Munich Re and Swiss Re are offering micro-insurance in parts of the developing world where insurance did not previously exist. Swiss Re created a project this year – the Climate Change Adaptation Program – that uses climate models and satellite data to determine when up to \$2 million in weather-related claims are to be paid in response to severe drought conditions causing food shortages in villages in Kenya, Mali and Ethiopia. Swiss Re has also sold weather-risk products to 320,000 small farmers in India.

While many of these efforts are modest, they indicate a vast potential for insurers to introduce new climate-friendly products and services through their core business, and to participate in the coming “green” revolution in the financial markets through their extensive investments. But most insurance companies are not yet experimenting with these products. Only about 1 in 10 of the insurers in our report are working in a visible way to understand the mechanics or implications of climate change. Only a third are offering innovative products and services. These rates are much lower when considered on an industry-wide basis.

The dearth of innovative products that would reduce climate risks and preserve insurability for homeowners is a particular concern, especially when considering the more than half a million homeowners who have lost private coverage in Florida alone in the past two years.

For that reason, we applaud the work of the National Association of Insurance Commissioners, which has established an executive task force to examine the impact of climate change on the insurance sector and prod the industry toward greater action.

As the world's largest economic sector, and one that reaches virtually every consumer and business in industrialized countries, the prospect for insurance industry involvement in the development and promotion of climate change mitigation strategies stands as an immense but as yet largely untapped opportunity.

Mindy S. Lubber
 President of Ceres
 Director of Investor Network on Climate Risk

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In Memory of Eugene Lecomte

Eugene ("Gene") Lecomte—a long-time friend, mentor, and colleague—passed away on March 10, 2007. Gene was a pioneer on climate-change issues from within the U.S. insurance community. Many readers knew him directly or through his writings, including the previous edition of this report.

I vividly remember my first meeting with Gene, about a decade ago at a conference in New England. I was new to the insurance world and had some trepidation about meeting this silver-haired industry statesman. I introduced myself and he said: "So *you're* the one who's been making such a stir about climate change and insurance." Just as I began to shake a little in my boots, he added "...and that's a *good* thing." We were instant friends.

Gene had a rare mix of humility and strength of conviction. To my knowledge, he was the very first in the U.S. insurance business to publicly take up the question of climate change, and had few colleagues in the enterprise for some years. Gene never let his politics eclipse his quest for truth. He was a patriotic Republican who scoffed at Washington when he disagreed with its policies. Often this was the case on the topic of climate change and disaster preparedness. He had deep conviction that human-induced climate change was real, and that it was a material issue for insurers. His views were often unpopular among his professional peers and he even lost a job because of them, but in his mind it was a small price to pay for hewing to what he believed. He lived to see the day when the insurance community began to turn the corner, thanks in no small part to his own efforts.

Gene was a veteran of more than fifty years in the insurance business. He worked for Kemper Insurance Company from 1947 until 1972; his last position was New England Fire Claim Manager and General Adjuster. In 1972, he joined The Massachusetts Property Insurance Underwriting Association and the Rhode Island Joint Reinsurance Association as their General Manager. In 1978, he joined the Massachusetts Automobile Rating and Accident Prevention Bureau and the Massachusetts Workers Compensation Rating Bureaus as the President and CEO. In 1980, he became President and CEO of the National Committee on Property Insurance and Property Insurance Plans Service Office. He founded, was President and CEO of the Insurance Institute for Property Loss Reduction (IIPLR). He also served as Executive Director of the Earthquake Project. IIPLR later became the Insurance Institute for Business and Home Safety. After more than 52 years of professional service he retired as President Emeritus (IBHS) on December 31, 1998. He kept working on insurance issues and other topics of interest in his community until his passing. Gene was born in 1929 and a veteran of the Korean War. He always had a joke and a story for friends who had time to listen.

In Memory of Tim Wagner

L. Tim Wagner—Nebraska Insurance Director—passed away on October 9, 2007. Tim played a key role in encouraging the US insurance industry, as well as his fellow regulators, to confront the challenges of climate change. Tim was the driving force behind the creation of the National Association of Insurance Commissioners (NAIC) Executive Task Force on Climate Change, and served as its co-chair until his death. As a Republican from a conservative state, Tim was a unique messenger on climate change, and he spoke tirelessly about the need for the U.S. to confront global warming, often focusing on the potentially devastating impacts of climate change on America's heartland.

Tim was also a kind, decent person who was dedicated to his family and to serving the state of Nebraska.

A 1963 graduate of Nebraska Wesleyan University, Tim spent more than 40 years in the insurance industry. He was a vice president with Central States Indemnity Co. of Omaha before becoming Insurance Director and started as an underwriter for State Farm Insurance Co. from 1963 to 1966. His other insurance jobs included rate analyst for the state Insurance Department from 1966 to 1970; various positions, ending as executive vice president, with Central National Insurance Group, 1972 to 1990; vice president of government relations for Central States Health & Life Co. of Omaha, 1991 to 1993; and vice president of government relations for Central States Indemnity Co. of Omaha, 1993 to 1999.

I. INTRODUCTION

“The insurance industry must start actively adapting in response to greenhouse gas trends if it is to survive.”
- Lloyds’ of London¹

At various points in history—the Great Dust Bowl of the 1930s, urban riots of the 1960s, and terrorism today—watershed events or trends ushered in structural changes within the insurance industry. While entirely different in their specifics, each of these had in common an element of acute surprise followed by subsequent realizations that the future would not be like the past. Global climate change is the next watershed of this type.² A survey of 139 insurance executives from 21 countries found that natural catastrophes were the number-two top concern and climate change ranked number four (out of a total of 33), while the majority of other concerns (e.g. actuarial assumptions) are arguably also linked to climate change.³ The growing destructive power of extreme weather events coupled with increasing insured exposures poses a material financial challenge to insurers. But, as described in this report, leading insurers are mobilizing a wide array of creative and proactive strategies to get in front of the climate change problem.

In August 2006, Eugene Lecomte and I co-authored a report for Ceres detailing proactive steps being taken by insurers around the world to address rising catastrophe losses and the specter of global climate change.⁴ Now, just 14 months later, the context of the climate change debate—and the insurance industry’s relationship to it—has shifted dramatically. The scientific debate is over, with the Intergovernmental Panel on Climate Change—representing the definitive scientific consensus—now using the considered term “unequivocal” in describing its certainty that climate change is here. The economic context has shifted as well, as reports like the UK government’s “Stern Review”⁵ turn on its head the conventional wisdom that taking action on climate change will harm the economy. Companies and investors now increasingly realize that, in fact, it is the lack of action to combat climate change that is the true threat to the economy, while engaging with the problem and mounting solutions represents not only a duty to shareholders but also a boon for economic growth.

There is growing acknowledgement that the impact of climate change on future losses is likely to be profound. The chairman of Lloyd’s of London said that climate change is the number-one issue for that massive insurance group. Europe’s largest insurer, Allianz, stated that climate change stands to increase insured losses from extreme events *in an average year* by 37 percent within just a decade while losses in a bad year could top \$400 billion.⁶

New domains of risk are emerging. Medical researchers at Sweden’s Karolinska medical university foresee a rise in global cardiovascular health problems in response to rising temperatures, underscoring the breadth of exposure for insurers. Symposia have been held at leading law schools on the legal implications of climate change. Climate risk has also begun to influence legal practice, with large law firms establishing sub-practices dedicated to the issue.⁷

Outside forces have begun to prod the industry toward action. Insurance regulators under a National Association of Insurance Commissioners Task Force have met regularly in the U.S. to discuss climate change, and the subject was among the top agenda items at the 2007 meeting of the International Association of Insurance Supervisors on October 18, 2007. Meanwhile, major institutional investors are increasingly demanding that the insurers they invest in analyze and disclose their risks.

The insurance sector thus finds itself on the front lines of climate change, and the response of insurers to this challenge has varied enormously. The response of many insurers, particularly in the United States, has been to focus on financial means for limiting their exposure to high-risk areas along the coast. Allstate, for instance, has said that climate change has prompted it to cancel or not renew policies in many Gulf Coast states, with recent hurricanes wiping out all of the profits it had garnered in 75 years of selling homeowners insurance.⁸ The company has cut the number of homeowners' policies in Florida from 1.2 million to 400,000 with an ultimate target of no more than 100,000. The company has curtailed activity in nearly a dozen other states. More difficult to detect than formal withdrawals or price spikes is the "hollowing out" of coverage through increased deductibles, reduced limits, and new exclusions.

A similar crisis in availability is occurring in many commercial insurance markets such as hotels and oil,^{9,10} despite the absence of price regulation for non-household insurance. This suggests that there are factors at work beyond regulatory obstacles that limit price increases, such as the increased unpredictability that climate change has brought to catastrophic losses projections. Bermuda-based ACE Limited has remarked that "[r]adical changes in natural catastrophe frequency and/or severity could eliminate certain of our markets [sic] through physical damage, price escalation, or regulatory activity... unpredictability could negate the use of actuarial techniques and undermine our ability to price and risk-manage product offerings."¹¹ Climate change of course conspires with settlement and land-use planning practices that magnify exposures to catastrophes.

After its members suffered a stunning \$7 billion in projected insured flooding losses during the summer of 2007 (130,000 claims), the Association of British Insurers called on the U.K. government to step up its investment in flood defenses as a necessary condition for maintaining insurability.¹² Also in 2007, European windstorm Kyrill inflicted \$10 billion in losses on insurers.¹³ While the crisis of insurance availability and affordability has deepened, a new study from the U.S. Governmental Accountability Office brought into question the ability of government-backed insurance to provide a reliable alternative.¹⁴ Restriction of insurance is often criticized, yet, in some cases, it can also be viewed as a recognition of previously hidden costs and an indication of society's limited ability to pay its way around the effects of climate change.

While many insurers continue to focus chiefly on financial risk management in response to climate change, others are realizing that a more proactive, holistic approach to the issue presents significant opportunities to grow revenues, reduce risk, and improve brand value. In the past year industry groups including the Association of British Insurers and CEA—the European Insurance and Reinsurance Federation—have called on insurers to more actively pursue climate change solutions to ensure the preservation of private insurance markets.¹⁵

To cite one example of the business opportunities presented by climate change, hundreds of billions of dollars will ultimately be spent on clean energy technologies and other responses, which in itself represents an enormous new capital base with associated business operations requiring insurance (Figures 1 and 2).¹⁶ As outlined in this report, several large insurers are already responding with announcements of special practices dedicated to the diversity of customers participating in this new market area. Examples include AIG's "Global Alternative Energy Practice,"¹⁷ Allianz's "Climate Solutions",¹⁸ Aon's "Agri-Fuels Group,"¹⁹ Travelers "Climate Change Committee,"²⁰ and Chubb's "Green Energy Team."²¹

Most insurers are behind the curve in developing forward-thinking products and services in response to climate change. As shown in Figure 3, only about one in ten of the insurers in our compilation are working in a visible way on contributing to understanding the mechanics and implications of climate change, with a similarly small proportion incorporating these considerations into asset management. A third are offering innovative products and services, and only four in ten have disclosed climate risks to shareholders. Insurers engaging in the policy discussion of climate change, or leading by example through energy and carbon management in their own operations, remain in the minority.

The insurance industry has much progress to make in contributing to climate change solutions. The actions described in this report indicate the vast potential for insurers to introduce new climate-friendly products and services through their core business, and to participate in the coming "green revolution" in the financial markets through their investments and asset management. The challenge will be to ensure that these products are brought to scale in time to have a material impact on what is likely to be the biggest challenge facing the industry in its history.

U.S. Electricity Sector Carbon Dioxide Emissions Reduction "Aggressive but Feasible" Scenario

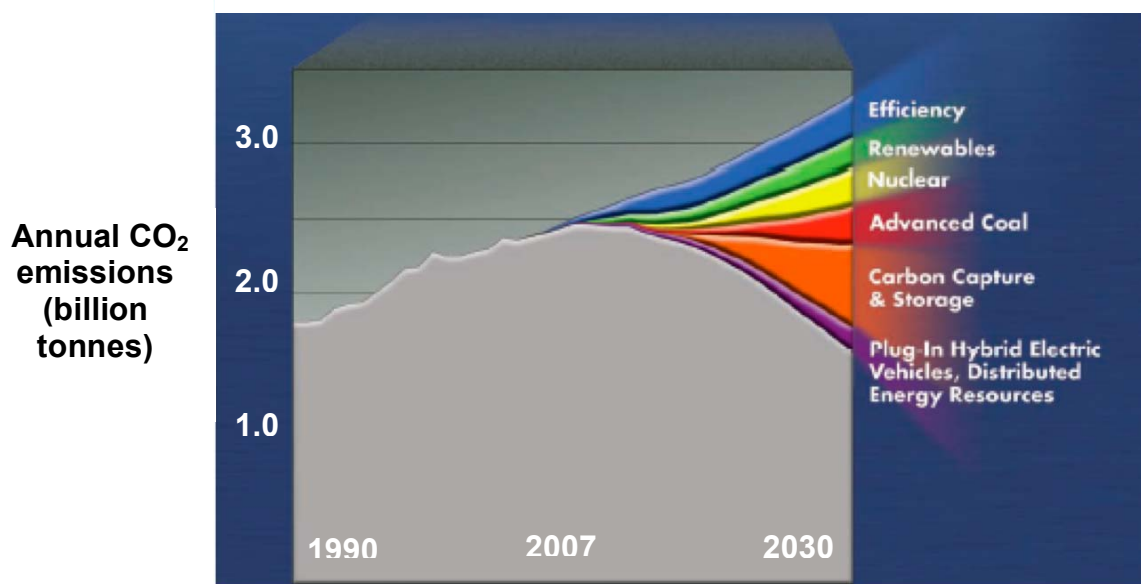


Figure 1. The U.S. Electric Power Research Institute's conception of the potential for new carbon-reducing technologies.



Figure 2. XL Insurance advertisement indicating perceived potential for renewable-energy insurance products.

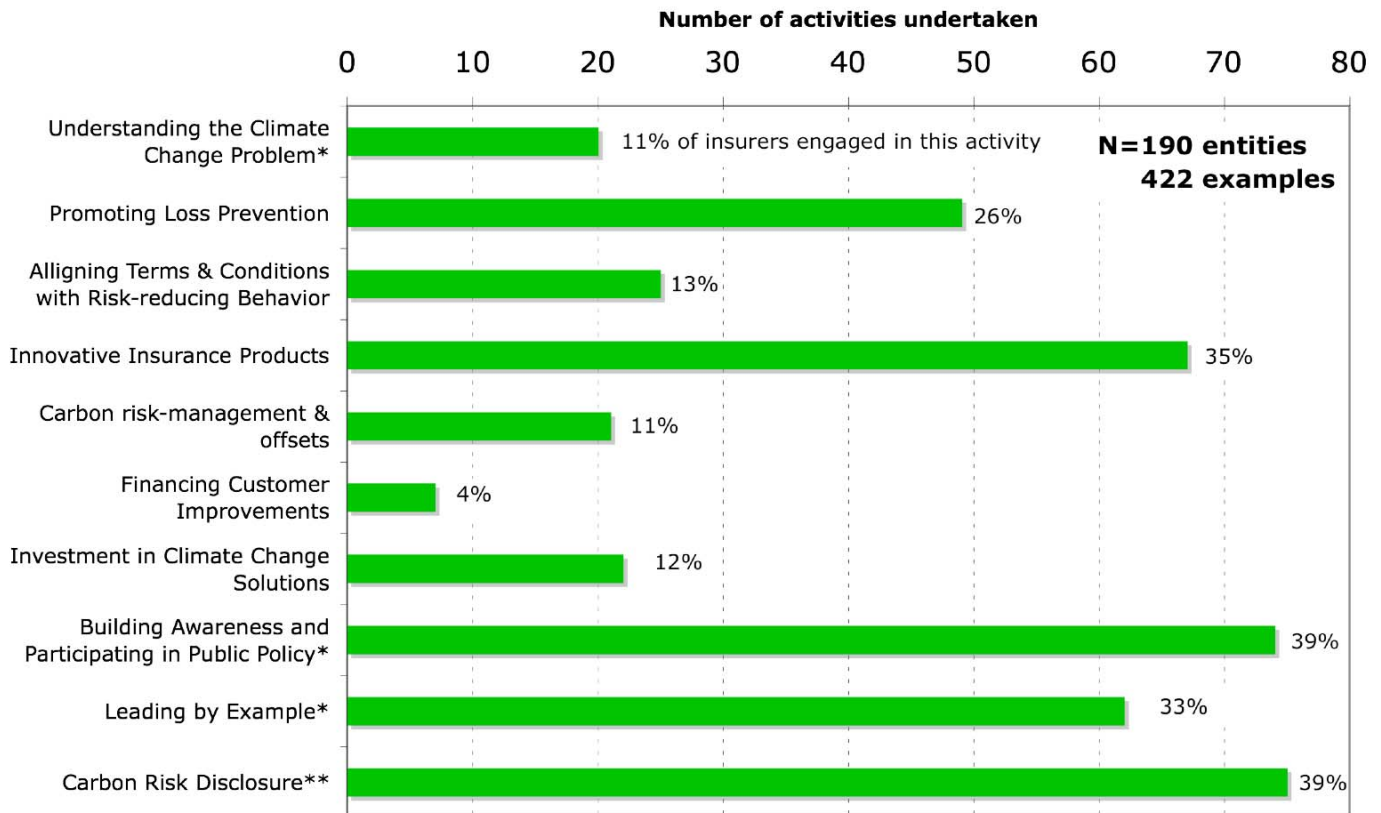


Figure 3. Range of insurer activities documented in this report. Key: * For these three columns, a maximum of 1 is tallied, as there is too much subjectivity in assigning weights to each individual activity. ** Multiple-year responses to a given disclosure initiative (e.g. Carbon Disclosure Project) are counted once.

II. ADVANCING SOLUTIONS

“AIG sees opportunities to improve the environment, protect customers and reward shareholders by developing products and investing in technologies that can mitigate the risk and the effect of climate change.”

- Martin Sullivan, CEO, AIG, 2007 Annual Letter to Shareholders

As the world's largest industry – generating about \$4 trillion in yearly premium revenue in 2006,²² plus another trillion or so in investment income – with core competencies in risk management and finance, the insurance industry is uniquely positioned to further society's understanding of climate change and advance creative solutions to minimize its impacts. Just as the industry has historically asserted its leadership to minimize risks from building fires and earthquakes, insurers have a huge opportunity today to develop creative loss-prevention solutions and products that will reduce climate change-related losses for consumers, government, and insurers.²³

We have identified a wide spectrum of insurance opportunities, with 422 real-world examples from 190 insurers, reinsurers, brokers, and insurance organizations from 26 countries. That's more than double the 192 activities we identified in our August 2006 report,²⁴ and 15 times as many as in the original compilation published in 1999.²⁵ We group these into 10 broad categories, as summarized in Figure 3, which we further break down into 32 specific classes of activity. An additional 23 organizations—ranging from energy utilities to foundations to governmental agencies—have collaborated with insurers or otherwise supported their initiatives. About 40 percent of the participants are U.S. companies. These activities reflect a wide range of strategies that help improve disaster resilience and adaptation to climate change, while reducing climate-related risks through strategies such as energy efficiency programs, green building design, sustainable driving practices, and carbon emissions trading. In some cases, the magnitude of progress or uptake can be quantified, as indicated in Box A. While this progress is encouraging, there is still little good data on how much traction these new activities have in the marketplace.

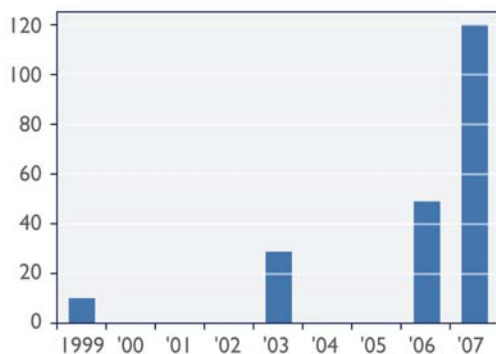
We applied various decision rules in determining if and how to include an insurance company and how to tally its activities. To be included, the company had to be conducting one or more of the types of activities described in the following ten sections. Planned activities are generally not included, unless there is a scheduled rollout. Multiple activities of a very similar nature are counted once (e.g. multiple reports on the implications of climate change, or multiple years responding to a given call for disclosure), while distinct but related

* The world oil market, for example, is US \$1.9 trillion/year at current production levels of 76Mbp and a unit price of \$70/bbl price; world electricity market in 2001 was US \$1 trillion at 14.8 trillion kWh generation assuming a unit price of US \$0.07/kWh; tourism receipts US \$434 billion; agriculture US \$1.2 trillion (2002); telecommunications 1.2 trillion (2002); world military expenditures US \$770 billion. Source: 2004-2005 *Statistical Abstract of the United States*.

BOX A

Products and Services

Insurers with Climate-friendly Products and Services



Sompo Japan Insurance: 3.25 million discounted auto policies for hybrid and alternative-fuel vehicles

Tokio Marine & Nichido: 6.23 million discounted auto policies for low-emission vehicles

AGF: Pay-as-you-Drive insurance – 250,000 policies (20%) as of 2006

Fortis: Preferential financing terms for energy-efficient homes: 20% of renovation loans

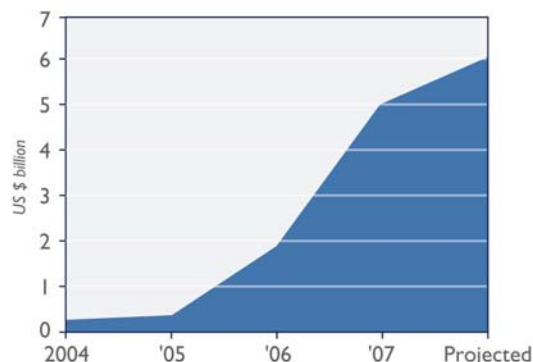
ING: 70% of car lease customers select energy-efficient option

Swiss Re: 320,000 small farmers covered with weather insurance in India

AXA: Windfarm Insurance – \$14 million in revenue in 2006

Investments

Cumulative Investments in Climate Solutions



AIG: \$300 million lending facility for efficiency and clean-energy projects

Swiss Re: \$429 million European Clean Energy Fund and \$320 million in individual investments

Sompo Japan: Green Open Fund – \$100 million

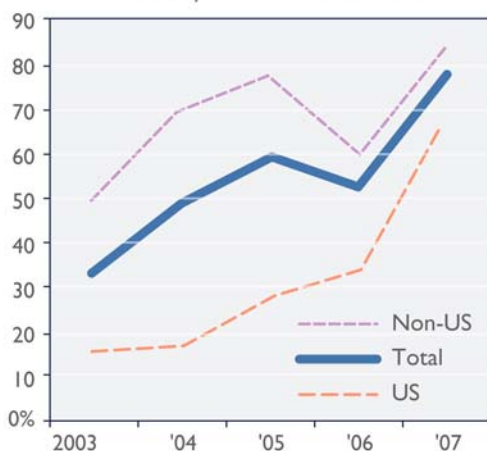
Gerling: Sustainable Development Project (venture capital): \$100 million

ING: Green Finance – \$1.16 billion as of 2006

Historical values include only 10 companies; projections include two companies

Disclosure

Carbon Disclosure Project Full Response Rates Over Time



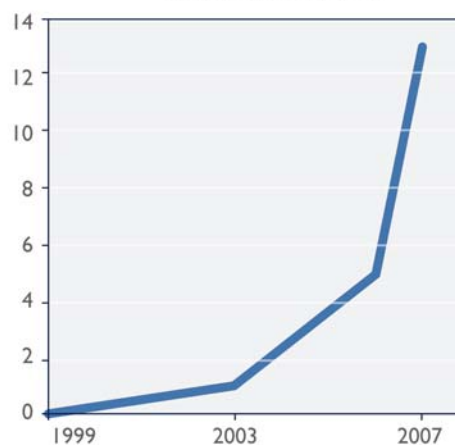
Carbon Disclosure Project: 77% reporting in 2007

SEC disclosures: 15% reporting in 2006

See figure 20 for aggregate responses: 2003–2007

Leadership

Insurers with Carbon-Neutral Goals



65 companies with in-house energy / carbon management activities

13 companies with carbon-neutral commitments

HSBC: Purchases 40% of electricity from renewables

activities (e.g. two separate innovative insurance products) are counted individually. In limited instances, a given activity is tallied twice (e.g. an insurance company's planting of mangroves to accomplish both carbon offsets and storm-surge loss reduction). See notes to Appendix A for additional details.

Among the new developments since last year's assessment are pledges by several companies to achieve carbon-neutrality across their operations; a significant increase in concern about liability insurance claims and associated disclosures of carbon risks; and growing interest in green-buildings insurance products. There is also a trend towards establishing new "boutique" insurers that specialize in energy/climate products.

Many of these activities have the potential to significantly reduce GHG emissions in some of the most energy intensive parts of the economy. For instance, motor vehicles create about 25 percent of all U.S. greenhouse gas emissions, and insurance policies like pay-as-you-drive and incentives for hybrid vehicles could reduce that amount by 10 percent or more if broadly implemented. Buildings account for 38 percent of U.S. GHG emissions, according to the EPA. Green building practices can reduce energy use, and thereby emissions, by up to 50 percent in many cases, and fully to zero when coupled with increasingly popular green power purchases. Significantly increasing energy efficiency has been identified by McKinsey & Company, among others, as the quickest and cheapest way to decrease global GHG emissions, and the insurance industry—through products like energy savings insurance—has a key role to play in encouraging investments in that area as well.²⁶

As expert messengers on risk, insurers can also play an important role in alerting policymakers to the need to proactively deal with climate change at the national and global level.

Insurers seizing these opportunities will improve their market position. To be sure, rising losses will create more demand for conventional forms of insurance, as well as new products such as weather derivatives and catastrophe bonds. This will be welcomed only if the changing risks can be understood and managed. There will also be demand for new forms of insurance, as well as for conventional insurance for new assets (e.g., renewable energy technology installations).²⁷ Innovative products like micro-insurance and new public-private partnerships will allow markets to grow to serve the billions of people in the developing world today lacking insurance.^{28, 29}

Described below are many of the creative services and products (full list is found in Appendix A). These activities represent an encouraging start, but only the tip of the iceberg when compared with what the industry could be doing and what is needed.

Understanding The Climate Change Problem

*"It is clear that weather-related hazards are already increasing in some regions of the world due to climate change, and, as a result, financial losses from extreme weather catastrophes, such as floods, droughts, heat waves, and storms, are also increasing. ... The increases in extreme weather have placed our current system for risk-management, such as insurance, under stress."*³⁰

- Robert Muir Wood, Chief Research Officer
Risk Management Solutions

The insurance industry has a history of helping society understand and adapt to emerging risks. Climate change is no exception, and several insurers are beginning to apply their expertise in data collection and risk analysis to better track trends and define the problems posed by climate change and point toward solutions for both the industry and society at large. Insurers are also looking to the scientific community to help it build forward-looking risk models that take climate change into account, with profound results.

Analyzing Loss Trends and Assessing Vulnerabilities

Well known for its decades-long efforts to track trends in weather-related events, their total economic costs, and associated insurance payouts, Munich Re (along with other companies like Tokio Marine and CGU) has been involved in the recent work of the Intergovernmental Panel on Climate Change, the most authoritative scientific body on the climate change question and co-recipient (with former U.S. Vice President Albert Gore) of the 2007 Nobel Peace Prize.

Among its many efforts, Swiss Re sponsored a multi-year study entitled "Climate Change Futures" to synthesize knowledge on the health-related impacts of climate change and other issues.³¹

Integrating Climate Change into Traditional Catastrophe Modeling

A major obstacle to insurers taking action on climate change has been that the models that the industry uses to manage and price risk are backward-looking and thus, by definition, unable to take climate change into account. The industry has focused significant effort in recent years on finding ways to reconcile its risk models with the forward-looking models used by climate scientists.

Arkwright Mutual Insurance Company (now part of US-based FM Global), examined climate change and trends in flooding.³² The Insurance Australia Group is working with the University of Oklahoma on high-resolution climate modeling, and Willis (a leading broker) is collaborating with researchers in the UK and Japan on next-generation climate modeling, with greater resolution to enable the evaluation of changing typhoon risks and associated insurance implications.³³

Swiss Re³⁴ and the Association of British Insurers (ABI)³⁵ have also coupled climate models with insurance loss models. Swiss Re projected an average increase in losses of 16 to 68 percent from European winter storms (and significantly higher for some individual countries) between 1975 and 2085, excluding the associated effects of storm surge and flooding and socioeconomic factors (inflation, insurance penetration, settlement patterns) that would further compound losses.³⁶ The ABI study estimated an increase of hurricane and tropical cyclone losses of up to \$27 billion in an *average* year in Europe, Japan, and the U.S., corresponding to an estimated 67 percent increase in premiums. The associated need for increased risk capital would be \$76 billion to cover the increased exposure in the U.S. and Japan. The worst years would bring 2 to 3 additional “Hurricane Andrews” in the U.S.

Munich Re is incorporating the physical effects of climate change into hurricane models (wind and storm surge), and associated economic effects such as the surge in demand (and prices) for construction materials following the events.³⁷ With support from AIG and Lloyds of London, Harvard University and the Insurance Information Institute are collaborating to better integrate climate change factors into insurance loss models.

Insurers and catastrophe modeling firms, such as RMS and AIR, are finding new business opportunities in helping their customers understand the risks of extreme weather and climate change. Notably, an evaluation of UK flood risk by the ABI found that emissions reductions (climate change mitigation) had a more profound effect on reducing future losses than improving flood defenses (adaptation), but the best effect came from the combination of both strategies (Figure 4). Analyses like this help insurers assess their own exposures, but also make major contributions to the broader public policy discussion.³⁸

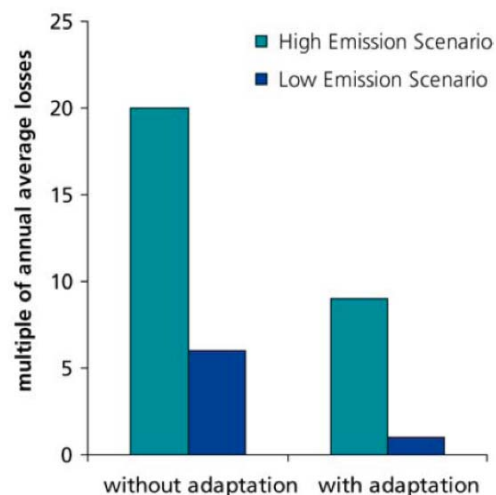


Figure 4. Projected UK flood damages with and without climate change mitigation and adaptation. Prepared by the Association of British Insurers.

Promoting Loss Prevention

“Energy efficiency improvements also reduce fire, explosion, or winter storm hazards. Insurers can support improvements in energy efficiency as long as they do not create new, unanticipated risks to human safety and property, particularly when energy efficiency strategies measurably improve safety and loss control.

- American Insurance Association³⁹

Managing risks and controlling losses is central to the insurance business, and is evident in the industry’s history as founders of fire departments and advocates for building codes. While the primary focus in recent years has been on financially managing risks (through exclusions, price increases, derivatives, etc.), physical risk management is receiving renewed attention from insurers, and could play a large role in helping to preserve the insurability of coastal and other high-risk areas. Improved building codes and land-use management are important starting points. Beyond that, innovations include a whole genre of energy-efficient and renewable energy technologies that also make infrastructure less vulnerable to insured losses. Improved management of forests, agriculture and wetlands also offers dual benefits—for example, withdrawal of carbon from the atmosphere and storage in biomass and soils coupled with increased resilience to drought, coastal erosion, and other products of weather extremes. In keeping with its history in developing specific fire and vehicle safety technologies, the insurance sector can play a role in bringing to market new technologies that help increase customers’ resilience to climate change impacts, as well as curbing greenhouse gas emissions.⁴⁰

Traditional Risk Management

As exemplified by the work of the insurer-funded Institute for Business and Home Safety (IBHS) in the U.S. and the Institute for Catastrophic Loss Reduction (ICLR) in Canada,⁴¹ there are many strategies for improving the disaster resilience of homes and businesses. The engineering-oriented FM Global has stated that the nearly 500 locations damaged by Hurricane Katrina that had implemented all of its recommended hurricane-loss-prevention methods experienced only one-eighth the losses of those who had not done so.⁴² These benefits came at a bargain, with \$500 million in losses avoided via customer investments of only \$2.5 million.⁴³ FM Global was one of the most profitable U.S. insurers during the year of Hurricane Katrina. MetLife and Allstate report giving incentives to customers that install storm shutters and other measures to “wind-proof” their homes.

Other studies have corroborated that proactive loss-prevention is highly cost-effective.⁴⁴ For example, UK-based Norwich Union sponsors *Project Flows*, a pan-European project looking

at the issue of flooding. As part of the project the company developed the Norwich Union flood resilient home model, which is projected to dramatically reduce the average cost of a flood claim from £50,000 to £10,000 through flood proofing and flood alarm systems.⁴⁵

A number of insurers, including Allstate and State Farm,⁴⁶ have pushed for the adoption of improved building codes. The benefits of strong building codes have been well documented; however, to be effective codes must be enforced, and the Insurance Services Office Building Code Effectiveness Grading Scale has been used to reward effective codes via insurance discounts or surcharges. In this regard, a specific win-win opportunity is the reduction in rooftop “ice dams” caused by excessive heat loss. Energy efficient construction mitigates the ice dam hazard (a major source of insurance claims in northern climates) *while* reducing the greenhouse-gas emissions associated with heating energy use. With these types of benefits in mind, IBHS and ICLR—both insurance-based organizations—have endorsed energy-efficient building codes.⁴⁷

Opportunities for promoting loss prevention extend well beyond the buildings sector to include crops, roadway safety, marine settings, and life/health. The insurance industry could put considerably more resources into these endeavors – IBHS’ budget is a mere 0.003 percent of associated national property/casualty insurance premiums.

Minimizing business interruptions is another key need. The French insurer AXA issued a publication with practical suggestions for how small businesses can prepare for the impacts of climate change.⁴⁸ Business interruptions typically comprise a quarter of all insured losses from catastrophe events.

Improving Land-Use Planning

Integrating climate change considerations into land-use planning is another natural role for insurers, although the public sector clearly has lead responsibility. Burby’s post-Katrina analysis revealed that per-capita economic losses were three-times lower in areas where building codes and comprehensive land-use planning were in use.⁴⁹ Allianz reviewed examples from many countries that supported the same conclusion.⁵⁰ In 2004, the Insurance Australia Group (IAG) developed a partnership with local government planners in New Zealand to determine the most appropriate flood planning levels for the future. IAG provided modeling results indicating changes in extreme rainfall, which the local government then used to determine the likely changes to future flood levels. This was then incorporated into its flood mitigation program, e.g., planning for higher levee banks. IAG also conducts wind and hail-related research intended to help improve roof designs and construction, observing that insurers are not adequately included in the broader public policy discussion about hazard management.⁵¹ In the UK, the Association of British Insurers has also advised local planning authorities on better integrating rising flood risks in East London.⁵² In the U.S., AIG serves on the steering committee of the Heinz Center’s “The Nation’s Coasts: A Vision for the Future,” which seeks to create a more viable approach to sustainability for coastal communities and surrounding regions.

Integrating Energy Management & Risk Management

In the context of climate change, win-win approaches to risk-management include a whole class of strategies that capture the insurance loss-prevention benefits of certain energy efficiency and renewable energy strategies. We previously chronicled nearly 80 technologies and practices that can lower greenhouse gas emissions while reducing the direct risk of property damage from mechanical equipment breakdown, professional liability, builders' risk, business interruption, and occupational health and safety.⁵³ A clear example pertaining to fire safety—a familiar concern for insurers—is the elimination of fire hazards with energy-efficient lighting solutions that give off less heat. A subset of these measures can directly enhance disaster resilience,⁵⁴ e.g. the ability of facility-integrated solar power systems to avert business interruptions following outages on the electricity grid or the resistance of foam insulation (as opposed to less-efficient fiber-based products) to water-logging after floods.⁵⁵

With rising concerns about occupational health and safety, as well as business interruptions, risk managers will find particular opportunities in industrial and high-technology settings. Recent work in data laboratories and data centers has identified strategies that enhance safety and reliability while reducing energy use and greenhouse-gas emissions.⁵⁶ Downtime in these facilities can yield large business-interruption insurance claims.

Better Management of Forestry, Agriculture, and Wetlands

While most greenhouse-gas emissions arise from the energy sector, substantial reductions can also be achieved in forestry, agriculture, and wetlands. Tropical deforestation alone accounts for 20 percent of all GHG emissions caused by humans.⁵⁷ Better forest management can reduce emissions by minimizing wildfires (a major source of carbon dioxide and associated public health problems), and lower the risk of flooding and mudslides that typically follow deforestation. Sustainable agricultural practices tend to help sequester carbon in the soil, while increasing drought resistance. Wetlands and mangrove protection also offers win-win benefits. Hurricane Katrina would have been less damaging had it not been preceded by decades of wetlands destruction. Well aware of cyclone-related risks, the Japanese Insurer Tokio Marine & Nichido has been active in mangrove protection (Figure 5). Since 1999, it has reforested 12,200 acres of mangroves in Indonesia, Thailand, Philippines, Myanmar, and Vietnam. The company claims that the Tsunami of 2005 did less damage to areas behind these plantations.⁵⁸

“Rebuilding Right” Following Losses

Insurers can promote risk-prevention strategies in the context of rebuilding after losses.⁵⁹ “Rebuilding Right” in the aftermath of Hurricane Katrina is an immediate opportunity, which could involve everything from wetlands restoration to energy-efficient and disaster-resistant housing to renewably-based distributed energy supplies that are less vulnerable to disruption from future extreme weather events. Fireman's Fund offers commercial insurance terms that encourage rebuilding to meet current “green construction” standards.

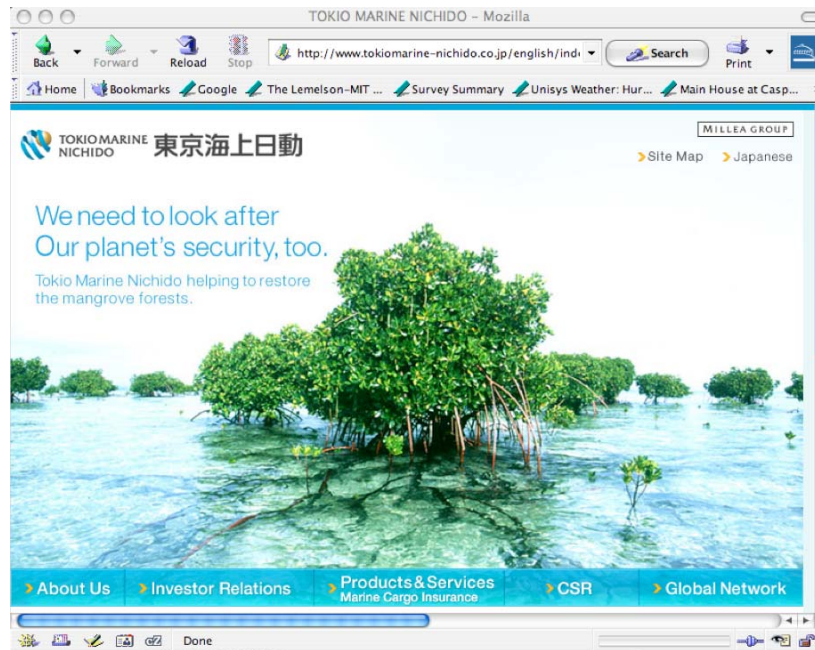


Figure 5. Home page of Tokio Marine & Nichido illustrating its mangrove restoration project designed to offset the company's carbon footprint and to improve protection of insured infrastructure to storm surge.

Cementitious Structurally Insulated Panels (CSIPs) are a promising technology being championed by the Federation of American Scientists, as part of the post-Katrina rebuilding effort.⁶⁰ With its wind-resistant cladding and styrofoam cores, this technology combines energy efficiency and disaster resilience, while reducing the amount of wood required for construction.

Technology Development

Although Swiss Re⁶¹ as well as the Reinsurance Association of America⁶² called for R&D initiatives in support of better resiliency a decade ago, the insurance industry has made limited progress on this front. An example of such R&D is an initiative of the Roofing Industry Committee on Wind Issues,⁶³ which includes all major roofing trade associations in North America and various insurance partners (including IBHS, RMS, and Allstate). One of the project's aims was to analyze mechanisms of roof failure during severe windstorms and identify linkages between energy efficiency and durability, e.g. specific ways in which energy-efficiency features can enhance roof structural integrity. Other promising areas include topics such as rooftop ice dam formation and mitigation or the causes of and remedies for sick building syndrome.

In another example, the Insurance Institute for Property Loss Reduction (IIPLR, now known as the Institute for Business and Home Safety) collaborated with Lawrence Berkeley National Laboratory and Waterhealth International on the development of an ultraviolet water disinfection unit for emergency-relief applications.⁶⁴

Aligning Terms and Conditions with Risk-Reducing Behavior

"We believe that companies that have demonstrated a commitment to sustainability should have lower insurance risks."

- Andrew Cavenagh
President of Gamet Captive Insurance Services⁶⁵

New kinds of insurance terms and policy exclusions – designed to instill behaviors that reduce greenhouse-gas emissions, as well as appropriate efforts to prepare for the impacts – are beginning to emerge in the face of climate change. Pay-as-you-drive insurance products have now been offered by a number of insurers, recognizing the link between accident risk (as well as energy use) and distance driven. Among the most discussed possibilities is the liability of corporate directors and officers for their actions (or lack of action) regarding climate change risks. Conversely, customers with a tendency to reduce climate vulnerabilities (e.g. drivers of hybrid cars) are increasingly being seen as “good risks” and are being rewarded accordingly by their insurers.

Pay-As-You-Drive Insurance

Proposals have circulated since the mid-1990s⁶⁶ to link automobile insurance to the price of gasoline or miles driven, with the intent of encouraging reduced driving in order to achieve safety and environmental benefits.

While some conventional auto policies take account of approximate mileage driven, they use very crude methods. It has been estimated that pay-as-you-drive (PAYD) insurance could reduce miles driven by 10 to 15 percent, and lower accident rates.⁶⁷ This has significant implications for climate change, as automobiles account for a quarter of U.S. GHG emissions. The General Insurance Association of Japan (a trade association) has also asserted a positive correlation between safe driving, fuel-economy, and environmental protection.⁶⁸ When GIS-based tracking systems are employed to record mileage, co-benefits for insurers include elimination of error or fraud in mileage-reporting and stolen-vehicle recovery.

A growing number of insurers are offering these products. Progressive Insurance (U.S.)⁶⁹ and Norwich Union (UK) conducted pilot tests with customers receiving up to 25-percent premium discounts depending on their driving habits.⁷⁰⁻⁷¹ Market tests have been conducted underway in Michigan, Minnesota, Oregon, Pennsylvania, Texas, and Washington. In a detailed evaluation of 93 pilot project participants, Progressive found that the average annual driving reduction for this group was 1,237 miles per year.⁷² In 2003, the Oregon legislature enacted a \$100/policy tax credit to insurers who offer PAYD insurance. The

Conservation Law Foundation created an insurance company that for a time offered group mileage-based automobile policies at a discount.⁷³ The U.S. Environmental Protection Agency is promoting the concept at the national level. However, the availability of mileage-based policies in the US is limited.

In 2004, General Motors' GMAC insurance began offering mileage-based insurance discounts of up to 40 percent, utilizing its OnStar technology to keep track of driving patterns. Japan's Aioi Insurance, Israel's Aryeh, and the Netherlands' Polis Direct also introduced PAYD products in 2004. Nedbank company offers the product in South Africa, and AXA offers such products in France, Belgium, and Canada and states that they are "extremely popular."⁷⁴ In Germany, premiums have been reduced by up to 50 percent for smaller cars driven shorter distances;⁷⁵ Rheinland Versicherungen offers premiums that are proportional to miles driven.⁷⁶ Gerling offers similar incentives.⁷⁷ In 2007, Unigard (based in Washington State) launched a PAYD experiment, explicitly targeting improved urban air quality and reduced greenhouse-gas emissions. The goal for that program was an initial pilot involving 5,000 drivers in the state.⁷⁸

Norwich Union has set a goal of 100,000 PAYD policies in force in the U.K. by the end of 2007, and total market penetration for particularly advanced systems (with time-of-day capability and differentiation by driver age) in Western Europe is projected to reach 5 to 10 percent by 2015, corresponding to premium revenues of \$700 million.⁷⁹ The Spanish insurer Mapfre is conducting pilot tests with 10,000 drivers. Approximately 20 percent of new customers of the French insurer AGF elect the PAYD option, with 250,000 such policies in force.⁸⁰

Considering the dependence of most Americans on personal automobiles and the high proportion of U.S. greenhouse emissions originating from vehicles, it is unfortunate that American insurers lag behind their European peers in offering PAYD products.

Assigning Directors & Officers Liability

In 2007, the three leading insurance trade journals devoted cover stories to the looming implications of climate change for insurance liability claims.⁸¹ The *Wall Street Journal* echoed the concern.⁸² Insurers providing Directors and Officers policies may face claims against their customers from shareholders. Conversely, insurers themselves could be found liable for not disclosing climate risks—both from their insurance business and their investments—to their shareholders.

The world's largest insurance broker, Marsh, has articulated the following questions with respect to assessing climate change and D&O risk.⁸³

- Management accountability/responsibility: Does a company allocate responsibility for the management of climate-related risks? If so, how?
- Corporate governance: Is there a committee of independent board members addressing the issues?
- Emissions management and reporting: What progress, if any, has a company made in quantifying, disclosing, and/or reporting its emissions profile?
- Regulatory anticipation: How well has a company planned for future regulatory

scenarios?

These emerging D&O risks can be managed. In collaboration with Yale University and Ceres, Marsh launched a program in September 2007—the Sustainable Governance Forum on Climate Risk—to educate corporate board members about the potential liabilities and strategic business opportunities global climate change can create for companies.⁸⁴

Swiss Re provides an interesting case study in identifying risk factors relating to climate change.⁸⁵ Late in 2002, Swiss Re acknowledged that climate change risks were among the many criteria it used to evaluate its exposures under corporate D&O policies. These exposures can include regulatory risks and the costs of compliance, non-disclosure of investment risks, and reputation risk. Swiss Re recognized that shareholder actions could precipitate D&O liability losses. As a first step toward assessing these risks, Swiss Re reviews responses of potentially exposed companies to the Carbon Disclosure Project (CDP). For customers not responding to the CDP, or if Swiss Re concludes that there is insufficient disclosure on potential carbon risks, customers are requested to respond to a questionnaire covering the following:

- Countries/jurisdictions of company operations;
- Accounting/reporting system in place for greenhouse gas emissions;
- Gases which are accounted for in the greenhouse gas reporting system identified;
- Outline of company intentions to address potential liabilities from emissions reduction related regulation (e.g., the Kyoto Protocol or the European Union Emissions Trading scheme);
- If available, report of data: (1) Gross greenhouse gas (GHG) emissions; (2) GHGs/\$ gross revenues; (3) GHGs/\$ EBITDA; (4) GHGs/\$ current assets; (5) GHGs/\$ long-term debt; and (6) GHGs/\$ outstanding market cap.

The positive effect of this activity is to stimulate the policyholders to focus on their climate-related exposures. This awareness-building itself is an important first step towards managing the risks. However, Swiss Re has yet to actually decline a policy or apply exclusions based on climate risks alone.

Recognizing and Rewarding Correlations Between Sustainable Practices and a Low Risk Profile

Some insurers perceive a “halo effect”⁸⁶ in which adopters of climate-change mitigation technologies are viewed as low-risk customers. This acknowledges an overlap between behaviors that are risk-averse with those that are environmentally responsive. In its 2006 Carbon Disclosure Project filing, AXA states that “‘Green’ customers tend to present better risk profiles, which can be translated into lower rates.”

Auto insurers have been key players in this area, with a number of companies offering discounts that are not mileage-dependent. For example, Sompo Japan Insurance has provided a 1.5-percent premium credit for low-emission and fuel-efficient vehicles, reaching 3.25 million policyholders since 2005, and Tokio Marine & Nichido reached 6.23 million customers (48-percent market penetration) as of 2006. Farmers Insurance introduced a 5-

percent premium credit in California in 2005,⁸⁷ expanding it to most remaining states in 2006. In 2006, Travelers – the original U.S. auto insurer – announced 10-percent premium credits for drivers of hybrid vehicles, citing the “preferred” characteristics of these drivers as well as a desire within the company to develop business associated with this “innovative” trend in technology and to play a part in accelerating the transition to more efficient vehicles.⁸⁸ AXA is offering discounts in France, Canada, Thailand, and Ireland.⁸⁹ Fortis provides a 10- percent discount.

There are technological reasons to expect a positive correlation between efficiency and a lower risk profile. For example, the emerging practice of “building commissioning” to ensure the expected performance of energy efficiency features has also been found to help detect and remedy risk-related issues such as indoor air quality problems or equipment breakdown risks.⁹⁰ The largest U.S. professional liability insurer for architects and engineers—DPIC—has offered a 10-percent premium credit for its customers that receive training in commissioning.

A new commercial insurance provider called GREEN is being formed, with membership available exclusively to companies with strong sustainability programs.⁹¹ It expects to screen applicants against the following sustainability criteria:

- Purchase or generate energy from renewable sources;
- Implement energy efficiency best practices;
- Set targets for reducing environmental impacts;
- Occupy LEED[®] certified buildings;
- Develop clean technologies and environmentally-friendly products;
- Provide services or products that support healthy lifestyles; and/or
- Participate in environmental community outreach programs.

The company anticipates being able to obtain lower insurance premiums for qualified companies for workers' compensation, general liability, and automobile liability insurance.

Crafting Innovative Insurance Products

“Climate changes could change the profile of risks that we are paid to assume, including weather-related property damage and other natural disaster-related property and casualty losses ... Potential opportunities for us could be the development of new risk management products for clients concerned about climate-related risks to their businesses.”

-Travelers Insurance Company (2005)⁹²

In order to avoid the worst physical impacts of climate change, the world will need to dramatically transform the way it produces and consumes energy. Insurers have an enormous opportunity to develop new profit

centers by providing innovative insurance products (or adding terms to existing policies) for energy users or providers of clean energy services. Insurers can also tap their core competencies to offer new services to assess and mitigate climate risks. Such activities would naturally develop into new business lines in energy auditing, retrofit evaluation, installation and management, as well as a host of quality-assurance services (e.g. commissioning) that manage the performance risks of energy saving and carbon-offset projects. New products such as “micro-insurance” are being introduced for those in the developing world currently lacking access to insurance.

New Insurance Products for Energy Service Providers

Various specialist groups that provide energy-efficiency services often lack access to appropriate insurance coverage. In one example of filling this void, Lockton Risk Services⁹³ has developed a package of professional liability, general liability, and property coverage for professional home energy auditors (Figure 6).⁹⁴ Eligible providers must be members of RESNET, the leading national professional organization of building energy performance certifiers. Commissioning providers are another group for whom a “program insurance” package could be crafted.

Energy-Savings Insurance

Energy savings insurance is an innovative product in which policies protect the installer or owner of an energy efficiency project from under-achievement of predicted energy savings. Recent studies have emphasized the importance of energy efficiency, concluding that any attempt to significantly lower global GHG emissions will need to derive half or more of its reductions from greater efficiency and conservation. Given this vast potential, and the nascent state of the ESI market, this is an area where increased insurer activity could have a major impact.

A prior study identified 12 past and present providers, and a potential \$1 billion market in the U.S. alone.⁹⁵ There are some market drivers for ESI. For example, some state statutes⁹⁶ require a contractor to obtain a performance and payment bond relating to the installation of energy efficiency measures in an amount equal to the predicted savings.⁹⁷ The Canadian government requires ESI or performance bonds to guaranty the energy savings on all energy saving projects conducted in government facilities.⁹⁸



Figure 6. Lockton Risk Services insurance program for home energy performance professionals.

Renewable Energy Project Insurance

The global market for renewable energy is projected to grow from \$55 billion in 2006 to over \$225 billion in 2016.⁹⁹

A recent survey found that many insurers offered at least one of eight forms of insurance for renewable energy projects, but many barriers were also noted.¹⁰⁰ AXA has built up a comprehensive insurance offering for wind farms, which generated \$14 million in premium revenues in 2006.¹⁰¹ Munich Re has successfully piloted exploration-risk insurance for geothermal energy companies (Figure 7).¹⁰² Growth in availability of such insurance is contingent on improved technical expertise within the insurance industry, processes for commissioning installations (to catch and correct problems at project startup), improved actuarial and performance data, and bundling of small scale projects and packaging of risks to achieve economies of scale, risk diversification and underwriting profit.

New products are emerging to manage performance risk for renewable energy systems. One example is wind power derivatives, in which payments are made to the producer if revenues fall below a pre-determined level, and, conversely, payments made to the derivative provider if performance exceeds expectations.¹⁰³

London-based Willis Holdings¹⁰⁴ and Tokio Marine & Nichido offer such products. Sampo Japan Insurance offers renewable-production insurance derivatives for both wind and solar-electric systems. Emblematic of the expansion of traditional energy insurers into alternatives is Navigators Group's new focus on wind energy. The company's Offshore Wind Turbine segment will include insurance for project cargo, contractor's all risks, start-up delays, operational material damage, business interruption and third party liability.¹⁰⁵

By increasing certainty around revenue, such products can make it easier for renewable energy projects to attract investment and financing. Renewable energy projects are, of course, also susceptible to conventional risks, e.g. equipment breakdown, business interruptions, or losses from natural hazards. In some cases with relatively high risks (e.g., offshore wind) insurance availability will be very limited, and in other cases the emerging nature of the technologies will correspond to higher perceived risk.¹⁰⁶ In 2007, Aon created a new agri-fuels group to offer risk-management services for the emerging biofuels industry.¹⁰⁷



Figure 7. Unterhaching site in Germany where geothermal energy exploration risk insurance is being pilot-tested.

Green-Buildings Insurance

With the rise in popularity of “green building” practices (residential green building alone is expected to be a \$40 billion to \$50 billion market by 2010), insurers have begun to consider new products for this arena. Many risk-management benefits have been associated

with green buildings,¹⁰⁸ ranging from improved indoor air quality to enhanced disaster resilience, and there are numerous ways in which insurers could capture these benefits.¹⁰⁹ An oft-cited case study of the loss-prevention benefits of green buildings (in this case reduced risk of business interruption) is the Harmony Resort on the island of St. John, which weathered hurricanes Marilyn, Bertha, Georges, and Lenny with no loss of (solar) power or (solar) hot water, while operations on other facilities on the islands were disrupted for weeks or months.¹¹⁰

In 2003 Sampo Japan Insurance—a \$10-billion company—introduced commercial insurance coverage for the incremental costs of green measures (recycled materials, energy efficient products, green roofs) following loss.¹¹¹ Certain Travelers boiler and machinery policies contain a provision that provides for up to 25 percent of the incremental costs of newer generation replacement equipment, including that which is more efficient and environmentally friendly.¹¹² Lloyds TSB offers similar coverage for renewable-energy equipment in buildings.

Fireman's Fund introduced several new "GreenGuard" insurance coverages for non-residential customers in 2006, becoming the first U.S. insurer to do so (Figure 8). Now approved in all 50 states, the policy is aimed at customers who have built green from the ground up (5-percent premium credit), have made green renovations to existing buildings, or want to rebuild green after a loss. The rationale is that buildings with these features are less susceptible to future losses. GreenGuard has been successful in the marketplace and has helped to authenticate the importance of green building in the real estate and commercial construction industries, as well as helped elevate the discourse surrounding the emerging field of green financial services. The Green Upgrade form, which gives building owners the advantage of rebuilding and replacing with green alternatives for buildings that are looking to go green, has been the most popular form of coverage. The coverage has been expanded to include Builders Risk, which covers the additional time and cost taken after a loss has occurred to maintain green certification, also known as "soft costs" or delays in construction process. Fireman's Fund is integrating and expanding green coverage into more commercial lines. Some of the commercial products that currently include green coverage options are: Senior Living, Historical Properties, and Durable Goods. In addition, Fireman's Fund Commercial business is working with its Personal Lines unit to develop a green product for homeowners. Meanwhile, the company is "walking the talk" by greening five floors it just occupied in Dallas, including construction material recycling, reclaimed and sustainably grown wood, and water efficiency.



Figure 8. Fireman's Fund green coverages, introduced in 2006.

A member company of American Insurance Group is introducing the first known green-buildings insurance product for residential customers, as well as the latest example of special coverages for green non-residential buildings (Box B).

BOX B

Lexington Insurance Company Offers New Green-Buildings Products for Residential and Commercial Properties

Lexington Insurance Company, a member of American International Group, Inc. is launching Upgrade to GreenSM, two new green-buildings programs in 2007, to be deployed as endorsements to standard homeowners and commercial property insurance policies. The endorsements allow residential or commercial properties to be rebuilt to higher green standards following a partial or complete loss.

Upgrade to GreenSM Residential

In the event of a partial loss, paid claims will cover certain products and materials identified as having "ENERGY STAR" or equivalent levels of energy efficiency. Specifically covered will be repairs or replacements of damaged or destroyed lighting systems, heating and cooling equipment, windows, insulation, appliances, home electronics, and electronic office equipment. Claims adjustment can also include indoor plumbing for improved water efficiency, low VOC paints and adhesives, rapidly renewable interior wood products, sustainably produced framing materials, and floor covering with recycled content. In the event of a covered total loss, the policy will pay to rebuild to the requirements specified in the applicable Energy Star Builders Option Package, and for a contractor participating in the *Home Performance with ENERGY STAR* program to rebuild; it will also pay for a RESNET¹¹³ certified home energy rater to verify compliance with ENERGY STAR, and to verify operation and optimization of the heating, ventilating, and air conditioning equipment.

Upgrade to GreenSM is the first of its kind green homeowner property insurance policy offered in the United States.

Upgrade to GreenSM Commercial

In the event of a covered loss, the commercial program allows an insured that is not currently LEED[®] certified to rebuild using LEED[®] Silver criteria.¹¹⁴ It also allows an insured that is currently LEED[®] certified to rebuild to higher level of LEED[®] certification if such a level is available. Moreover, additional coverage is provided for: recycling materials, as opposed to disposing of the materials in a landfill; flushing out reconstructed space upon construction completion; hiring a LEED[®] accredited architect or engineer to participate in the design or reconstruction of the damaged portion of the building; and, hiring a Professional Engineer to commission or re-commission systems. If the building is already LEED[®] certified, the coverage will also pay registration and certification fees charged by the United States Green Building Council (USGBC) incurred if the building needs to be recertified.

One of the Lloyds of London syndicates offers a "Naturesave" product from which 10 percent of homeowner, personal accident, and travel insurance premiums are redirected towards energy and environmental projects. Its commercial property policy emphasizes the compatibility of sustainable development and risk management, with 10 percent of premiums being donated to environmental projects and environmental performance surveys and financial assistance in reducing carbon emissions offered to policyholders.¹¹⁵

Coping with the challenging issue of mold and moisture, which is expected to worsen under climate change, is also related to the buildings arena. Insurers have traditionally refused to insure mold risks, but some are recognizing that this risk is insurable if appropriate risk-management measures are taken (many of which also enhance energy efficiency).¹¹⁶ By making a previously uninsurable risk insurable, insurers open a large new market for themselves while also benefiting consumers.

Insurance for the Developing World

Most of the world's population cannot afford insurance. Compounding the problem, residents of the developing world are also often the most vulnerable to the impacts of climate change. Yet, growth of insurance in these “emerging markets” is the future of the industry, which has otherwise reached relative market saturation in the industrialized countries. In one example of new directions, the International Association of Insurance Supervisors is encouraging insurers to develop micro-insurance products.¹¹⁷

Insurers are beginning to explore these opportunities, finding ways to grow their business while helping to manage and spread the risks associated with climate change.¹¹⁸ Notably, the Munich Climate Insurance Initiative (led by Munich Re) is identifying insurance-related climate change solutions such as micro-insurance and conducting pilot projects and education within the industry (Figure 9). A number of individual insurers and reinsurers are offering micro-insurance products, among them Eureko Re (Netherlands), Pakisama Mutual Benefit Association (Philippines) AIG-Uganda (Uganda), and Trinity Life Assurance Company (Tanzania).^{119,120} Swiss Re created one such project in 2007—which it calls the Climate Change Adaptation Program—that utilizes model results and satellite data to determine when up to \$2 million in weather-derivative claims are to be paid in response to severe drought conditions causing food shortages in selected villages in Kenya, Mali, and Ethiopia representing 400,000 inhabitants.¹²¹ Swiss Re's earlier weather-risk products had been sold to 320,000 small farmers in India.



Figure 9. Munich Climate Insurance Initiative publication.

Initiated in 1993, CDMP was a project of the U.S. Agency for International Development, implemented in several countries by the Organization of American States, to promote sustainable public/private disaster mitigation mechanisms that lessen loss of life, reduce potential damage, and shorten disaster-recovery periods. Project activities included support for national insurance associations in organizing technical conferences, disseminating hazard and risk information, and producing hazard and risk maps and information to promote safer location of development.¹²² Beginning in 1998, Barbados-based United Insurance began a

program in which homeowners and businesses can qualify for significant reductions in insurance premiums if they retrofit homes and buildings to better withstand hurricane wind forces. The project operated in Dominica, Saint Lucia, Saint Kitts/Nevis, Antigua, and Barbuda and trained 145 homebuilders.¹²³ In the Antigua-Barbuda Pilot Project, 100 homeowners and three of the country's major insurers participated. In the Hurricane Resistant Home Improvement program, a U.S. non-governmental organization strengthened the capacity of local builders to offer disaster-resilient homes using home improvement loans from local banks. In St. Lucia, a group insurance policy was obtained for participants. Possibilities for leveraging efforts to date include incorporating village-scale measures with joint adaptation/mitigation qualities.

Offering Carbon Risk-Management and Carbon-Reduction Services

Providing structured insurance and financial products for [carbon trading] risk is significant because it validates the market-based approach to reducing greenhouse gas emissions and in tackling climate change.

- Swiss Re¹²⁴

Climate change has become a risk to be managed, and insurers and brokers are well positioned to develop and offer such expertise. Most of the regulatory frameworks (such as the Kyoto Protocol) that have been proposed for managing greenhouse gas emissions on a global, national, or regional level rely on a "cap-and-trade" system that allows emissions to be reduced in the most cost-effective manner. Insurers have the potential to spur the burgeoning market for carbon trading while securing additional business for themselves by providing mechanisms for participants to better manage risk. Combined expertise in risk analysis and finance makes insurers natural participants in the emerging markets for carbon offsets and trading. Some companies are also bundling carbon offsets with their products, particularly automobile and travel insurance. Insurers can also be involved in providing property and liability insurance for carbon-reduction capital projects, as well as consultative services in designing and managing such projects so as to maximize their technical and financial upside. A growing number of insurers are moving into these business areas, and the opportunity will be large as increasingly aggressive carbon regulation is adopted around the world.

Climate Risk Management Services

A variety of business and performance risks are associated with projects designed to achieve reductions in carbon emissions. In a recent study Marsh, the world's largest broker,

drew upon its core competencies in insurance and risk management to develop a roadmap of sorts to help businesses assess their climate vulnerabilities and opportunities. This document, *Risk Alert – Climate Change: Business Risks and Solutions*, exemplifies the natural “fit” between the insurance industry and climate change solutions. This is particularly relevant for brokers like Marsh, which function as risk advisors to their corporate clients. The impact of such advice can be considerable. Marsh’s client base, for instance, includes 75 percent of the Fortune 500 companies. Marsh described the potential opportunities in its submission to the Carbon Disclosure Project in 2007:

- Business risk assessments and economic evaluations of physical, competitive, compliance, litigation and strategic risks;
- Business continuity planning;
- Climate risk strategy development, including asset allocation in view of climate risk and an understanding of climate risk adjusted costs of capital;
- Directors’ and officers’ liability analysis in view of evolving science, legal, and disclosure standards;
- Arrangement of insurance related to renewable energy risks;
- Strategic consulting relating to greenhouse gas emissions trading;
- Due diligence regarding new emissions reduction projects and developing “wrap-around” insurance products designed to facilitate emissions trading;
- Understanding the impact upon brand value of climate actions and developing strategies to enhance brand value from climate positioning;
- Assistance to pension funds and their boards regarding responsible investing;
- Assistance regarding increasing calls for enhanced climate risk disclosure and shareholder activism.

HSB Solomon Associates, an AIG company, offers an integrated set of engineering, benchmarking, project development, and risk-management services for developing and executing energy- and emissions-reduction projects, particularly in industrial facilities.¹²⁵ While not yet attempted, the creation of “super audits,” combining risk- and energy-management inspections and using tools such as infrared cameras, pressure testing and indoor-air-quality measurements, could prove to be a powerful and cost-effective way of bundling services that simultaneously improve energy efficiency and disaster resilience.

Sompo Japan Insurance offers business continuity management services to its commercial customers, with emphasis on recovery and continued operations following large-scale disasters.

Carbon Trading

Many risks are associated with carbon trading, and new insurance products and services are being developed to manage them. Under the European Union Emissions Trading System, over 6,000 companies face mandatory emissions-reduction targets and stringent penalties

for non-compliance. Signatories to the Kyoto Protocol (all industrial countries with the exception of Australia and the U.S.) also have obligatory emission reduction targets. Even companies in the U.S. are voluntarily reducing their emissions to—and even beyond—Kyoto levels, responding to local initiatives (e.g. a voluntary commitment championed by 200-plus mayors) or otherwise seeking to get a head start in working towards increasingly likely mandatory targets.

In an early example of insurer involvement in emerging carbon markets, Aon established a Climate Change Solutions group that helps customers develop carbon risk-management strategies for participating in emissions trading markets. Aon was retained by the BG Group, a global energy company, to assess the effect of climate change on both its assets and operations. Aon helped BG understand the European Union's carbon trading system and potential business opportunities arising from the use of natural gas to reduce emissions.¹²⁶

AIG, through its Solomon subsidiary, is actively marketing to clients a program to identify efficiency improvements that translate directly into carbon reductions, supporting the registration process for CDM and JI projects, exploring funding and assisting with the sale of carbon credits.¹²⁷

Managing Risk for Clean Development Mechanism (CDM) and Carbon-Offset Projects

The value proposition for carbon credit insurance is quite real. For instance, the Regional Greenhouse Gas Initiative (an agreement by a group of states in the northeastern US to jointly cap power plant GHG emissions) requires a 10-percent “discount rate” on any offsets obtained from carbon-sequestration projects due to uncertainties with that technology. However, this penalty is waived if the performance of those projects is insured.¹²⁸

RNK Capital LLC and Swiss Re claim to have jointly implemented the carbon markets' first insurance product for managing Kyoto Protocol-related risk in carbon credit transactions.¹²⁹ The insurance provides coverage for risks related to Clean Development Mechanism (CDM) project registration and the issuance of Certified Emission Reductions (CERs) to RNK under the Kyoto Protocol. These risks include failure or delay in the approval, certification and/or issuance of CERs from CDM projects by the United Nations Framework Convention on Climate Change (UNFCCC). RNK states that the availability of this insurance removes a key barrier to its ability to maximize investment in this area.

Munich Re offers a “Kyoto Multi Risk Cover” that compensates entities that invest in CDM and JI (Joint Implementation) projects if losses arise from failure to deliver the agreed number of emission rights.¹³⁰

AIG Financial Products Corp. participated as credit support provider in a large transaction under the World Bank's Umbrella Carbon Facility involving the purchase of Certified Emissions Reductions (CERs) from two Chinese manufacturing companies by a consortium of companies from developed countries.¹³¹

Enabling Customers to Purchase Carbon Offsets

Australia's NRMA Insurance Climate Help Program enables customers to calculate the carbon dioxide emissions from their vehicles, and provides options for customers to buy carbon credits to offset those emissions.¹³² Another initiative brings together a set of insurers who, for every vehicle or travel policy bought through online broker Climatesure, contribute a percentage of the premium to the company Climate Care, which operates carbon-offsetting projects and provides a 100-percent offset for the customer's travel.¹³³ Among the insurers offering policies through Climatesure are Axa, Norwich Union, Groupama Insurances, and Premier Underwriting; premiums are lower for fuel-efficient cars.¹³⁴ Allianz is also offering certified carbon offsets for drivers—with a sticker for qualifying cars (Figure 10)—and plans to augment this with some sort of premium incentive.¹³⁵ Royal & Sun Alliance's "More Than" automobile insurance provides a 15-percent discount for qualifying vehicles, including 100-percent offset for the first 3000 miles driven each year, with an option to the customer to purchase offsets for the remaining amount.¹³⁶ Similarly, Cooperative Insurance's *Ecoinsurance* product automatically offsets 20 percent of emissions for buyers of its automobile insurance (Figure 11).¹³⁷



Figure 10. Allianz label for automobile carbon-dioxide emission offsets.

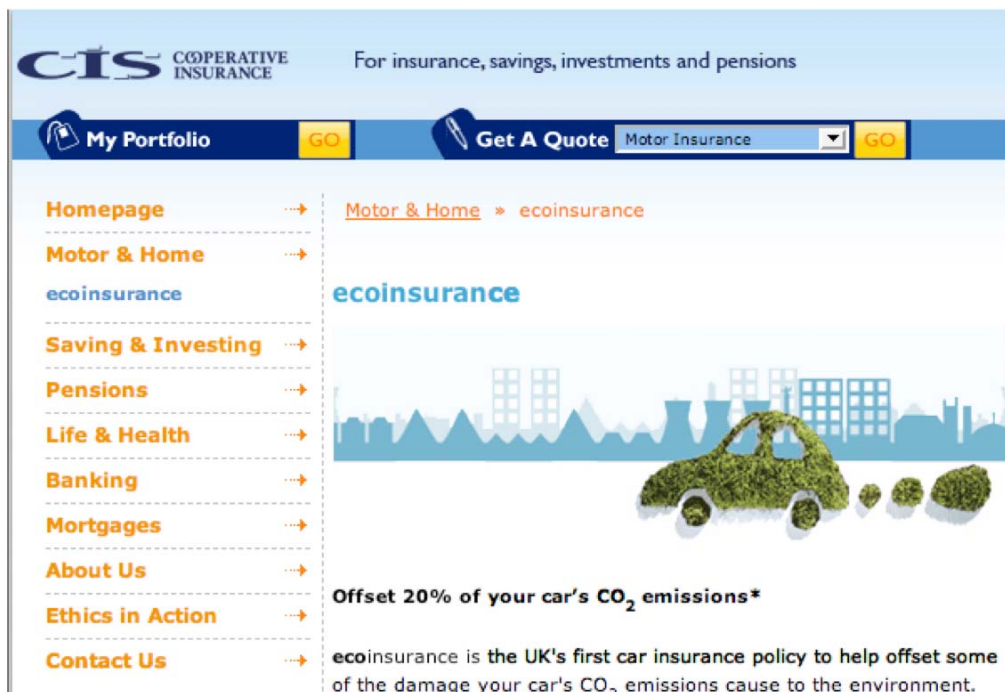


Figure 11. Example of the many new insurance products that couple carbon offsets with automobile insurance.

Financing Climate-Protection Improvements

“By addressing [socio-economic] risks ING lowers the credit risk of its own portfolio and helps clients design more socially and environmentally responsible projects.”

- ING

Insurers, especially those associated with banking operations, are in a position to engage in financing customer-side projects that either improve resilience to the impacts of climate change or contribute to reducing emissions.

Preferential Lending Terms

We have seen few examples of this practice, one of which is Fortis' preferential mortgage rate (5.5 percent) for energy-efficient appliance and home upgrades. Launched in 2006, about 20-percent of home-renovation loans made by the company are of this type. The company also offers “Clean Car Credit”, i.e. financing for low-emission vehicles. This can be coupled with the company's 10-percent credit for such vehicles, for an added incentive.¹³⁸ KBC Group (Belgium) offers preferential financing through its “Green Energy Loan” for homeowners borrowing to make energy-efficient improvements.

Targeted Lending

Fortis' “Green Bank” provides commercial financing for environmental projects, with a volume of \$106 million as of the end of 2006. HSBC – another bank with insurance operations – has become active in financing renewable projects, e.g. \$45 million for wind in India. ING car leasing (which operates 300,000 cars across Europe) offers its customers in the Netherlands fuel-efficient options (selected by 70 percent of customers) and a carbon-neutral option, and its Green Finance unit issues loans to microfinance institutions. In India, ING Vysya's local offices in rural areas issue microcredit and savings products to individuals and ING Vysya provides wholesale credit to microfinance institutions in India.¹³⁹

Investment in Climate Change Solutions

“Climate change may impact the performance of investment portfolios, increasing market volatility and affecting the value of companies whose products or operations are perceived as particularly vulnerable to climate change consequences.”

- Zurich Financial Services

Response to Carbon Disclosure Project Survey(2007)

Insurers are among the most significant players in financial markets, with \$16.6 trillion in financial assets as of 2005. Like other large investors, insurers are beginning to realize that climate change presents significant risks and opportunities. We have logged a total of \$6 billion in green investment from 10 of the leading companies (total investment is not known), as well as significant examples of “green” real-estate asset management.

Sustainable Asset Management

Tremendous concern has been expressed about the potential for “correlated risks” from climate change that simultaneously increase an insurer’s underwriting losses while also negatively impacting the invested assets that the insurer uses to pay off those claims. While adverse impacts on investments may be temporary in some cases, considerable liquidity problems could nonetheless arise.

Climate change also brings huge new opportunities for investors. Legendary venture capitalist John Doerr has called clean technology “the largest economic opportunity of the 21st century.” Climate change has significant implications for the investment strategies pursued by insurers, which in turn has significant implications for insurers’ long-term financial health and solvency. As a result, the National Association of Insurance Commissioners is examining the issue of insurers’ invested assets as part of its executive task force on climate change.

Insurers have made direct investments in energy-efficiency, renewable energy, and forestry projects. The largest U.S. insurer, AIG, has committed to allocating equity investments to “projects, technologies or other assets that contribute to greenhouse gas (GHG) emission mitigation,” forming an Investments Sustainability Initiative to coordinate its efforts internally in recognition that environmental, social, and governance issues can be material to the creation and protection of shareholder value. In 2007 AIG’s Global Investment Group joined the Investor Network on Climate Risk (INCR), a network of institutional investors and financial institutions focused on the financial risks and investment opportunities posed by climate change. With its \$700 billion under management, AIG is the sixth largest member of the \$4 trillion group.¹⁴⁰ The company already has hundreds of millions of dollars invested in renewable energy projects. Since 1996, Swiss Re has built up a portfolio of direct investments (i.e. project finance and venture funding), focusing on alternative energy, water and waste management, and recycling. This portfolio was valued at 376 million CHF (US\$320 million) as of 2006.¹⁴¹ The German insurer Allianz has stated that it will invest between \$350 and \$600 million in renewable energy sources by the year 2010,¹⁴² and among its early projects are the ownership and operation of three wind farms in Germany and development of another in Italy.¹⁴³

Insurers have also initiated or participated in funds with a green and climate-friendly focus. Among the first insurers to establish traded environmentally oriented funds, based on screens applied to existing securities, were Storebrand (the Storebrand-Scudder Environmental Value Fund c. 1997, now called the Storebrand Principle Global Fund¹⁴⁴) and Sompo (Sompo Japan Green Open) in 1999, which, with \$100 million invested, has

outperformed the Tokyo Stock Price Index by nearly 10 percent since its inception. Sampo introduced a second fund (Sampo Japan SRI Open) in 2005.

Gerling, a UK-based insurer, founded the Gerling Sustainable Development Project, through which it operates a \$100 million initiative that includes venture capital for new technologies to help address climate change risks.¹⁴⁵ Gerling also operates the “Gerling Select 21” fund,¹⁴⁶ AGF (the French subsidiary of Allianz) has invested some 10 million euros in the European Carbon Fund and plans to increase its investments in renewable energy by 300 to 500 million euros over a five-year period.¹⁴⁷

AIG’s Global Investment Group is evaluating the development of new investment products that include climate change and GHG related criteria. Together with JF Asset Management, AIA Pension and Trustee Co Ltd, a member of AIG, launched the first Green Fund in the Hong Kong Mandatory Provident Fund Market to invest in environmentally friendly companies. With AIG Global Marine and Energy, AIG Investments has established a \$300 million lending facility to support energy efficiency and clean energy projects worldwide. The facility is backed by loan guarantees from the Overseas Private Investment Corporation (OPIC) and will be available to support energy efficiency and performance upgrades to refineries, petrochemical plants, pipelines and power generation plants, as well as renewable and alternative energy projects.¹⁴⁸

In April 2007, Swiss Re announced the close of the EUR 329 million (US\$429 million) European Clean Energy Fund, one of the largest funds of its type in Europe. The Fund, a UN accredited investment vehicle, provides capital to European clean energy projects which are environmentally beneficial and generates carbon credits or tradable renewable energy certificates. Swiss Re is the anchor investor in the Fund and acts as carbon advisor for the selected projects. In 2006, Swiss Re became an active trader in the global OTC and exchange-based carbon markets.¹⁴⁹

Some companies have established explicit targets, notably Munich Re’s requirement that at least 80 percent of investments in equities and bonds have to meet sustainability criteria.¹⁵⁰

Green Buildings Development

In another example, Swiss Re developed a distinctive green building at 30 St. Mary Axe, in London commonly known by its nickname “The Gherkin” (Figure 12). The building features energy-efficiency, daylighting, and natural ventilation. The building is said to use half as much energy as its peers.¹⁵¹

In another example, AIG is increasingly developing and acquiring buildings that meet the U.S. Green Building Council’s Leadership in Energy and Environmental Design (LEED®) standards, or local standards that emphasize sustainable energy. AIG’s Global Real Estate team includes a LEED®-certified architect. The company cites increased asset value in addition to the environmental benefits of green construction. In addition to its interest in green building, it puts special emphasis on



Figure 12. “The Gherkin”, an energy-efficient building designed and occupied by Swiss Re.

reclamation and redevelopment of brownfield sites, as exemplified by its role in the Atlantic Station development (Figure 13), for which there is 8.5 million square feet of existing and future development registered with the LEED® program.¹⁵²

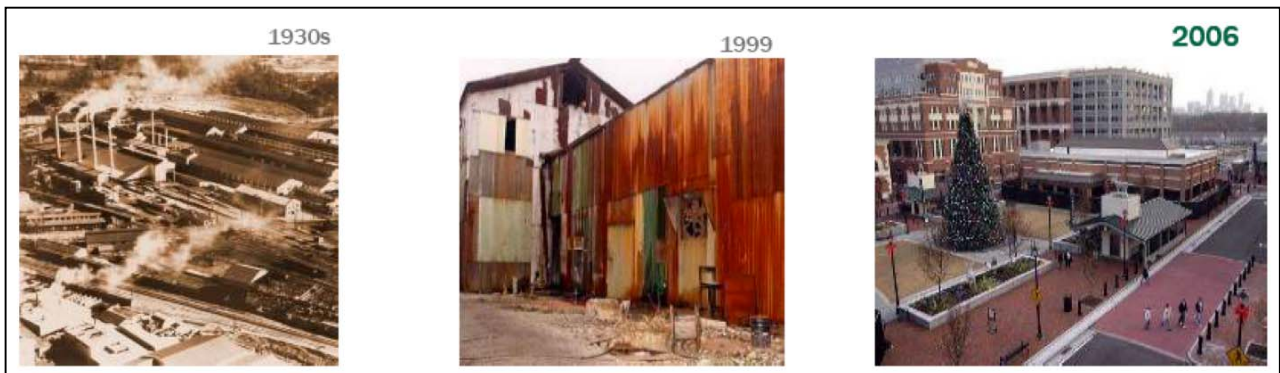


Figure 13. AIG Atlantic Station brownfields redevelopment project. Winner of EPA and Sierra Club awards, as well as registered for 8.5 million square feet of LEED-rated buildings.

Building Awareness and Participating in the Formulation of Public Policy

“The issue of climate change is real, and we believe a domestic regulatory response is both necessary and inevitable. With this perspective in mind, we believe that we are better off as a company, and industry, if we develop and implement an effective moderate response now. If we wait 5-10 years, we may discover the need for a much more drastic and difficult response.”

- Chris Walker, Swiss Re

Testimony before the U.S. Senate Committee on Commerce,
Science and Transportation¹⁵³

Insurers regularly engage in public policy discussions, whether concerning terrorism, public health, or natural hazards. It is in the business interest of insurers to support policy that reduces risk and makes risks more predictable. As a result, many insurers have begun to extend their self-assigned mandate to include the issue of climate change and energy policy, and are interjecting their views into the national and international discussion. For example, 38 insurers and insurance organizations from around the world have joined in the *ClimateWise* program to promote a policy and market agenda for proactive responses to climate change risks. AIG and Marsh joined companies like ConocoPhillips and Duke Energy in

the US Climate Action Partnership, which calls on the U.S. to establish mandatory targets to reduce GHG emissions 60 to 80 percent over several decades. Insurers can also utilize their existing relationships with customers to instill loss-prevention behavior.

Information and Education

If a survey conducted in Canada is any indication, insurance customers do not feel that their insurers do enough to help them understand and prepare for natural disasters.¹⁵⁴ Opportunities clearly exist to do better.

Insurers have engaged in various direct consumer education activities relevant to the question of climate change. This is exemplified by an energy-efficiency guidebook prepared by USAA Insurance Company for its customers. Several Massachusetts insurers gave 10-percent premium credits to homeowners taking a six-hour course on topics such as energy weatherization, home repair, and lead-paint hazards.¹⁵⁵ Insurance Australia Group (IAG), in partnership with the *Australian Financial Review* newspaper, has developed education materials on climate change for the high-school curriculum.^{156,157} In addition, IAG already offers an interactive web-based consumer education tool.¹⁵⁸ Esurance has extensive consumer information on its website, and offers a carbon calculator.¹⁵⁹ Fortis offers a user-friendly carbon footprint calculator.¹⁶⁰

In a concrete integration of the strategies discussed in this report, the Institute for Business and Home Safety (IBHS) has laid out a program to foster new home construction that surpasses the minimum performance practices embodied in building codes. According to IBHS, its “Fortified ... for safer living” home is:

- Energy efficient, using 1/3 to 1/2 less energy,
- Healthier, ensuring excellent indoor air quality,
- Stronger/Safer, paying attention to construction details like connections and using disaster-resistant materials, and
- Environmentally friendly, preventing the release of greenhouse gases and using long-lasting or recycled materials.

One “Fortified...” home built in New Jersey¹⁶¹ is said to use 80 percent less energy, while being considerably more disaster-resistant. Several insurers are offering premium discounts for homes that follow the guidelines: South Carolina Farm Bureau Mutual Insurance Company (5 percent), American National Property and Casualty Company (25 percent), AAA Chicago Motor Club, Mississippi Windstorm Underwriting Association (25 percent), Travelers of Florida, and the South Carolina Hail/Wind Pool (10 percent).¹⁶²

Some insurers and their trade organizations have also set out to educate their peers and various non-customer groups. Swiss Re has run full-page advertisements in industry trade journals for several years (Figure 14).

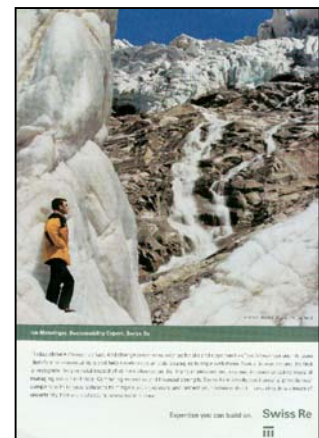


Figure 14. Advertisement from Swiss Re discussing climate change. Frequently published in insurance trade press.

Three US insurance trade organizations have developed publications or websites synthesizing industry-relevant information on climate change. These include the US-based American Insurance Association,¹⁶³ Insurance Information Institute,¹⁶⁴ and the National Association of Mutual Insurance Companies (NAMIC).¹⁶⁵ The UK's Association of British Insurers has, by far, been the most prolific insurance trade association on this topic.¹⁶⁶

In a recent high-profile example, 38 insurance companies and affiliated organizations from around the world joined together in 2007 to form the *ClimateWise* program (Figure 15).¹⁶⁷ Signatories pledge to “lead the way in analysing and reducing risks; support climate awareness amongst our customers; incorporate climate change into our investment strategies; inform and engage in public policy debate; and reduce the environmental impact of our businesses.” Notably, *ClimateWise* includes several U.S. insurers, including AIG, Navigators, and UNUM.



Figure 15. ClimateWise signatories. Additional signatories as of 17 Sept 2007: ACE, Amlin, ARK, Beazley, BIBA, Chaucer, Diagonal Underwriting, Equity Group, Hardy's Underwriting, Hiscox, Legal & General, Marketform, Navigators, NFU Mutual, Prudential, QBE European Operations, RJ Kiln, RMS, Standard Life, UNUM, and XL.

Participating in the Formulation of Public Policy

Perhaps the first appearance of insurers in the public policy discussion of climate change was at the Berlin Climate Summit in April 1995, at which Munich Re, Storebrand, Swiss Re, and Lloyd's of London took part. Shortly thereafter, the United Nations Environment Programme began convening dozens of insurers to discuss their industry's vulnerabilities to climate change and recommend constructive actions.¹⁶⁸ There were 36 members of the UNEP initiative as of Fall 2007, representing 15 countries (Figure 16). The group has directed its informational campaigns to international policymakers, as well as to peers throughout the financial services sector. The *ClimateWise* program (noted above) is a more recent initiative with overlapping objectives.

Insurers and allied companies have signed on to a variety of consensus statements and initiatives to move the climate change discussion forward. Notable among these are the Ceres-led Investor Climate Policy 'Call to Action' in March 2007, which included Allianz SE, and the United States Climate Action Partnership (USCAP), which includes AIG and Marsh as members alongside other household names such as General Electric, Conoco Phillips, and Ford Motor Company.¹⁶⁹ In addition to calling on the federal government to quickly enact strong national legislation to require significant reductions of greenhouse gas emissions, USCAP's six guiding principles are:

1. Account for the global dimensions of climate change;
2. Create incentives for technology innovation;
3. Be environmentally effective;
4. Create economic opportunity and advantage;
5. Be fair to sectors disproportionately impacted; and
6. Reward early action.

Achmea	Netherlands
Aioi Insurance Co., Ltd	Japan
Alcyone Finance	France
Alecta	Sweden
Allianz SE	Germany
American International Group (AIG)	USA
Aviva plc	UK
AXA - Group Management Services	France
Bangkok Insurance Public Company Ltd	Thailand
CarbonRe AG	Switzerland
Dexia	France
Folksam	Sweden
Groupama Asset Management	France
Helvetia Patria Versicherungen	Switzerland
HSBC Insurance Brokers	UK
Hyundai Marine and Fire Insurance Co. Ltd.	South Korea
Insurance Australia Group Limited	Australia
Interamerican Hellenic Life Insurance Company SA	Greece
KPA AB	Sweden
Lloyd's	UK
Manulife Financial Corporation	Canada
MAPFRE	Spain
Medibank Private Ltd.	Australia
Mitsui Sumitomo Insurance Co., Ltd.	Japan
Munich Reinsurance Company	Germany
Nipponkoa Insurance Co., Ltd.	Japan
Norwich Union	UK
OEKO Capital Lebensversicherung AG	Germany
Pool Español de Riesgos Medioambientales	Spain
QBE Insurance Group Ltd.	Australia
Sompo Japan Insurance Inc.	Japan
Storebrand	Norway
Swiss Reinsurance Company	Switzerland
The Co-operators Group Limited	Canada
Tokio Marine & Nichido Fire Insurance Co., Ltd.	Japan
XL Insurance	Switzerland

Figure 16. United Nations Finance Initiative: insurance signatories as of September 2007. See: <http://www.unepfi.org/>

The Global Roundtable on Climate Change issued a statement from corporate leaders around the world, calling for policy action on climate change. Insurer signatories included Allianz, ING Group, Marsh, Munich Re, and Swiss Re. Some insurers have also ventured individually into the realm of climate policy. Insurance Australia Group is involved in formal advocacy for climate change policies in Australia.¹⁷⁰ AIG states in the opening paragraphs of its corporate statement on climate change that it supports mandatory limits on GHG emissions.¹⁷¹

Endorsing Voluntary Energy-Saving Policies

The American Insurance Association (AIA) and Advocates for Highway and Auto Safety (whose members include most major auto insurance, health insurance, and public health and safety organizations) support telecommuting¹⁷² and increased funding for public transportation, which conserves energy and reduces greenhouse gas emissions.¹⁷³

Promoting Energy-Efficiency Codes and Standards

In early 2002, the Insurance Institute for Highway Safety became the first insurance organization to support the stalled Corporate Average Fuel Economy (CAFE) standards, citing new technologies to improve fuel economy without compromising safety through reduced vehicle weight.^{174,175} An article in *Scientific American*, observes that “the lower CAFE standard for trucks has fostered a proliferation of behemoth SUVs and pickups that cause thousands of deaths every year when they plow into cars,” and that cars could be made 40- to 50-percent more fuel-efficient without reducing vehicle size.¹⁷⁶ The American Insurance Association and Advocates for Highway and Auto Safety also support tightened federal controls on speed limits.

Leading by Example

“The Hartford sees opportunity in establishing itself as an employer and insurer of choice by demonstrating its commitment to responsible energy use and management and GHG [greenhouse-gas] reduction.”

- Company response to the Carbon Disclosure Project Survey (2007)

Leadership by example is one of the most potent means of effecting change. While insurers are not major emitters of greenhouse gases, the energy used by their vast real estate holdings is significant – probably valued at several billion dollars per year in the U.S. alone. U.S. life insurance companies are owners of 22 percent of all institutional real estate. A growing number of insurers have pledged to become carbon-neutral through various combinations of reducing energy intensity and the purchase of carbon offsets. Some insurers (e.g. Swiss Re, AIG, IAG) prepare annual sustainability progress reports.¹⁷⁷

In-House Energy/Carbon Management

Insurers appropriately point out that they are not a “heavy” industry when it comes to emissions. Yet the use of electricity in buildings (such as insurers’ offices) and business travel are major contributors, in aggregate, to global emissions. Carbon-intensity varies by a factor of seven among insurers: from 1.2 to 8.3 tonnes per employee per year for the 20 insurers reporting that information to the most recent Carbon Disclosure Project survey (Figure 17). Together, these companies emit 4 million tonnes of CO₂ emissions each year, across 1.3 million employees.

It is notable that the median emissions by insurers – about 3 tonnes of CO₂ per employee per year – is equivalent to the global average emissions per capita for transportation energy, and greater than that for housing.

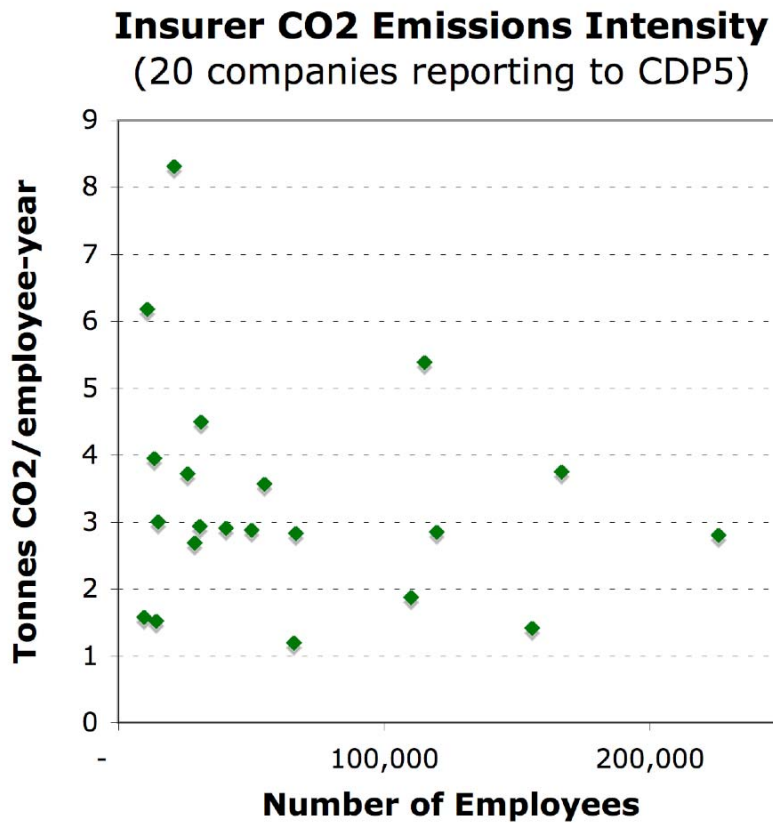


Figure 17. Range of carbon footprints for global insurers. Source: Carbon Disclosure Project company filings: 2007

Participation in voluntary programs such as ENERGY STAR, sponsored by the U.S. Environmental Protection Agency and the U.S. Department of Energy, or the Leadership in Energy and Environmental Design (LEED®) labeling program, can yield substantial reductions in energy and emissions – 50 percent or more in many cases. Hartford Steam Boiler (an AIG company) was the first insurer to receive the ENERGY STAR building performance label, and many insurers have followed suit, including some larger companies such as State Farm (Box C).

Box C.

State Farm's Efforts to Improve Energy Efficiency.

State Farm has taken aggressive steps to protect the environment by reducing its own GHG emissions. As a member of the Business Roundtable Climate RESOLVE Initiative since 2002, State Farm voluntarily reports its progress on managing GHG emissions. The Company has:

- Reduced its emissions per policy in force by 35 percent (far exceeding the Business Roundtable goal of an 18 percent reduction by 2012); Greatly improved the energy efficiency rating of its buildings (State Farm's buildings are more efficient than 73 percent of comparable buildings, compared with 49 percent in 1999)*
- Implemented an electronic claims system that significantly reduces the use of paper.*
- Adopted a companywide recycling program that includes thousands of computers per year*

In an effort to reduce gasoline consumption, State Farm has reduced the size of its fleet of motor vehicles, and has included in that fleet about 100 new hybrid vehicles, 3,000 flexible fuel vehicles and an increasing percentage of vehicles with four cylinder engines.

Source: State Farm News Release¹⁷⁸

Swiss Re offers incentives to employees who devise innovative energy-management strategies. Sompo Japan Insurance has operated an in-house energy management program since 1992 that now reaches 350 buildings throughout Japan. The company has given “corporate social responsibility training” to 15,000 employees and achieved a 22-percent reduction in carbon-dioxide emissions between 2002 and 2004.

Munich Re Group—with 50 locations and nearly 7,000 employees worldwide—has committed to becoming carbon-neutral by 2012¹⁷⁹ as have Insurance Australia Group¹⁸⁰ and Swiss Re. Folksam (Sweden)¹⁸¹ Reducing energy use is usually the keystone of in-house program to become carbon-neutral. Methods vary, with some simply purchasing offsets and others directly implementing carbon-reduction projects, as is the case with FP Marine which developed wind energy projects in India in order to offset its own emissions. Allstate has set a goal of reducing its greenhouse-gas intensity,¹⁸² and Lloyds TSB and Prudential Financial have set explicit goals of 30-percent reductions by the year 2012 and 5 percent by 2009, respectively.¹⁸³

Some companies have aggressively shifted to purchasing renewably generated electricity. HSBC is at 40 percent, Swiss Re at 32 percent, and ING at 17 percent. Tokio Marine & Nichido entered a 15-year contract to purchase 1 million kilowatt-hours per year of wind-generated electricity.¹⁸⁴

Aviva¹⁸⁵ and Royal & Sun Alliance¹⁸⁶ (UK) achieved carbon neutrality in 2006 by reducing their emissions by 50 percent (Figure 18) and purchasing offsets for the balance. Fortis (Belgium), HSBC (United Kingdom), and FP Marine (Hong Kong)¹⁸⁷ have already achieved carbon neutrality and Storebrand (Norway) plans to achieve the target by 2008. The U.S.-based broker Rutherford was the first to become 100-percent carbon-neutral in its operations by purchasing carbon offsets.¹⁸⁸

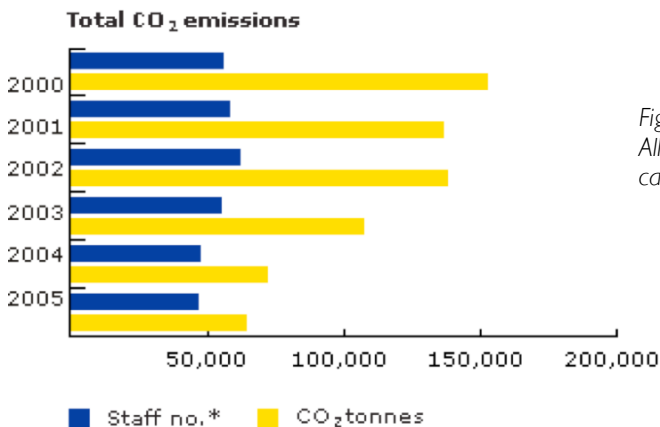


Figure 18. Royal & Sun Alliance's progress towards carbon reductions.

Sustainable Operations

Improving energy efficiency can lead to operational benefits beyond lower energy bills. In a carefully controlled research study, West Bend Mutual Insurance Company reported a 7-percent increase in productivity (numbers of files processed pertaining to applications, endorsements, renewals, and quotes) following implementation of a number of energy- and non-energy-related environment improvement measures.¹⁸⁹ In another example of operational efficiencies, American Modern Insurance Group has tested the use of grid-independent solar photovoltaic cells for powering its portable claims-handling offices, which are deployed in the field following natural disasters.¹⁹⁰ Esurance provides its claims personnel with hybrid vehicles.

A number of insurers have begun to publish annual "Corporate Sustainability" reports, including Allianz, Insurance Australia Group, Munich Re, Sompo Japan, Storebrand, Swiss Re, AIG, Tokio Marine and Nichido. Storebrand and Sompo were among the first, releasing their initial reports in 1998.¹⁹¹

Carbon Risk Disclosure

“Insurance companies should develop comprehensive climate change strategies, and disclose the actions they are taking. Disclosure is improving, but investors need better information about the materiality of the risks insurers face, as well as the impact insurance pricing and terms have on capital investment decisions across the wider economy.”

- F&C Investments, 2007¹⁹²

The process of assessing and disclosing climate risks contributes to insurers' ability to evaluate the impacts of climate change on their business, leading insurers to take steps to address the risks and opportunities that climate change presents. Meanwhile, disclosure enables consumers and investors to gauge whether to purchase a policy from or invest in a particular insurance company, and it helps regulators to meaningfully monitor the financial condition of insurance companies and the progress they are making towards addressing climate change risks. Insurers have made such disclosures in documents to federal regulatory agencies such as the U.S. Securities and Exchange Commission, while others are in response to formal requests from institutional investor groups, the largest example of which is the annual call by the Carbon Disclosure Project (CDP), representing global investors with \$41 trillion in assets. Approximately one-third of U.S. insurers receiving the CDP questionnaire have responded (cumulatively 2003-2007), versus two-thirds of non-U.S. insurers.

Disclosure To Regulatory Agencies: The U.S. Securities and Exchange Commission

The insurance sector has the poorest record on climate disclosure of any industry sector in the United States. According to a recent survey of SEC filings,¹⁹³ only 15 percent of U.S. insurers even mention climate change in their 10Ks, which are supposed to describe all issues material to a company. In contrast, the electric utility sector had an essentially 100-percent disclosure rate, and in the oil industry 80 percent of companies discuss climate change in their 10K forms. These other industries of course release vastly higher amounts of greenhouse gases, but all have significant vulnerability to the impacts of climate change. Although the response rate remains low, this represents an increase from a response rate of approximately 3 percent from the first survey in this series in 2001. Some companies have been very consistent (e.g. Chubb reported in each year 2001-2005, whereas Allstate reported in only 2003). In 2007, major institutional investors—including California Treasurer Bill Lockyer and Controller John Chiang, the California Public Employees' Retirement System, and the California State Teachers' Retirement System demanded that the SEC mandate these disclosures.¹⁹⁴

Disclosure To Investors: The Carbon Disclosure Project

The Carbon Disclosure Project (CDP)¹⁹⁵ distributes an annual survey from large investors to the CEOs of the largest publicly traded global corporations, asking a series of questions about how the recipients are preparing to respond to climate change. In 2007, the fifth annual CDP letter was signed by investors representing an astounding \$41 trillion in assets. Signatories included companies like Goldman Sachs, Morgan Stanley, and AIG Investments. The rate of full responses by U.S. insurers is up from only 15 percent in 2003 to 68 percent in 2007, compared to 50 percent and 84 percent, respectively, for non-U.S. insurers (Figure 19). With important exceptions, the U.S. responses tended to be superficial compared to those of their peers in other countries, and a larger share of responding U.S. companies declined to have their responses made public. The responses by country and year are shown in Appendix B.

Insurer Responses to the 2003-2007 Carbon Disclosure Project Surveys

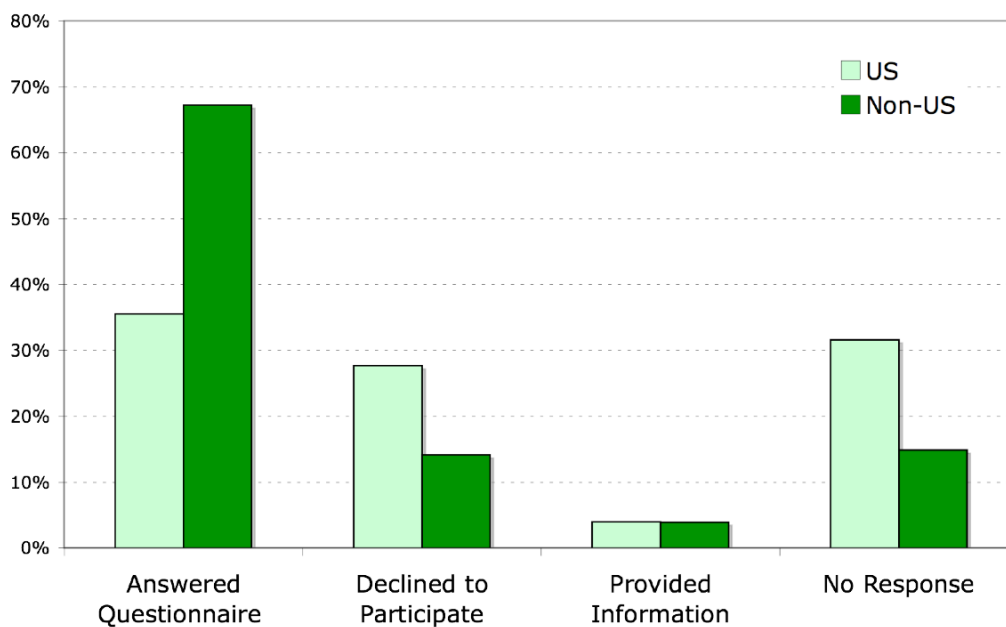


Figure 19. Carbon Disclosure Project response rates (2003-2007 inclusive) for US- and non-US-based insurance companies. Respondents who “provided information” did not complete the formal questionnaire. Annual trends shown in Box A.

Some individual investors are seeking their own disclosure, as evidenced by F&C Investments' query to 31 insurance companies.¹⁹⁶ They, too, found a lower response rate among U.S. insurers compared to their peers in other countries. It can be expected that customers, investors, and rating agencies will continue to press for this information. Participating insurers will likely benefit in terms of managing shareholder and reputation risks associated with their responses to climate change.

III. THE ESSENTIAL ROLE OF REGULATORS

“Global warming is upon us, and it poses unprecedented new threats to the insurance industry and vast segments of society that rely on insurance for peace of mind and financial security.”¹⁹⁷

- Michael Kreidler, Washington Insurance Commissioner

- Tim Wagner, Nebraska Insurance Commissioner

Regulators have two overarching and interrelated goals: to maintain the availability and affordability of insurance for customers, and to guard against insurer insolvency. While there are many appropriate roles for regulators in climate change vulnerability assessment,¹⁹⁸ we focus here on their role in enabling the types of traditional and innovative responses described in this report.¹⁹⁹

Regulators have a responsibility to see that rates are adequate and provide for the solvency of insurers, and that state-operated insurance pools have adequate capacity to pay losses. In a changing climate this will, among other things, require consideration of the ability of catastrophe models to account for climate change.

Where insurers desire to provide differentiated premiums or financial incentives to encourage risk-reducing behavior, it is often necessary to show regulators that there will be an offsetting reduction in losses. This is done to ensure rate adequacy. Reviews vary from state to state, and are negligible in some cases while quite thorough in others. Insurers interviewed by the Iowa Department of Natural Resources cited difficulties in gaining regulatory approval for premium credits as a key barrier.²⁰⁰ In the U.S., insurers are essentially free to develop new fee-based services outside of the insurance core business, such as the risk assessment and management services for carbon offset projects mentioned above.

For insurers to engage in research and development, or equity/venture-capital investments in “climate friendly” companies, they must first demonstrate that their reserves are adequately backed up with bonds. Once this is done, insurers are effectively free to invest elsewhere with the surplus.

It is thus important that concerned insurance regulators review existing rules and policies, identifying potential barriers and providing more flexibility for “doing the right thing.” Similarly, they should play an active role in ensuring the validity of insurer climate initiatives. One example would be to review the quality of carbon offsets offered to customers.

Requests or requirements to undertake the sorts of innovative strategies outlined in this report could originate *from* the insurance regulators. For example, regulators could call for separate rating of hybrid vehicles, keep track of loss experience, and ultimately utilize the

results to propose differential treatment of customers owning these cars.

Regulators can also call for more complete disclosure of climate risks, both in the core business of insurance underwriting as well as in the selection of weather-sensitive investments that could affect their solvency.

Recognizing the material threat of climate change, in 2006 the U.S. National Association of Insurance Commissioners (NAIC) created an executive-level Task Force to study the issue in detail.

IV. TOWARD BEST PRACTICES

“The insurance sector has a key role to play in helping to mitigate the effects of climate change by providing financial indemnification, compensation and relief against climate change events and by developing new products and solutions that can support emerging GHG and renewable energy markets.”

- Marsh (2004)²⁰¹

Discussions of climate change often convey a “gloom-and-doom” outlook for the future. Yet, as the preceding pages testify, there are a host of actionable opportunities for insurers. They have in common the potential for improving the business position of insurers while addressing the risks posed by climate change. While the tightening of terms and conditions and upward adjustments of prices will be appropriate in some contexts, these measures should be regarded as only one class of the options available to insurers.

Giving priority to increasing the resilience of insurance customers to climate risks, and simultaneously taking steps to reduce climate change itself, will go farthest towards minimizing the loss of insurance markets and revenues, while creating a market advantage and new sources of economic value for those insurers advancing proactive solutions.

A remarkable number of examples are identified in this report. It should be noted that these forward-looking activities are largely modest initiatives and are collectively far from what would constitute a best-practice offering within the insurance industry. No single insurer has embraced what we would consider a comprehensive strategy, but many are well on the road in that direction.

An insurer could integrate best practices into its business by implementing the following ten-point strategy:

1. Make concerted efforts to restore and maintain the insurability of extreme weather events. This may require partnerships with governments, e.g., in the cases of improved land-use planning and enforced building codes.
2. Improve the modeling and other methods of analyzing climate-change risks.
3. Utilize terms and conditions to foster the right decisions by customers. This could range from rewarding risk-minimizing behavior to excluding climate change liabilities for those who make imprudent decisions either as emitters of greenhouse gases or managers of risks associated with climate change.
4. Develop new products and services to facilitate maximum customer utilization of climate-friendly technologies and practices, especially in cases where they yield loss prevention co-benefits.
5. Invest in strategic R&D and rebalance investment portfolios to (a) recognize climate-related risks to investments and (b) capitalize on opportunities for emerging industries that will participate in climate change solutions.
6. Actively participate in carbon markets, both as investor and risk manager.
7. Lead by example in minimizing the insurer's own "carbon footprint." This includes minimizing the climate impacts of real estate owned by the insurer, as well as the "carbon footprint" of business operations, and by analyzing and disclosing exposures to climate change.
8. Take an active role in the education of customers about climate-related risks and opportunities for minimizing them.
9. Actively engage in public policy discussions about responses to climate change.
10. Tighten terms and conditions, withdraw from markets, or increase insurance prices only when the aforementioned best practices have been exercised to their fullest cost-effective potential.

Corollary best practices for rating agencies will involve assessing insurers' handling of climate risks. Other trade allies—such as brokers, agents, and risk managers—can reinforce the aforementioned best practices on behalf of insurance customers.

Grasping these opportunities is fully consistent with the industry's history as founders of fire departments, early promoters of Underwriters Laboratory, and key players in physical risk management. Insurers have also historically played a role in public policy, whether it is the ongoing debate about terrorism or advocacy for improved building codes.

The opportunities described above can enable individual insurers to differentiate their products from the competition, while enhancing their reputations in the eyes of a public increasingly looking for all quarters of industry to come forward with constructive responses to the climate change threat. Indeed, insurance customers will come to demand the types of innovative responses documented in this report.

Sustainable energy technologies will be deemed particularly relevant if they help address other acute strategic issues faced by insurers. A good example is the rapid growth in mold and indoor air quality claims and construction defects litigation haunting many insurers;²⁰² many of these claims trace back to poor design and application of energy-related systems.

The growing insurance risks associated with electricity reliability²⁰³ are another example that can be addressed, in part, through efficiency and distributed renewable energy supply solutions. There are even synergies between making buildings energy-efficient and less vulnerable to chemical and biological attack, e.g., improved ventilation controls used to minimize energy use in normal operation and to protect occupants during an emergency.²⁰⁴ Lastly, the crisis of corporate governance is also among the broader strategic issues already troubling insurers, which will only be made more difficult by climate change.

Insurers cannot be expected to capture all of these opportunities single-handedly. In many cases, linkages are called for with other initiatives outside the insurance industry. Improving building codes so that they make maximal use of hazard resistant technologies and practices while minimizing energy use is an example of a strategy that requires the leadership of local government. State Farm purportedly chose to re-enter the Louisiana coast market after the state agreed to tighten building codes.²⁰⁵ Some initiatives will rely on alliances with energy utilities (e.g. offering financial incentive programs that simultaneously reward hazard-resilience and energy efficiency), as was done in a collaborative promotion of fire-safe, energy-efficient light fixtures between FM Global Insurance company and Boston Edison.²⁰⁶

It is important to anticipate and avoid inadvertent adverse side effects of carbon-reduction strategies.²⁰⁷ A well-worn example is degraded indoor air quality due to over-tightening of buildings. In many cases these concerns are unfounded, but in others they are legitimate (but surmountable). An example of the latter is that small/light cars exist that are as safe or safer than SUVs.²⁰⁸ Concerning energy supply issues, questions have arisen^{209,210} about unquantified liabilities associated with the rising popularity of proposals to capture carbon dioxide at the point of production (e.g. power plant stacks) and inject it, hopefully safely and permanently, into the earth or seabed. The insurance sector may be unwilling to insure a rebirth of nuclear power, argued by some to be important climate mitigation strategy.

Given that insurance is the world's largest economic sector, and that insurers reach virtually every consumer and business in developed countries, the prospect for their involvement in the development and promotion of climate change mitigation and adaptation strategies stands as an immense but as yet largely untapped opportunity.

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REFERENCES

- ¹ Lloyd's of London. 2006. "Climate Change Adapt or Bust," June.
http://www.lloyds.com/News_Centre/Features_from_Lloyds/Climate_change_adapt_or_bust.htm
- ² Mills, E. 2005. "Insurance in a Climate of Change," *Science* Vol. 308:1040-1044, 12 August.
- ³ Centre for the Study of Financial Information and PricewaterhouseCoopers survey.
- ⁴ Mills, E. and E. Lecomte. 2006. "From Risk to Opportunity: How Insurers Can Proactively and Profitably Manage Climate Change." Published by Ceres, Boston, MA.
- ⁵ The Stern Review on the Economics of Climate Change. Published by the Treasury of the United Kingdom. October 2006. http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/sternreview_index.cfm
- ⁶ Mac-Donald-Smith, A. 2007. "Climate Change to Boost Insured Losses, Allianz Says," Bloomberg, September 18.
- ⁷ Ross, C., E. Mills, and S. Hecht. 2007. "Limiting Liability in the Greenhouse: Insurance Risk-Management in the Context of Global Climate Change." *Stanford Environmental Law Journal and the Stanford Journal of International Law*, Symposium on Climate Change Risk, Vol. 26A/43A:251-334.
- ⁸ Conley, J.L. 2007. "Gathering Storm." *Daily Report*, September 18.
http://www.dailyreportonline.com/Editorial/News/new_singleEdit.asp?individual_SQL=9%2F18%2F2007%4016655_Public_.htm
- ⁹ Dixon, L., J.W. Macdonald, and J. Zissimopoulos. 2007. "Commercial Wind Insurance in the Gulf States: Developments Since Hurricane Katrina and Challenges Moving Forward." RAND Institute for Civil Justice, 14pp.
- ¹⁰ Ruquet, M.E. 2007. "Oil Producers Scramble for Coverage." *National Underwriter Online News Service*, April 20.
- ¹¹ ACE Limited response to the Carbon Disclosure Project 5 questionnaire (2007)
- ¹² Wearden, G. 2007. "Insurers Say Authorities Partly to Blame for Flood Damage." *The Guardian*, August 20.
- ¹³ Felsted, A. 2007. "Insurance: Managing the Risks of Climate Change Perils." *Financial Times*. October 12, 2007.
- ¹⁴ U.S. General Accounting Office. 2007. "Climate Change: Financial Risks to Federal and Private Insurers in Coming Decades are Potentially Significant." GAO-07-285.
- ¹⁵ CEA: The European Insurance and Reinsurance Federation. 2007. "Reducing the Social and Economic Impact of Climate Change and Natural Catastrophes: Insurance Solutions and Public-Private Partnerships." July, 40pp. CEA, Brussels.
- ¹⁶ Electric Power Research Institute. 2007. "The Power to Reduce CO₂ Emissions: The Full Portfolio." Prepared for the EPRI 2007 Summer Seminar, The EPRI Energy Technology Assessment Center.
- ¹⁷ AIG Global Marine and Energy Launches Alternative Energy Practice, AIG News Release, April 11, 2007.
<http://phx.corporate-ir.net/phoenix.zhtml?c=76115&p=irol-newsArticle&iD=983705&highlight=>
- ¹⁸ See http://www.allianz.com/en/allianz_group/press_center/news_dossiers/climate_und_energy/news_2007-05-29.html
- ¹⁹ AON News Release, "Aon Establishes New Agri-Fuels Group to Manage Renewable Fuels Industry Risks," January 31, 2007, see http://www.aon.com/about/news/press_release/pr_00697117_Agri-Fuels_Manage_Renewable_Risks_Established.jsp
- ²⁰ Corporate News Release, "Travelers Stays In-synch with Climate Change," September 24, 2007
- ²¹ "Chubb Assembles Green Energy Team," Chubb News Release, August 20, 2007
<http://www.environmentalleader.com/2007/08/20/chubb-assembles-green-energy-team/>
- ²² Swiss Re. 2007. World Insurance: 2006. *Sigma*.
- ²³ Dlugolecki, A. 2004. "A Changing Climate for Insurance." Association of British Insurers, 24pp.
- ²⁴ Mills and Lecomte. 2006. *Op. cit.*
- ²⁵ Mills, E. 2003. "The Insurance and Risk Management Industries: New Players in the Delivery of Energy-Efficient Products and Services." *Energy Policy* 31:1257-1272. Prior versions published in *Proceedings of the ECEEE 1999 Summer Study*, European Council for an Energy-Efficient Economy, May 31-June 4, 1999, Mandelieu, France.
- ²⁶ Enkvist, P-A., T. Nauclér, and J. Rosander. 2007. "A cost curve for greenhouse gas reduction", *McKinsey Quarterly* Number 1 http://www.mckinseyquarterly.com/article_page.aspx?ar=1911&L2=3&L3=41&srid=27&gp=0
- ²⁷ Marsh. 2006. "Survey of Insurance Availability for Renewable Energy Projects." 15pp, March.

- ²⁸ Mills, E. 2004. "Insurance as an Adaptation Strategy for Extreme Weather Events in Developing Countries and Economies in Transition: New Opportunities for Public-Private Partnerships." Lawrence Berkeley National Laboratory Report No. 52220.
- ²⁹ The Munich Climate Insurance Initiative. No date. "Insurance-Related Options for Adaptation to Climate Change." 10pp.
- ³⁰ Hofmann, M.A. 2007. "RMS Links Weather Losses, Climate Change." *Business Insurance*, April 9, p. 20.
- ³¹ Epstein, P. and E. Mills (eds.). 2005. "Climate Change Futures: Health, Ecological and Economic Dimensions." Published by Harvard Medical School, sponsored by Swiss Re and the U.N. Development Programme.. (Contributing Authors: Pamela Anderson, John Brownstein, Ulisses Confalonieri, Douglas Causey, Nathan Chan, Kristie L. Ebi, Jonathan H. Epstein, J. Scott Greene, Ray Hayes, Eileen Hofmann, Laurence S. Kalkstein, Tord Kjellstrom, Rebecca Lincoln, Anthony J. McMichael, Charles McNeill, David Mills, Avaleigh Milne, Alan D. Perrin, Geetha Ramnathugala, Christine Rogers, Cynthia Rosenzweig, Colin L. Soskolne, Gary Tabor, Marta Vicarelli, X.B. Yang).
- ³² Zeng, L. and P.J. Kelly. 1997. "A Preliminary Investigation of the Trend of Flood Events in the United States." Presented at the National Association of Real Estate Investment Managers Senior Officer Property Insurance Forum, Boston, (March 18-19). Arkwright Mutual Insurance Company.
- ³³ McLeod, D. 2007. "Japan's Earth Simulator to Model Catastrophes." *Business Insurance*, February 26, p. 3.
- ³⁴ Swiss Re. 2006. "The Effects of Climate Change: Storm Damage in Europe on the Rise." Report 6/06 2500en
- ³⁵ Association of British Insurers. 2005. "Financial Risks of Climate Change."
- ³⁶ Swiss Re. 2006. *Op. cit.*
- ³⁷ Hoeppe, Peter. ND. "Munich Re's Response to the Challenges of Climate Change." Munich Reinsurance Company, Geo Risks Research. Presentation.
- ³⁸ Association of British Insurers. 2005. *Op. cit.*
- ³⁹ American Insurance Association. 2000. "Potential Areas of Focus for the OECD with Regard to Global Catastrophe Mitigation." American Insurance Association, Washington, D.C.
- ⁴⁰ Mills, E. and I. Knoepfel. 1997. "Energy Efficiency Options for Insurance Loss Prevention." *Proceedings of the ECEEE Summer Study*, June 9-14, Prague.
- ⁴¹ Kovacs, P. 2006. "Hope for the Best and Prepare for the Worst: How Canada's Insurers Stay a Step Ahead of Climate Change." *Policy Options*, p. 53-56, December/January.
- ⁴² Dankwa, D. 2006. "FM Global Touts Underwriting by Engineering as Superior." *Best's Review*, p. 93, June.
- ⁴³ Green, M. 2006. "Preparing For the Worst." *Best's Review*, pp. 40-44, April.
- ⁴⁴ Multihazard Mitigation Council. 2006 "Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities." National Institute of Building Sciences. Prepared for FEMA.
- ⁴⁵ Aviva CSR report, see <http://www.aviva.com/csr06/index.asp?pageid=21>
- ⁴⁶ See <http://www.protectingamerica.org>
- ⁴⁷ Lecomte, E. A.W. Pang, J.W. Russell. 1998. "Ice Storm '98." Institute for Catastrophic Loss Reduction and Institute for Business and Home Safety.
- ⁴⁸ AXA. 2006. "Preparing for Climate Change – A Practical Guide for Small Businesses" http://www.axa.co.uk/aboutus/corporate_publications/climatechange_docs/AXA%20Preparing%20for%20climate%20change.pdf
- ⁴⁹ Burby, R.J. 2006. "Hurricane Katrina and the Paradoxes of Government Disaster Policy," *Annals of the American Academy of Political and Social Science*, March.
- ⁵⁰ Dlugolecki, A. and S. Lafeld. 2005. "Climate Change and the Financial Sector: An Agenda for Action." Allianz and the World Wildlife Fund, 59 pp.
- ⁵¹ Stagnitta, L. and K. Forster. 2005. "Is Climate Change for Real and if so What is the Cause, Likely Impact, and Remedy?" *Proceedings of the Australian Building Codes Board National Conference*, Insurance Australia Group.
- ⁵² Association of British Insurers. 2005. "East London Sub-Regional Development Framework: Consultation." July.
- ⁵³ Vine, E., E. Mills, and A. Chen. 1998. "Energy-Efficient and Renewable Energy Options for Risk Management & Insurance Loss Reduction: An Inventory of Technologies, Research Capabilities, and Research Facilities at the U.S. Department of Energy's National Laboratories." LBNL-41432. A briefer version is published in *Energy*, 25(2000): 131-147 and Vine, E., E. Mills, and A. Chen. 1999. "Tapping Into Energy: New Technologies and Procedures that Use Energy More Efficiently or Supply Renewable Energy Offer a Largely

- Untapped Path to Achieving Risk Management Objectives." *Best's Review-Property/Casualty Edition* May, pp. 83-85. Oldwick, NJ: A.M. Best Company.
- ⁵⁴ Mills, E. 2006. "Synergisms between Climate Change Mitigation and Adaptation: An Insurance Perspective," *Mitigation and Adaptation Strategies for Global Change*, Special Issue on Challenges in Integration Mitigation and Adaptation Responses to Climate Change. (in press)
- ⁵⁵ Wendt, R. and H. Aglan. 2004. "After The Flood—There's Hope: Homes that are damaged by flooding can be repaired and made more durable." *Home Energy*, September/October, pp. 18-23.
- ⁵⁶ Shamshoian, G., M. Blazek, P. Naughton, R.S. Seese, E. Mills, and W. Tschudi. 2005. "High-Tech Means High-Efficiency: The Business Case for Energy Management in High-Tech Industries." Lawrence Berkeley National Laboratory Report LBNL-59127.
- ⁵⁷ <http://www.sciencemag.org/cgi/rapidpdf/1136163v1.pdf>
- ⁵⁸ See http://www.millea.co.jp/en/social_respon/earth.html
- ⁵⁹ Parker, D. 2005. "Post-Hurricane Opportunities." *Home Energy*, March/April, p. 24-27.
- ⁶⁰ See <http://www.fas.org/main/content.jsp?formAction=297&contentId=64>
- ⁶¹ Mills, E. and I. Knoepfel. 1997. *Op. cit.*
- ⁶² Nutter, F.W. 1996. *Op. cit.*
- ⁶³ See <http://www.ricowi.com/>
- ⁶⁴ <http://www.waterhealth.com/products/under-development.php>
- ⁶⁵ *Insurance Journal*. 2007. "New 'GREEN' Captive Insurer Promises Savings for Eco-Friendly Businesses." May 22. <http://www.insurancejournal.com/news/national/2007/05/22/79925.htm>
- ⁶⁶ Tom Wenzel. 1995. "Analysis of National Pay-as-you-Drive Insurance Systems and Other Variable Driving Charges," Lawrence Berkeley National Laboratory.
- ⁶⁷ Victoria Transport Policy Institute. 2005. An excellent compendium of information is provided here: <http://www.vtpi.org/tdm/tdm79.htm> See also "Pay-As-You-Drive Vehicle Insurance." <http://www.vtpi.org/paydsum.pdf>
- ⁶⁸ General Insurance Association of Japan. 2007. "The Eco & Safety Drive" Program, http://www.sonpo.or.jp/e/about_us/pdf/eco_brochure.pdf
- ⁶⁹ See http://pressroom.progressive.com/releases/Tripsense_04.asp
- ⁷⁰ ICF. 2003 "Insights: Pay-As-You-Drive Insurance Offers Potential Benefits to Consumers and the Environment." (Winter) <http://www.icfconsulting.com/transportation>
- ⁷¹ O'Connor, R. and L. Goch. 2004. "U.S. and U.K. Policyholders Test 'Pay As You Drive'." *Best's Review*, p. 54, October.
- ⁷² Progressive Insurance Company. "Pay As You Drive (PAYD) Insurance Pilot Program Phase 2 Mid-Course Project Report." <http://www.nctcog.org/trans/air/programs/payd/index.asp>
- ⁷³ See <http://www.clf.org/general/index.asp?id=604>
- ⁷⁴ See AXA response to the Carbon Disclosure Project 5 survey (2007)
- ⁷⁵ Zwimer, O. 2000. "Impact of Greenhouse Gas Mitigation on the Insurance Industry." In Bernstein, L, Pan, J. (eds.), Sectoral Economic Costs and Benefits of GHG Mitigation, *Proceedings of an IPCC Expert Meeting*, Eisenach, Germany, 14-15 February 2000, pp. 260-269.
- ⁷⁶ Berz, G. and T. Loster. 2000. Munich Reinsurance Company. Private communication.
- ⁷⁷ See http://www.gerling.de/de/internet/content/kfz_oekotarif/jsp/intro.jsp?uid=Mail_unf
- ⁷⁸ Roberts, G. 2007. "Drive Less During Rush Hour, Get a Lower Insurance Rate." *Seattle Post-Intelligencer*, March 28. http://seattlepi.nwsource.com/transportation/309180_kingtrans28.html
- ⁷⁹ Frost and Sullivan Research Service. 2007. "Pay As You Drive (PAYD) – New Age Vehicle Insurance Based on Core Telematics Foundation." June 6. <http://www.frost.com/prod/servlet/market-insight-top.pag?docid=99661873>
- ⁸⁰ http://www.galileo-toulouse.com/article.php3?id_article=253
- ⁸¹ *Best's Review, Business Insurance, and National Underwriter*.
- ⁸² Hoeppe, Peter. ND. "Munich Re's Response to the Challenges of Climate Change." Munich Reinsurance Company, Geo Risks Research. Presentation.
- ⁸³ Marsh. 2006. *Op. cit.*
- ⁸⁴ Marsh, Yale and Ceres Join To Educate Corporate Directors About The Risks, Opportunities Posed By Climate Change. 2006. Ceres News Release, September 21 http://www.ceres.org/news/news_item.php?nid=229
- ⁸⁵ This section from Ross et al., 2007. *Op. cit.*

- ⁸⁶ Credit to Rick Jones of AIG/Solomon for coining this term in the context of energy efficient behavior.
- ⁸⁷ Company news release. 2005. "Farmers Insurance Group Announces Hybrid Vehicle Discount in California," October 17.
- ⁸⁸ Travelers. 2006. "Travelers to Offer Hybrid Owners Across U.S. 10 Percent Discount on Auto Insurance." News Release, January 5. Hartford.
- ⁸⁹ See AXA response to the Carbon Disclosure Project 5 survey.
- ⁹⁰ Mills, E., H. Friedman, T. Powell, N. Bourassa, D. Claridge, T. Haas, and M.A. Piette. 2004. "The Cost-Effectiveness of Commercial-Buildings Commissioning: A Meta-Analysis of Energy and Non-Energy Impacts in Existing Buildings and New Construction in the United States." Lawrence Berkeley National Laboratory Report No. 56637
- ⁹¹ *Insurance Journal*. 2007. "New 'GREEN' Captive Insurer Promises Savings for Eco-Friendly Businesses." May 22.
- ⁹² Submission to the Carbon Disclosure Project #3, <http://www.cdproject.net/>
- ⁹³ <http://www.locktonaffinity.com/resnet/>
- ⁹⁴ Brovik, C. 2006. "New Insurance Benefit for RESNET Members." *Home Energy Magazine*, p. 5, July/August.
- ⁹⁵ Mills, E. 2003. "Risk Transfer via Energy Savings Insurance." *Energy Policy*, 31:273-281. LBNL-48927.
- ⁹⁶ See D.C. Code § 2-303.22 (a)(3)
- ⁹⁷ Seifert, B. 2006. "The Emerging Arena of Sustainable Building and The Contract Surety." *Surety Institute Claims Newsletter*, Vol. 18, No. 2, p. 4.
- ⁹⁸ Mills, E. 2003. *Op. cit.*
- ⁹⁹ Makower, J., Pernick, R., Wilder, C. 2006. "Clean Energy Trends 2006." Clean Edge, Inc. p.3. McGraw Hill.
- ¹⁰⁰ Marsh. 2006 (March). *Op. cit.*
- ¹⁰¹ See response to Carbon Disclosure Project questionnaire.
- ¹⁰² Perspectives: Today's Ideas for Tomorrow's World." 2004. Munich Reinsurance Company, p. 29.
- ¹⁰³ Marsh 2006 (March). *Op. cit.*
- ¹⁰⁴ Collins, S. 2007. "Risk Managers Grapple with Renewable Energy," *Business Insurance*, June 10, p. 12.
- ¹⁰⁵ D. Childs. 2007. "Insurers Eye Profits in Greentech." *Inside Green Tech*. April 11
<http://www.insidegreentech.com/node/1002>
- ¹⁰⁶ Marsh. 2006 (March). *Op. cit.*
- ¹⁰⁷ AON News Release, "Aon Establishes New Agri-Fuels Group to Manage Renewable Fuels Industry Risks," January 31, 2007, see http://www.aon.com/about/news/press_release/pr_00697117_Agri-Fuels_Manage_Renewable_Risks_Established.jsp
- ¹⁰⁸ Kats, G., L. Alevantis, A. Berman, E. Mills, and J. Perlman. 2003. "The Costs and Financial Benefits of Green Buildings: A Report to California's Sustainable Building Task Force." Capital E, Washington D.C.
- ¹⁰⁹ Cheslin, N. 2005. "Insuring a Green Future: A Proposal to Integrate the Interests of the Insurance and Green Buildings Industries." The Green Roundtable, Massachusetts.
- ¹¹⁰ Deering, A. and J.P. Thornton. 1998. "Solar Technology and the Insurance Industry: Issues and Applications." NREL/MP 520-25866, National Renewable Energy Laboratory, Golden, CO, 14pp.
- ¹¹¹ Sompo Japan Insurance. 2005. "Corporate Social Responsibility Report: 2005."
- ¹¹² Corporate News Release, "Travelers Stays In-synch with Climate Change," September 24, 2007.
- ¹¹³ See <http://www.natresnet.org/>
- ¹¹⁴ For a description of the LEED rating system, see www.usgbc.org/LEED/
- ¹¹⁵ See <http://www.naturesave.co.uk/>
- ¹¹⁶ Chen, A. and E. Vine. 1999. "It's in the Air: Poor Indoor Air Quality in Commercial Buildings is Costing Insurers More." *Bests Review*, pp. 79-80. Oldwick, NJ: AM Best Company.
- ¹¹⁷ International Association of Insurance Supervisors. 2007. Annual Report 2006-07
- ¹¹⁸ Mills, E. 2004. "Insurance as an Adaptation Strategy for Extreme Weather Events in Developing Countries and Economies in Transition: New Opportunities for Public-Private Partnerships." Lawrence Berkeley National Laboratory Report No. 52220. http://eetd.lbl.gov/EMills/PUBS/Insurance_Emerging_Markets.html
- ¹¹⁹ <http://www.microinsurancecentre.org>
- ¹²⁰ United Nations Environment Programme Finance Initiative. 2007 "Insuring for Sustainability," 59pp.
- ¹²¹ Swiss Re. 2007. "Swiss Re Provides Innovative Drought Cover to Smallholder Farmers in Africa." Corporate News Release. September 6. See also "Swiss Re Launches Climate Program," *Insurance Journal*, September 27, 2007. <http://www.insurancejournal.com/news/international/2007/09/27/83759.htm>
- ¹²² USAID-OAS. 1996. "Insurance, Reinsurance and Natural Hazard Protection Reduction." The Caribbean

-
- Disaster Mitigation Project, Organization of American States, Unit of Sustainable Development and Environment, for the USAID Office of Foreign Disaster Assistance and the Caribbean Regional Program. <http://www.oas.org/cdmp/document/insuranc.htm> and <http://www.oas.org/cdmp/bulletin/insur.htm>
- ¹²³ UNDP. 2004. "Reducing Disaster Risk: A Challenge for Development." United Nations Development Programme, Bureau for Crisis Prevention and Recovery. 146pp. <http://www.undp.org/bcpr/disred/rdr%20report.htm>
- ¹²⁴ RNK Capital and Swiss Re. 2006. "RNK Capital and Swiss Re Structure First Insurance Product for CDM Carbon Credit Transactions: Insurance Instrument Mitigates Kyoto-Related Transaction Risk for Global Carbon Credit Trading." News Release, June 13.
- ¹²⁵ See <http://www.solomononline.com/>
- ¹²⁶ Aon. 2005. "Aon Provides Strategic Climate Change Review to BG Group." In *Alternative Views: Aon Captive Services Group Newsletter*, Issue 43, July.
- ¹²⁷ AIG's Policy and Programs on Environment and Climate Change, version dated May 14, 2007.
- ¹²⁸ Regional Greenhouse Gas Initiative Model Rule, 1/5/07. Part XX CO₂ Budget Trading Program, page 130, Section XX – 10. http://www.rggi.org/docs/model_rule_corrected_1_5_07.pdf
- ¹²⁹ RNK Capital and Swiss Re. 2006. *Op. cit.*
- ¹³⁰ Munich Re. 2007. "Topics Geo: Natural Catastrophes 2006: Analyses, Assessments, Positions." Munich Reinsurance Company, 50pp.
- ¹³¹ AIG's Policy and Programs on Environment and Climate Change, version dated May 14, 2007.
- ¹³² See <http://www.climatehelp.com.au/>
- ¹³³ Osborne, H. 2006. "'Green' Insurance Offsets Carbon Emissions." *The Guardian*, http://money.guardian.co.uk/insurance/_motor/story/0,,1783919,00.html
- ¹³⁴ See <http://www.climatesure.co.uk/>
- ¹³⁵ Allianz. 2007. "Ecologically-aware driving with Allianz and the WWF", Company Release, September 5 http://www.allianz.com/en/allianz_group/press_center/news/business_news/insurance/news_2007-09-05-1.html
- ¹³⁶ See http://www.wedomore.co.uk/Eco_Insurance
- ¹³⁷ See <http://www.cis.co.uk/>
- ¹³⁸ See company response to the 2007 Carbon Disclosure Project questionnaire.
- ¹³⁹ See http://www.ing.com/group/showdoc.jsp?docid=262013_EN&menopt=ins%7Csps%7Cmcf
- ¹⁴⁰ AIG Global Investment Group Joins Investor Network on Climate Risk. AIG News Release, October 24, 2006. <http://phx.corporate-ir.net/phoenix.zhtml?c=76115&p=irol-govresponsNews&ID=945781&highlight=>
- ¹⁴¹ Private communication, Andreas Spiegel, Swiss Re, October 1, 2007.
- ¹⁴² Swiss Re. 2005. "German Allianz to Invest in Renewable Energies." *German News Digest*, 29 June.
- ¹⁴³ Collins, S. 2007. "Risk Managers Grapple with Renewable Energy," *Business Insurance*, June 10, p 12.
- ¹⁴⁴ See <http://www.storebrand.com/Storebrand/nyaapen/stbcomsri2.nsf/sok/9C7622954CF17C1AC1256FF1003BB261?OpenDocument>
- ¹⁴⁵ See <http://www.gerling.com/navigation/load.asp?ARTICLE=132&V=3>
- ¹⁴⁶ See <http://www.gerling.com/navigation/load.asp?ARTICLE=155&V=3>
- ¹⁴⁷ See <http://www.allianz.com/azcom/dp/cda/0,,838721-44,00.html>
- ¹⁴⁸ AIG's Policy and Programs on Environment and Climate Change, version dated May 14, 2007.
- ¹⁴⁹ Material in this paragraph, private communication, Andreas Spiegel, Swiss Re, October 1, 2007.
- ¹⁵⁰ *Insurance Journal*. 2007. "New 'GREEN' Captive Insurer Promises Savings for Eco-Friendly Businesses." May 22. <http://www.insurancejournal.com/news/national/2007/05/22/79925.htm>
- ¹⁵¹ http://en.wikipedia.org/wiki/30_St_Mary_Axe
- ¹⁵² Private communication, Lauren Day, AIG, August 30, 2007.
- ¹⁵³ See [http://www.swissre.com/internet/pwsfilpr.nsf/vwFilebyIDKEYLu/DDAR-5S6JBH/\\$FILE/TestimonyChrisWalkerUSSenateCommerceCommitteeOct103.pdf](http://www.swissre.com/internet/pwsfilpr.nsf/vwFilebyIDKEYLu/DDAR-5S6JBH/$FILE/TestimonyChrisWalkerUSSenateCommerceCommitteeOct103.pdf)
- ¹⁵⁴ Kovacs, P. 2005. "Homeowners and Natural Hazards." *Canadian Underwriter*, January 2.
- ¹⁵⁵ Steitner, M. 1996. "Virtue Has its Rewards." *Worth Magazine*, p. 154, November.
- ¹⁵⁶ Kellie Lewis. 2006. Insurance Australia Group. Private communication, May 25.
- ¹⁵⁷ See <http://www.afrbiz.com.au>
- ¹⁵⁸ See <http://www.climatehelp.com.au/>

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- ¹⁵⁹ <http://www.esurance.com/sos>
- ¹⁶⁰ See <http://www.footprint.fortis.com/>
- ¹⁶¹ See <http://www.betterhomebetterplanet.com/index.php?mode=benefits§ion=strength>
- ¹⁶² Ryland, H. 2006. "IBHS Leads the Way to Safer Living." *Natural Hazards Observer*, pp. 11-12, July. Additional information from Chuck Vance, IBHS, private communication August 1, 2006. Private communication with Chuck Vance and Peter Hamer, IBHS.
- ¹⁶³ American Insurance Association. c.1999. *Op. cit.*
- ¹⁶⁴ Valverde, L.J. Jr. and M.W. Andrews. 2006. "Global Climate Change and Extreme Weather: An Exploration of Scientific Uncertainty and the Economics of Insurance." Insurance Information Institute.
- ¹⁶⁵ See <http://www.climateandinsurance.org/initiatives.htm>
- ¹⁶⁶ See <http://www.abi.org.uk/climatechange>
- ¹⁶⁷ See <http://www.climatewise.org.uk/>
- ¹⁶⁸ See <http://www.unep-fi.net>
- ¹⁶⁹ See <http://www.us-cap.org/>
- ¹⁷⁰ See <http://www.businessroundtable.com.au>, and <http://www.wwf.org.au/articles/australian-climate-group-acg/>
- ¹⁷¹ AIG's Policy and Programs on Environment and Climate Change, version dated May 14, 2007.
- ¹⁷² American Insurance Association. 2000. *Op. cit.*
- ¹⁷³ American Insurance Association. c.1999. *Op. cit.*
- ¹⁷⁴ Beattie, J. 2002. "Auto Insurers Back new CAFE Plan." *The Energy Daily*, 30 (17):1.
- ¹⁷⁵ Green, M. 2006. "SUVs No Safer Than Passenger Cars for Kids." *Best's Review*, p 97, February.
- ¹⁷⁶ Alpert, M. 2007. "Saving Gas and Lives." *ScientificAmerican.com*, October.
- ¹⁷⁷ See <http://insurance.lbl.gov/csr-reports.html>
- ¹⁷⁸ State Farm Endorses Business Roundtable Climate Change Statement. 2007. Corporate News Release, July 17. http://www.earthtimes.org/articles/show/news_press_release,140728.shtml
- ¹⁷⁹ "Munich Re's Reinsurance Group to be Carbon Neutral by 2012. 2007. Munich Reinsurance Company, Press Release, June 27.
- ¹⁸⁰ http://www.iag.com.au/news/news_story/docs/20061115a.pdf
- ¹⁸¹ http://www.folksam.se/polopoly_fs/1.106251/sustainabilityreport_2006.pdf
- ¹⁸² See <http://www.allstate.com/Community/PageRender.asp?Page=environment.html>
- ¹⁸³ See company submissions to the Carbon Disclosure Project (round 5).
- ¹⁸⁴ See company's submission to Carbon Disclosure (round-5).
- ¹⁸⁵ <http://business.guardian.co.uk/story/0,,1979037,00.html>
- ¹⁸⁶ <http://www.royalsun.com/royalsun/media/showpressitem.jsp?type=press&ref=371&link=4&sub=56&sup=>
- ¹⁸⁷ http://www.fp-marine.com/press_centre_press.html
- ¹⁸⁸ Ruterfoord. 2006. "Rutherford First in Insurance Industry to Go Carbon Neutral", News Release, August 31.
- ¹⁸⁹ Kroner, W., J.A. Stark-Martin, and T. Willemain. 1992. "Using Advanced Office Technology to Increase Productivity." Center for Architectural Research and Center for Services Research and Education, Rensselaer University, Troy, NY.
- ¹⁹⁰ Gordes, J. 2000. "The Power to Insure: Reducing Insurance Claims with new Electricity Options. Greenfield, MA: Northeast Sustainable Energy Association.
- ¹⁹¹ A partial list of downloadable reports is available here: <http://insurance.lbl.gov/csr-reports.html>
- ¹⁹² F&C Investments. 2007. *Op. cit.*
- ¹⁹³ M. C-Fishel. 2006. "Fifth Survey of Climate Change Disclosure in SEC Filings of Automobile, Insurance, Oil & Gas, Petrochemical, and Utilities Companies." Friends of the Earth – US, 188pp.
- ¹⁹⁴ Lifsher, M. 2007. "Warming Threat Disclosure Sought." *Los Angeles Times*, September 18.
- ¹⁹⁵ See <http://www.cdproject.net/>
- ¹⁹⁶ F&C Investments. 2007. *Op. cit.*
- ¹⁹⁷ Mills, E. and E. Lecomte. 2006. *Op. cit.*
- ¹⁹⁸ Mills, E., R.J. Roth Jr., and E. Lecomte. 2006. "Availability and Affordability of Insurance Under Climate Change: A Growing Challenge for the U.S." *Journal of Insurance Regulation*, Winter 2006, Vol. 25, Issue No. 2, pp. 109-149.
- ¹⁹⁹ Mills, E. 2007. "The Role of NAIC in Responding to Climate Change," forthcoming in the *UCLA Journal of Environmental Law and Policy*, Volume 26, Issue 1. Originally published as Testimony to the National

Association of Insurance Commissioners, December 8, 2006, San Antonio, TX.

<http://eetd.lbl.gov/EMills/PUBS/PDF/NAIC-Mills-Testimony-8Dec06.pdf>

²⁰⁰ IDNR. 2000. "Insurance Industry Participation in Promotion of Building Energy Codes." Prepared by the Center for Business and Economic Research, Louisiana State University, for Iowa Department of Natural Resources, August.

²⁰¹ Marsh. 2004. "Responding to Climate Change Risks and Opportunities." Topics Letter Number XVI.

²⁰² Green, M. 2003. "A Hole in the Wall." *Best's Review*, p. 51, July.

²⁰³ Mills, E. 2001. "When the Lights Go Out." *Best's Review*. Oldwick, NJ: A.M. Best Company, pp. 73-77, July.

²⁰⁴ See <http://securebuildings.lbl.gov/>

²⁰⁵ F&C Investments. 2007. *Op. cit.*

²⁰⁶ Avery, D., E. Mills, M. Breighner, and J. Naylis. 1998. "Campus Lighting--Lighting Efficiency Options for Student Residential Living Units: A Study at Northeastern University, Boston, Massachusetts". LBNL/PUB-816. Also published by Arkwright Mutual Insurance Co. and by the University Risk Management and Insurance Association's *URMIA Journal*, 1999, pp. 44-52, Chevy Chase, MD.

²⁰⁷ See Mills, E. and I. Knoepfel. 1997, as well as Mills, E. 2005. *Op. cit.* for more discussion of this point.

²⁰⁸ Ross, M. and T. Wenzel. 2002. "An Analysis of Traffic Deaths by Vehicle Type and Model." LBNL Report No 49675. <http://www.lbl.gov/Science-Articles/Archive/assets/images/2002/Aug-26-2002/SUV-report.pdf>

²⁰⁹ Wilson, E.J., T.L. Johnson, and D.W. Keith. 2003. "Regulating the Ultimate Sink: Managing the Risks of Geologic CO₂ Storage," *Environmental Science and Technology*, 37:3476-3483.

²¹⁰ Wilson, E.J. and M.A. de Figueiredo. 2006. "Geologic Carbon Dioxide Sequestration: An Analysis of Subsurface Property Law." *Environmental Law Review*, 36:10114.

APPENDIX A. Compendium of Insurer Responses to Climate Change

The number of activities are indicated in each cell	Country	Understanding the Climate Change Problem*	Promoting Loss Prevention	Aligning Terms & Conditions with Risk-reducing Behavior	Innovative Insurance Products	Carbon risk-management & offsets	Financing Customer Improvements	Investment in Climate Change Solutions	Building Awareness and Participating in Public Policy*	Leading by Example*	Carbon Risk Disclosure**
INSURANCE & REINSURANCE COMPANIES											
AAA Chicago Motor Club	US		1	1							
ACE	UK								1		1
Achmea	NL								1		
Admiral Group	UK										1
Aegon	NL									1	2
Aetna	US									1	1
Aioi Insurance	JP			1					1		
Alcyone Finance	FR								1		
Alecta	SE								1		
Allstate	US		3							1	3
Allianz	DE	1	1		3	2		2	1	1	3
AGF	FR		1	1	1	1		1	1	1	1
Firemans Fund Insurance Company	US		1		5					1	
KPMG	DE										1
American International Group (AIG)	US	1	1		3	1		1	1	1	2
Hartford Steam Boiler	US				1	1				1	
Lexington Insurance	US			1							
American Modern Insurance Group	US									1	
American National Property and Casualty Company	US		1								
Amlin	UK								1		
AMP Limited	AU										1
Aon Risk Services	US	1			1	1				1	1
Arveh	IS			1							
Aspen Insurance	US										1
Aviva	UK		1	1				1	1	1	1
AXA	FR		1	1	2	1			1	1	2
Bangkok Insurance Public Company Ltd	TH								1		
Bankers Insurance Group	US									1	
Berkshire Hathaway Life Insurance Company & GEICO	US								1		1
Blue Cross & Blue Shield Mutual of Ohio	US									1	
Boiler Inspection & Insurance Company	CA				1						
Cathay Financial Holding	TW										1
CarbonRE AG	CH					1			1		
CGNU	UK	1				1				1	
Chaucer Insurance	UK								1		
China Life Insurance	CN										1
Chubb	US		1		1	1					2
CIGNA	US										1
Cincinnati Financial Corporation	US										2
CNP Assurances	FR										1
Connecticut Mutual Life Insurance Home Office	US									1	
Continental Insurance	US									1	
Cooperative Insurance	UK				1				1		
Co-operators Group Limited	CA								1		
Covea	FR					1					
Delta Lloyd Verzekeringsgroup NV	FR									1	
Developers Professional Insurance Company (DPIC)	US				1						
Dexia Insurance	BE							1	1		
Employers Re	US	1									
Environmental Insurance Agency	US				1						

The number of activities are indicated in each cell	Country	Understanding the Climate Change Problem*	Promoting Loss Prevention	Aligning Terms & Conditions with Risk-reducing Behavior	Innovative Insurance Products	Carbon risk-management & offsets	Financing Customer Improvements	Investment in Climate Change Solutions	Building Awareness and Participating in Public Policy*	Leading by Example*	Carbon Risk Disclosure**
Esurance	US								1	1	
Euler Hermes	NL										1
Eureko Re	NL				1						
First Treasury	CA				1						
FM Global	US	1	1							1	
Folksam	SE								1	1	
Fortis	BE				1		3				1
FP Marine	HK									1	
Friends Provident	UK								1	1	1
GMAC	US			1							
Garant Insurance	AU					1					
Gerling	UK				1			1			
GREEN	UK				1						
Groupma Insurances	UK				1						
Groupama Asset Management	FR								1		
Hanover	US				1						
Hannover Ruckversicherung AG	DE										1
Harleysville Mutual Insurance Company	US									1	
Hartford Financial Group	US									1	2
HBOS	UK								1		1
Helvetia Patria Versicherungen	CH								1		
Hiscox	UK								1		1
Hollard	SA			1							
HSBC	UK		1						1	1	1
Hyundai Marine and Fire Insurance Co.Ltd.	KR								1		
Independent Insurance	UK									1	1
ING Group	NL						3	1	1	1	
Insurance Australia Group	AU	1	1			1			1	1	1
Intramerica Hellenic Life Insurance Company	GR								1		
ITT Hartford Group, Incorporated	US									1	
Johnson & Higgins	US									1	
KBC Bankassurance	BE							1		1	1
KPAAB	SE								1		
Legal & General Group	UK				1				1	1	1
Lloyds of London	UK	1	1		3	1		1	1		1
Beazley	UK								1		
Diagonal Underwriting	UK								1		
Hardy Underwriting	UK								1		
Kiln	UK								1		
Lloyd's TSB	UK				1					1	1
Manulife Financial	CA								1		1
MAPFRE	ES			1					1		
Marketform	UK								1	1	
MBIA	US										1
Medibank Private Ltd.	AU								1		
MetLife	US		1								1
Millea Group	JP										
Tokio Marine & Nichido	JP	1	1		2			1	1	1	2
Milwaukee Insurance	US									1	
Minnesota Mutual Life Insurance Company	US									1	
Mississippi Windstorm Underwriting Association	US		1								
Mitsui Sumitomo	JP		1		1	1	1	2	1	1	1

The number of activities are indicated in each cell	Country	Understanding the Climate Change Problem*	Promoting Loss Prevention	Aligning Terms & Conditions with Risk-reducing Behavior	Innovative Insurance Products	Carbon risk-management & offsets	Financing Customer Improvements	Investment in Climate Change Solutions	Building Awareness and Participating in Public Policy*	Leading by Example*	Carbon Risk Disclosure**
Victoria/Ergo	DE					1		1			
Westbend Mutual	US									1	
WGV	DE			1							
XL Insurance	UK								1		1
Zurich American Insurance Group / Steadfast	US				1						
Zurich Financial	CH				1				1		2
Farmers Insurance	US				1						
INSURANCE BROKERS											
Aon	US	1				1					
Benfield	UK								1		
Clair Odell Group	US				1						
Garnet Captive Insurance Services	US			1							
Marsh	US	1	1						1	1	1
Guy Carpenter and Company (subsidiary of Marsh)	US		1							1	
Morris & Mackenzie	CA				1						
NRG Savings Assurance	US				1						
Rutherford	US									1	
Willis Corroon/Willis Canada; Willis Group Holdings London	US/CA	1			2						
INSURANCE ORGANIZATIONS											
Advocates for Highway and Auto Safety	US		1						1		
Alliance of American Insurers	US		1								
American Insurance Association (AIA)	US	1	1								
Association of British Insurers	UK	1	1						1		
British Insurance Brokers Association (BIBA)	UK								1		
CEA: The European Insurance and Reinsurance Federation	33 co's	1									
General Insurance Association of Japan	JP		1						1		
Institute for Business and Home Safety (IBHS)	US		1						1		
Institute for Catastrophic Loss Reduction	CA	1	1						1		
Insurance Information Institute	US	1	1								
Insurance Institute for Highway Safety (IIHS)	US		1						1		
Insurance Services Organization	US		1								
International Association of Insurance Supervisors	Int'l			1							
Lockton Risk Services	US				1						
National Association of Independent Insurers	US		1								
National Association of Insurance Commissioners (NAIC)	US		1						1		
National Association of Mutual Insurance Companies (NAMIC)	US		1						1		
United Nations Environment Programme Financial Services Initiative	Int'l	1	1								
OTHER ORGANIZATIONS***											
Boston Edison Company	US		1								
Building Air Quality Alliance (BAQA)	US				1						
Building Code Assistance Project (BCAP)	US								1		
Ceres	US		1						1		
Conservation Law Foundation	US			1					1		
The Climate Group	UK		1						1		
Environmental Defense	US				1				1		
Federal Highway Administration (FHA)	US		1								
Institute for Business and Home Safety	US		1						1		

The number of activities are indicated in each cell	Country	Understanding the Climate Change Problem*	Promoting Loss Prevention	Aligning Terms & Conditions with Risk-reducing Behavior	Innovative Insurance Products	Carbon risk-management & offsets	Financing Customer Improvements	Investment in Climate Change Solutions	Building Awareness and Participating in Public Policy*	Leading by Example*	Carbon Risk Disclosure**
International Energy Agency	Int'l		1						1		
Iowa Department of Natural Resources	US		1						1		
Millennium Promise	US				1						
Natural Resources Defense Council	US	1	1						1		
Pacific Gas & Electric Company	US								1		
RESNET	US				1						
Rockefeller Family Fund	US		1						1		
Roofing Industry Committee on Wind Issues (RICOWI),	US		1								
U.S. Department of Energy	US	1	1						1		
U.S. Department of Transportation	US								1		
U.S. Environmental Protection Agency	US	1	1						1		
Waterhealth International	US		1								
World Wildlife Fund	US	1	1						1		

Notes: Table summarizes examples enumerated in the text, based on interviews, company publications, or third-party reports. Not all activities underway have necessarily been captured.

Mergers and acquisitions are indicated where the information is available. Not all companies or activities may be active as of the date of this publication.

* For these three columns, a maximum of 1 is tallied, as there is too much subjectivity in assigning weights to each individual activity.

** Multiple-year responses to a given disclosure initiative (e.g. Carbon Disclosure Project) are counted once.

*** Activities attributed to "Other Organizations" are only those conducted in collaboration with the preceding insurer groups.

Appendix B

Insurance sector responses to the Carbon Disclosure Project surveys (as of October 9, 2007)													
Insurance Company - USA						Insurance Company - Other							
		2007	2006	2005	2004	2003			2007	2006	2005	2004	2003
Aetna Inc	USA	✓	-	-	-	-	ACE Limited	BM	✓	0	-	✓	0
Aflac	USA	0	X	0	X	0	Admiral Group	UK	-	✓	-	-	-
Allstate	USA	✓	0	X	X	✓	Aegon	Netherlands	✓	✓	i	0	X
Ambac Financial Group	USA	0	0	-	-	-	AGF	France	✓	✓	✓	-	-
American International Group	USA	✓	✓	✓	✓	✓	Allianz	Germany	✓	✓	✓	✓	✓
Aon	USA	✓	✓	-	-	i	AMB Generali Holding AG	Germany	-	0	-	-	-
Berkshire Hathaway	USA	0	0	0	X	0	Amlin	UK	-	X	-	-	-
Chubb*	USA	0	X	i	0	X	AMP Limited	Australia	-	✓	-	-	-
Cigna	USA	✓	-	-	-	-	April Group*	France	-	0	-	-	-
Cincinnati Financial	USA	✓	i	-	-	-	Aviva	UK	✓	✓	✓	✓	✓
Hartford Financial Services	USA	✓	i	X	X	X	AXA Asia Pacific Holdings Limited - AXA Group	Australia	-	✓	-	-	-
Jefferson-Pilot	USA	-	0	-	-	-	AXA Group	France	✓	✓	✓	✓	✓
Lincoln National	USA	-	X	-	-	0	AXA Konzern AG - AXA Group	Germany	-	✓	-	-	-
Loews Corporation	USA	-	0	-	X	0	Benfield Group	UK	-	0	-	-	-
Marsh & McLennan	USA	✓	✓	✓	0	-	Brit Insurance Holdings	UK	-	0	-	-	-
MBIA	USA	✓	✓	-	-	-	Cathay Financial Holding	Taiwan	0	✓	✓	✓	-
Metlife	USA	0	X	0	0	0	Catlin Group LD Coms	UK	-	i	-	-	-
Progressive	USA	✓	X	X	X	X	China Life Insurance	China	X	✓	-	-	-
Prudential Financial	USA	✓	X	X	X	X	Cnp Assurances	France	✓	✓	-	-	-
Regions Financial Corp.	USA	0	-	-	-	-	E-L Financial	Canada	-	0	-	-	-
Safeco	USA	✓	✓	-	-	-	Euler Hermes	France	-	✓	-	-	-
St. Paul Travelers	USA	✓	✓	✓	✓	0	Fairfax Financial Holdings	Canada	-	0	-	-	-
Torchmark	USA	-	0	-	-	-	Fortis	Belgium	✓	-	-	-	-
UnumProvident	USA	-	✓	-	-	-	Friends Provident	UK	-	✓	-	-	-
N-total (US)		19	21	11	12	13	Generali	Italy	-	i	X	X	X
N-Answered questionnaire		13	7	3	2	2	Great West Lifeco	Canada	X	X	0	X	-
% Answered questionnaire		68%	33%	27%	17%	15%	Hannover Ruckversicherung AG	Germany	-	✓	-	-	-
* Chubb had a pending post-deadline response as of 9 Oct 2007							HBOS	UK	✓	-	-	-	-
Grand Total (World)		44	75	29	29	27	Helphire Group	UK	-	0	-	-	-
N-Answered questionnaire		34	39	17	14	9	Hiscox	UK	-	✓	-	-	-
% Answered questionnaire		77%	52%	59%	48%	33%	HSBC	UK	✓	-	-	-	-
							Hub International	Canada	-	X	-	-	-
							Industrial Alliance Insurance	Canada	-	X	-	-	-
							ING Group	Netherlands	✓	-	-	-	-
							Insurance Australia Group Limited	Australia	-	✓	-	-	-
							KBC Group	Belgium	✓	-	-	-	-
							Kingsway Financial Services	Canada	-	0	-	-	-
							Kookmin Bank	South Korea	0	-	-	-	-
							Legal and General	UK	✓	✓	-	-	-
							Lloyd's TSB	UK	✓	-	-	-	-
							Manulife Financial	Canada	✓	✓	✓	i	i
							Millea Holdings	Japan	✓	✓	✓	✓	-
							Mitsui Sumitomo Insurance	Japan	✓	✓	✓	-	-
							Munich Re	Germany	✓	✓	✓	✓	✓
							Nipponkoa Insurance Co Ltd	Japan	-	0	-	-	-
							Nürnberg Beteiligungs-AG	Germany	-	X	-	-	-
							Ping An Insurance*	China	-	0	-	-	-
							Promina Group Limited	Australia	-	X	-	-	-
							Prudential plc	UK	✓	✓	✓	✓	✓
							Qbe Insurance Group Limited	Australia	-	X	-	-	-
							RAS	Italy	-	✓	✓	✓	✓
							Resolution	UK	-	✓	-	-	-
							Royal & Sun Alliance	UK	-	✓	-	-	-
							Scor	France	-	✓	-	-	-
							Sompo Japan Insurance	Japan	-	✓	-	-	-
							Sun Life Financial	Canada	-	✓	✓	X	X
							Swiss Re	Switzerland	✓	✓	✓	✓	✓
							T&D Holdings	Japan	-	✓	-	-	-
							Tower Ltd	New Zealand	-	0	-	-	-
							XL Capital	UK	-	0	X	✓	X
							Zurich Financial Services	Switzerland	✓	✓	✓	✓	0
							N-total (non-US)		25	54	18	17	14
							N-Answered questionnaire		21	32	14	12	7
							% Answered questionnaire		84%	59%	78%	71%	50%

Key & Stats for All Years:	Total-N	%	US-N	US%	Other-N	Other-%	
Surveyed	204		76		128		
Answered Questionnaire	✓	113	55%	27	36%	86	67%
Declined to Participate	X	39	19%	21	28%	18	14%
Provided Information	i	8	4%	3	4%	5	4%
No Response	0	43	21%	24	32%	19	15%
Not in given round of CDP	-						

Count total 120 305
Count not surveyed 44 177

Source: <http://www.cdproject.net>

* = had promised a reply, but none submitted

Declined for submission to be public information