

From Risk to Opportunity

Insurer Responses to Climate Change

2008

Evan Mills, Ph.D.
April 2009



 **Ceres**
A Ceres Report

This annual 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 78 institutional investors from the U.S., Europe, and Canada who collectively manage over \$7 trillion in assets. This project was sponsored by grants from Blue Moon Fund, The Kresge Foundation, The Pew Charitable Trusts, Rockefeller Brothers Fund, and Rockefeller Family Fund. The original compilation of case studies was performed by Lawrence Berkeley National Laboratory, and sponsored by the U.S. Department of Energy and the U.S. Environmental Protection Agency. The views expressed in this report are the author's and do not necessarily reflect those of the sponsors.

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Dr. Mills's insurance-related research is collected at <http://insurance.lbl.gov>

For a downloadable version of this report, errata, the most current repository of information on insurance company activities in response to climate change, and to submit new initiatives for consideration in future reports, see: <http://insurance.lbl.gov/opportunities.html>

About the cover: The imagery invokes the sources of human-induced climate change, the diversity of consequences on land and sea, and impacts spanning financial systems and human settlements. In this simulation of the Battery area of lower Manhattan (NECIA/UCS, 2007, *Image generated by Applied Science Associates, Inc.*), the light-blue area depicts today's FEMA 100-year flood zone for the city (a 1% chance of flooding in any given year). With additional sea-level rise by 2100 under a higher-emissions scenario, this area is projected to have a 10% chance of flooding in any given year; under a lower-emissions scenario, a 5% chance of flooding in any given year.

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Companies and Organizations Referenced in this Report

INSURANCE & REINSURANCE COMPANIES

AAA	BGL	Grange Mutual	MBIA
ACE	Blue Cross & Blue Shield	Green Insurance Company	MetLife
Achmea	Bradford & Bingley	Groupama Asset Management	Midwest Family Mutual
Admiral Group	Caitlin	Hanover	Milemeter
Aegon	Cathay Financial Holding	Hannover	Milwaukee Insurance
Aetna	CarbonRE AG	Ruckversicherung AG	Minnesota Mutual Life Insurance Company
AFLAC	Chaucer Insurance	Hardy's Underwriting	Mississippi Windstorm Underwriting Association
Aioi Insurance	China Life Insurance	Harleysville Mutual Insurance Company	Mitsui Sumitomo
Alcyone Finance	Chubb	Hartford Financial Group	Mobiliar
Alecta	CIGNA	HBOS	Munich Re
Alleanza Assicurazioni S.p.A	Cincinnati Financial Corporation	HDI Gerling	Nationwide Mutual Insurance Company, Inc.
Allstate	CNP Assurances	Helvetia Patria Versicherungen	Allied
Allianz	Connecticut Mutual Life Insurance Home Office	Heritage	Navigators Group
AGF	Continental Insurance	Hibernia	Nedbank
Firemans Fund Insurance Company	Cooperative Insurance	Hiscox	New York Life Insurance & Annuity Corp.
KPMG	Co-operators Group Limited	Hollard	NFU Mutual
AMBAC Financial Group	Sovereign General Insurance Company	Real Insurance	Nipponkoa Insurance CO.,Ltd
AMB Generali	Covea	HSBC	NRMA Insurance
American International Group (AIG)	Delta Lloyd Verzekeringsgroup NV	Hyundai Marine and Fire Insurance Co.Ltd.	Pakisama Mutual Benefit Association
Hartford Steam Boiler	Developers Professional Insurance Company (DPIC)	Independent Insurance	OEKO Capital Lebensversicherung AG
Solomon Associates	Desjardins General	ING Group	Pennsylvania Blue Shield
Boiler Inspection & Insurance Company	Dexia Insurance	Insurance Australia Group	Phoenix Home Life Mutual Insurance Co.
Lexington Insurance	Diagonal Underwriting	NZI	Plymouth Rock Insurance Co.
American Modern Insurance Group	Ecclesiastical	Intramerica Hellenic Life Insurance Company	Polis Direct
American National Property and Casualty Company	Environmental Insurance Agency	ITT Hartford Group, Incorporated	Pool Espanol de Riesgos Medioambientales
Amlin	Equity Insurance Group	Jackson National Life	Premier Underwriting
AMP Limited	Esurance	Johnson & Higgins	Presidio Excess Insurance Services
Ark	Euler Hermes	Kaiser Permanente	Progressive Auto Insurance
Aryeh	Eureko Re	KBC Bankassurance	Provident Life & Accident Insurance Co.
Aspen Insurance	F&C Investments	Kiln	Prudential Assurance
Aviva	First Treasury	KLP Insurance	Prudential Financial
Norwich Union	FM Global	KPA AB	QBE Insurance Group Ltd.
AXA	Affiliated FM	La Capitale General Insurance	Unigard
Baloise Holding	Mutual Boiler Re	Legal & General Group	RAS
Bangkok Insurance Public Company Ltd	Folksam	Liberty Mutual	RBS Insurance
Bankers Insurance Group	Fortis	Lloyds of London	Rheinland Versicherungen
Beazley	FP Marine	Lloyd's TSB	
Berkshire Hathaway Life Insurance Company & GEICO	Friends Provident	Manulife	
	GMAC	MAPFRE	
	Garant Insurance	Marketform	
	Genworth Financial	Massachusetts Auto Insurance	

Resolution	Farmers Insurance	CEA: The European Insurance and Reinsurance Federation	Conservation Law Foundation
Royal Maccabees Life Insurance Company	Steadfast	Climatewise	The Climate Group
RSA	INSURANCE BROKERS & INTERMEDIARIES	General Insurance Association of Japan	Environmental Defense
Safeco	Aon	General Insurance Research Organization (GIRO)	Federal Highway Administration (FHA)
SARA	Ascent	Geneva Association	Harvard University, Center for Health and the Global Environment
Scor	Benfield	Insurance Bureau of Canada	International Energy Agency
Secura Mutual	Clair Odell Group	Institute of Actuaries of Australia	International Finance Corporation
SINAF	Ecover	Institute for Business and Home Safety (IBHS)	Iowa Department of Natural Resources
Sompo Japan Insurance	Environmental Transport Association	Institute for Catastrophic Loss Reduction	Lawrence Berkeley National Laboratory
Sorema Re	Garnet Captive Insurance Services	Insurance Information Institute	London School of Economics
South Carolina Farm Bureau Mutual Insurance Company	Independent Insurance Services	Insurance Institute for Highway Safety (IIHS)	Millennium Promise
South Carolina Hail/Wind Pool	JLS Group	Insurance Services Organization	Natural Resources Defense Council
Spectrum	Lockton Risk Services	International Association of Insurance Supervisors	Northeastern University
Standard Life	Marsh & McLennan	National Association of Independent Insurers	North Central Texas Council of Governments
State Compensation Insurance Fund	Guy Carpenter and Company (subsidiary of Marsh)	National Association of Insurance Commissioners (NAIC)	Pacific Gas & Electric Company
State Farm	McGriff, Seibels & Williams	National Association of Mutual Insurance Companies (NAMIC)	Princes Rainforest's Project (Prince of Whales)
State Farm Mutual Automobile Ins Co	Morris & Mackenzie	Risk and Insurance Management Society (RIMS)	RAND
Storebrand	NRG Savings Assurance	Risk Management Solutions	Reinsurance Association of America
Sun Life Financial	Rutherford	United Nations Environment Programme Financial Services Initiative	RESNET
Swiss Re	Solar Group	OTHER ORGANIZATIONS	Rockefeller Family Fund
North American Capacity Insurance Co.	Specialized Broking Associates	Asian Development Bank	Roofing Industry Committee on Wind Issues (RICOWI),
Employers Re	Willis Corroon/Willis Canada; Willis Group Holdings London	Boston Edison Company	U.N. World Food Programme
T&D Holdings	Xelector	Building Air Quality Alliance (BAQA)	U.S. Department of Energy
Tapiola	INSURANCE ORGANIZATIONS	Building Code Assistance Project (BCAP)	U.S. Department of Transportation
Tokio Marine Holdings	Advocates for Highway and Auto Safety	Ceres	U.S. Environmental Protection Agency
Tokio Marine Nichido	Alliance of American Insurers	Columbia University	Waterhealth International
The Travelers Companies	American Insurance Association (AIA)		World Bank
Trinity Life Assurance Company	Association of British Insurers		World Wildlife Fund
Trygg-Hansa	Asociación Mexicana de Instituciones de Seguros, A.C. (AMIS) [Mexican Insurance Association]		Yale University
TrygVesta	British Insurance Brokers Association (BIBA)		
UNIPOL	Casualty Actuarial Society (CAS)		
United Insurance			
USAA			
UNUM			
Victoria/Ergo			
Westbend Mutual			
WGV			
World Nomads Insurance			
XL Capital			
Zurich Financial Services			

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* Responding companies in 2008 included AIG (U.S.), Allianz SE, (DE) Allstate (U.S.), Association of British Insurers (UK), AXA Group (FR), ClimateWise, The Co-operators (CA), MAPFRE (ES), McGriff, Seibels & Williams, Inc (U.S.), Munich Re (DE), Risk Management Solutions (U.S.), RSA Insurance Group (UK), Swiss Re (CH), Tokio Marine & Nichido Fire Insurance (J), The Travelers Companies, Inc. (U.S.), Willis (U.S.), XL Capital (U.S.), Zurich Financial Services (CH).

† Institutional names and affiliations are shown as of the time of correspondence.

Foreword

Climate change has become a hotter topic than ever before, thanks to the new political leadership in the United States. Despite the financial crisis, a growing number of political, financial and business leaders are calling for immediate action to drastically reduce global warming pollution. For the first time, fighting climate change is seen not just as a long-term imperative but also as a short-term stimulus for a struggling economy.

Insurers have more incentive than any other industry to catalyze global action on climate change. Though 2008 brought no Katrina-scale catastrophes, catastrophic losses to the economy were the third highest ever, exceeding \$200 billion globally in 2008, including \$40 billion in losses from Hurricanes Ike and Gustav in the U.S. alone, according to global insurer Munich Re.

Last year's figures are not an anomaly, but are part of a disturbing pattern. "This continues the long-term trend we have been observing," said Torsten Jeworrek, a member of Munich Re's Board of Management. "Climate change has already started and is very probably contributing to frequent increasing weather extremes and ensuing natural catastrophes."

Climate trends are creating risks on both sides of the insurance house—underwriting and investment. But these trends also create vast opportunities, from product innovation to investment alpha, for insurers to be part of the global warming solution.

This Ceres report outlines the insurance industry's significant progress in developing wide-ranging products and services to help global consumers and businesses reduce their exposure to climate change—and to reduce the emissions causing global warming. The report identifies 643 real-world examples from 244 insurers, reinsurers, brokers and insurance organizations from 29 countries—a 50 percent jump in such activity compared to November 2007, when Ceres issued a similar report.

Insurance coverage for green buildings, renewable energy, carbon capture and storage and carbon trading are being offered by more insurers than ever before. For the first time, two insurers, Zurich and Liberty Mutual, have introduced directors and officers' coverage specifically tailored to address liability risks associated with climate change.

But the bulk of deep market activity is in Europe, primarily from property and casualty (P&C) insurers. And even among these P&C firms, the offerings—and overall market saturation—are very limited.

Insurer activities go far beyond offering new products. This report documents the industry's growing investments in businesses that are developing and offering low- and no-carbon technologies—specifically, a total of \$11 billion in direct investments by 15 insurers, nearly double that observed in 2007.

Industry leaders are also driving forward improvements in the climate science that will help governments better understand and prepare for future risks—government action that is critical to the preservation of the private insurance market. And a small but growing number of insurers are creating the right internal structures to manage the correlated risks posed by climate change.

There is no question that the industry is more aware of the need to act on climate change than ever before. Surveys of industry analysts, representatives and boards consistently rank climate change at the top of the list of risks facing the insurance industry today. Yet the scale, depth and market reach of activities outlined in this report do not reflect the urgency conveyed by those surveys. The industry's response, from underwriting to investment to public policy engagement, is still incremental. The scale of risk this industry faces—and the opportunities that can be captured by those who act—call for much more dramatic and far-reaching action.

Now is the time to take transformative action. The next few years are likely to see a flurry of activity driven by the changed political and economic context—projects that seek to retool and de-carbonize the global energy system, to make family homes and commercial buildings more energy efficient, to reduce dependence on oil, and to jumpstart national and international carbon trading markets.

The opportunities for insurers to drive these transformative changes, through direct investments and exponentially more green products and services, are unparalleled. Just as the industry once asserted its leadership and expertise in tackling building fire and earthquake risks the past, today insurers can capitalize on their enormous creativity and market clout to preserve and grow their businesses in the face of this unprecedented challenge.

Without insurance innovation and investment we will not achieve the challenge of avoiding extreme climate change impacts and realizing a low-carbon global economy. So here is a challenge to the industry: How will insurers help policymakers, the capital markets, and customers meet these challenges?

The answer to this question may well determine the future of the industry.

Mindy S. Lubber

President of Ceres

Director of Investor Network on Climate Risk

Executive Summary

“Climate change is a fact. Countering it is a must. We are convinced that climate protection makes economic sense, as it would be more expensive in the long term to pay for the damage it causes. It offers companies and national economies that react quickly great opportunities ...” (MEAG 2008)

~ Peter Hoeppe, Munich Re

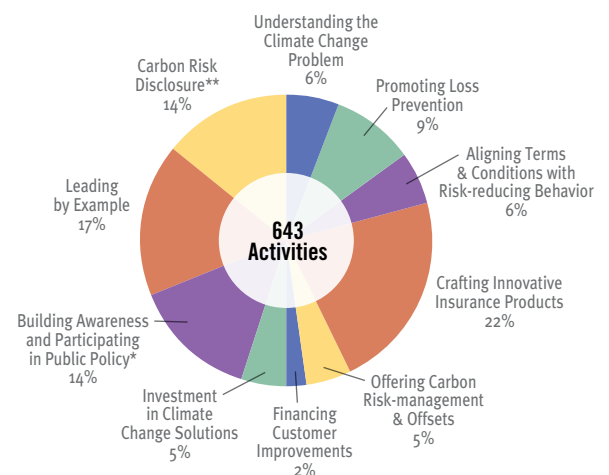
A vanguard of insurers is taking bold steps to adapt their business models to the realities of climate change, while progress by the industry as a whole is still in its infancy. In many ways, insurers are still catching up both to mainstream science and to their customers, which, in response to climate change and energy price volatility, are changing the way they construct buildings, transport people and goods, design products, and produce energy. Customers, as well as regulators and shareholders, are eager to see insurers provide products and services that respond to the “greening” of the global economy, expand their efforts to improve disaster resilience, and otherwise be proactive about the climate change threat.

Insurers have begun to embrace a more sophisticated approach to climate change, increasingly recognizing the issue as one of “enterprise risk management,” which cuts across the domains of underwriting, asset management, and corporate governance. The year 2008 saw a marked increase in the number of insurance activities responding to climate change risks and opportunities, more creative offerings, deeper institutionalization of the activities within the companies, and a growing variety of partnerships with non-insurers. Insurance companies and their trade allies are “drilling deeper” and targeting more specific market segments and product types in a growing number of countries.

Based on a review of more than 300 source documents, plus a direct survey of insurance companies, this Ceres report identifies 643 specific activities from 244 insurance entities from 29 countries (**Figure 1; Appendix A**)—representing a 50% year-over-year increase in activity.* In addition to activities on the part of 189 insurers, eight reinsurers, 20 intermediaries, and 27 insurance organizations, this report identifies 34 non-insurance entities that have collaborated in these efforts.

Property insurance companies are driving the majority of the activity (homeowner, commercial, and auto), while life-health companies are lagging far behind. Within the property segment there is still considerable room for improvement, and we have seen no activity on the part of certain segments (e.g. offshore property, aviation, ocean marine, or standing-timber insurers). The past year has witnessed a very significant increase in activity on the part of liability insurers, raising the possibility that more insurers might willingly assume the responsibility of climate-related litigation costs borne by their policyholders. There has been relatively minor activity in the travel, warranty, industrial, business interruption, inland marine, workers compensation, crop, professional liability, and commercial auto insurance markets, with much left to be done in these segments.

Figure 1. Prevalence of Insurer Climate Activities: 2008



Notes to Figures 1 and 2: These results do not represent a “census” or random sample of the insurance industry. There are thousands of insurers, many of which have no activities. The values for each year reflect the cumulative experience up to that point, including historical activities that might or might not still be in place.

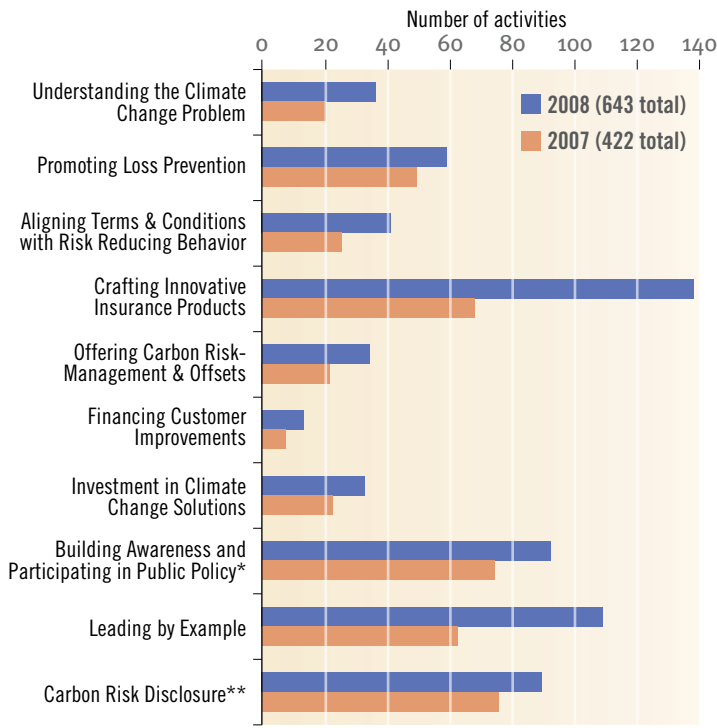
Key:

* 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.

* These entities collectively represent \$1.2 trillion in annual premiums and \$13 trillion in assets, while employing 2.2 million people. These values represent data for 65 of the 243 insurers, reinsurers, and intermediaries cataloged in this report, albeit the largest ones.

Figure 2. Number and Types of Insurer Climate Activities: 2008 vs. 2007



Refer to notes on Figure 1

(although that of U.S. insurers has risen to match that of the rest of the world). Disclosure through securities filings or corporate reporting has leveled off at a far lower level.

In the past 10 years, the number of climate-related activities has increased considerably, with eight times as many activities logged as in the original review in this series. This reflects not just an increase in activity across the industry but also within individual companies (from an average of 1.2 to 2.6 over this period, with up to 25 in some cases). **Box 1** shows the multi-year trends for a number of categories: products and services, investment, climate disclosure, and carbon neutrality commitments. This catalog is most certainly not comprehensive, as new activities are emerging almost daily and we are still discovering ones that have been quietly underway for some time.

In addition to the raw growth in the number of activities, we have observed sophisticated and targeted product design and initiatives more directly focused on spurring the use of new technologies and practices to combat climate change.

Among the key innovations and trends detailed in this report:

- ◆ Many more insurers are offering “green-buildings” products and services, including products and services especially designed for new green buildings, and upgrades to “green” traditional buildings either following a loss or in the course of normal renovations. The sophistication and specificity of existing products is increasing, with 22 companies collectively offering 39 products or services for “Green Buildings” and/or equipment therein.
- ◆ Almost all of the climate-related innovations in liability insurance for directors and officers, political risk, professional liability, and environmental liability have appeared in the past year. Both Zurich and Liberty Mutual launched products specifically designed to cover boards of directors in the event of climate change litigation, a significant development given pending lawsuits that could allocate significant costs to major emitters of greenhouse gases.

European insurers have the deepest history with these initiatives, and some of the more comprehensive strategies can be found there. Considerable creativity and innovation has emerged from the United States, with 37% of the all activities logged in our database (the most of any country). There is somewhat more activity in Europe as a whole (47%) than North America (40%). Although Asian insurers have been first movers in many areas, few new initiatives have come to our attention. Some Australian insurers are quite active on a variety of fronts. In every country, leadership is demonstrated primarily by larger companies. Insurance brokers—primarily in the United States—also have shown significant leadership.

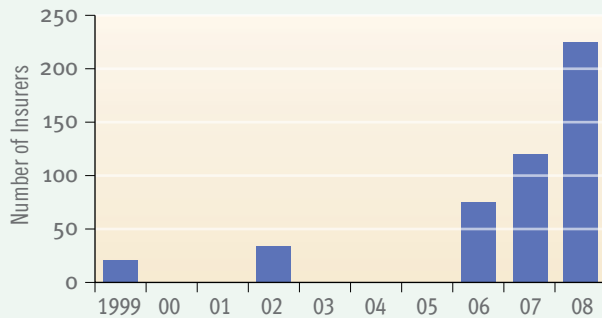
Growth since 2007 has occurred in each of the 10 areas we track (**Figure 2**), but has been particularly strong in the areas of contributing to climate science and analysis, crafting innovative products, carbon risk-management and offsets, and leading by example, e.g. through in-house carbon-neutrality efforts. Among the areas with the lowest year-over-year increase in activity are loss prevention and direct investment in climate-friendly industries. The response rate for voluntary disclosure of climate-related risks to shareholders, regulators and the public through the Carbon Disclosure Project, has leveled off at about 65%

Box 1. Survey Results

All values shown are cumulative as of the given year

Offerings

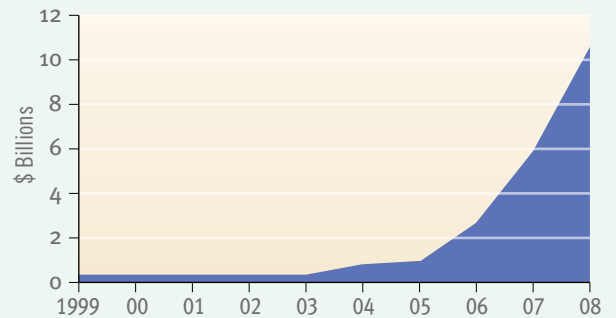
Insurers with Climate-friendly Products & Services (number)



43 instances of pay-as-you-drive insurance or credits for low-emission vehicles
 13 microinsurance programs
 22 companies offering 39 green-buildings products and services
 9 companies offering carbon offsets to customers

Investments

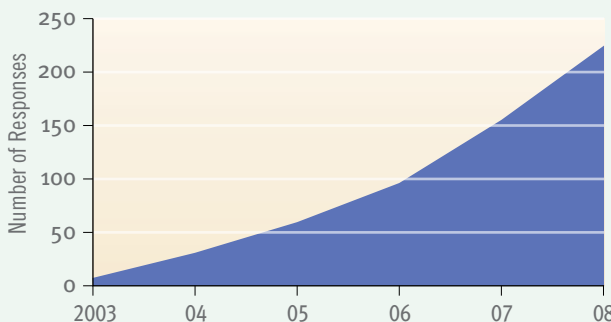
Investment in Climate Solutions (\$Billion)



24 companies making direct investments
 13 instances insurer financing of green projects

Disclosure

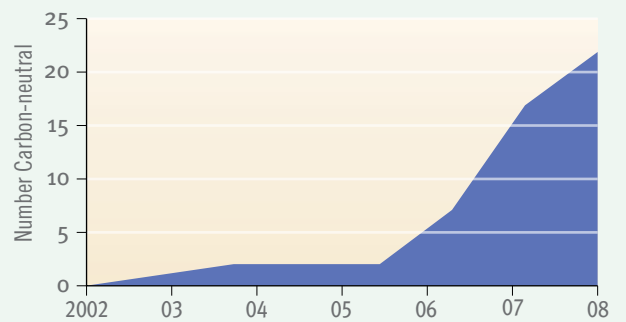
Insurer Responses to Carbon Disclosure Project Survey (number)



Carbon disclosure project: 66% reporting
 SEC Disclosures: 15% reporting in 2006
 See Appendix B for details: 2003–2008

Leadership

Carbon-Neutral Insurers and Intermediaries (number)



25 companies publishing corporate responsibility reports
 23 companies with carbon-neutral commitments
 Date is year carbon neutrality achieved

- ◆ Auto and transportation offerings are becoming more numerous and diverse. Two dozen companies now offer pay-as-you-drive (PAYD) insurance products—with discounts up to 60% for policyholders who drive less than the average driver—an incentive demonstrated by insurers’ own research to significantly reduce miles driven. We have logged 17 instances of discounts for fuel-efficient or low-emission vehicles. Fireman’s Fund launched the first replacement-upgrade product for hybrid cars. In the first example of a marine insurance product, Travelers offered a premium discount for hybrid-electric boats and yachts of up to 10%.
- ◆ In 2008, for the first time, insurers launched products to manage diverse risks from carbon capture and storage (CCS) projects, while publishing research helping to understand the limits of insurability. Products offered by ACE and Zurich, cover several types of risk unique to CCS, the process of capturing carbon dioxide at the source of the

pollution and injecting it into geological formations beneath the surface of the Earth, as well as the longer-term containment. The controversial process—still not demonstrated at full scale—is gaining significant interest from electricity producers, venture capitalists, and regulators as a technological solution to pursuing carbon-intensive energy, such as coal, while lowering greenhouse gas emissions.

- ◆ Renewable energy is receiving more attention as a market for insurance products and services. Coverages for energy providers faced with less-than-anticipated solar or wind energy production have been brought to market by AXA, Munich Re, Navigators, Sampo Japan, and Tokio Marine Holdings.
- ◆ Climate-related microinsurance, which provides coverage for low-income populations without access to traditional insurance, is reaching a greater number of policyholders than most climate-related products in the traditional market. This report identifies microinsurance products covering about 7 million policyholders. Many of these products respond to food and water shortages in rural areas of South America, Africa, and Asia, and much of the market activity tends to be driven by European insurers.

Figure 3. The Progressive Automotive X-Prize



Insurance companies are developing innovative incentives to combat climate change, such as Progressive Automotive's \$10 million X-Prize that rewards efficient automobile design.

- ◆ While insurer investment in and financing of low- and no-carbon technologies is becoming more common, it remains a vanishingly small proportion of the industry's total investments of \$16.6 trillion in 2005. This report catalogs a total of \$11 billion in cumulative direct investments in low- and no-carbon technologies by 15 insurers, almost double that observed as of 2007. While many large insurers have strategically assessed the climate risks they face in their broader investment portfolios. European insurers remain far ahead of their American and Asian counterparts in investing in climate solutions and setting voluntary standards for sustainable investments, with the notable exception of AIG as a leader among American insurers.
- ◆ Insurers are increasingly participating in carbon markets, which now include carbon trading, insurance for credit risks, political risks, and others, plus advisory services, and carbon-neutral products. Quality control in carbon-offset projects has been encouraged through the reward of reduced related insurance premiums projects that are certified by the Gold Standard rating service.

- ◆ More insurers are attempting to improve corporate citizenship (as evidenced by at least 25 insurers now preparing annual Corporate Social Responsibility Reports).
- ◆ Many more insurers are recognizing a correlation between sustainable practices and reduced risk, in some cases giving discounts on Workers Compensation and Environmental coverages for customers with sustainable practices and products.
- ◆ Some insurers have ventured considerably outside of the proverbial "box," as exemplified by Progressive's \$10 million X-Prize for efficient automobile design (**Figure 3**).
- ◆ Insurers are increasingly recognizing the importance of addressing their own carbon footprints. We estimate that the global industry emits about 12 million metric tons of carbon dioxide equivalent each year, which is equivalent to the emissions from 2.5 million U.S. cars, four large electric power plants, or 60,000 train cars full of coal. This includes most forms of energy use, but not indirect emissions from business operations (e.g. those associated with paper consumption, supply chains, or employee commuting transportation). Seventeen insurers and reinsurers and six brokers have achieved carbon neutrality, and others have public commitments to attain carbon neutrality at a specific point in the future.

Figure 4. Market Impact Indicators for Climate-Friendly Insurance Products and Services

	Market Metrics	Time Frame	Notes
Pay-as-you-drive program participation			
AGF	250,000 policies (20%) as of 2006		
Aryeh	200,000	As of 2007	15% of all cars in Israel
Aviva	10,000 policies	2005–2007	
AXA	Belgium (8% of customers); Canada (15%); Switzerland (17%); Germany (discount varies, 1.124 million policies)		
GMAC	20,000 policies		with OnStar; 34 states; up 200% in most recent year
Norwich Union	30% reduction in claims and a 90% renewal rate		
Polis Direct	200,000 customers (15% of the Netherlands' cars)	2004–2008	
Unipol	400,000 customers	2008	
Fuel-efficient/low-emission vehicle incentives			
Sompo Japan Insurance	3.25 million policies		
Tokio Marine & Nichido	6.23 million policies	1999-2006	48% of customers
Green-Building Products			
Fireman's Fund (Allianz)	750 policies; \$65M total policy premiums	mid-2007–mid-2008	Doubled from prior year
AXA	3,800 policies	6 months	
Allianz	All policyholders	Full conversion	Homeowners green coverages in Australia
Financing			
AXA	1,115 policies	first 11 months	Energy@home green loans at a preferential borrowing rate (fixed 5.95%) to finance residential equipment or renovations for energy efficiency, solar panels, etc. (Belgium)
Fortis	20% penetration		Preferential financing terms for energy-efficient homes
ING	70% penetration	as of 2006	Energy-efficient option for car leases
Microinsurance			
AIG	2,250,000 customers (\$45 million in premiums)		Uganda
Allianz	976,000 customers		Columbia (639,000); Indonesia (65,000); India (242,000), Egypt and Senegal (30,000); Cameroon, Ivory Coast, Madagascar, Burkina Faso, Benin, Togo, Mali
Aviva	1,750,000 customers		India—mix of life, credit, and savings products
ING	56,000 customers	2006	India
SINAF	120,000 customers		Brazil
Swiss Re	720,000 small farmers		Weather insurance in India (320k); drought insurance in Africa (400,000)
Zurich	>1,000,000		Africa, Latin America, and through its partners in China
Various	122 different agricultural microinsurance programs; \$1,077 million premium volume (2005)		

We also observed a number of more fundamental strategic developments in 2008. These include: increased engagement of trade allies (actuaries, catastrophe modeling firms, intermediaries) and a considerable uptick in the engagement of insurance regulators, particularly in the United States with the release of a major policy paper by the National Association of Insurance Commissioners and follow-on work concerning climate risk disclosure. Insurers also have continued their engagement with the public policy discussion about responses to climate change at the national and international levels.

Insurance trade organizations remain relatively disengaged on climate change (compared to their most engaged member companies), with a few notable exceptions. The Association of British Insurers has become an important hub of activity in the UK, and the Reinsurance Association of America adopted its first climate change policy in 2008. The Insurance Information Institute has hosted meetings on integrating catastrophe (CAT) and climate modeling.

Keeping pace with the growing activity within the industry, there has been a very significant increase in engagement by the insurance trade press, with coverage now routine versus nonexistent just a couple of years ago. These publications are playing an important role in educating the industry and accommodating a range of viewpoints, and have become vastly more sophisticated and thoughtful in their treatment of the myriad insurance issues and nuances.

There is considerable and well-founded interest in the materiality of these efforts to the broader insurance business and the degree of “traction” being obtained by this proliferation of new green insurance products and services in the marketplace. While in most cases the efforts have moved well beyond public relations, scant information is available on market penetration. This report identifies more than 18 million policies that have been created by these initiatives, the largest category being incentives for low-emissions vehicles followed by microinsurance in the developing world (**Figure 4**). While the full scale of market penetration is not known, it no doubt represents a tiny fraction of global policies, suggesting that the overall insurance market remains considerably undeveloped in terms of climate change products and services.

Challenges and opportunities going forward include bringing promising products and services to scale, continuing to identify and fill coverage gaps (**Figure 5**), and becoming more sophisticated in identifying and confirming the performance benefits of green improvements. It has not yet been demonstrated how some insurance lines might respond to climate change, and a number of market segments have not yet been served with a single “green” insurance product or service. As insurer activities obtain more prominence, they also will be subject to more scrutiny and expectations that they are not simply greenwashing.

Insurers are perfectly placed to make the case for unifying “green” and “disaster-resilient” practices across many domains (construction, energy, agriculture, land use), yet scant effort has been exerted in this regard. It will become increasingly incumbent on insurers to demonstrate the loss-reducing benefits of the green technologies and services that they reward. Loss-prone infrastructure cannot be truly “sustainable”.

The outlook for continued innovation through 2009 is very strong. The global financial crisis might curb certain activities, but those with business materiality will persist, especially in the United States given the energy and environment agenda of the new administration.

While the prolific development of green insurance initiatives proves that the economy and environment can go hand in hand, some even within the industry caution against limiting insurer climate change responses strictly to those that are immediately profitable. Not only do the slogans of many insurers portray them as guardians of human well-being, but acting on climate change is paramount to the very survival and prosperity of the industry.

“The industry should not be afraid to be bold on this issue. In fact, this might just be the perfect opportunity for the insurance industry to demonstrate how it really does advance the interests of all of us ahead of its own, narrower commercial interests”
(Canadian Underwriter 2007).

Figure 5. “Green Insurance” Market Map

- ◆ At least one current example of implementation by an insurer, reinsurer, or intermediary
- Applicable but no current insurer implementation
- Not applicable

This chart maps the universe of possible climate-focused insurance product or service offerings, as well as other means of responding to climate risks. Activities represent emissions-reductions or customer-focused efforts to adapt to the effects of climate change. Green diamonds (◆) represent cases where at least one such product or service has been offered. Blue dots (●) indicate a potential “fit” but for which there are no known examples in practice. No attempt has been made here to qualify or gauge the potential market size, affordability, or actuarial soundness of any given activity. The presence of a green diamond by no means indicates market saturation.

Insurance Line	Rebuild more resilient or “green” after loss	Bundled carbon offsets	Incentives for low-emissions or loss-resilient profile	Performance: Energy savings & carbon reduction risk	Performance: Energy production & carbon reduction risk	Finance for carbon-reducing or loss-resilient improvements	Advisory, inspections, or risk-management services	Climate-risk modeling services
Consumer Lines								
Homeowners	◆	◆	◆	●	◆	◆	◆	–
Auto	●	◆	◆	–	–	◆	–	–
Accident & Health (individual)	–	–	●	–	–	–	–	–
Life (individual)	–	●	●	–	–	●	–	–
Travel	–	◆	–	–	–	–	–	–
Warranty	●	◆	–	●	●	–	–	–
Commercial Lines								
Industrial, energy property	◆	●	◆	◆	◆	●	◆	◆
Real Estate	◆	●	◆	◆	●	●	◆	◆
Offshore property	●	●	●	●	●	●	●	●
Business Interruption	●	–	●	●	◆	–	●	●
Aviation	●	●	●	●	–	●	●	●
Flood	●	–	●	–	–	●	●	●
General Liability	–	–	◆	–	–	–	●	●
Inland Marine	–	●	◆	–	–	●	●	●
Directors & Officers Liability	–	●	●	–	–	●	◆	●
Professional Liability	–	–	◆	●	●	–	●	●
Environmental Liability	●	–	◆	–	–	●	●	●
Ocean Marine	●	●	●	●	–	●	●	●
Excess Casualty	●	–	●	–	–	●	●	●
Workers Compensation	–	–	◆	–	–	●	●	●
Crop	●	●	●	◆	–	●	◆	●
Standing Timber	●	●	●	●	–	●	●	●
Travel	–	●	–	–	–	–	●	●
Life (corporate)	–	●	●	–	–	–	●	●
Accident & Health (corporate)	–	–	●	–	–	–	●	●
Commercial Auto	◆	●	◆	–	–	●	●	●
Warranty	●	●	–	●	●	–	–	–
Political Risk	–	–	–	●	◆	–	●	●
Asset Management								
	–	◆	–	–	–	◆	–	◆

Activities Other Than Products & Services

- ◆ Contributing to climate science and modeling
- ◆ In-house energy management and carbon offsets
- ◆ Carbon-offset projects (e.g. to obtain RECs, White Certificates, or for in-house offsets)
- ◆ Promotion of improved building codes, standards, etc.
- ◆ Engagement in public-policy discussion
- ◆ Conducting and fostering carbon-risk disclosure (possible customer service as well)
- ◆ Filling coverage gaps for low-emission technologies, practices, or service providers (e.g. liability cover for energy-service providers; microinsurance in emerging markets; warranties for vehicles that use blended fuels, etc.)

I. Introduction

A healthy and sustainable environment is a precursor to the long-term well-being of society, the strength of the economy, and the continuing success of our business. We recognize that climate change is one of the most significant risks facing the world today...
(Marsh 2007)

~ Marsh & McLennan

Taking the Temperature of the Insurance Industry

The insurance sector finds itself on the front lines of climate change, and its response to the challenge has varied enormously. Insurers are, by definition, selective and cannot be expected to insure all risks. At a minimum, insurers are messengers of climate risks through their pricing, terms, and conditions, and help society diversify the costs of losses. Insurers are intrinsically vulnerable and, in some cases, hampered by insufficient data.

Mainstream insurers have increasingly come to see climate change as a material risk to their business. The worldwide toll of natural disasters in 2008—\$181 billion in total economic losses and 236,000 deaths—was two and three times the averages seen this decade (*United Nations 2009*).

In 2007, a PricewaterhouseCoopers survey of 100 insurance industry representatives from 21 countries indicates climate change is the No. 4 issue (out of 33), with natural disasters number two (*PricewaterhouseCoopers 2007*). The majority of the other issues are arguably compounded by climate change. The following year, Ernst & Young surveyed more than 70 insurance industry analysts around the world to determine the top-10 risks facing the industry (*Ernst & Young 2008*). Climate change was rated number one, and most of the remaining 10 topics (e.g. catastrophe events and regulatory intervention) also are compounded by climate change. The investigators noted that “it was surprising that this risk, which is typically viewed as a long-term issue, would be identified as the greatest strategic threat for the insurance industry.”

Progress in the scientific understanding is no doubt driving the growing engagement of insurers. The scientific debate is over, with the Intergovernmental Panel on Climate Change (IPCC)—representing the definitive scientific consensus and receiving the Nobel Peace Prize in 2007 for its work—now using the considered term “unequivocal” in describing its certainty that climate change is here. IPCC also has pinpointed human activity as the main driver of observed and projected warming. It has been steadily eliminating sources of uncertainty and reinforcing the conclusion that further delaying action would be highly ill-advised. Many in the insurance world agree. In the words of an associate editor at “National Underwriter”: “*Given the stakes for insurers covering catastrophic losses, waiting for proof instead of taking action now would amount to just plain foolish behavior*” (*Ruquet 2007*).

The economic analysis has shifted as well, as reports such as the UK government’s “Stern Review” (*Stern Review 2006*) 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.

The insurance community has become increasingly accepting of the science and macroeconomic modeling. Some still prefer to dismiss the science or take remaining uncertainties as a reason to wait on the sidelines, while others take it as precisely the reason for insurers not to be complacent. Most agree that reducing vulnerability to weather extremes should be a higher priority, but some dispute the need for insurers to engage in addressing the core drivers of climate change or the need to discern the relative roles of human influence and natural factors (*Friedman 2007*).

Insurers' own analyses have provided a sobering outlook for insured economic risks, and one that is increasingly consistent with what scientists predict for the physical world. Modeling studies conducted by The Association of British Insurers find that losses in typical and extreme future years will exceed today's by a factor of two or three (*ABI 2007*).

Even those insurers who did not partake in earlier waves of insurer engagement on climate change are now publicly recognizing its potential threats. State Farm is "concerned about the prospect of global climate change, its possible impact on severe weather patterns, and the challenges this presents to the business of insurance" (*State Farm 2008*).

Allstate—insurer of 1 in 9 vehicles and 1 in 8 homes in the United States recognizes the onset of climate change, and the presence of human fingerprints:

"Allstate recognizes the emerging scientific consensus that the world is getting warmer, and that this trend is influenced to some extent by emissions of greenhouse gases. Climate change, to the extent it produces rising temperatures and changes in weather patterns, could impact the frequency or severity of extreme weather events and wildfires. Such changes could also impact the affordability and availability of homeowners insurance" (response to 2008 Carbon Disclosure Project Survey).

The chairman of Lloyd's of London said that climate change is the No. 1 issue for the massive insurance market. Europe's largest insurer, Allianz, stated that climate change stands to increase insured losses from extreme events in an average year by 37% within just a decade while losses in a bad year could top \$400 billion (*MacDonald 2007*). UNEP has put the value at \$1 trillion (*Dlugolecki 2006*).

The initial reaction of many insurers—particularly in the United States—has been to focus on financial means for limiting their exposure to losses, e.g. by limiting availability, tightening terms, and raising prices (*Mills et al. 2006*).* The availability-affordability issue places a bright light on the respective roles of the public sector and insurers (*GAO 2007a*), and the likelihood that government will have to assume more climate risks if the private sector recedes. This comes as the existing subsidy-based model for public flood insurance in the United States, the FEMA-managed National Flood Insurance Program (*Postal 2008*), was rendered insolvent in 2005 by Hurricane Katrina and likely again in 2008 by Hurricane Ike, with a combined deficit approaching \$30 billion.

Climate Change as the Ultimate Enterprise Risk Management Challenge

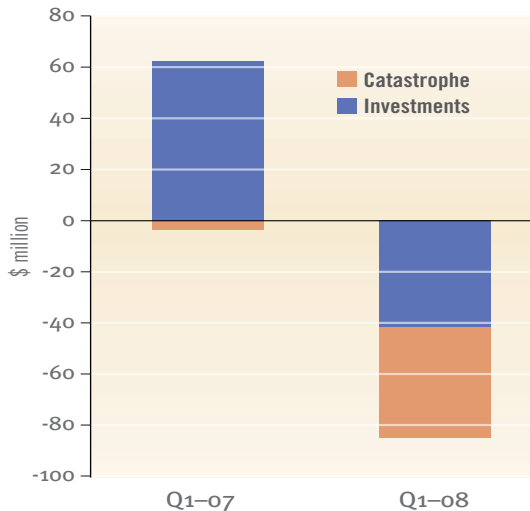
Climate change—and how to respond to it—is not "yet another" issue for insurers. It is, rather, bound up in the very fabric of the industry and its business environment, namely:

- ◆ Customer retention
- ◆ Corporate governance, investor relations, and disclosure
- ◆ Balance sheet strength, risk-based capital, and solvency

* The Independent Insurance Agents & Brokers of America found that nearly 3.0 million U.S. households have lost their homeowners coverage between 2003 and mid-2007, only half of which stated that they were able to find new coverage (IIABA 2007). Those retaining their insurance have had to face price increases of 75% in many states, and up to 500% in particularly risky areas (Environmental Defense 2007). For more on this subject, see <http://insurance.lbl.gov/availability-affordability>.

**Figure 6: The “Perfect Storm”—
Cincinatti Financial Results: Q1 2007 and 2008**

Greenwald (2008a)



- ◆ Competitiveness
- ◆ Emerging markets
- ◆ Reputation & trust
- ◆ Loss-model accuracy
- ◆ Regulation

Moreover, in addition to existing risks, the very technological and behavioral responses to climate change will usher in new risks. Examples include safety issues associated with a resurgence of nuclear power or the introduction of carbon capture and storage technology. Even some “green” strategies will bring new risks, while mitigating old ones.

As such, climate change is a textbook example of Enterprise Risk Management (ERM), a modality that has resonated very strongly with the insurance community in recent years by integrating an otherwise fragmented risk-management process. ERM recognizes the combined influence of internal and external pressures and how they interact across a broad portfolio of activities, including underwriting and asset management operations. The Casualty Actuarial Society notes that ERM “expresses risk not just as a threat, but as an opportunity” (*CAS 2003*).

The past year’s results for many companies put in sharp relief the potential for simultaneous uncorrelated natural catastrophe losses and adverse market conditions (**Figure 6**). The global industry saw an estimated \$45 billion in insured catastrophe losses, superimposed on a financial meltdown and softening of insurance prices (*Munich Re 2008a; Cavanaugh 2008*). In the third quarter of 2008, Swiss Re saw \$757 million in net investment losses versus \$1.3 billion gain the year before. At the same time, net claims that quarter for two large hurricanes were \$365 million (*Greenwald 2008b*).

The recent spike in energy prices provides an excellent illustration of seemingly uncorrelated influences. For example, observers have suggested that opposition to credit scoring for personal auto underwriting could be amplified as the rising costs of gasoline create a cost crunch for consumers (*Bennett 2007*). Meanwhile, consumer organizations along with the Governor of New York have argued that the price-elasticity effect of rising gasoline prices has reduced the amount of driving and thus should translate into reduced premiums (*Hunter 2008*). This argument has been used in support of the California insurance regulator’s recent effort to encourage pay-as-you-drive insurance (*Lifsher 2008*). Some argue that the increased price of energy has driven up the cost of repair parts, offsetting gains resulting from reduced driving (*Hays 2008a*). Meanwhile, shifts in vehicle transportation choices can accentuate other risks, e.g. those associated with vanpools or telecommuting (*Whitfield 2008a*). Observers have noted adverse implications for risk-management in the airline industry, spanning financial and safety considerations (*Shapiro 2008*). Taking all of these factors into account, at least one major carrier (GEICO) withdrew a pre-existing rate increase request (*Hays 2008a*).

Global (Business) Climate Change

Irrespective of how a given insurer interprets the science of climate change, insurers are increasingly aware that the business environment is changing around them. In terms of risk perception, investors, rating companies, banks, customers, risk managers, and regulators are each in their own way perceiving climate change as a threat and looking to those they interact with—including insurers—to support their response. For example, in 2008 major investment banks issued statements of concern about financing coal-fired power plants (*NRDC 2008*). Meanwhile, many insurers perceive massive opportunities in responding to climate change. Green-building construction investment is expected to exceed \$12 billion in 2008, while hybrid car sales grew by 38% to 350,000 vehicles (almost 50% year-over-year growth) (*Green 2008*). The electric power industry foresees large investments in renewable technologies and end-use energy efficiency (*EPRI 2007*).

Another indicator of this changing business environment is shareholder resolutions regarding climate change. The number of such resolutions hit an all-time record of 57 in 2008, as well as an all-time high of 25% of shareholders voting for the resolutions. The number of subsequent withdrawals provides an indication that shareholders obtained their desired outcomes (**Figure 7**).

Such resolutions have been filed in various years with at least six U.S. insurance companies (ACE, AIG, Chubb, Cigna, Hartford, Marsh, and Travelers). Shareholders were subsequently encouraged when ACE joined the EPA Climate Leaders program and the CEO spoke publicly about the importance of addressing climate change. ACE also developed a broader set of products and services related to climate change. A resolution filed with Chubb Group was withdrawn after the company pledged to arrange a meeting with shareholders to discuss climate risk issues. The resolutions filed with Hartford Insurance and Prudential Financial were withdrawn after the companies agreed to improve their public reporting and disclosure regarding the potential financial risks they face from climate change and strategies for mitigating those risks. The companies specifically agreed to respond to a climate risk disclosure questionnaire sent to companies each year by the Carbon Disclosure Project.

With all of these factors in mind, insurance regulators under a National Association of Insurance Commissioners Task Force have met regularly in the United States to discuss climate change, and issued a major white paper in 2008. The subject was among the top agenda items at the 2007 meeting of the International Association of Insurance Supervisors.

Figure 7. Shareholder Resolutions on Climate Change

Source: Ceres

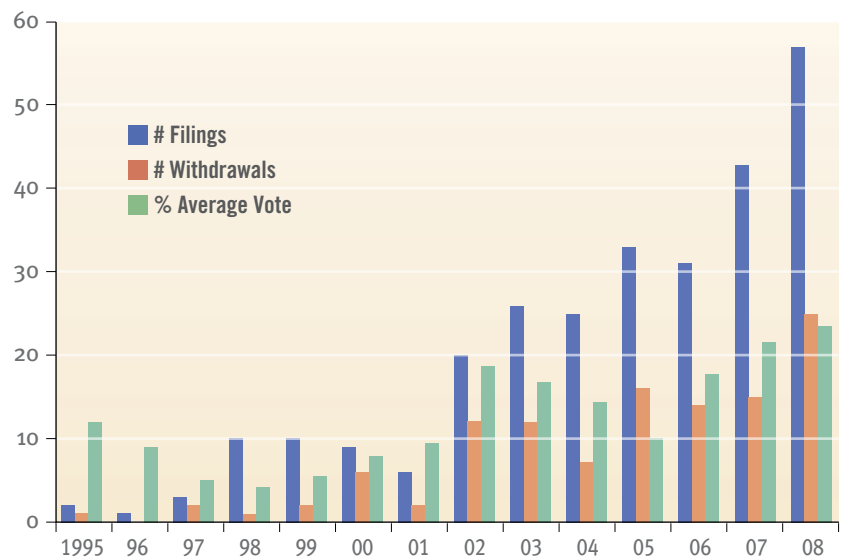


Figure 8. Covers of Three Leading U.S. Insurance Trade Journals Featuring Climate Change and “Green-Insurance” Issues in 2007–2008



From Risk to Opportunity

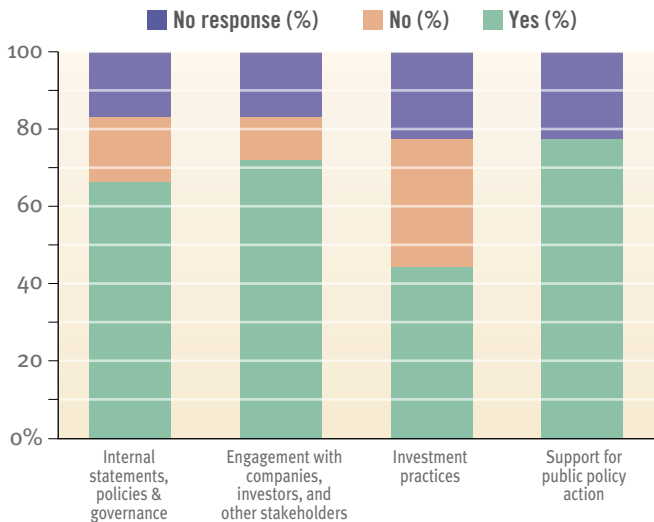
Insurers and reinsurers along with other members of their community (actuaries, brokers, agents, modelers, risk managers, asset managers, and regulators) are increasingly seeing their industry as part of the solution through the creation of innovative products and services to promote emerging technologies and practices, while also harkening to their historical roots and devising new strategies for adapting to otherwise unavoidable impacts of climate change.

The topic of climate change went from one that was rarely if ever addressed in the trade press just a few years ago, to a regular news item. As a reflection of the trends, in 2008 the three leading U.S. insurance trade journals (Best’s Review, Business Insurance, and National Underwriter) devoted special issues to climate change and the “greening” of insurance (Figure 8). 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 (CEA 2007).

The topic of climate change went from one that

Figure 9. Strategic Climate Change Activities Among Reporting Insurers

Source: LBNL survey – 18 companies



Insurers have begun to institutionalize climate risk practices for underwriting, investment, and asset management (Figure 9).

The activities 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.

II. Advancing Solutions

Aside from the obvious risk of increased insured losses, the greatest peril comes in adopting the view that relegates climate change to a public relations and environmental issue that's best dealt with by delaying action, rather than taking the view of climate changes as a true business opportunity that demands action now (Climateandinsurance.org 2008a).

~ **Howard Mills**

*Director and Chief Advisor, Insurance Industry Group
Deloitte & Touche USA LLP*

As the world's largest industry*—generating more than \$4 trillion in premium revenue in 2007 (*Swiss Re 2008a*), 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 themselves.

A number of major insurers are creating special crosscutting teams or practices to formulate strategies and set priorities across their organizations. Examples include:

- ◆ **ACE:** “ACE Green” (<http://www.acegreen.com>)
- ◆ **AIG:** “ecoPractice” and “Advanced Energy Solutions” (*AIG 2007a*)
- ◆ **Allianz:** “Allianz Climate Solutions” (*Allianz 2007a*)
- ◆ **Aon:** “Aon Carbon” (*Environmental Finance 2000*)
- ◆ **Allstate** cross-functional executive team (*Allstate 2008a*)
- ◆ **Aon:** “Agri-Fuels Group” (*AON 2007a*)
- ◆ **Chubb:** “Green Energy Team” (*Chubb 2007*)
- ◆ **RMS:** “Climate Change Practice” (*RMS 2008*)
- ◆ **Travelers:** “Core Business Climate Change Project” (*Climateandinsurance.org 2008b*)
- ◆ **Willis:** “Climate Change Task Force” (*Insurance Journal 2007a*)
- ◆ **Zurich:** “Climate Initiative” (*Zurich 2008a*)

These activities are becoming more deeply rooted in the companies, rather than in public affairs or government relations. Zurich's Climate Office is embedded in the underwriting unit (*Zurich 2008a*). Another illustration is given by Allstate, which in its response to our survey describes its activity as a team “that includes lead officers for all of the companies major areas of responsibility (e.g., Human Resources, Real Estate and Administration, Procurement and Sourcing, Investments, Law and Regulation, Corporate Relations, Marketing, Product Operations, etc.).”

There is also a recent emergence of specialized “green” brokers, intermediaries, and insurers. For example, the Environmental Transportation Association in the UK bundles carbon neutrality for personal lines homeowner and auto insurance. Other examples are Green Insurance Co., Climatesure, Milemeter, and Renewco Underwriting. On the other hand, some companies have appropriated green-sounding names (e.g. “Solar Insurance Services”), yet do not appear to offer corresponding products or services.

* For sources, <http://insurance.lbl.gov/opportunities/industry-size.xls>

Insurers are “drilling deeper,” filling coverage gaps, testing new delivery strategies, and developing new partnerships with parties outside of the insurance sector. We have identified a wide spectrum of insurance opportunities, with 643 real-world examples from 243 insurers, reinsurers, brokers, and insurance organizations from 29 countries* (Appendix A). Our database contains a total of about 5,200 data elements (descriptions, sources, dates, etc).

The number of activities recorded in this report is eight times as great as in the original compilation published in 1999 (*Mills 1999; Mills 2003*), and 50% greater than that found in last year’s report (*Mills 2007*). This catalog is most certainly not comprehensive, as new activities are emerging almost daily and we are still discovering ones that have been quietly underway for some time.

In tandem with this growth, we have observed a continued proliferation of collaborations between insurers and non-insurance groups—ranging from energy utilities to foundations to governmental agencies—currently numbering 35 in all (Appendix A). Recent examples include the Earth Institute at Columbia University working with Swiss Re to implement satellite-based remote sensing in support of microinsurance for small farmers in Africa, and a joint project between Munich Re and the London School of Economics to refine our understanding of the economics of climate change. Other partnerships have been initiated with the Asian Development Bank, The Heinz Center, the International Finance Corporation, and RAND.

We group the activities into 10 broad categories (**Figures 1 and 2**), which we further break down into 35 specific classes† of activity. These activities reflect a wide range of approaches to improving 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, carbon emissions trading, and investments in emerging technologies. In some cases, the magnitude of progress or uptake can be quantified, as indicated in Box 1. While this progress is encouraging, there is still little good data on how much traction these new activities have in the marketplace.

We gather information from a variety of mostly primary sources, e.g. company news releases, corporate social responsibility reports, filings with the Carbon Disclosure Project, corporate websites, insurance trade press, direct communications with insurers, scholarly journals, and other reports. Initiatives that aggregate insurers (e.g. ClimateWise and the UNEP Finance Initiative) also were reviewed. To augment these data sources, we distributed a Web-based survey to several hundred insurance industry contacts around the world, to major insurance trade journals, and via the Climateandinsurance.org Web portal. By the deadline, 18 detailed responses were received, primarily from larger insurers, reinsurers, and brokers. This survey remains open for companies to contribute their information for subsequent reports.‡

We rely primarily on self-reported information from insurers, which is not independently audited or verified. In certain areas companies appear to be bundling/repackaging existing offerings, rather than truly innovating to fill coverage gaps or carefully tailor coverage to the unique features of “green” technologies. The details are often not provided in cursory published materials or company websites. The notes and reference sections of this report comprises some 300 source documents, which readers can use to conduct further research.

We apply various decision rules in determining if and how to include the activities of individual companies. To be included, the company had to be currently or historically conducting one or more of the types of activities described in this report. An activity does not need to be currently in practice for it to be logged in our database. Prospective activities are generally not included, unless there is a firm publicly announced rollout date. Multiple activities of a very similar nature

* The most active country, in terms of domicile of insurer and number of activities we have logged, is the United States with 37% of the total. Following is the UK (19%), and Germany, Switzerland, and Japan, each with 7%. These crude tallies are of course not a measure of the relative quality or impact of the activities, or geographical reach, as many companies operate globally. We cannot rule out sampling bias, although every effort has been made to gather information from around the world. In the past year, we have had visitors from 103 countries to the website where our survey/data-call resides.

† This framework is the same as last year’s, with the addition of sections on: (1) Performing Research on Green Technologies and Climate Change Solutions, (2) Warranty and Service Contracts, (3) Participating in Carbon Markets, (4) Corporate Social Responsibility (CSR) Reporting, and (5) Products and Services for Liability Risks.

‡ Visit http://www.surveymonkey.com/s.aspx?sm=hk3D_2bNQUFMCoYVmyYEIMQ_3d_3d

are counted once (e.g. multiple reports on the implications of climate change, multiple years responding to a given call for disclosure, multiple efforts at reducing in-house greenhouse gas emissions, multiple years of corporate social responsibility reporting, or more than one country in which microinsurance products are offered), while distinct but related activities (e.g. two separate innovative insurance products) are counted individually. Routine activities, such as rationalizing pricing, going paperless, encouraging generic disaster preparedness, or conventional insurance of renewable energy systems (which many insurers have done for decades), are not tabulated here as they are viewed as mainstream activities or not primarily motivated on the basis of responding to new climate change risks. Similarly, “passive” activities such as memberships in organizations (e.g. the U.S. Green Buildings Council) merit mentioning, but are not logged as formal activities in our database. We do not include items that we deem to have a tenuous “green” value, e.g. insurers promoting GPS systems in autos but not accompanying it with mileage-differentiated premiums. See notes to Appendix A for additional details.

Many of these activities have the potential to significantly reduce greenhouse gas emissions in some of the most energy intensive parts of the economy. For instance, motor vehicles create about 25% of all U.S. greenhouse gas emissions, and insurance policies such as pay-as-you-drive and incentives for hybrid vehicles could reduce that amount by 10% or more if broadly implemented. Buildings account for 38% of U.S. greenhouse gas emissions, according to the EPA. Green building practices can reduce energy use, and thereby emissions, by more than 50% 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 greenhouse gas emissions, and the insurance industry—through products such as energy-savings insurance—has a key role to play in encouraging investments in that area as well (*Enkvist et al. 2007*).

As expert messengers on risk, insurers can play an important role in alerting policymakers to the need to proactively deal with climate change at the national and global levels. As major players in financial markets, insurers can be in the forefront in capital formation and investment in new climate-friendly technologies.

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 also will be demand for new forms of insurance, as well as for conventional insurance for new assets (e.g., green buildings or renewable-energy technology installations) (*Marsh 2006a*). Innovative products such as microinsurance and new public-private partnerships will allow markets to grow to serve the billions of people in the developing world today who lack insurance (*Mills 2004; Munich Climate Insurance Initiative n/d*). Insurers seizing these opportunities will improve their market position.

The activities described in this report reflect substantial progress since 2007, but only the tip of the iceberg when compared with what the industry could be doing and what is needed. As shown in the Figure 4, there are a number of particularly notable untapped opportunities. These include products and services for crop insurance, commercial-lines automotive products, liability insurance and risk-management, carbon offsets beyond the auto and travel segments, greening warranties, and moving beyond insuring green systems or carbon offsets to actually managing customers’ risk and improving carbon accounting and project performance. Coverage extensions allowing upgrades to greener technologies upon total loss have now been utilized extensively for buildings, but vast opportunities exist for similar offerings across many other lines of property insurance. While certain green-energy technologies have benefited from new insurance products and services, carbon capture and storage still remains a relatively difficult-to-insure practice. Life-health insurers continue to be only marginally active in developing customer-facing initiatives. Regarding insurers in-house energy activities, most remain relatively naive (focusing on efficient lighting, etc.), whereas the more energy/carbon-intensive processes, such as those associated with IT equipment, are often overlooked. Insurers are increasingly involved in climate and energy research, but must do much more in order to reinforce the underwriting argument for developing green products and services. In many domains, insurers have done more to promote “green” activities than to manage the risks of climate change and adapt to unavoidable impacts.

Understanding The Climate Change Problem

Climate change is clearly one of the most critical issues of our time and an area of vital ongoing scientific investigation (Insurance Journal 2008a).

~ Karen Clark
Founder, Applied Insurance Research

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, catastrophe modeling, 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 also are partnering with the scientific community to perform basic research and help build forward-looking risk models that take climate change into account. Insurers' traditional modeling techniques are still ill-suited for understanding the implications of climate change, and fine-grain loss data are incomplete and underutilized in understanding the trends.

Analyzing Loss Drivers and Assessing Vulnerabilities

Well known for its decades-long efforts to track trends in weather-related events, its total economic costs, and its associated insurance payouts, Munich Re (along with other companies such as Tokio Marine Holdings and CGU) has been involved as authors in the work of the Intergovernmental Panel on Climate Change.

Insurers are increasingly delving into very specific elements of the climate system. The Caitlin Group is sponsoring a 2009 Arctic expedition to measure the changing thickness and density of the North Pole ice caps (*Dowding 2008*). Willis has sponsored work at the National Center for Atmospheric Research (NCAR) to estimate how global warming will affect Gulf-area hurricane activity (*Dowding 2008*). Tokio Marine Holdings has worked with the Center for Climate System Research at the University of Tokyo on using climate-simulation models and with Nagoya University to examine the effects of global warming on typhoons. Benfield, Crawford & Company, RSA, and XL funded recent peer-reviewed research that found a strong correlation between ocean-surface temperatures and Atlantic hurricane activity (*Saunders and Lea 2008*). XL also is one of the founders of the Risk Prediction Initiative (www.bios.edu/rpi) that studies the correlation between sea-surface temperature and Atlantic Ocean hurricane development. XL is also a member of the Bermuda Underwater Exploration Institute (www.buei.bm) that conducts research on sea level changes (*XL 2008*). Benfield sponsors the University College London's Hazard Research Center, which, among other objectives, explores the overarching questions regarding how to attribute observed climate changes to human versus natural factors (*Dowding 2008*).

Insurers are beginning to translate natural-science research into analysis of the impacts on their industry. The International Association for the Study of Insurance Economics, (also known as The Geneva Association) has launched its "CC+I" project: Research Project on Climate Change and its Economic Impact on Insurance) (*Geneva Association 2008*). The project is exploring some of the larger macroeconomic implications of climate impacts on insurers. The industry has yet to make much use of stress-test scenarios to explore the range of potential impacts, although the catastrophe modelers are beginning to do so.

Some insurers are conducting research on how to respond to climate change. Zurich Canada is funding Simon Fraser University's Adaptation to Climate Change Team (ACT) to examine ways to cope with extreme weather events triggered by global climate changes (*Harris 2008*). IAG

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 (*Stagnitta and Forster 2005*).

Integrating Climate Change into Traditional Catastrophe Modeling

A leading modeler recently drew considerable attention by stating that the industry has become overly dependent on these models, to the point of complacency, and has “stopped thinking about risks independently” (*Gusman 2008*). While accused of allowing models to “dumb down the underwriting process”, insurers are endeavoring to become more cautious and skilled in using these models (*Friedman 2008*).

With all of the caveats about using CAT models to understand current regimes, the overlay of climate change makes the process even more problematic. A major obstacle to insurers taking action on climate change has been that the models the industry uses to manage and price risk have been backward-looking and thus, by definition, unable to take climate change into account. The modeling industry has, to its credit, focused significant effort in recent years on finding ways to reconcile its risk models with the forward-looking models used by climate scientists. The three leading CAT modeling firms have each made efforts to integrate the effects of climate change, as have many insurers that run their own in-house models. Following are some examples:

- ◆ Arkwright Mutual Insurance Company (now part of U.S.-based FM Global), as among the first insurers to conduct primary research on climate change and trends, examining flooding data in the mid-1990s (*Zeng and Kelly 1997*).
- ◆ The leading CAT modelers—RMS, AIR, and EQECAT—have independently studied how warmer ocean temperatures could influence hurricanes in the Atlantic basin (*Garcia and Benn 2008; Trembly 2008*).
- ◆ The Insurance Australia Group worked with the University of Oklahoma on high-resolution climate modeling.
- ◆ Willis collaborated 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 (*McLeod 2007*).
- ◆ Swiss Re projected an average increase in losses of 16% to 68% 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 (*Swiss Re 2006*).
- ◆ The Association of British Insurers 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% increase in premiums (ABI 2005a). The associated need for increased risk capital would be \$76 billion to cover the increased exposure in the United States and Japan. The worst years would bring two to three additional “Hurricane Andrews” in the United States.
- ◆ Munich Re has incorporated 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 (*Hoeppe n/d*).

The catastrophe (CAT) models used by the insurance industry to understand its exposure to large weather-related events have been focused almost exclusively on windstorm risk. Efforts have been made recently to broaden their application to other hazards (e.g. wildfire, storm surge, and sinkholes) (*Trembly 2008*).

With sponsorship from AIG and Lloyd's of London, Harvard University and the Insurance Information Institute (with ACE, Allstate, Guy Carpenter, Marsh, Munich Re, Travelers, and Willis), insurers are collaborating through the Catastrophe Modeling Forum to better integrate climate change factors into insurance loss models (*CMF 2007*).

Insurers and catastrophe modeling firms are finding new business opportunities in helping their customers understand the risks of extreme weather and climate change. RMS examines the implications of climate change for catastrophe risk by peril; near- and longer-term climate change considerations in their catastrophe models; insurability, and the loss-reduction benefits of risk mitigation; emerging risks in a low-carbon economy (including risk modeling for clean technology exposures); and climate-insurance solutions as a form of climate risk adaptation for emerging market/developing regions (e.g. microinsurance, index-linked securities) (**Box 2**). The company is expanding its analysis, in collaboration with RAND, to include liability issues (*Herweijer 2008*).

In addition to serving their traditional purpose of informing insurance business analysis, modeling can make important contributions to the broader public policy discussions around climate change, e.g. in isolating the effect of climate change from socioeconomic factors such as subsidence, economic development, and population growth (**Figure 10**). In one example, 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. Analyses such as this help insurers assess their own exposures, but also make major contributions to the broader public policy discussion.

Promoting Loss Prevention

The Hartford will strongly advocate for better land use planning as well as for improved and more vigorously enforced building standards. The Hartford will continue to oppose subsidies and other incentives that promote development in areas most exposed to natural disasters.

~ Hartford Financial, *CDP response, 2007*

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. Insurers are increasingly engaging in the process of adapting to climate change. While their primary focus has been on financially managing risks (through exclusions, price increases, derivatives, etc.), physical risk management is receiving renewed attention, and could play a large role in preserving the insurability of coastal and other high-risk areas. Improved building codes and land-use management are important starting points, but insurers and others face many barriers. Insurers are increasingly finding value in a whole genre of energy-efficient and renewable-energy technologies that also make infrastructure less vulnerable to insured losses, and in improved management of forests, agriculture, and wetlands. Insurers are gradually finding a role in helping to understand the risk profiles of "green" technologies and practices. The scale and breadth of insurer efforts in all of these areas remain extremely modest in the context of their overall business operations.

Traditional Risk Management

The climate-policy community has concluded that the only effective response to climate change requires a combination of loss prevention (adaptation) coupled with emissions reductions (mitigation). Most of the examples from the insurance sector documented in this report pertain to the latter, but insurers have long been involved in loss prevention as well, which traditionally

Box 2. RMS: Catastrophe Modeling & Climate Change

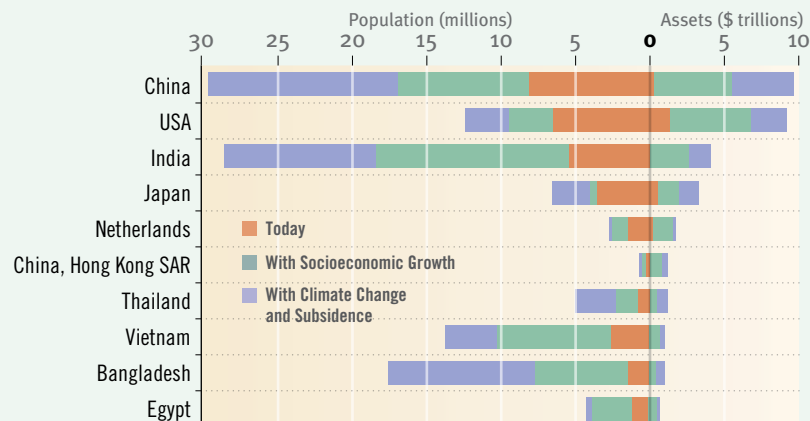


Figure 10. Global port cities today and in the future: Exposure to climate extremes

Source: Nichols et al (2008)

The chart includes the top-10 cities, ranked by exposed assets including climate change and subsidence. Values reflect exposure to 100-year extreme water-level events in the 2070s in lieu of new defenses or other adaptations.

Catastrophe modeling firms such as RMS can serve as important conduits of risk assessment intelligence for insurers, reinsurers, and other stakeholders. RMS reports that it engages in regular dialogue with its clients in the insurance industry on climate-change risk. In 2007, the company created a dedicated Climate Change function with a stated purpose to provide: “a coherent cross-organizational framework for managing the business risks posed by climate change, investing in climate change R&D, and realizing the opportunities for new services/products that the challenge of climate change presents.” Examples of RMS activities presently include:

Fostering Disaster Resilience—RMS is a partner in the Ceres and Heinz Center Resilient Coasts initiative—a unique collaboration between private- and public-sector groups to address the need for climate adaptation in the coastal regions of the United States. RMS is contributing technical expertise on climate-driven catastrophe risk and adaptation modeling. RMS worked with Lloyd’s of London on the fourth Lloyd’s 360 risk project report on climate change entitled “Coastal Communities and Climate Change: Managing Future Insurability,” which examined the impact of climate change on flood risk at a number of coastal locations, and the loss-reduction benefits of a variety of adaptation measures. RMS is also a member of the OECD climate change and cities working group that produces key research publications on urban climate resilience (Figure 10).

Participating in the Public Policy Debate—RMS is a signatory of the insurer-led ClimateWise principles; an active contributor to the initiatives undertaken by the U.S. National Association of Insurance Commissioners (NAIC) to assess the implications of climate change for the regulations of insurance; and engaging with policymakers in the UK national government and U.S. state and local governments on impacts of climate change, the benefits of adaptation, and the implications for future insurability.

Modeling Exposures of Renewable-Energy Technologies—RMS initiated a research activity in 2008 to investigate the emerging insurable risks arising from the transition to a low-carbon economy. The R&D effort will inform development of RMS research and services to enable insurers to evaluate the risks associated with climate-change mitigation technologies, in particular their vulnerability to natural catastrophes. For example, the RMS Industrial Facilities Model has been adapted to enable specific clean-technology energy generation facilities to be modeled, including wind farms and hydroelectric facilities.

Climate Change Risk Screening Service—RMS aims to identify potential sensitivities to physical changes in climate within a business or policymaker portfolio, as they manifest in probable financial losses stemming from property damage and business interruptions. CAT models and climate model output are combined to provide stress-test scenarios. In addition to traditional risks (e.g. windstorms), a broader set of considerations is incorporated into the methodology, including gradual impacts (e.g. changes in water availability), and implications for asset management and supply chain risk. Impact information is combined with a range of physical and operational vulnerability measures (e.g. adaptive capacity, resiliency, supplier sensitivity) to allow the client to identify hotspots of future risk and to prioritize adaptation needs.

Climate Liability Research—RMS (in partnership with RAND) is undertaking a focused study into emerging and potentially emerging mass litigation risks associated with climate change, both from the failure to mitigate and the failure to adapt.

often takes place at the individual customer level (improved storm shutters, fire suppression, etc.) Climate change certainly calls for more of this, but also for prevention at much larger scales, especially for regional defensive infrastructure.

As exemplified by the work of the insurer-funded Institute for Business and Home Safety (IBHS) in the United States and the Institute for Catastrophic Loss Reduction (ICLR) in Canada (*Kovacs 2006*), there are many strategies for improving the disaster resilience of homes and businesses. Analyzing claims following Hurricane Rita, IBHS discovered that losses were more than four-fold greater (2.5 times more frequent and almost twice as costly per loss) among homes not built to the 1996 Florida codes compared to those that were built to the codes (*IBHS 2004*).

Hurricane Katrina provided opportunities to assess the value of pre-event loss-prevention efforts. In a review of loss experience at 476 “commercial” locations in the path of Hurricane Katrina, representing \$42 billion in insured commercial property, FM Global found that:

- ◆ 310 sites valued at \$24.4 billion spent \$2.3 million to prevent \$480 million in loss.
- ◆ Those clients who had losses and had also followed FM Global’s loss prevention advice reduced their dollar losses by 85% compared to those who had engineering recommendations yet to complete. (*FM Global 2008*).

FM Global was one of the most profitable U.S. insurers during the year of Hurricane Katrina.

Other studies have corroborated that proactive loss-prevention is highly cost-effective (Multihazard Mitigation Council 2006). 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 a flood-resilient model home, which is projected to dramatically reduce the average cost of a flood claim from £50,000 to £10,000 (about \$75,000 to \$15,000) through floodproofing and flood alarm systems (*Aviva 2006*).

Through the ProtectingAmerica.org initiative, a number of insurers, including Allstate and State Farm, 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. The Insurance Services Office Building Code Effectiveness Grading Scale has been used to reward effective codes via insurance discounts or surcharges. IBHS and ICLR—both insurance-based organizations—have endorsed energy-efficient building codes (*Lecomte et al. 1998*).

With the cost of damage from natural disasters in Canada doubling every five to seven years since the 1950s, and more and more people living in vulnerable areas, The Co-operators insurance company has produced a demonstration disaster-resilient home together with the Institute for Catastrophic Loss Reduction (ICLR) (**Box 3**).

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 devote orders of magnitude more resources into these endeavors—IBHS’ budget is a mere 0.003% of associated national property/casualty insurance premiums.

Minimizing business interruptions is another key need. French insurer AXA issued a publication with practical suggestions for how small businesses can prepare for the impacts of climate change (*AXA 2006*). Business interruptions typically comprise a quarter of all insured losses from catastrophe events. Reports from risk managers suggest vulnerabilities within the food-products industry that arise from disruptions to the water supply and livestock mortality as a result of weather extremes (*Roberts 2007*).

Improving Land-Use Planning

Supporting the integration of 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

Box 3. “Better-than-Building-Code” Demonstration Home

Located in Prince Edward Island and designed and constructed to withstand winds up to 200 km/hour, a new “better-than-building-code” demonstration house is the first to be completed under the Designed...for safer living program. The new house was designed to withstand the most hazardous weather conditions in the area—windstorms and extreme winter weather. The Institute for Catastrophic Loss Reduction (ICLR) and The Co-operators company developed the project.

Special construction features include:

- ◆ Impact-resistant windows rated for high wind pressures; 1-inch-thick steel rods that anchor the floors together, including anchoring the first floor and the foundation
- ◆ Steel braces securing the trusses to the framing, and braced gable ends to withstand high winds;
- ◆ Special shingles designed to meet 200 km/h standards, installed using additional nails and cement;
- ◆ Heavy roof sheathing designed to stay dry, fastened with ring-shank nails in a tight nailing pattern;
- ◆ Water-resistant sealing around windows and doors;
- ◆ Adhesive weather-resistant strips installed over every joint in the roof sheathing to protect against water intrusion;
- ◆ Special wind-resistant siding, fascia, and soffits.

Many of the special features were imported from the United States, where a similar program was developed several years ago by ICLR’s sister organization, the Institute for Business and Home Safety.

More “safer-living” homes will be rebuilt in various regions of Canada. The homes will be designed to be resilient to the weather perils in that area, which could include earthquakes, prairie wildfire, tornados, and hail storms.

For more information, see: <http://www.insurance-canada.ca/consinfohome/safer-living-home-document-611.php>

building codes and comprehensive land-use planning were in use (*Burby 2006*). Allianz reviewed examples from many countries that supported the same conclusion (*Dlugolecki and Lafeld 2006*).

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.

In the United States, AIG serves on the New York City Panel on Climate Change, which was established to help the city develop a strategy for adapting to climate change impacts (*City of New York 2008*).

In the UK, the Association of British Insurers (ABI) also has advised local planning authorities on better integrating rising flood risks in East London (*ABI 2005b*). Following the catastrophic floods of 2000 in England and Wales, ABI negotiated increased government spending on flood defenses and better stakeholder engagement in decisions around future development in floodplains, by threatening to withdraw flood insurance from locations at greatest risk (*Wilbanks et al. 2007*).

In a public-private partnership launched in 2008, The Heinz Center, a nonprofit institution dedicated to improving the scientific and economic foundation for environmental policy through collaboration among industry, government, academia, and environmental organizations is partnering with Ceres, an environmentally focused coalition of investor groups to convene the Resilient Coasts Initiative. The goal of the initiative is to develop public policy and private-market solutions to help protect coastal communities from rising sea levels and other potentially damaging consequences of climate change. The Resilient Coasts Initiative will work to identify policy and market-based solutions that might include initiatives to: limit new development in the most vulnerable areas; strengthen and upgrade existing buildings to prevent further losses; and promote infrastructure investments that will help communities adapt to sea level rise. Insurance-sector sponsors include AIG and Travelers, with participation from Swiss Re, Lloyd’s, RMS and IBHS (*CSR Wire 2008*).

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. Nearly 80 technologies and practices have been identified 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 (*Vine et al. 1998*).

Many risk-management benefits have been associated with green buildings (*Kats et al. 2003*), ranging from improved indoor air quality to enhanced disaster resilience, and there are numerous ways in which insurers could capture these benefits (*Cheslin 2005*). The disaster-resilience link is particularly pertinent to insurers (*Mills 2006*), 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 (*Wendt and Aglan 2004*). Commissioning of building envelopes has been noted to not only support improved indoor air quality and energy savings, but also to reduce moisture damage following severe hurricanes (*Parzych and MacPhaul 2005*). 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 (*Deering and Thornton 1998*).

Another 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. 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. FM Global has recognized this in its promotion of fire-safe and energy-efficient compact fluorescent replacements for halogen lights (*Avery et al. 1998*).

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 (*Mills et al. 2008*). 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 also can be achieved in forestry, agriculture, and wetlands. Deforestation alone accounts for about 20% of all greenhouse gas emissions caused by humans. Better forest management can reduce emissions by minimizing wildfires (a major source of carbon dioxide and associated public health problems), lower the risk of flooding and mudslides that typically follow deforestation, or avert tree mortality caused by pests and disease. Sustainable agricultural practices have the additional benefit of helping 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. A recent study indicates that coastal wetlands offer \$23.2 billion per year in storm-protection value in the United States alone (*Costanza et al. 2008*).

Few insurance companies have pursued sustainable land-management practices as part of their carbon-offset programs. As an example, well aware of cyclone-related risks, the Japanese insurer Tokio Marine Nichido has been active in mangrove protection (**Figure 11**). Since 1999, it has reforested 5,395 hectares (13,331 acres) of mangroves in Indonesia, Fiji, Thailand, Philippines, Myanmar, and Vietnam, and its work continues. The company states that the tsunami

of 2005 did less damage to areas behind these reforested areas, though the company does not underwrite in these areas (*Tokio Marine Holdings 2008*).

AIG has included forestry projects in its in-house carbon-offset program. To our knowledge, no insurers have yet offered products for insuring forestry-related carbon offsets (*Doyle 2008*).

In a promising recent development, the Prince's Rainforests Project (PRP), founded by the Prince of Wales, is working closely with the Manager of Emerging Risks at Lloyd's of London to consider how the insurance industry can play a role in preserving the value of living forests (Prince's Rainforests Project 2008). The PRP aims to draw together a major international private, public, and NGO partnership to identify and develop solutions to reduce the further loss of tropical forests (*Maynard 2008*).

'Rebuilding Right' Following Losses

Insurers can promote risk-prevention strategies in the context of rebuilding after losses (*Parker 2005*). "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. As discussed below, insurers are increasingly recognizing the power of the insurance claims process in motivating reconstruction to more resilient and greener levels of performance.

The concept is beginning to spread to transportation. In 2008, Fireman's Fund introduced the first commercial-fleet hybrid vehicle upgrade endorsement in the event of loss, which includes significant additional incentives by covering full-replacement value (no depreciation) and no deductible for the first three years (*FFIC 2008a*).

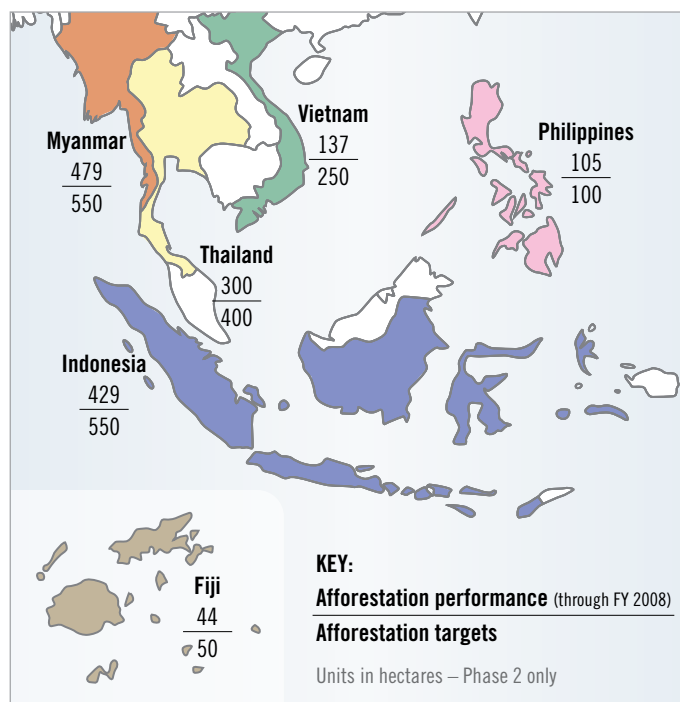
Performing Research on Green Technologies and Climate Change Solutions

Although Swiss Re (Mills and Knoepfel 1997) as well as the Reinsurance Association of America (*Nutter 1996*) have for more than a decade called for R&D initiatives in support of better resiliency, until recently the insurance industry has made limited progress on this front.

As green buildings become more commonplace, it will be critical to understand any differences (positive or negative) in their risk profiles compared to conventional buildings. Potential downside issues include material longevity or longer periods of business interruption if there are delays in rebuilding to green (*Whitfield 2008b*). Insurers have tended to highlight the downsides, but there is a large body of engineering evidence for upside benefits as well (*Vine et al 1998*). Virtually no actuarial analysis has been performed on these factors, although insurers are increasingly studying them (*Taylor 2008; Marsh 2008*).

Figure 11. Scope of Tokio Marine Nichido Mangrove Afforestation Project

Source: Tokio Marine Holdings (2008)



Insurers can mitigate the costs of climate change by investing in sustainable land-management activities. Actively protecting mangroves in Southeast Asia since 1999, Tokio Marine Nichido helped to lessen the effects of the tsunami there in 2005.

Improving energy efficiency also can lead to operational benefits to insurers' own operations. In a carefully controlled research study, West Bend Mutual Insurance Company reported a 7% increase in productivity (numbers of files processed pertaining to applications, endorsements, renewals, and quotes) following implementation of a number of energy- and nonenergy-related environment improvement measures (*Kroner et al. 1992*). In another example of operational efficiencies, American Modern Insurance Group 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 (*Gordes 2000*).

In 2008, Zurich initiated its Applied Research Program, intended to facilitate knowledge development with respect to economic, finance, and policy issues associated with climate change. The first such partnership is with the Bren School of Environmental Science & Management at the University of California, Santa Barbara. Zurich also has analyzed and written extensively about policy issues and managing risks associated with carbon capture and storage (*Trabucchi and Patton 2008*).

FM Global conducted an in-depth assessment of "Green Roofing Systems", which have become popular, and issued guidelines for proper application (*FM Global 2007*). This work no doubt provided important underpinnings for its own green buildings insurance product (and the inclusion versus exclusion of green roofing), and might have inspired other companies to accept this technology as well.

Specific research has been done on driving behavior in the face of rising gasoline prices or differentiated insurance premiums. An actuary found that elevated gasoline prices had a durable effect on driving behavior (*Boison 2005*), and in 2008 Progressive concluded exhaustive research on the effect of mileage-based insurance. Progressive's study was funded through federal (\$1.5 million) and local governments (\$375,000 from North Central Texas Council of Governments) and was located in the North Central Texas Ozone Non-attainment Area (*Progressive 2008*).

In a novel insurer initiative, Progressive and the X-Prize foundation have announced an international "X-Prize" competition with a purse of up to \$10 million for the design of a super-fuel-efficient passenger car (*Progressive 2008*), with a target fuel economy equivalent to 100 miles per gallon. At least 60 teams have signed up to compete.

Aligning Terms and Conditions with Risk-Reducing Behavior

"Green" customers tend to present better risk profiles, which can be translated into lower rates.

~ AXA, response to 2006 Carbon Disclosure Project Survey

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 (PAYD) insurance products have now been offered by at least 26 insurers around the world, recognizing the link between accident risk (as well as energy use) and distance driven. Privacy remains a central concern for PAYD programs, but some insurers are finding solutions. In another example, potential liability of corporate directors and officers for their actions (or lack of action) regarding climate change risks has only recently been reflected in insurance policies. Conversely, customers with a tendency to reduce climate vulnerabilities (e.g. drivers of hybrid cars or operators of green manufacturing operations) are increasingly being seen as "good risks" and are being rewarded accordingly with lower premiums by 17 insurers. Many insurers have become convinced about the "halo" effect, although more data and research are needed to sufficiently understand it and fully reflect it in insurance product design.

Pay-as-You-Drive Insurance

The Brookings Institution has referred to the traditional paradigm of pricing auto insurance as an “all-you-can-eat” approach, i.e. providing an unlimited ability to drive for a fixed premium (*Bordoff 2008*). Moreover, this implicit averaging process means that low-mileage drivers subsidize high-mileage ones. At best, traditional systems differentiate crudely based on self-reported driving habits. Proposals have circulated since the mid-1990s (*Wenzel 1995*) to link automobile insurance to the price of gasoline or miles driven, with the intent of encouraging reduced driving in order to simultaneously achieve safety and environmental benefits. There are many reasons—emissions, congestion, and roadway safety—to make the price signals better reflect the cost of driving. One estimate puts the societal cost of driving at \$300 billion per year in the United States alone (*Dubner and Levitt 2008*).

Most mileage-based systems utilize telematics, i.e. GPS tracking systems that automatically tabulate and report mileage. Observers have noted collateral benefits for insurers, beyond having a more risk-related premium. These include elimination of error or fraud in mileage reporting, better data collection to inform underwriting, theft prevention and detection, remote unlock, crash notification, navigation, usage authentication, and remote vehicle maintenance and diagnostics (*Coyne 2009*).

It has been estimated that pay-as-you-drive insurance (PAYD) insurance could reduce miles driven by 10% to 15%, and lower accident rates (*Victoria Transport Policy Institute 2005*). The Brookings Institution put the number at 8%, which they translate into an aggregate societal benefit of \$52 billion per year (presumably just in the United States), with two-thirds of households enjoying reduced premiums (*Bordoff 2008*). This has significant implications for climate change, as automobiles account for a quarter of U.S. greenhouse gas emissions.

Progressive introduced the first-ever usage-based automobile insurance program available to consumers in the United States in 1998. Called AutographSM, the program was first test marketed in Houston and was made available to drivers throughout the state of Texas in 1999. A growing number of insurers are now offering these products. Progressive Insurance (U.S.) and Norwich Union (UK) conducted pilot tests with customers receiving up to 25% premium discounts depending on their driving habits (*ICF 2003; O'Connor and Goch 2004*). In a detailed evaluation of 93 pilot project participants, sponsored by the North Central Texas Council of Governments, Progressive found an average annual driving reduction for this group of 560 miles per year (5%) (*Progressive 2008*). In 2003, the Oregon legislature enacted a \$100 per 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 (*CLF 2005*). The U.S. Environmental Protection Agency has nominally promoted the concept at the national level. However, the availability of mileage-based policies in the United States remains limited.

In 2004, U.S. General Motors' GMAC insurance began offering mileage-based insurance discounts of up to 54%, utilizing its OnStar technology to keep track of driving patterns. Canada's Aviva offers discounts up to 35%, based on mileage, time of day driven, and speed. Japan's Aioi Insurance, Israel's Aryeh, and the Netherlands' Polis Direct introduced PAYD products in 2004. Aryeh's program had reached 200,000 customers (15% of the country's cars) by 2007 (*Bordoff 2008*). Nedbank offers the product in South Africa. In Germany, premiums have been reduced by up to 50% for smaller cars driven shorter distances (*Zwirner 2000*); RheinLand Versicherungen offers premiums that are proportional to miles driven. HDI-Gerling offers similar incentives. 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 (*Roberts 2007*). The Spanish insurer Mapfre is conducting pilot tests with 15,000 drivers (*PAYD Bulletin 2007a*).

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% by 2015, corresponding to premium revenues of \$700 million (*Frost and Sullivan 2007*). Approximately

20% of new customers of the French insurer AGF elect the PAYD option, with 250,000 such policies in force (*PAYD Bulletin 2007b*), and Unipol claims to have 400,000 (*Unipol 2008*).

Recent years have seen considerable maturation in PAYD products and their underlying technology, accompanied by reduced consumer concern over privacy (*Slavin 2008*). Recent spikes in oil prices have fueled consumer interest in being rewarded for reduced driving. The culmination of 15 years of research (*Slavin 2008*) is Progressive's new "MyRate" program, which provides an instant 10% premium reduction for those who enroll and up to a 60% reduction for low mileage. The program is currently offered in eight states and is slated for national rollout in 2009. Progressive states that the product has produced "better losses, better retention and better consumer acceptance." GMAC has garnered 20,000 subscribers in its program, and subscriptions increased 200% year over year. Norwich Union claims a 30% reduction in claims and a 90% renewal rate. AXA offers mileage-based premiums in Canada, Italy, Belgium, Switzerland, and Germany, and states that they are "extremely popular" (*AXA 2007*). It is the only company we are aware of that also charges a premium penalty for high mileage of up to 10% in some countries (*AXA 2008*).

Efforts by Iryeh and other insurers are underway to allay privacy concerns through modifications to the product design (*Troncoso et al. 2007*). For example, methods are being developed that are not based on vehicle tracking. Mileage-denominated Auto insurance "cards" are being sold by a new startup company called Milemeter in increments as small as 1,000 miles and as large as 6,000 miles. Pricing is dependent on geography, driver's age, vehicle, and coverage level. The insurance card expires when the vehicle reaches a certain mileage (*Perr & Knight 2008*). A similar "trust-based" program has been instituted in Australia by Real Insurance, wherein a sticker must be displayed on the windshield showing the odometer reading up to which premiums have been paid (*Hays 2008b*).

Regulators also are promoting the PAYD concept. The California Insurance regulator has proposed an optional pay-as-you-drive auto insurance product for all consumers (*CADOI 2008*). Oregon passed legislation in 2003 to encourage insurers—through a \$100 per policy tax credit—to offer pay-as-you-drive insurance. For a time in Massachusetts, all insurers were required to provide a 10% discount for verified annual mileage is 5,000 miles or less, and 5% if the value was between 5,001 and 7,500 miles. The state now defers to the insurers to promote reduced driving through their product design. The Governor of New York has asked insurers to reduce premiums in response to price-induced reductions in driving (*Hunter 2008*). In its recent climate change white paper, the National Association of Insurance Commissioners encouraged insurers "to give much greater weight to the miles that policyholders drive as a rating factor" (*Hays 2008c*).

Though new PAYD offerings continue to emerge and be scaled upward, the market is still considerably under-developed. UK-based Norwich Union terminated its PAYD offering for personal autos in 2008 (*Company Car Driver 2008*). Offerings in the United States are especially scant given the size of the personal auto market. Considering the dependence of most Americans on personal automobiles and the high proportion of U.S. greenhouse gas emissions originating from vehicles, it is unfortunate that U.S. insurers lag behind their European counterparts in offering PAYD products associated with significant risk reduction, more risk-based pricing, and carbon savings from reductions in miles driven.

Assigning Directors & Officers Liability

In 2007, the three leading U.S. insurance trade journals devoted cover stories to the looming implications of climate change for insurance liability claims. The Wall Street Journal echoed the concern. Insurers providing Directors and Officers policies might face claims against their customers from shareholders. Business Insurance noted that D&O insurers have not given the issue nearly as much scrutiny as have shareholders (*Lenckus 2008a*). Conversely, insurers themselves could be found liable for not disclosing climate risks—both from their insurance business and their investments—to their shareholders.

Swiss Re provides an interesting case study in identifying risk factors relating to climate change (*Ross et al 2007*). 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. As a first step toward assessing these risks, Swiss Re reviews responses of potentially exposed companies to the 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. The potentially 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 toward managing the risks. However, to our knowledge, Swiss Re has yet to actually decline a policy or apply exclusions based on climate risks alone.

The world's largest insurance broker, Marsh, has articulated the following questions with respect to assessing climate change and D&O risk (*Marsh 2006a*):

- ◆ 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?

In collaboration with Yale University and Ceres, Marsh launched a program in 2006—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 (*Ceres 2006*). More than 200 board members from Fortune-1000 companies participated in the training (*Yale 2006*).

In 2008, Zurich added D&O coverage extensions to incorporate climate change. Liberty Mutual introduced what it referred to as liability coverage for “global warming litigation,” including directors and officers, employment practices liability, fiduciary responsibility, pollution defense and standard ISO crime fidelity (*National Underwriter 2008*).

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

A growing number of insurers perceive a “halo effect”* 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. For example, Travelers has stated that:

“Travelers believes that commercial property owners who embrace ‘green’ technologies are likely to be more risk management-minded, practicing greater care in building maintenance and operation” (Travelers 2008).

Similarly, AXA echoed this sentiment:

“The environmental added value is based on the fact that ‘Green’ customers tend to present better risk profiles, which can be translated into lower rates” (AXA 2008).

The broker Aon also subscribes to this view:

“The owners and occupants of green buildings are often among the most careful of insured classes. With better attention to maintenance, the buildings are often superior

* Credit to Rick Jones of HSB/Solomon for coining this term in the context of energy-efficient behavior.

to their conventional counterparts. ... Claims arising out of the building environment are much less likely than in conventional structures due to reduced levels of volatile organic compounds and healthier fresh air” (Taylor 2008).

Fireman’s Fund recognizes it in the manufacturing sector as well:

“Manufacturers that enforce green standards benefit from higher employee productivity, reduced absenteeism, improved product safety and lower energy bills. Sustainable businesses present fewer risks and are, therefore, better risks to insure” (FFIC 2008b).

Auto insurers also have recognized the “halo effect.” A Japanese trade association asserted a positive correlation between safe driving, fuel-economy, and environmental protection (*General Insurance Association of Japan 2007*). A number of vehicle insurers are offering discounts for policyholders of fuel-economic vehicles. For example, Sompo Japan Insurance has provided a 1.5% premium credit for low-emission and fuel-efficient vehicles, reaching 3.25 million policyholders as of 2005, and Tokio Marine Nichido reached 6.23 million customers (48% market penetration) as of 2006. Farmers Insurance introduced a 5% premium credit for hybrid vehicles in California in 2005 (*Farmers 2005*), expanding it to 37 states in by mid-2008. Farmers’ parent, Zurich, also offers the product in Japan and Germany. In 2006, Travelers announced 10% 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 (*Travelers 2006a*). Berkshire/Geico is offering such credits as well. AXA is offering discounts for hybrids or low-emissions vehicles in France (50%), Canada (10%), Switzerland (20%) Thailand, and Ireland (20%–30%) (*AXA 2007*). Fortis provides a 10% discount. The UK broker Ecover offers a discount (through Norwich Union) of up to 10% for homes or businesses attesting to green practices (*Ecover 2008*).

There are technological reasons to expect a positive correlation between efficiency and a lower-risk profile. Despite the contrarian rhetoric on this topic during the 2008 U.S. Presidential campaign (*Rhee 2008*), Allstate encourages customers to keep car tires filled for joint safety and environmental benefits. The U.S. Governmental Accountability Office corroborates these benefits (*GAO 2007b*). In another example, the emerging practice of “building commissioning” to ensure the expected performance of energy-efficiency features also has been found to help detect and remedy risk-related issues such as indoor air quality problems or equipment breakdown risks (*Mills et al. 2004*). The largest U.S. professional liability insurer for architects and engineers—DPIC—has offered a 10% premium credit for customers who receive training in commissioning. Firemans’ Fund and Zurich have commercial lines policies that in some cases cover the costs of re-commissioning following a loss.

Recognizing a correlation between sustainable practices and low-risk, in 2008 Allianz/FFIC instituted premium reductions up to 5% for Workers Compensation and Environmental coverages in the manufacturing sector for customers with sustainable practices and products. To our knowledge, this is the first initiative focused on the industrial sector and Environmental Liability or Workers Compensation lines (*FFIC 2008b*). The underwriting behind this offering recognizes three important factors:

- ◆ **Lean manufacturing**—reducing material use and energy costs while also improving housekeeping reduces slip-and-fall injuries
- ◆ **Reductions in the use of flammable liquids**—reduces carbon footprint since most flammables are petroleum based—also improves property safety and public/employee safety
- ◆ **Newer, more energy efficient machinery**—runs cooler (fewer fires) and has superior machine guarding (fewer injuries).

In an analogous offering for the automotive lines, Allianz provides a 10% auto insurance discount to customers in Austria that have annual public transportation passes.

Crafting Innovative Insurance Products & Services

To take advantage of the opportunities and respond to risk attendant to climate change, certain sectors of the economy must adapt or reinvent their business models. Proper enterprise risk management dictates a re-evaluation of existing risk management tools in response to this ‘green’ paradigm shift. Insurance is one of those tools that can be used to both achieve competitive advantage and corporate social responsibility—if properly leveraged (Zurich 2008a).

~ Lindene Patton

Climate Products Officer, Zurich Financial Services

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 recognize an enormous opportunity to develop new profit centers by providing innovative products and services (or extending existing policies) for energy users or providers of clean energy services. Insurers and catastrophe modelers also can tap their core competencies to offer new services to assess and mitigate climate risks. The majority of recent activity has focused on green buildings. Microinsurance is being introduced at large scale for those in the developing world currently lacking access to insurance, and innovative pilot projects are pioneering techniques through which insurers can collaborate with international aid organizations to improve disaster resilience. Renewable energy has seen a flurry of activity, but most appears to be little more than bundling/repackaging of existing offerings, rather than pure innovation to fill coverage gaps or carefully tailor coverage to the unique features of these technologies. More fundamental opportunities could be tapped through 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. Warranty and service contracts represent an emerging area with few examples, but considerable potential.

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 Services has developed a package of professional liability, general liability, and property coverage for professional home energy auditors (Brovik 2006). 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.

We are aware of only one new activity in 2008. Allianz Germany has introduced coverage responding to the special liabilities of providers of renewable-energy or energy-efficiency services. Included among those eligible for the coverage are energy auditors, technicians, builders, energy-performance raters, architects and engineers for financial losses resulting from providing energy services.

Energy-Savings Insurance

Recent studies have emphasized the importance of energy efficiency, concluding that any attempt to significantly lower global greenhouse gas emissions will need to derive half or more of its reductions from greater efficiency and conservation. Given this vast potential, this is an area where increased insurer activity could have a major impact.

Energy-savings insurance (ESI) is an innovative product in which policies protect the installer or owner of an energy-efficiency project from under-achievement of predicted energy-savings. ESI differs in fundamental ways from surety bonds that might be associated with energy-savings projects. Surety bonds are designed strictly to guarantee the installation-of-measures portion of a project. The surety will specifically exclude from coverage of operational energy savings or any savings guarantee.

A prior study identified 12 past and present providers, and a potential \$1 billion market for ESI in the United States alone (*Mills 2003*). There are some market drivers for ESI. For example, some state statutes (*D.C. Code § 2-303.22 (a)(3)*) 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 (*Seifert 2006*). The Canadian government has required ESI or performance bonds to guaranty the energy savings on all energy-saving projects conducted in government facilities (*Mills 2003*).

Demand is low. This is no doubt partly because of the ways in which performance-based financial products have fallen out of favor more generally, combined with a profound lack of recognition on the part of customers that predicted energy savings cannot be taken for granted. In many cases, energy-efficiency projects suffer from lack of quality control, and under perform as a result (*Mills et al. 2004*).

The market for energy-savings insurance has been stalled for several years, but a number of insurers are working quietly on new products and approaches. Such efforts can be expected to make claims of “green” performance stand up to more rigorous tests, offering an avenue for both risk management and quality assurance.

Renewable-Energy Project Insurance

The global market for renewable-energy is projected to grow from \$55 billion in 2006 to more than \$225 billion in 2016 (*Makower et al. 2006*). Insurers have for decades offered varying degrees of coverage for renewable-energy projects, and we do not attempt to catalog those here. Our focus is on innovative products or endorsements that fill coverage gaps or otherwise improve on the standard coverages.

A survey conducted by Marsh found that many insurers offered at least one of eight forms of insurance for renewable energy projects, but numerous risks and barriers also were noted (*Marsh 2006b*). On the other hand, as noted by the CEO of Allianz Specialized Investments, the technical risks for established renewable technologies “are probably lower than conventional power plants” (*Collins 2007*). Supply chain risks exist, e.g. where spare parts or repair services cannot be obtained quickly, thereby resulting in business interruptions.

One insurance-related obstacle for the renewable-energy sector has been the fragmented nature of insurance and the need to assemble multiple forms of coverage in order to manage risk across the full project cycle. AIG established its Advanced Energy Solutions Group in 2008 to integrate and coordinate product offerings in this domain (*Mucerino 2008*), to create products such as “Windsure,” which combine insurance with engineering and finance consultation. Sovereign General Insurance Company (a member of The Co-operators Group in Canada) has bundled diverse coverages (e.g. property, builders risk, liability) into a turnkey product they call “Windsurance” (*Sovereign 2008*). Travelers’ has a similar offering: “WindPak” (*Travelers 2006b*), and Renewco is the first Lloyd’s syndicate member to also provide this kind of offering (*Lloyd’s 2007*). Chubb, Zurich, and others have announced more comprehensive offerings for the renewable-energy sector (*Climateandinsurance.org 2008c*). In 2008, RSA created three ‘Centres of Excellence’ (UK, Canada and Denmark) to support 20 renewable-energy teams around the world (*RSA 2008a*). AXA has built up a comprehensive insurance offering for wind farms, which generated \$14 million in premium revenues in 2006 (*AXA 2007*).

The ambiguity around many of these efforts is the degree to which the companies are simply integrating and “repackaging” existing capacity as opposed to creating new products and services. A good example is the case of off-shore wind systems, which some insurers exclude (citing higher risks and repair costs) while others cover.

New products are emerging to manage performance risk for renewable energy systems.

- ◆ **Wind Power:** One example is wind power derivatives, in which payments are made to the producer if revenues fall below a predetermined level, and, conversely, payments made to the derivative provider if performance exceeds expectations (*Marsh 2006b*). London-based Willis Holdings (*Collins 2007*) and Tokio Marine & Nichido offer such products. Sompo 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 (*Childs 2007*). Swiss Re is reported to cover wind-resource risks under its carbon-offset delivery insurance program (*Roberts 2008*).
- ◆ **Solar Photovoltaics:** In 2008, Munich Re introduced a product for insuring income shortfalls from solar photovoltaic plants and wind farms resulting from fluctuations in solar resource availability (*Munich Re 2008b*). AXA offers coverage for production shortfalls for wind and solar photovoltaic projects above 150 kilowatt-peak (kWp).
- ◆ **Geothermal Energy:** Munich Re has successfully piloted exploration-risk insurance for geothermal energy companies (*Munich Re 2004*), AXA’s unit in Germany also offers cover for geothermal “drilling productivity losses.” With funding from the Global Environmental Facility (GEF), The World Bank has created a \$3.7-million “Geothermal Risk Insurance” exploration-risk product in conjunction with investment and consultancy services for the first geothermal energy plant to be constructed in Hungary (*Enex 2006; World Bank 2006*).
- ◆ **Biofuels:** Aon created a new agri-fuels group to offer risk-management services for the emerging biofuels industry (*AON 2007a*).
- ◆ **Various:** AIG is emphasizing the applicability of a long-standing “Systems Performance Insurance” product to green projects. The product is “designed to help owner –operators respond to banks and investors who seek to protect their investment against the risk that a deficiency in the design of the technology will result in the underperformance of the facility, as measured by post-construction acceptance tests” (*AIG Advanced Energy Solutions website*).

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 (*Marsh 2006b*).

Growth in availability of such insurance is contingent on improved technical expertise within the insurance industry, processes for commissioning installations (to detect 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. Meanwhile, terms will reflect the quality of maintenance programs, and other risk-management practices such as ensuring supply of replacement parts (*Collins 2007*).

Green-Buildings & Equipment Insurance

With the rise in popularity of “green-building” practices—already at \$36 billion to \$49 billion per year in the United States alone and projected to be a \$140 billion market by 2013 (*Slavin 2009*), insurers have considerably stepped up their efforts to develop new products for this arena. By 2010, 10% of new commercial building construction is projected to be green (*Whitfield 2008b*).

The market is evolving so rapidly, that Marsh felt compelled to issue an update of its June 2008 report (*Marsh 2008a*) in December of the same year (*Marsh 2008b*).

There are many opportunities for extending existing insurance contracts to fill coverage gaps, or otherwise differentiate insurance products and services, and even opportunities for services for green building, and also opportunities for entirely new products and services. However, as localities increasingly incorporate green features into existing building codes and standards, “green” practices are becoming the new norm and will be automatically covered under some insurance contracts (e.g. those with code-upgrade clauses). In either case, there is a complex array of risks for a variety of parties around the construction and operation of the green buildings, any of which could result in insurance claims. Aon characterizes these risks as follows (*Taylor 2008*):

For owners:

- (1) not being able to get the building certified or not achieving the expected level of certification
- (2) being unable to qualify for a tax credit that is contingent upon certification
- (3) not meeting requirements to qualify for a loan or green-building incentive
- (4) increased soft costs because of delays in completion or the requirement for additional documentation

For design professionals:

- (1) a higher standard of care due to the requirement that LEED certified individuals participate in the process
- (2) design defects that result in the failure to achieve certification or the level of certification promised
- (3) liability arising out of the operating phase due to systems or components that do not perform as intended over the life cycle of the structure

For contractors:

- (1) failure to deliver features or performance promised in the construction contract
- (2) construction defects
- (3) failure of the completed structure and systems to perform as intended over the lifecycle of the building

Marsh has observed examples of actual claims that reflect the aforementioned risks (*Marsh 2008*):

- ◆ Claim by developer against architect because building did not achieve LEED Gold Certification
- ◆ Claim against architect and structural engineer because of water infiltration from a green roof
- ◆ Claim against design team because the cork flooring they specified resulted in water retention and mold
- ◆ Claim against architect because lack of green product availability caused project delays
- ◆ Claim against architect because health problems of tenants’ employees increased despite warranties that the indoor air quality would improve

While any of these risks might compel an injured party to seek a remedy through litigation and insurance, current policies might or might not provide the desired coverage. Insurance policies have begun to respond to these issues (*Marsh 2008*). Although emerging products have focused initially on reconstruction after a loss to replace pre-existing green features (*Chubb 2008*) or upgrade to meet a higher green standard of performance, their scope is gradually increasing.

Most observers note potential new risks (*Slavin 2009*), but often fail to recognize the upside benefits described earlier in this report.

At least 22 companies have collectively offered (mostly in 2008) 39 specific policies, endorsements, coverage extensions, or services for “Green Buildings” and/or equipment therein:

- | | | |
|---------------------------------|-------------------------------------|------------------------|
| ◆ ACE (3 policies) | ◆ AXA (4) | ◆ Lloyds TSB (1) |
| ◆ Affiliated Factory Mutual (1) | ◆ Chubb (1) | ◆ Mitsui Sumitomo (1) |
| ◆ AIG (4) | ◆ Fireman’s Fund (5) | ◆ Mutual Boiler Re (1) |
| ◆ Allianz (2) | ◆ HSB (1) | ◆ QBE (1) |
| ◆ Allied (1) | ◆ Lexington (3) | ◆ RSA (1) |
| ◆ Aon (1) | ◆ La Capitale General Insurance (1) | ◆ Sampo Japan (1) |
| ◆ Ascent (1) | ◆ Liberty Mutual (1) | ◆ Travelers (2) |
| | | ◆ Zurich (2) |

In 2003, Sampo Japan Insurance introduced commercial insurance coverage for the incremental costs of green measures (recycled materials, energy-efficient products, green roofs) following loss (*Sampo 2005*).

Fireman’s Fund introduced several “GreenGard” insurance coverages for non-residential customers in 2006, becoming the first U.S. insurer to do so. Now approved in all 50 states, the coverages are aimed at customers who have built green from the ground up (5% premium credit), have made green renovations to existing buildings, or want to rebuild green after a loss. GreenGard has been successful in the marketplace with about 750 policies sold in the first two years for a total premium of \$65 million, and has helped to authenticate the importance of green building in the real estate and commercial construction industries, as well as helped to 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 (and covering commissioning costs), has been the most popular form of coverage. The additional premium is about 1 or 1.5% (*Brodsky 2008*). The coverage has been expanded to include Builders Risk (*Insurance Journal 2007b; FFIC 2008c*), 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 has enriched its offering by including green-buildings risk management consultation service at no additional cost to commercial policyholders as part of its “Sustainable Building Practices Assessment.”

In 2007, Lexington, a member company of American Insurance Group serving high-net-worth customers, introduced the first-known green-buildings insurance product for residential customers, as well as the latest example of special coverages for green non-residential buildings (*AIG 2007b; details in the 2007 version of this report*). Lexington subsequently introduced an “Eco-Homeowner” insurance product focused on covering revenue losses during system downtime for homes generating their own power (*AIG 2008a*). The “AIG Green Rebuilding Cost” coverage extension provides up to an additional 20% above the amount of coverage to restore, repair, or replace damaged property with materials as well as consulting services and/or registration fees, up to \$500 to purchase carbon offsets for emissions resulting from the loss. Also included is coverage for the cost of power purchases while on-site power systems are being repaired, and ecological landscaping.

In 2008, Zurich introduced a manuscripted endorsement to the commercial property policy that can cover replacement of damaged property with green and energy-efficient building

products. This endorsement also can extend cover to damages, including business interruption, to renewable-energy power systems associated with the property. A separate Zurich Professional Liability Policy extension has been introduced to cover Building Information systems and LEED services (Taylor 2008). Commissioning costs on a green rebuild are covered as part of the claim cost, if required, e.g. if there is a need for to recertify to LEED-qualified architect (which requires commissioning).

Figure 12. Affiliated FM Global's Green Coverage Endorsement

◆ Environmentally-Sound Green-Building Practices

- Additional costs to replace damaged property and materials with alternatives
- Additional costs to replace damaged roofs with green-roofing systems including vegetative-roofing systems
- Additional costs for the green removal, disposal, and recycling of damaged property



Photo Credit: Greenroofs.com

◆ Healthy Indoor Building Environments

- Air flushing with 100% outside air
- Replacement filtration media for ventilation systems

◆ Green Certification

- Costs to hire an accredited green consultant to assist in green design and reconstruction
- Certification or recertification in accordance with the client's choice of recognized green authorities

◆ Business Interruption

- Business interruption coverage for the increased time it might take to undertake covered green practices, including the additional time it might take to secure green certification

See: http://www.affiliatedfm.com/products_green.asp

In 2008, AXA began offering a 10% premium discount for buildings renovated to reduce greenhouse gas emissions (with energy efficiency or building-integrated renewables). About 3,800 policies had been sold by mid-2008.

Also in 2008, FM Global introduced an exemplary green-building policy (Figure 12). Interestingly, it includes additional costs to replace damaged roofs with green-roofing systems, i.e. living vegetative material integrated into the roof. This is notable in that "green roofs" are sometimes cited as a strategy that might have adverse implications for insurance. FM Global, however, conducted an in-depth engineering analysis of green roofing methods, identifying acceptable applications and design practices (FM Global 2007).

The coverage addresses another often-cited barrier to green construction by extending business interruption coverages to allow for the extra time it may take to build in a green fashion and obtain associated certifications. At least two brokers (AON and the JLS group) are accommodating green roofs (Climateandinsurance.org 2008d).

ACE, Travelers, and Liberty Mutual also provide coverage for commercial businesses that desire to rebuild to a "greener" standard in the event of a loss to an existing property. ACE offers an environmental consulting service to help customers develop LEED buildings, with special attention paid to indoor air quality (Business Insurance 2008).

In 2008, Travelers explicitly added an endorsement for "vegetative roofs" and for the delays that might be entailed for rebuilding to an improved, green performance level (Travelers 2008). Liberty Mutual (Insurance Journal 2008) and others also cover vegetative roofs.

Also in 2008, Allianz Australia added new environmental coverage to all homeowner policies, with no premium increase. In the event of a total loss, Allianz building policies will provide an additional \$5,000 (AU) that can be used for a range of environmental upgrades such as solar power, rainwater tanks, and grey water recycling. Damaged appliances also will be replaced with qualifying efficient models (Allianz 2008a).

Aon is the first broker to come to market with its own green-buildings policy (Insurance Journal 2008c), as an "All-Risk" coverage extension for its Global Property Policy for repair of existing green buildings, or upgrade upon reconstruction following a covered loss. The policy references the LEED and Green Globes rating programs in the United States and the Energy Performance

Directive in the European Union as standards to which qualifying properties can be expected to conform, although “equivalent” systems or improvements required by local laws and ordinances also will be accepted. Costs of design/certification also are covered, as are extra costs of business interruptions associated with additional time required to obtain green products and services. The program covers building envelopes and systems as well as equipment within, the latter of which is to be upgraded to EnergyStar performance levels or furnishings meeting GreenGuard indoor air quality criteria. The extra costs for recycling construction debris also are included.

Some insurers have focused on “green-upgrade” offerings for specific equipment within facilities, as opposed to generalized property coverage. Since 1998, HSB’s boiler and machinery coverage has included coverage for up to 125% of the loss for “additional cost to replace with equipment that we agree is better for the environment, safer for people or more energy efficient than the equipment being replaced.” Mutual Boiler Re also offers an equipment-upgrade product for personal and commercial lines. Certain Travelers boiler and machinery policies contain a provision that provides for up to 25% of the incremental costs of newer generation replacement equipment “which improves the environment, increases efficiency or enhances safety,” (*Business Wire 2007*) and a commercial buildings product which provides up to 5% (maximum \$25,000) of the total loss for green upgrades as well as 30 days business-interruption coverage for any delays associated with the implementing green replacement features (*Greener Buildings 2008*). Lloyd’s TSB offers similar coverage for renewable-energy equipment in buildings.

While green buildings have perhaps made a larger “splash” than any other insurer response to climate change, the devil remains in the details. According to an insightful white paper by Aon, many coverage gaps remain. For example, existing policies tend to provide “no coverage for claims arising out of promises to achieve certification or a specified level of performance from the components or systems installed in a green building. The lack of insurance protection for guarantees of performance by architects is leading to a tension among the parties working to develop green building projects” (*Taylor 2008*). Nested coverage sub-limits also can limit the protective value of green insurance policies. In late 2008, AIG introduced a novel product for reputational risk associated with green building projects, focusing on adverse publicity presumably arising from under-attainment of performance objectives, and another addressing indoor environmental quality and associated coverage gaps in green buildings.

Warranty and Service Contracts

Insurance companies participate in the market for many technologies as (often invisible) providers or reinsurers of warranties or various forms of service contracts. Opportunities for “greening” these offerings have received little attention.

Zurich might be the first insurer to venture into this area (*Zurich 2008b*). The company discovered that traditional service contracts did not work effectively for hybrid autos, as the types, costs, and risk profiles of replacement parts varied in some cases from those in traditional automobiles. Zurich developed new underwriting methods and terms and conditions appropriate to the new technology. This is not a new product, per se, but reflects the importance of insurers identifying coverage gaps or other ways in which products can or must be modified to accommodate climate-friendly technologies and practices.

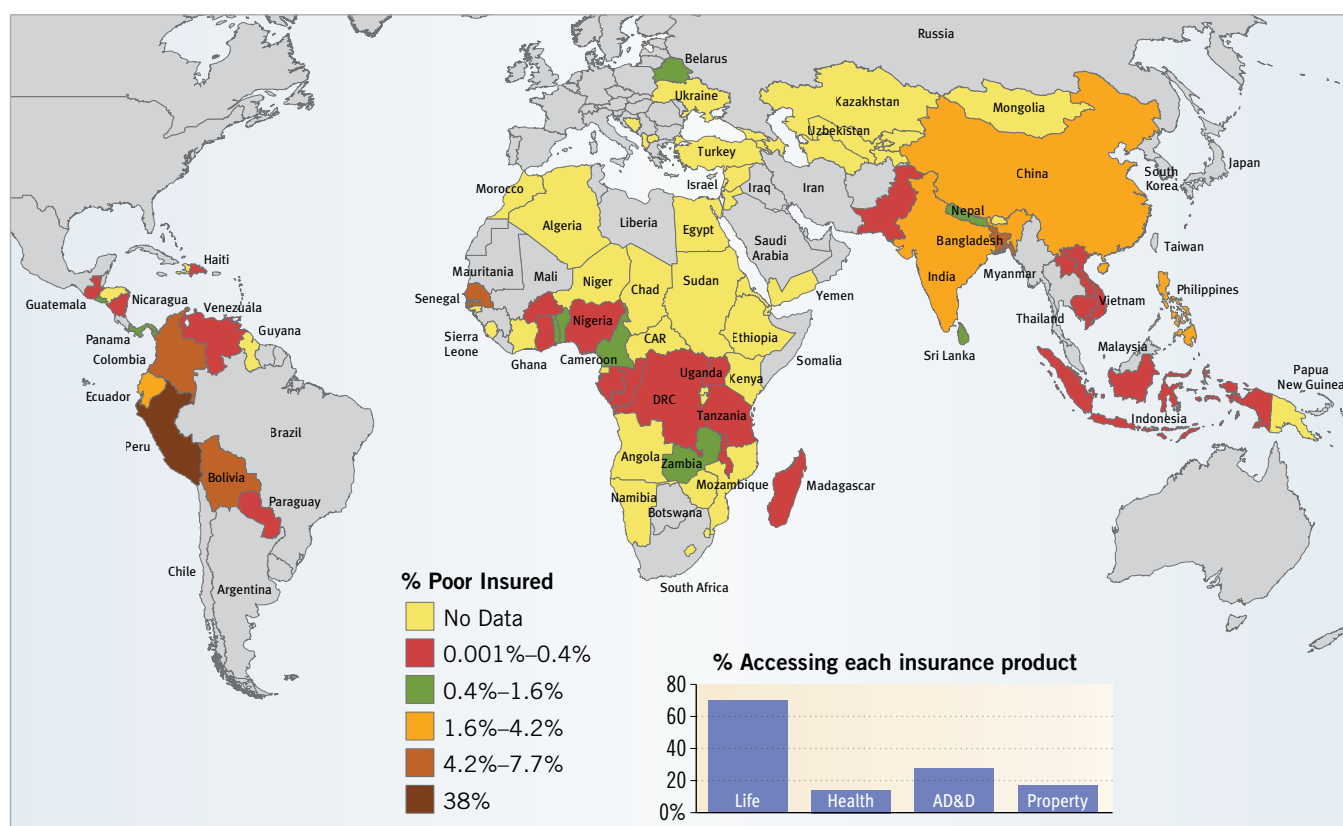
Warranty “coverage gaps” exist in other domains. For example, wind turbine manufacturers are said to have rolled average warranty periods from five to 10 years back to two years in many cases (*Collins 2007*). Use of biofuels might void warranties of certain vehicles or engines. Insurers could opt to fill this void with new products.

Microinsurance and Other Initiatives for the Developing World

Most of the world's population cannot afford conventional insurance for health, life, crops, or property. The practice of microinsurance dates back at least to the 1950s, although the entry of commercial insurers is relatively recent. Microinsurance for property is much less common than that for life and health. A comprehensive study found that only 3% of the poor (albeit 78 million people) (Figure 13) in the world's 100 poorest countries have access to insurance products (Roth et al. 2007). A separate study identified 122 microinsurance products for agriculture, about two-thirds of which were in Latin America, followed by Asia and then Africa (Roth and McCord 2008). Total premiums for 2005 were estimated at more than \$1 billion. Risks tend to be borne by a mix of public and private players.

Figure 13. World Microinsurance Availability and Type by Country

Source: Microinsurance Centre



Compounding the need, 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.

Insurers have been exploring ways to grow their business while helping to manage and spread the risks associated with climate change (Mills 2004). Notably, the Munich Climate Insurance Initiative (led by Munich Re) is identifying insurance-related climate change solutions such as microinsurance and conducting pilot projects and education within the industry. A number of individual insurers and reinsurers are offering microinsurance products, among them Allianz (Germany), Eureko Re (Netherlands), Pakisama Mutual Benefit Association (Philippines)

AIG-Uganda (Uganda), Munich Re, Swiss Re, and Trinity Life Assurance Company (Tanzania) (*UNEP 2007*).*† AIG garnered \$45 million in premiums from 2.25 million microinsurance policies in 2007 (*Wall Street Journal 2007*).

In 2007, Swiss Re created the Climate Change Adaptation Program, a high-tech microinsurance product for drought (**Box 4**) (*Insurance Journal 2007c*). Swiss Re's original weather-risk products for developing countries had been sold to 320,000 small farmers in India.

Initiated in 1993, the Caribbean Disaster Mitigation Project (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 (*USAID-OAS 1996*).

Beginning in 1998, Barbados-based United Insurance began a program in which homeowners and businesses could 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 (*UNDP 2004*). About 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.

In 2008, AXA Re introduced the first-ever insurance for humanitarian emergencies (**Box 4**), an innovative approach that reduces human suffering and drastically reduces the overall cost of responding to humanitarian crises by mobilizing aid faster than is possible using traditional approaches (*Cavanaugh 2006*).

Box 4. Innovative Insurance for Faster and Less Costly Humanitarian Relief

Beginning with catastrophic crop-loss risk faced by farmers in Ethiopia, AXA crafted a rainfall derivative product purchased by the United Nations World Food Programme (WFP). Pooling data from 26 weather stations across Ethiopia, rainfall amounts and patterns are tracked and used to develop an index. If the trigger is surpassed, claims are paid well in advance of when post-event relief would be distributed. Participants in the program estimate that \$7 million of insurance claims paid before the catastrophe avert \$1 billion in conventional aid that would otherwise be required. As a result, the ultimate costs of the event are lower and the amount of human suffering much reduced. The WFP estimates that the new mechanism speeds up the process of delivering relief by four to six months.

In September 2007, Swiss Re launched its Climate Adaptation Development Programme (CADP) at the Clinton Global Initiative 2007 meeting. The program is designed to develop a financial risk transfer market for the effects of adverse weather in emerging countries. In a first phase, it will aim at providing financial protection against severe drought conditions for up to 400,000 people in several villages in Kenya, Mali, and Ethiopia. The contracts protect smallholder farmers against drought-related livelihood shocks such as food shortages and famines. Satellite-based sensing is used to determine when the loss trigger is passed (*Swiss Re 2007*).



Family farming in Ethiopia.
Photo: iStockphoto.com/Lingbeek

* See <http://www.microinsurancecentre.org>

Offering Carbon Risk-Management and Carbon-Reduction Services

Project portfolio underperformance and counterparty risks have dramatically increased in the last 6 months and buyers, lenders, and investors in emission reduction projects are concerned about their money—compliance buyers about their license to produce! ... At project level in developing countries and emerging markets there is a lack of risk management and insurance coverage to protect the investments needed to fight global climate change (Carbon Re 2008).

~ Dirk P. Kohler, CEO, Carbon Re

Climate change has become a risk to be managed, and insurers and brokers are well positioned to develop and offer such expertise. Included in this is managing the risks associated with responses to climate change. A small but increasing number of insurers has spurred the burgeoning market for carbon trading while securing additional business by providing mechanisms for participants to better manage carbon risk. There has been a recent burst of activity involving bundling carbon offsets with insurance products, particularly automobile and travel insurance. Insurers are becoming 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. Lack of a mandatory trading system in the United States is often cited by insurers as their reason for hesitating to enter the market. Insurers also have begun to pay attention to the quality of carbon-offset approaches.

Climate Risk-Management Services

A variety of business and performance risks are associated with projects designed to achieve reductions in carbon emissions. 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 (Marsh 2006a). This is particularly relevant for brokers such as Marsh, which function as risk advisors to their corporate clients. 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.

As a value is put on carbon, emitters either receive revenue for selling surplus carbon emission allowances or purchase them to offset their own emissions, there is the potential for costs (insured or uninsured) if operations are disrupted in ways that impair the expected cash flows. Observers anticipate the development of new “carbon wording” within insurance contracts to cover these contingencies (Reeves 2007).

The market response to the emergence of carbon markets is exemplified by a new intermediary—Carbon Re—that specializes in the area (Carbon Re 2008). Working closely with Munich Re, Carbon Re offers a series of insurance products and risk-assessment/management services (Figure 14).

HSB Solomon Associates 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, such as oil refineries. The broker Rutherford offers carbon-baseline analysis services to its customers. RSA offers energy audits to commercial customers (RSA 2008b; Ascent 2007),* as does AXA as part of a broader environmental-risk audit service.

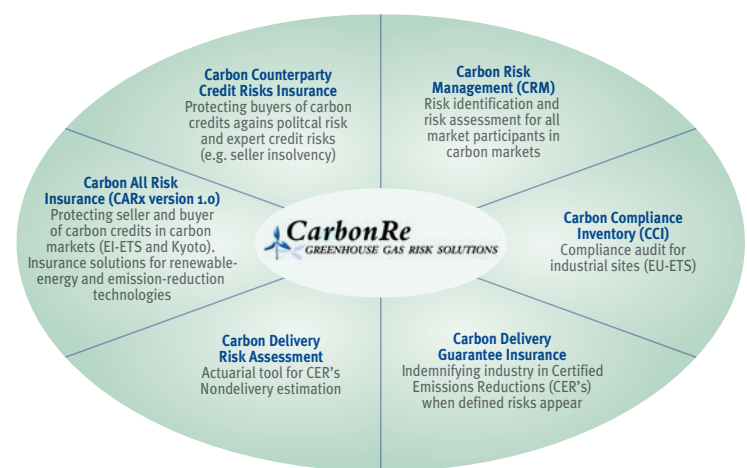
Brokers also are beginning to provide climate-risk advisory services to their customers. For example, Willis reports that it is advising clients on how to identify, quantify, and manage their business risks associated with climate change.

It is tempting to embrace estimates of energy savings, production, or other strategies for reducing greenhouse-gas emissions as fact. There is increasing awareness, however, that systems are not always implemented as designed and, even if they are, do not always perform as anticipated. Gifford (2008) has raised important questions about the efficacy of rating systems such as LEED in actually delivering energy savings, and, by inference, greenhouse gas emission reductions. Others have raised questions about the veracity of carbon-offset projects (Holly 2008). In recognition of this, a significant base of knowledge and techniques is being built up (outside the insurance industry) to measure and verify energy savings associated with efficiency projects, certain carbon-offset projects are required to go through a rigorous validation process, etc. Insurers must, on the one hand, beware of these uncertainties and not represent their own green initiatives as “green” if savings are later proven to be ephemeral. At the same time, these risks constitute a market opportunity for insurers to intervene with new products and services to manage and transfer performance risk.

Carbon Trading

The world’s carbon markets are projected to be valued at more than \$166 billion by the end of 2008, growing to \$550 billion by 2012 and \$3 trillion by 2020 (The Climate Group 2008). Many risks are associated with carbon trading, and new insurance products and services are being developed to manage them (Bowers 2003; Brady 2008; Roberts 2008). Under the European Union Emissions Trading System, more than 6,000 companies face mandatory emissions-

Figure 14. Carbon Insurance and Risk-Management Offerings from Carbon Re, a Swiss-Based Reinsurer Specializing in Carbon Markets



* See also <http://www.rsabroker.com/energy/index.html>

reduction targets and stringent penalties for noncompliance. Signatories to the Kyoto Protocol (all industrial countries with the exception of the United States) also have obligatory emission reduction targets. Some companies in the United States 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). In the United States, regional trading systems are being put in place and the Obama administration will no doubt institute a national mandatory cap-and-trade program in the near future.

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 (*Aon 2005*).

AGF (an Allianz Company) invests indirectly through the EU Carbon Fund, which specializes in this market (*Allianz 2007a*).

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 United States to jointly cap power plant greenhouse gas emissions) imposes a 10% “discount rate” on any offsets obtained from carbon-sequestration projects because of uncertainties with that technology. Insurers of carbon-offset projects have the opportunity as well to reward better practices that reduce risk through higher-quality project design. Carbon Re has done this in a partnership with the Gold Standard program for quality assurance in carbon offsets—lower carbon delivery risk premiums are awarded if projects are certified by Gold Standard.

RNK Capital LLC and Swiss Re jointly implemented the carbon markets' first insurance product for managing Kyoto Protocol-related risk in carbon credit transactions (*Insurance Journal 2006*). 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).

Notably, the aforementioned Swiss Re program can pay claims either in monetary units or by providing replacement offsets (*Roberts 2008*). Payment with offsets is an idea originally proposed by Storebrand (*Willums 1999*).

Munich Re offers a “Kyoto Multi Risk Cover” that insures an agreed value per carbon credit and compensates entities that invest in CDM and JI (Joint Implementation) projects if losses arise from failure to deliver the agreed number of emission rights (*Munich Re 2007*). Standard risks (property, engineering, surety, and credit) are included.

ACE offers political-risk and trade-credit insurance for carbon emissions trading, citing risks including “governmental interference, embargo, license cancellation, war and political violence which could interrupt the production, certification and delivery of carbon credits.” (*ACE 2008*).

Zurich has introduced a political-risk insurance coverage extension for carbon-credit projects covering political risks (*Zurich 2008c*). The coverage includes risk of a host government's actions that prevent an investor from receiving benefits associated with emission credits, and political violence events, including war and terrorism, which disrupt operations, as well as comprehensive credit insurance for carbon-credit projects that protects against both commercial defaults as well as political risks. Munich Re includes political risk in its aforementioned Kyoto policy. Carbon Re also offers a political-risk product as well as other risks associated with carbon-reduction projects.

In 2006, 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 (*AIG 2007c*). AIG provided a letter of credit guaranteeing the payment obligations of the entities purchasing the CERs, through Natsource. Because the transaction happens over a period of seven years and there are multiple buyers, this letter of credit allowed the transaction to take place. AIG also is developing a carbon-delivery risk product (*AIG 2007d*).

A carbon-delivery policy is offered by Zurich through the environmental underwriting unit to lenders as opposed to project owners/developers. Known as the “CER/VER Delivery Securitization Policy,” the target buyer is a multi-lateral or multi-national bank. The policy is designed upon a triggering event to provide protection to lenders on CDM projects in the event of non-delivery of carbon credits.

Enabling Customers to Acquire Carbon Offsets

With “green is the new black” for many mainstream consumers, there is considerable interest in purchasing carbon offsets to compensate for energy use at home, during travel, and even that embedded within products. Some insurers are diversifying their core offerings by adding optional 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.*

Another initiative brings together a set of insurers that, 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% offset for the customer’s travel (including up to 40 flight hours per policy) with no price premium (*Osborne 2006*). Among the insurers offering policies through Climatesure are AXA, Norwich Union, Groupama Insurances, and Premier Underwriting; premiums are lower for fuel-efficient cars.†

Allianz also is offering certified carbon offsets for drivers, and plans to augment this with some sort of premium incentive (*Allianz 2007b*). RSA’s More Than Green Wheels automobile insurance provides a 15% discount for qualifying vehicles, including 100% carbon offset for the first 3,000 miles driven each year, with an option to the customer to purchase offsets for the remaining amount. Similarly, Cooperative Insurance’s Ecoinsurance product automatically offsets 20% of emissions for buyers of its automobile insurance (*CIS 2008*). BGL, Environmental Transport Authority, Esurance, the Green Insurance Company, and the Budget Insurance Group are offering offsets for homes and/or autos.

In 2008, Swiss direct insurer Mobiliar and Swiss Re offered motorists the option to offset the carbon emissions of their vehicles (*Swiss Re 2008d*). In recognition of increased interest in the quality and other nuances of carbon offsets, Swiss Re set the following offset selection criteria: (*Swiss Re 2008b*).

- ◆ Priority to projects which support renewable-energy technologies and energy-efficiency improvements
- ◆ Preference to photovoltaic power generation, solar, thermal, ecologically-sound biomass and biogas (including landfill gas), wind, geothermal, small and low-impact hydro
- ◆ Large hydro projects generating a clear sustainable benefit and low environmental impact (i.e. no dams or reservoirs)
- ◆ No offsets from projects which support carbon sinks (geological or biological)
- ◆ Priority to projects with pronounced sustainable social benefits to improve the quality of life for local communities.

* See <http://www.climatehelp.com.au>

† See <http://www.climatesure.co.uk/>

Financing Climate-Protection Improvements

Climate change creates significant costs for the financial industry. In the interest of our clients and shareholders we are obligated to take these risks into account when making decisions on insurance underwriting, investments or lending credit (Innovest 2007).

~ Joachim Faber

Allianz SE Board Member and CEO of Allianz Global Investors

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. In some cases this takes the form of secondary credit support. Only in the past two years have insurers ventured into this area—often building insurance products with financing—which is one of the least developed in our entire inventory.

Preferential Lending Terms

We have seen few examples of preferential lending terms, one of which is Fortis' preferential mortgage rate (5.5%) for energy-efficient appliance and home upgrades. Launched in 2006, about 20% 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% premium credit for such vehicles, for an added incentive (*Fortis 2007*).

KBC Group (Belgium) offers preferential financing through its "Green Energy Loan" for homeowners borrowing to make energy-efficient improvements.

AXA is perhaps the most active insurer in this domain. AXA MPS (Italy) offers an all-risk insurance product for photovoltaic systems linked with loans. The main guarantees are: damages caused by natural events, photovoltaic system's damages, fire, civil responsibility, and loss of revenue in case of low production.

AXA's Belgium unit offers Energy@home green loans for energy-saving renovations with a preferential borrowing rate (fixed 5.95%) to finance new equipment or renovations improving their home's energy efficiency, solar panels, etc. More than 1,000 policies were sold in the first 11 months.

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-energy projects in India. RBS offers special financing for homeowner solar-electric systems (*HSBC 2008*).

ING car leasing (which operates 300,000 cars across Europe) offers its customers in the Netherlands fuel-efficient options (selected by 70% 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. ING Vysya also provides wholesale credit to microfinance institutions in India, and microinsurance to 56,000 people as of 2006 (*ING 2008*).

In 2006, AIG-FP participated as credit-support provider in a transaction under the World Bank's Umbrella Carbon Facility (*AIG 2007c*). The transaction involved the purchase of euro 799 million euros worth of Certified Emissions Reductions (CERs) by a consortium of companies from two Chinese industrial companies. The companies are using a portion of the proceeds of the transaction to purchase incinerator technology for the decomposition of HFC-23 gas generated from the manufacturing of refrigerant. The CERs will be generated as the Chinese companies commence operation of the HFC-23 gas incinerators (*IBRD 2006*).

Direct Investment in Climate Change Solutions

[O]ur wind energy investments are a case where we are making money by doing good. We're investing in a cleaner environment and earning a premium return in the process (Prudential 2008).

~ Frank Gould, head of Structured Transactions Group, Prudential

Insurers are among the most significant players in financial markets, with \$16.6 trillion in financial assets as of 2005 (UNEP 2007). Like other large investors, insurers are beginning to realize that climate change presents significant risks and opportunities on the asset side of their organizations. We have logged a total cumulative value of \$11 billion in "climate-friendly" investment from 15 of the leading companies (total investment is not known), as well as significant examples of "green" real-estate development and management. While this level of activity is nearly double that observed in last year's report, it is a modest portion of all investment in this space and a vanishingly small part of insurers' own portfolios. Many have expressed concern about the vulnerability of insurers' assets to the effects of climate change, but data has not been forthcoming on whether or not insurers have made material efforts to rebalance their portfolios.

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 might be temporary in some cases, considerable liquidity problems could nonetheless arise. Examination of the "sustainability" of investment practices must begin with looking at the resilience of an insurer's portfolio to climate change.

On a more positive note, 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.

AXA is said to have become the latest socially responsible investor, and through the Enhanced Analytic Initiative (EAI) rewards brokers that publish research on extra-financial issues such as climate change and brand management (*Mehra n/d*). The Initiative controls assets in excess of \$2.4 trillion.

In 2007, AIG Investments 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, in early 2008 AIG was the fourth largest member of the \$7-trillion group (*AIG 2006*). AIG already has hundreds of millions of dollars invested in renewable-energy projects.

Some companies have established explicit targets for “greening” their portfolios, notably Munich Re’s requirement that at least 80% of investments in equities and bonds have to meet sustainability criteria.

Many insurers are making direct investments in specific technologies or companies.

- ◆ Allianz owns and operates three wind-energy projects in Germany, and is developing a fourth in Italy (*Collins 2008*), with a combined investment of £150 million (approximately \$220 million). Allianz has stated that it will invest between \$350 million and \$600 million in renewable-energy sources by the year 2010 (*German News Digest 2005; Collins 2007*).

- ◆ AIG invested in an 18-megawatt solar photovoltaic project in Spain (*SunPower 2007*).

- ◆ 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 (U.S.\$320 million) as of 2006.

- ◆ By the end of 2007, Prudential had invested \$500 million in wind-energy production, which it notes represented enough energy to power nearly 500,000 homes (**Figure 15**).

- ◆ Allstate notes that it has \$200 million in “environmentally beneficial” investments (*Allstate 2008a*), and plans to double this number.

- ◆ Co-operators made a direct investment in EverPURE Biodiesel.

Some insurers 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 (established in 1996), now called the Storebrand Principle Global Fund).
- ◆ Sompo (Sompo Japan Green Open) in 1999, which, with \$100 million invested, has outperformed the Tokyo Stock Price Index by nearly 10% since its inception. Sompo introduced a second fund (Sompo Japan SRI Open) in 2005.
- ◆ In 2008, MEAG (Munich Ergo Asset Management Group) launched the KlimaStrategie Equity Fund, to invest in a wide range of companies that focus on combating the effects of climate change. The fund invests in the sectors that profit from climate change. These include companies involved in renewable energy, energy efficiency, water

Figure 15. Wind-power Investments by Prudential

Source: Prudential 2008

Powered by wind

A state-by-state look at Prudential’s wind-energy investments and how many homes can be powered by each

State	Capacity (Megawatts)	Households Powered*
Texas	619	185,580
Colorado	301	90,150
Washington	205	61,410
California	150	45,000
Kansas	150	45,000
New York	116	34,650
Minnesota	101	30,150
TOTAL	1,642	491,940

* 1 Megawatt powers about 300 households.

treatment and supply, recycling and waste management, environmental management and environmental damage management, transport technologies, carbon storage and separation, and forestry. Munich Re has actively provided technical support in the development of the fund (*MEAG 2008*).

- ◆ 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.
- ◆ In April 2007, Swiss Re announced the close of the EUR 329 million (\$429 million) European Clean Energy Fund, one of the largest funds of its type at the time in Europe. The Fund, a UN-accredited investment vehicle, provides capital to European clean-energy projects that 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 (*Spiegel 2007*).
- ◆ AXA's WF Clean Tech Fund invests in companies that develop technologies, products, or services that have a positive impact on global warming, environment and linked concerns: pollution, over-population, desertification, deforestation, and diminishing natural resources. These companies must be active in renewable energy, water treatment, pollution control and waste treatment or energy efficiency. Forty-million dollars was invested as of mid-2008.
- ◆ Fortis' Start Green Sustainable Innovation Fund I helps innovative entrepreneurs in the Netherlands who have sustainable new technology ideas and are looking to start their own business. The fund is a joint venture between Fortis DOEN Participaties and Triodos Innovation Fund, initiated by Fortis Venturing. The objective is to commercialize sustainable technology. Fortis states that it is seeking to maximize returns, benefit the community, and contribute to sustainable development (*Fortis 2007*).
- ◆ Swiss Re also operates CleanTech Venture fund and other proprietary investments with more than \$500 million invested as of 2008.
- ◆ HDI Gerling founded the Gerling Sustainable Development Project, through which it created a \$100-million initiative that includes venture capital for new technologies to help address climate change risks. HDI Gerling also operates the Gerling Select 21 fund.
- ◆ The Allianz Group's EcoTrends Fund invests in companies offering products and services in renewable energy, environmental protection (environmental quality, waste disposal, recycling) and water enhancement projects." They report £938 million (about \$1.4 billion) invested as of June 2007 (*Allianz 2007a*).

In May 2007, Dresdner Kleinwort (a member of the Allianz Group) and the European Investment Bank (EIB) launched the Green Bond, which is linked to an index of companies with environmentally-responsible practices. It is expected to become the largest syndicated equity-index-linked bond ever launched, and revenues from the bond will be used to fund projects in renewable energy and energy efficiency (*Allianz 2008a*).

Life insurers managing portfolios on behalf of their customers have additional opportunities. For example, Zurich Life offers a variety of unit-linked life insurance products that direct investments into a series of climate and environmentally-sustainable funds. These products include Zurich Best Invest 2017, DWS Invest Sustainability Leaders, Aegon Ethical Equity Fund, Aegon Ethical Corporate Bond Fund, Calvert Social Small Cap Growth, Dreyfuss Socially Responsible Fund, Jupiter Ecology Fund, and Pioneer Global Equity Fund.

Green Buildings Development

Insurers are major owners of real estate and are engaging in the “green-buildings” movement, both as real-estate developers and occupants of buildings. As an indicator of this interest, 19 insurance companies had become members of the U.S. Green Buildings Council as of December 2008.

In one example, Swiss Re developed a distinctive green building at 30 St. Mary Axe, in London commonly known by its nickname “The Gherkin.” The building features energy efficiency, daylighting, and natural ventilation. The building is said to use half as much energy as its peers,* although some have asked for more analysis.

In another example, AIG is 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 reclamation and redevelopment of brownfield sites, as exemplified by its role in the Atlantic Station development, for which there is 8.5 million square feet of existing and future development registered with the LEED program (*AIG 2007e*).

New in 2008, a coalition of five major corporations (AEW Europe, AXA REIM, Bureau Veritas, GE Real Estate Europe, and ING Real Estate) is developing a “Global Green Rating” to help owners and property managers assess, rate, and benchmark the environmental performance of their existing properties. The rating will be based on measurable indicators for energy, carbon, water, waste, health, and transport (*Global Green Rating 2008*).

Investing in Carbon Markets

Insurers have begun to invest directly in carbon-offset and carbon-trading projects. In fact, an insurance entity (Dresdner Kleinwort, a member of the Allianz Group) made the very first carbon trade on the European market in 2004 and continues to trade in this market through the EU Carbon Fund and by investing directly in offset projects (*Allianz 2008a*).

AIG Capital Partners, Inc. has invested in London-based Sindicatum Carbon Capital Ltd, a principal financier/developer of greenhouse gas abatement projects (*AIG 2007f*). AIG and Swiss Re have created their own “Carbon Trading Desks.”

* See http://en.wikipedia.org/wiki/30_St_Mary_Axe (accessed Dec. 30, 2008)

Building Awareness and Participating in the Formulation of Public Policy

An integrated climate change strategy needs to be implemented coherently across national, devolved, regional and local boundaries and it needs to maximise the synergies between emissions reduction (dealing with the causes of climate change) and climate risk management measures (tackling the consequences of climate change) (ABI 2008a).

~ Association of British Insurers

Consultation on Proposals for a Scottish Climate Change Bill

Insurance is often thought of as a tool to be brought into play only after a loss has been sustained. In actuality, insurers regularly engage in proactive public policy discussions, whether concerning terrorism, public health, or natural hazards. It is in the business interest of insurers to support public policies that reduce and make risks more predictable. In the case of climate change, society can prevent losses, both by trimming the emissions that cause climate change and adapting to unavoidable impacts. A number of excellent examples exist, but industry-wide engagement in these pursuits is nowhere near its potential. ClimateWise has become a very significant initiative in this respect, involving 41 mostly European insurers and associations. AIG and Marsh participate with companies such as ConocoPhillips and Duke Energy in the U.S. Climate Action Partnership, which calls on the United States to establish mandatory targets to reduce greenhouse gas emissions 60% to 80% over several decades. Beyond this, activity in the United States remains muted.

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, and, by inference, to prepare for climate change (Kovacs 2005). Opportunities clearly exist to do better.

In a recent high-profile example launched in 2007, 41 insurance companies and affiliated organizations* from around the world joined have formed the ClimateWise program.† 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, UNUM, and XL.

Insurers have long engaged in various direct consumer-education activities on 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% premium credits to homeowners taking a six-hour course on topics such as energy weatherization, home repair, and lead-paint hazards (Steitner 1996). Insurance Australia Group (IAG), in partnership with the Australian Financial Review newspaper, has developed education materials on climate change for the high-school curriculum (Lewis 2006) and general public. Esurance has extensive consumer information on its website and offers a carbon calculator (Esurance 2008). Fortis offers a user-

* ClimateWise signatories as of Oct. 23, 2008 include: Aviva, AXA, ACE, AIG, Allianz, Amlin, ARK, Association of British Insurers, Beazley, Benfield, British Insurance Brokers Association, Catlin, Chaucer, Cooperative Insurance, Diagonal Underwriting, Ecclesiastical, Equity Group, F&C Investments, Friends Provident, FSA, Hardy's Underwriting, HBOS, Heritage, Hiscox, Legal & General, Lloyd's of London, Lloyds TSB Group, Munich Re, Navigators, NFU Mutual, Prudential, QBE European Operations, RBS Insurance, RJ Kiln, RMS, Spectrum, Standard Life, Swiss Re, UNUM, XL, and Zurich.

† See <http://www.climatewise.org.uk/>

friendly carbon footprint calculator,* and AXA has one under development.

The Institute for Business and Home Safety (IBHS) has laid out a public-education 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 such as 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 Jersey is said to use 80% less energy, while being considerably more disaster-resistant (*BASF 2008*). Several insurers are offering premium discounts for homes that follow the guidelines: South Carolina Farm Bureau Mutual Insurance Company (5%), American National Property and Casualty Company (25%), AAA Chicago Motor Club, Mississippi Windstorm Underwriting Association (25%), Travelers of Florida, and the South Carolina Hail/Wind Pool (10%) (*Ryland 2006*).

Three U.S. insurance trade organizations have developed positions, publications, or websites synthesizing industry-relevant information on climate change. These include the U.S.-based American Insurance Association (*American Insurance Association 2000*), Insurance Information Institute (*Valverde and Andrews 2006*), the National Association of Mutual Insurance Companies (NAMIC) (*NAMIC 2008*), and the Reinsurance Association of America (*RAA 2008*). The UK’s Association of British Insurers has, by far, been the most prolific insurance trade association on this topic.†

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. There were 33 members of the UNEP initiative as of December 2008 representing a diverse set of 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, F&C Asset Management, 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).‡ In addition to calling on the federal government to quickly enact strong national legislation to require significant mandatory 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;

* See <http://www.footprint.fortis.com/>

† See <http://www.abi.org.uk/climatechange>

‡ See <http://www.us-cap.org/>

4. Create economic opportunity and advantage;
5. Be fair to sectors disproportionately impacted; and
6. Reward early action.

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 through the Australian Business Roundtable.*

In commenting on a proposed Scottish Climate Change Policy, Association of British Insurers (representing 400 companies), recognized in 2008 that reducing climate change and adapting to inevitable impacts must be pursued simultaneously (*ABI 2008a*). In a letter to the Director General for Environment of the EU, ABI also supported the notion of binding emissions targets and stated that climate change is already causing more “erratic and extreme weather” (*ABI 2008b*).

In 2008, several insurance companies (along with representatives of most other significant industries) signed the “CEO Climate Policy Recommendations to G8 Leaders” at the 2008 Gleneagles Dialogue on Climate Change, coordinated by the World Economic Forum and the World Business Council for Sustainable Development (*WEF and WBCSD 2008*). Insurer participants included AIG, Munich Re, Prudential, and Swiss Re along with industries such as Alcoa, Duke Energy, British Airways, Applied Materials, and Shell.

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 telecommuting and increased funding for public transportation, which conserves energy and reduces greenhouse gas emissions (*AIA 2000*). Massachusetts insurers are required to provide premium credits for consumers using public transit, i.e. a 10% discount if 11 months of commuter passes are purchased and the personal car is not used more than 10 days per month to drive to work. The state also gives a 10% credit if the car is driven less than 5000 miles per year.

Figure 16. United Nations Finance Initiative: Insurance Signatories as of October 2008

Achmea	Netherlands
Aioi Insurance Co., Ltd.	Japan
Allianz	Germany
American International Group	USA
Aviva plc	UK
AXA	France
Bangkok Insurance Public Company, Ltd.	Thailand
CarbonRe AG	Switzerland
Export Finance and Insurance Corporation (EFIC)	Australia
Folksam	Sweden
Helvetia	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
QBE Insurance Group Ltd.	Australia
RSA	UK
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

See: <http://www.unepfi.org>

* See <http://www.businessroundtable.com.au/html/documents.html>

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 (*Green 2006; Beattie 2002*). An article in *Scientific American*, observed 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% more fuel-efficient without reducing vehicle size (*Alpert 2007*). The American Insurance Association and Advocates for Highway and Auto Safety also support tightened federal controls on speed limits.

Insurers also have endorsed energy-efficient building codes. In 2008, Fireman's Fund voiced support for the International Energy Conservation Code (IECC).

“Energy efficient buildings cost less to operate for homeowners and businesses, they have higher property values, they improve comfort for residents, and they reduce the risks of loss and damage. ... We are aligning our products and our advocacy with improved energy efficiency in buildings because it is one of the most cost-effective measures for reducing greenhouse gas emissions at the scale necessary. ... Improved building codes, complemented by incentive-based insurance policies, are an important part of how our industry can work together with policymakers to help our customers and society respond to climate change and energy challenges” (Courtemanche 2008).

Leading by Example

If insurers publicly advocate for and develop products that influence change in consumer behaviours, then sure enough, the insurance industry will appear to be in the vanguard of the environmental movement. The industry should not be afraid to be bold on this issue. In fact, this might just be the perfect opportunity for the insurance industry to demonstrate how it really does advance the interests of all of us ahead of its own, narrower commercial interests.

~ David Gambrell, *Editor, Canadian Underwriter (2007)*

Leadership by example—“Walking the Talk”—is one of the most potent means of effecting change, while managing reputational risk. Insurers are among the early adopters of Corporate Social Responsibility (CSR) reporting—with 25 examples to date—as well as efforts to reduce their own carbon footprints. While insurers are not major emitters of greenhouse gases, the energy used by their extensive real-estate holdings and employee travel is more significant than casual observers might expect, and we found a remarkable 14-fold variation between the highest and lowest emitters (on a per-dollar basis). At least 17 insurers and reinsurers and six brokers have pledged to become carbon-neutral through various combinations of reducing energy intensity and the purchase of carbon offsets. Many insurers tout their in-house energy/carbon management efforts, some of which are significant but many are quite modest, with important energy-intensive activities associated with information technology are sometimes overlooked. Carbon accounting methods are hardly standardized within the industry, which confounds efforts to benchmark and track progress.

Corporate Social Responsibility Reporting

Publication of annual “Corporate Social Responsibility” (CSR) or more specialized environmental/sustainability reports has become widespread among large corporations. The general approach is to review the company’s environmental and social impacts and to articulate, implement, and track progress toward voluntary goals for improvement beyond what might be required by law. The scope includes customers, shareholders, employees, supply chain, the broader community, and the environment.

CSR succeeds when it identifies ways to harmonize social/environmental considerations with the profitability and sustainability of the core business. The very act of CSR reporting can be argued to have business value by proactively identifying potential liabilities; opportunities for new profits through product innovation or new avenues of investment; while fostering employee loyalty and enhanced corporate governance. Saving energy and reducing the associated costs are classic examples of joint environmental and economic benefits. On the other hand, disingenuous CSR reports do not amount to more than greenwashing. Efforts are underway to ensure and reward the quality of CR reporting. For example, Ceres and the Association of Chartered Certified Accounts (ACCA) award the best sustainability reports each year (*Ceres 2008*).

Insurers have joined the movement toward CSR reporting. We have identified 25 insurance entities (**Figure 17**) that have issued such reports. These include one insurance trade association (the General Insurance Association of Japan). The earliest examples date back to 1997 (Swiss Re), 1998 (Storebrand), and 1999 (Aviva).

Figure 17. Partial List of Corporate Social Responsibility and/or Sustainability Reports Issued by Insurers as of Late 2008*

AEGON (Netherlands)	2007
AIG (United States)	2007
Allianz (Germany)	2007
Allstate (United States)	2003–present
Aviva (United Kingdom)	1999–present
AXA (France)	2007
Chubb (United States)	2006
Fortis (UK)	2004–present
Friends Provident (UK)	2001–present
General Insurance Association of Japan (Japan)	
HBOS (United Kingdom)	2003–present
Hyundai (Korea)	2005–present
ING (Netherlands)	2000–present
Insurance Australia Group (Australia)	2002–present
KBC (Belgium)	2004–present
Marsh & McLennan (United States)	2007
Mitsui Sumitomo (Japan)	2006–present
Munich Re (Germany)	2003
RBS Insurance (United Kingdom)	2004–present
RSA (United Kingdom)	2000–present
Sompo Japan Insurance (Japan)	2003–present
Storebrand (Norway)	1998–present
Swiss Re (Switzerland)	1997–present
Tapiola Insurance Group (Finland)	2007
Tokio Marine & Nichido (via Millea Holding) (Japan)	2004–present

* For links to these reports, see: <http://insurance.lbl.gov/csr-reports.html>

In-House Energy & Carbon Management

Insurers' Carbon Footprint

Insurers generate greenhouse gas emissions through the energy consumed in buildings they occupy or lease, business travel, IT processes, and materials they consume at various points throughout their supply chain. Many are quick to point out that insurance is not a “heavy” industry when it comes to emissions. Yet the use of carbon-intensive electricity in buildings (such as in insurers’ offices) and business travel are major contributors, in aggregate, to global emissions.

Insurers are increasingly disclosing their greenhouse gas emissions via their own voluntary Corporate Social Responsibility reporting, or through centrally coordinated initiatives such as The Carbon Disclosure Project (CDP). However, insurers have not adopted a consistent reporting system or boundary conditions (e.g. inclusion of business travel or electricity used in buildings, geographies included, emissions factors applied to electricity, emissions associated with supply chains) and thus hasty comparisons are suspect.* The CDP survey would be far more useful if such standardization emissions were obtained.

Trucost gathers data from a variety of sources and provides a degree of quality assurance/quality control to make inter-comparisons more valid, and differentiates among classes of company emissions (or Scope, 1 to 3, direct emissions to supply-chain emissions), taking care to ensure comparability (e.g. not comparing results from one company that only reports emissions from the use of energy in its buildings to those of another that also include business travel (*Trexler 2006*)).

We normalized this data by revenues and number of employees to obtain metrics that allow comparisons for a single company over time or across companies at any given point in time. It is notable that the median emissions by insurers— about 3 tonnes of CO₂-equivalent per employee per year— is equivalent to the global average emissions per

capita for transportation energy, and greater than that for housing. This—coupled with the wide range in apparent emissions—suggests considerable scope for emissions reductions among the higher emitters.

Emissions per unit of revenue vary widely among insurance entities (**Figures 18 and 19**). For 14 companies for which Scope 1 to 3 emissions are available (representing \$770 billion in

* Based on review of methodologies used by 10 companies responding to the CDP survey (Aetna, Allianz SE, ACE, Admiral Group, Aegon, AGF, Allstate, AIG, Amlin, and AMP), five used the Greenhouse Gas Protocol, three used no methodology, and two used other methods (which Allianz listed as an international standard promulgated by the Association for Environmental Management in Banks, Savings Banks & Insurance Companies (VFU), which is in conformity with the Global Reporting Initiative, though it separately used the Greenhouse Gas Protocol for their business travel). The use of Greenhouse Gas Protocol methodology does not appear to ensure an apple-to-apple comparison either, owing to inconsistent calculations (e.g. (1) Aegon stating that because calculation of its business travel covers only its large business units and is therefore incomplete, it is not included in their total global emissions or (2) AMP’s inconsistent application of emissions intensity pertaining to flights for business travel calculations), incomplete/partial data provided (e.g. (1) Aetna providing data for Scopes 1 and 2 but not 3 or (2) AMP not providing indirect emissions from outsourced activities and its considering emissions analysis from investments managed by AMPCI as confidential or (3) AIG providing only business travel data portion of Scope 3) or almost no data provided (e.g. Amlin gives only a total global emissions number and no details and had no external audit).

annual revenues), intensities vary by a startling 4-fold. If this sample is indicative of the industry as a whole, the world’s insurers collectively emit 12 million tons of CO₂-equivalent each year. These emissions—which represent only a subset of total emissions—equal those from 2.4 million typical American cars, or four large electric power plants, or 57,000 train cars full of coal.*

In-House Energy Management

For the in-house energy/carbon management element of our compilation, we focus on insurers who have made concerted efforts at in-house energy management and/or carbon offsets. We do not tabulate incidental efforts such as “changing to energy-saving light bulbs,” as this has become a pervasive practice and in and of itself is not indicative of a comprehensive approach, or those that appear nominal or otherwise appear to be “window dressing.”

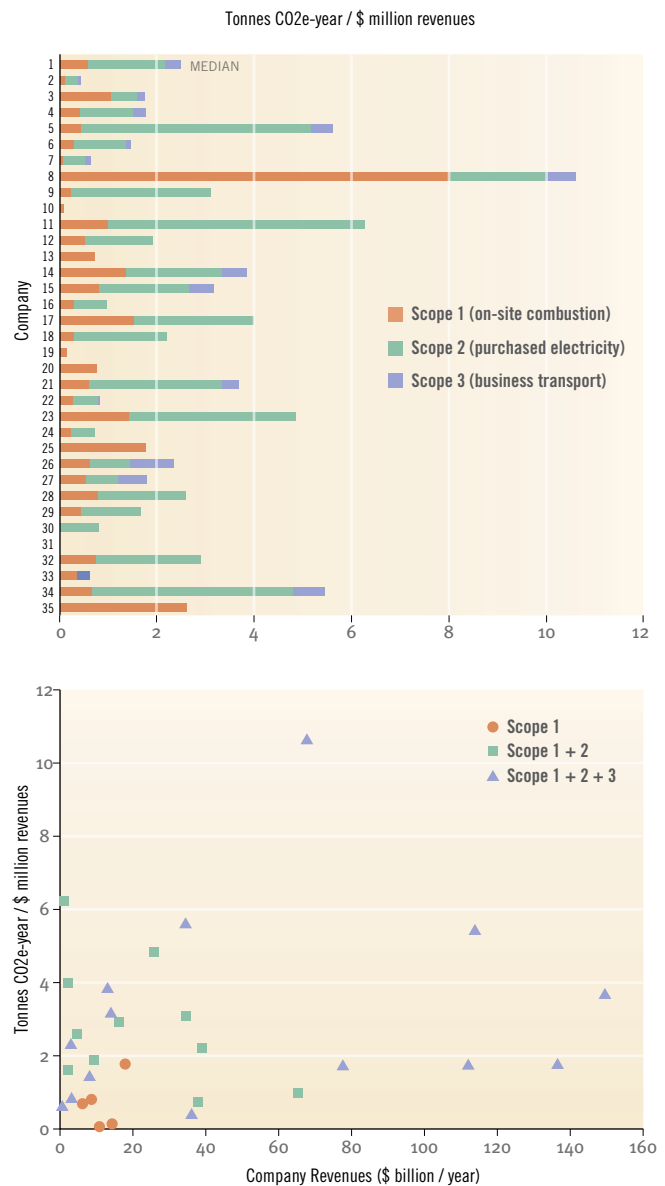
Managing energy use (and the associated emissions) can yield material economic benefits as well as reduced emissions. According to its 2008 Carbon Disclosure Project submission, Allstate, for example, spends nearly \$13 million each year on energy use for the buildings it owns (i.e. excluding leased space or business-related transportation). Kaiser Permanente has trimmed its costs by \$10 million per year through energy-savings strategies and other environmentally-focused measures (Cordes 2008). MetLife is reported to be saving \$7 million per year through similar practices (Panko 2008).

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% reduction in carbon-dioxide emissions between 2002 and 2004. Many companies have set specific reduction goals (including Allianz, Axa, State Farm, Tokio Marine, Travelers) while others have become or plan to become fully carbon-neutral.

Insurers have focused most on managing energy use in their buildings, but are increasingly looking at transportation energy. For example, Esurance provides its claims personnel with hybrid vehicles. State Farm has 100 hybrids and 3000 flex-fuel vehicles (Ruquet 2007). Co-operators has embarked on a three-year program to achieve a 20% reduction in greenhouse gas emissions associated with its 400-car corporate fleet.

Importantly, a few insurers such as Metlife are beginning to focus on energy use and savings potential in their data-centers—the most energy-intensive segments of their

Figures 18–19. Greenhouse Gas Emissions Vary Widely Among Insurers



Notes: “Scope 1” emissions include those under the operational control of the company and range from fuel consumed on-site to produce electricity or central heat to business vehicles. “Scope 2” emissions include those from purchased energy such as electricity, natural gas, or district heating. “Scope 3” emissions include those associated with business travel only (in other contexts this could include second-order emissions associated with materials consumption, supply chain, employee commuting travel, etc.).

Emissions data courtesy of James Salo (Trucost)

* Assumptions: Scope 1 to 3 insurance-sector emissions estimated by Trucost (Scope 1 to 3 emissions were available for 14 of 30 companies). We apply this ratio (2.94 Tons/\$million net revenues) to the global industry revenues of \$4.061 trillion (insurance + reinsurance) as estimated by Swiss Re, Sigma. Conversion factors: Power Plants—3.16 BkWh at 940gCO₂/kWh. Coal cars—100 short tons/car, 100kg CO₂ MMBTU coal, 20.8 MMBTU/short tonne. American passenger cars—22.4 miles per gallon and 12,427 miles driven per year, and 19.5 pounds CO₂/gallon of gasoline (fleet averages per U.S. Energy Information Administration data).

operations.* Allstate reports conducting virtualization and consolidation of IT equipment to reduce energy demand by 70%, upgrading to more efficient equipment, and reconfiguring server racks and ventilation to reduce cooling energy requirements (*Allstate 2008b*).

Toward Carbon-Neutrality

At least 17 insurers and reinsurers and six brokers, have achieved carbon neutrality, and others have made public commitments to attain carbon-neutrality at a specific point in the future.

Reducing energy use is usually the keystone of in-house programs to reduce greenhouse gas emissions. 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 emissions. In some cases, companies have noted the portion of their overall carbon offset that has been achieved with in-house measures (e.g. reducing energy demand) versus acquired by purchasing offsets. AIG describes its carbon-offset strategy in detail (**Box 5**). The relative contributions reported in the LBNL Survey range from 0%/100% to 30%/70% (in-house efficiency/offsets).

Some companies have aggressively shifted to purchasing renewably generated electricity. HSBC is at 40%, Swiss Re at 32%, and ING at 17%. According to the company's CDP-5 response, Tokio Marine Nichido entered a 15-year contract to purchase 1 million kilowatt-hours per year of wind-generated electricity. The Royal Bank of Scotland purchases 100% renewable electricity for its UK operations and is undertaking a \$100 million project to retrofit its 450 facilities to be more energy-efficient (*RBS 2008*).

Allstate's website says that the company will test a "Green Agency" Program to allow agency owners to offset the environmental impact of operating its offices via a contribution to Carbonfund.org, with donations directed to reforestation and wind-energy projects within the United States. In addition, participating agencies will receive tips and advice on reducing the energy usage of their business (*Allstate 2008c*).

The "paperless" movement has been underway for some years (as a cost-cutting measure), but insurers are looking more to their paper use as an element of their overall carbon footprint. Allianz is utilizing a program from Deutsche Post AG to ensure that the 140 million mailings (which the company says is 15-times the height of the Matterhorn) that it distributes each year are done via carbon-neutral channels (*Allianz 2008b*). The "Allstate Green" program offers a discount of up to 2% for customers who opt for an electronic (paperless) billing relationship, which saves the company money and trims the carbon embodied in paper production and handling.

Counting emissions in the supply chain is particularly important for the insurance sector, as some of their most energy-intensive operations (datacenters and other IT functions) are outsourced. This is not in itself a reason to exclude these emissions, as they are integral to revenue generation.

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% 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 (see Box C in the 2007 version of this report).

The U.S. EPA also has attracted three insurers (ACE, Jackson National Life, and Travelers) and one broker (Rutherford) to participate in its "Climate Leaders" program.

Climate Leaders is an EPA industry-government partnership that works with companies to develop comprehensive climate change strategies. Partner companies commit to reducing their impact on the global environment by completing a corporate-wide inventory of their greenhouse gas emissions based on a quality management system, setting aggressive

* See <http://hightech.lbl.gov/datacenters>

*reduction goals, and annually reporting their progress to EPA. Through program participation, companies create a credible record of their accomplishments and receive EPA recognition as corporate environmental leaders.**

In a step well beyond their obligation as emitters, insurers have begun to help their own employees achieve greenhouse gas emissions reductions at home. Swiss Re is the first to innovate in this fashion. The company's "COyou2 reduce and gain" program provides employees with up to CHF 5000 (about \$4,800) for qualifying environmentally friendly personal investments. In the first year, 527 employees took advantage of the benefit, with photovoltaic panels, efficient appliances, hybrid cars, efficient heating systems, and public transportation being the most common measures funded (*Swiss Re 2008b and 2008c*).

Box 5. AIG's Offset Strategy for Carbon Neutrality

Source: excerpted from: AIG (2008b)

To attain carbon neutrality, in 2008 AIG announced a portfolio of agricultural projects in China and the United States to offset 630,000 metric tons of carbon-dioxide emissions, at a cost of \$4 million, or about \$6.50 per tonne.

The China projects are located in the Xinjiang and Sichuan provinces, and are being developed by U.S.-based Environmental Defense and will be supported and assessed by Boston-based nonprofit EcoLogic. The offsets will be registered and retired in the China Beijing Equity Exchange.

Among the most notable benefits, the China projects will:

- ◆ Allow crops to be grown with lower consumption of water and fossil fuels [a]
- ◆ Promote more efficient use of nitrogen fertilizers
- ◆ Produce biogas from human and agricultural wastes that will be used for cooking and lighting [b, c]
- ◆ Improve water management in rice farming and production
- ◆ Help retain water, control dust, and reduce soil erosion through trees planted in desert lands

In the United States, a portfolio of three projects will focus on reforestation and ecosystem enhancement. Specifically:

- ◆ A project funded through Equator Environmental, LLC, will result in marginal farmlands in North Dakota, South Dakota, and Montana being converted back to native grasslands. This effort will be registered and offsets retired in the Environmental Resources Trust, Inc. (ERT)/Winrock GHG Registry®. [d]
- ◆ A project funded through Trust for Public Land will result in the reforestation of marginal cropland in the Mississippi River delta region of Louisiana. This effort also will be registered and retired in the GHG Registry.
- ◆ A project funded through The Conservation Fund will result in improved management of California harvested timberlands designed to produce increased standing-volume biomass. This effort will be registered in the California Climate Action Registry and retired in the GHG Registry. [e]



Photography provided by AIG

* See <http://www.epa.gov/climateleaders/>

Climate Risk Disclosure

A disclosure for climate change risks is necessary because of the potential magnitude of climate change on insurer solvency and insurance availability and affordability across all major categories of insurance: property casualty, life and health. ...Such responses will enable regulators to follow up with questions as necessary and will allow investors and consumers to incorporate additional information into their investment and purchasing decisions.

~National Association of Insurance Commissioners
Climate Risks Disclosure Proposal (Aug. 15, 2008 draft)

The process of assessing and disclosing climate risks enhances the ability of insurers 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 builds confidence and enables consumers and investors to gauge whether to purchase a policy from or invest in a particular insurance company, and helps regulators to meaningfully monitor insurers' financial condition and the progress they are making toward managing climate change risks. Insurers have made such disclosures in documents to federal regulatory agencies, such as the U.S. Securities and Exchange Commission, and have made such information publicly available in response to formal requests from institutional investor groups, the largest example of which is the annual voluntary call by the Carbon Disclosure Project (CDP). Until recently, U.S. insurers lagged far behind those domiciled in other countries; average response rates are now around 70%. The U.S. National Association of Insurance Commissioners is exploring a mandatory climate-disclosure process, which has been strongly resisted by some and readily accepted by others.

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 survey of SEC filings (*Fishel 2006*), only 15% of U.S. insurers even mention climate change in their 10K forms, which are supposed to describe all issues material to a company. In contrast, the electric utility sector had an essentially 100% disclosure rate, and in the oil industry 80% of companies discuss climate change in their 10K forms. These other industries of course release vastly higher amounts of greenhouse gases, but insurers also have emissions as consumers of energy, combined with significant vulnerability to the impacts of climate change. Although the 10K climate-risk disclosure rate among insurers remains low, it has increased from approximately 3% 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 (*Lifsher 2007*). A parallel issue is the effective enforcement of SEC requirements. More recently, insufficient disclosure of climate risks in regulatory filings has led to legal action, as in 2008, when the New York attorney general reached settlements with Xcel Energy and Dynegy Inc. that require those companies to disclose information on climate change risks to investors (*Office of the Attorney General 2008*).

Disclosure to Investors: The Carbon Disclosure Project

In 2008, the Carbon Disclosure Project (CDP) concluded their sixth 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 (*CDP 2008*). The invitation letter was signed by investors representing an astounding \$57 trillion in assets, including companies such as Goldman Sachs, Morgan Stanley, and AIG Investments.

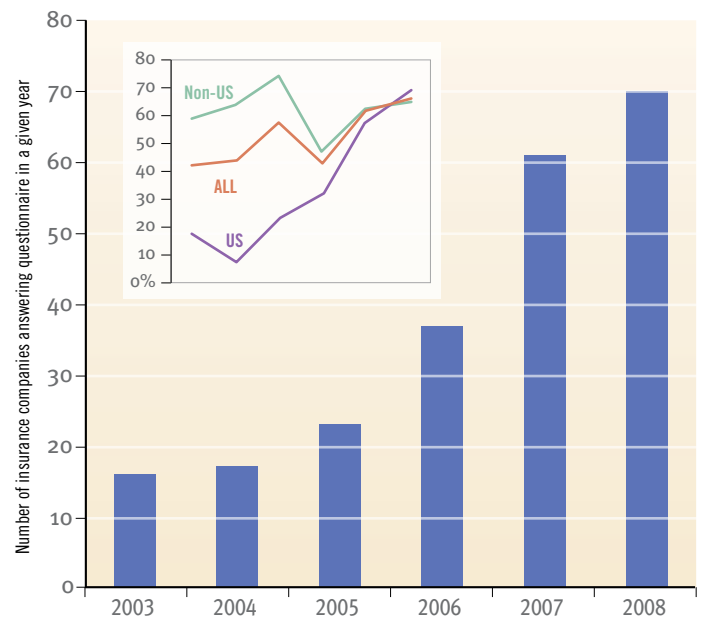
Recipients over the life of the CDP have included 106 insurance interests. The rate of full responses by U.S. insurers was up very significantly from only 13% in 2003 to 69% in 2008, converging with that of non-U.S. insurers for the first time (**Figure 20**). However, with important exceptions, the 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 (44% versus 18%) declined to have their responses made public. Response rates for this sector remain lower than those from other sectors (*Innovest 2007*). The responses by company, country, and year are shown in Appendix B.

Published responses to the CDP provide a gold mine of information on innovation within the insurance sector, and are consulted carefully in the preparation of this report. Insurers also find that going through the process of responding to the survey provides a constructive opportunity to take stock, internally, of issues and activities. The resulting documents are often used for other purposes, e.g. as fodder for regulator and shareholder communications.

Some parties have suggested that the CDP is a sufficient instrument for U.S. insurance regulators seeking climate-risk disclosures (see below).

However, the survey is only distributed to a small number of firms (26 received it in 2008 and 18 answered the questionnaire); the questions are not necessarily tailored to insurance issues, and the response rates are still well below 100%.

Figure 20. Carbon Disclosure Project Response Rates (2003–2008 inclusive) for U.S.- and non-U.S.-based Insurance Companies



Other Climate-Risk Disclosure Activities

Some individual investors are seeking their own disclosures, as evidenced by F&C Investments' query to 31 insurance companies (*F&C Investments 2007*). 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.

The leading trade association in the UK—The Association of British Insurers—has promoted a different view to its 400 member companies:

"[Our] 'Guidelines on Responsible Investment Disclosure' require companies to identify and manage material environmental, social and governance risks to the long and short-term value of the business, including Climate Change where appropriate. The Company's

disclosures should include information on how the Board considers these risks and the policies, procedures and verification systems in place to manage them. The ABI has advised its Pension Fund Trustees that it supports the ClimateWise principles and suggested that this should be taken into account when considering investment decisions” (ABI 2008c).

The U.S. National Association of Insurance Commissioners is actively exploring a mandatory climate-disclosure process. The NAIC white paper on climate change (*NAIC 2008a*) recommends that state insurance regulators develop standardized climate-risk disclosures that answer the following questions:

1. Are insurers adequately including climate risk, and climate-risk changes, in their internal risk assessment process?
2. Are insurers adequately informing and incentivizing policyholders as to their risks?
3. Are the insurers’ governance structures sufficient to keep its board members informed about climate risk?
4. Are insurers taking adequate steps to mitigate their own risks and to foster policyholder mitigation?

U.S. insurance trade associations and some individual companies have thus far tended to disapprove of NAIC’s disclosure initiative (*Hays 2008c; Fletcher 2008*). Interestingly, many U.S. insurance companies have voluntarily responded to the CDP and other disclosure requests internationally, although response via SEC in the United States has been relatively weak. Given the fallout from undisclosed financial risks responsible for the global “meltdown” in late 2008 (and which hit some insurers especially hard), greater regulatory oversight of climate risks and other evolving risks can be expected to increase.

III. Climate Change Liability: Emerging Risks, Emerging Opportunities

Business leaders are also concerned about emerging environmental liabilities, in the context of growing scrutiny of corporate environmental performance and fears about the impact of climate change and industrial pollution.

~ Lloyd's of London (2008)

While much has been said on the issue of property losses from climate change, it is becoming increasingly clear that losses arising from the causes/impacts of climate change as well as the emerging responses also will pierce the liability lines. The numerous potential triggers include:

- ◆ Responsibility for:
 - Abrupt impacts of extreme events linked to climate change
 - Gradual impacts such as increased mold losses from warmer and wetter climates and flooding (*Lavoie 2006*)
 - Secondary consequences of climate-linked events (e.g. waste spills) (*Maier 2006*)
 - Failure to adapt quickly or adequately to climate change impacts (*Lenckus 2008b*)
- ◆ Demands for compensation for prudent adaption costs
- ◆ Political risks
- ◆ Poor corporate governance and failure to fulfill fiduciary duties in light of climate change risks and opportunities
- ◆ Professional liability associated with implementation of new technologies
- ◆ Contract performance in carbon-offset or energy production/saving projects; carbon credit nondelivery
- ◆ False advertising (greenwashing)
- ◆ Disinformation/fraud (**Figure 20**)
- ◆ Inadequate fiduciary responsibility (investment choices)
- ◆ Worsening roadway risks affecting vehicle liability losses

Insurers have been assuming certain risks in this domain (e.g. under pollution liability covers) for which they are neither collecting adequate underwriting information or premiums, or having adequate surplus (*Lenckus 2008b*). Meanwhile, professionals working in this sphere need to be attentive to changing standards of care, as new data, methodologies, and technologies become the norm (*Sandridge 2008*). In one example, the first litigation concerning a green building appeared in 2008, invoking questions of project quality and delivery of agreed performance (*Del Percio 2008*). Similar risks—perhaps manifesting as product liability claims—will be faced by appliance and equipment manufacturers, e.g. for meddling with energy test procedures used for product labeling. An example of the latter occurred in 2008 (*Consumer Reports 2009*) when the manufacturer's product did not live up to its promised energy savings. As a result, the company will refund all purchasers for electricity not saved; the product also has lost its Energy Star certification (*Bhambhani 2008*).

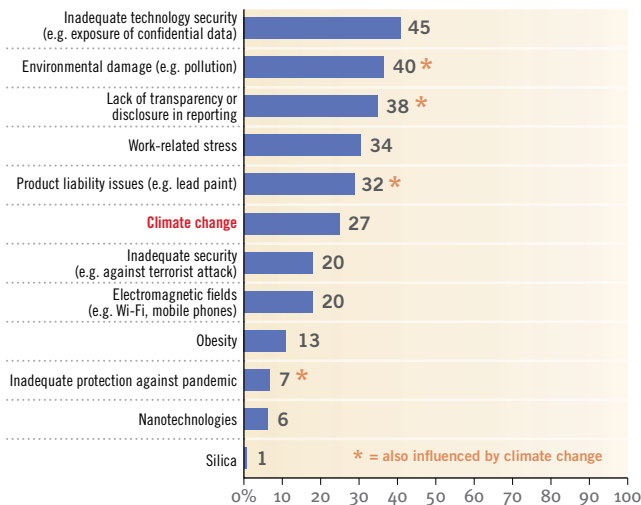
Figure 21. Newsweek Cover Story About the Disinformation Campaign on Global Warming



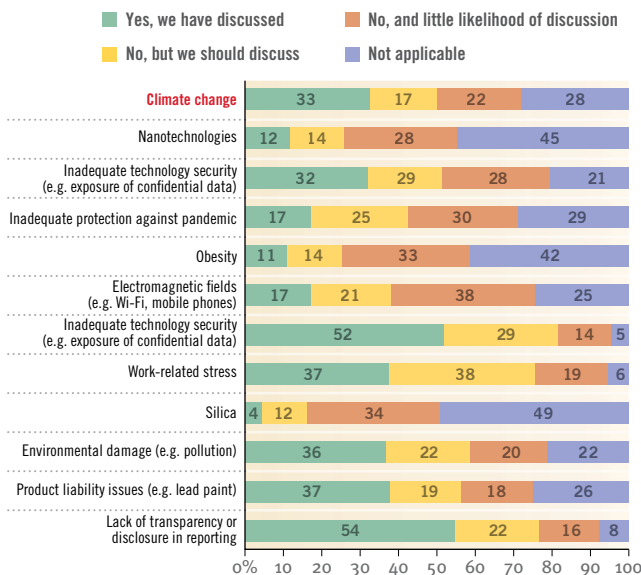
Figures 22–23. Corporate Directors and Officers Perceive Climate Change as a Significant Potential Source of Liability Claims (top) And Discuss It As Often or More Often Than Other Well-Known Risks (bottom)

Source: Adapted from Lloyd's of London (2008)

Looking ahead five years, which of the following could give rise to a major new wave of liability claims?



Has your company discussed the potential risks at the board level?



An array of insurance lines and customer segments can be affected by liability claims as well as defense costs (Ross et al 2007). Aon discusses the hypothetical case of

“the permanent loss of ecological assets as a result of irreversible changes caused by climate change. This might involve ski resorts in Colorado bringing claims against power generators because there is no longer enough snow to operate on a normal schedule, fishermen filing claims against industrialized nations because species they harvested are no longer present due to warmer ocean temperatures, and Alaskan natives filing claims against automobile manufacturers alleging that global warming due to CO₂ emissions have reduced ice floes making hunting more dangerous” (Aon 2007b).

More than a quarter of board members surveyed by Lloyd's of London believe that climate change could trigger a major wave of liability claims in the next five years (Lloyd's of London 2008), and several other risks that could be compounded by climate change received even higher scores (Figure 22). About half of board members have discussed climate change in the boardroom or think it should be a topic of discussion. This compares to their perceptions of terrorism, pandemic, and general environmental risks, and product liability (Figure 23).

Indeed, some such losses could manifest far in advance of physical losses, as parties bring claims against emitters and other parties. About 100 such cases have been brought to date (Arnold & Porter 2008). Suits do not always seek economic damages. For example, a judgment against ConocoPhillips required energy-efficiency upgrades, etc. However, insurers will incur defense costs irrespective of the remedy sought or the outcome of the case.

Several universities (Stanford, U.C. Berkeley, U.C. Los Angeles) have dedicated entire symposia to the questions of climate change and the law, including the implications for insurers. Lloyd's of London's latest “360” report surveyed the issues and surveyed corporate officers and directors. Munich Re held a workshop on the topic at the North America headquarters in 2008 (Munich Re 2008c). All major insurance trade journals ran cover stories on the issue, which is perceived to become more tangible given the high degree of certainty of the human influence on climate change reported in 2007 by the Intergovernmental Panel on Climate Change. Liabilities associated with climate change and its responses were featured in a series of articles in Business Insurance in late 2008.

Insurance brokers are among the first to envision a role for new insurance products, drawing analogies to asbestos, tobacco, and mold. Willis has noted:

“To stay competitive, corporations with any sort of greenhouse gas emissions will soon have little choice but to integrate exposure to global warming liability into their risk management programs. Insurance products being developed in the market are likely to play an important part in these programs” (Orleans 2007).

Box 6. Carbon Capture and Storage: The Billion-ton Coverage Gap

Carbon capture and storage (CCS) is one of the most heralded—and unproven—techniques for responding to climate change. The intriguing process involves capturing carbon dioxide at the point of combustion (currently conceived only for large stationary combustion locations) and injecting the material into geological formations beneath the surface of the Earth, where it is hoped to remain indefinitely. The somewhat Orwellian term “clean coal” often has been offered in the context of the prospective use of CCS with coal-fired electric power plants. In reality, non-CO₂ emissions are still released along greenhouse gas emissions such as methane associated with the precombustion phase of the fuel-cycle. This, combined with post-combustion toxic fly ash (such as that contained in an accidental release of 1 billion gallons of slurry in Tennessee—100-times the size of the notorious Exxon Valdez disaster—in the closing days of 2008), contributes to what some refer to as “The Myth of Clean Coal” (Walsh 2009). CCS is thus not a panacea for the environmental impacts of energy use, but does promise to manage one of the key greenhouse gas pollutants.

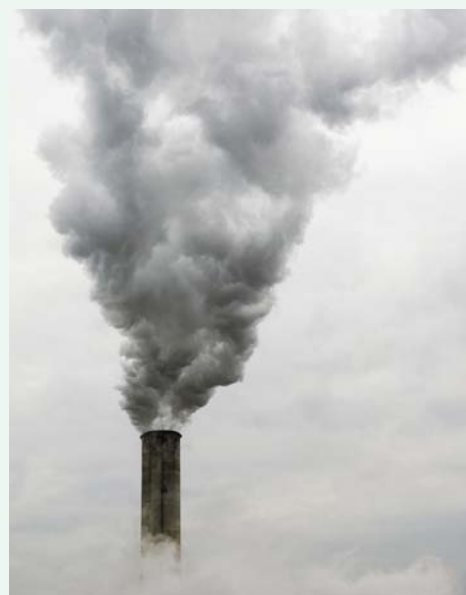
The technological enthusiasm for this approach—and the societal imperative to better manage greenhouse gas emissions—has thus far eclipsed the effort spent on technical and financial risk assessment.

One insurer noted that “the public dialogue to date has focused on the technology and has not yet focused on the business risk models in a disciplined way because not all the correct stakeholders are at the table” (Patton 2008a) and expressed concern that subsidies and public indemnity of CCS projects could mask or even magnify CCS risks, while creating complacency and moral hazard (Patton 2008b).

An executive from Duke Energy recently stated that “utilities would be foolish to build large CCS facilities without having assurance that they would not be liable for damages if the CO₂ leaks out” (Inside Energy 2008). The insurance risks of CCS range from generic considerations pertaining to any technological system (construction, property, machinery breakdown, business interruption, general liability, credit risk, etc.) to a host of risks specific to the technology. These include unintended environmental impacts such as the contamination of drinking water or injury or death to humans or animals if the captured gas leaks in sufficient quantities (Wilson, Friedman, and Pollack 2007), as well as engineering risks such as vapor cloud explosion (VCE) or catastrophic failure of the cryogenic air separation unit (ASU) (Carroll and Seakins 2008). CCS projects would have a particularly complex lifecycle, including political, financial and regulatory risks before project start-up; site identification/development; at the point of capture; during carbon transport; during the citing and sequestration process; during closure of injection points; and during the stewardship period (Trabucchi and Patton 2008). Containment will have to span centuries, which presents long-term risks that private insurers would presumably prefer to defer to governments (similar to the insurance provided by governments for nuclear power plants). As part of the business proposition of CCS is to capture “carbon credits” for CO₂ not released to the atmosphere, the same performance and liability risks apply to CCS as discussed elsewhere in this report for other strategies for trimming emissions.

Coverage gaps no doubt remain. According to ACE, “CCS presents a unique risk profile, with heightened technical, political, and financial risk, albeit on a much larger scale [than those from carbon reduction technologies].” ACE and Zurich have introduced products and services for CCS (ClimateBiz 2008; Zurich 2009). One of Zurich’s products addresses “pollution event liability, business interruption, control of well, transmission liability, and geomechanical liability,” while the other addresses injection well “closure and post-closure activities.” At least one broker represents CCS products, but detailed information was not made available.

The true costs of CCS are as yet unknown. For a start, the process consumes 10% to 40% (depending on the process) of the power produced by the power plants it serves (IPCC 2005), and thus increases the cost of that energy proportionately. Insurance for CCS projects will add to its cost and thus influence the relative cost-effectiveness and competitiveness of this carbon-management strategy compared to others.



As one indicator of the rising concern, shareholder resolutions were filed with 57 U.S. companies in 2008, almost half of which were withdrawn after the companies responded, while those that were voted on received a nearly 25% rate of support, which is significant given the extent of nonvoting, automatic voting with management, and the high concentration by major shareholders (**Figure 7**).

Liabilities also are associated with certain responses to climate change, particularly carbon capture and storage (**Box 6**) and nuclear power. For the latter, questions of waste and public health have not been resolved, and the specter of weapons proliferation looms large when one some estimates call for 4000 new nuclear power plants around the world in order to curb greenhouse gas emissions (*Kramer 2008*). The chair of a Nuclear Regulatory Commission Panel testified in Spring 2008 that the U.S. proposals “will create significant technical and financial risks by prematurely narrowing technical options” (*Kramer 2008*). Even “green” responses can bring unintended liabilities, e.g. claims about performance or product attributes that are not borne out (*Patton 2008a,b*).

In response to the perceived risks, a number of insurers have created new products and services (mostly in the 2007–2008 period) to help customers proactively manage the risks (**Figure 24**).

Lastly, a host of insurers have implemented mileage-based insurance products, which help stem auto-liability losses as well as property losses.

In addition to customer-side liability risks, insurers have their own exposures. Claims could arise from assertions that insurers are not responding in ways that adequately protect customers or fulfill fiduciary duties to shareholders (in underwriting or asset management), as well as the types of “wind versus water” challenges that arose particularly strongly in the wake of Hurricane Katrina. Claims could also assert that the availability and pricing of insurance encouraged mal-adaptation, i.e. excessive exposure in at-risk areas. Lastly, while not industrial-scale emitters, by virtue of owning and occupying buildings, and operating in a travel-intensive industry, insurers are directly responsible for material greenhouse gas emissions. As described above, more than 100 insurers have accepted invitations to voluntarily disclose their climate risks, and doing so is one manner of managing those risks. Insurers have also participated actively in capitalizing emerging carbon-free technologies and industries, and have been outspoken in their calls for public policy reform to address climate risks.

Figure 24. Map of Climate-Change Liability Products, Services, and Other Activities

	Directors & Officers	Environmental Liability	Political Risk	Professional Liability	Builders Risk	Advisory Services	Workshops/Training	Carbon Risk Disclosure
ACE		Various liability-related coverages associated with carbon capture and storage and emissions trading			Builders Risk coverage for green buildings			
AIG		Sustain-a-build insurance (environmental liability premium credit for nonresidential buildings)		Liability coverage for technicians, builders, architects, engineers for financial losses associated with the provision of renewable-energy or energy-efficiency services				Investor members of Carbon Disclosure Project
Allianz								
AXA				Premium credit to architect and engineers who become trained in a loss-control process called "commissioning"				Investor members of Carbon Disclosure Project
DPIC								
Fireman's Fund		Liability insurance premium reductions for companies with sustainability practices (Brodsky 2008)			Builders Risk coverage for green buildings			
Folksam								Investor members of Carbon Disclosure Project
HSB/Solomon						Advisory services for carbon projects (including liability risks)		Investor members of Carbon Disclosure Project
KLP								Investor members of Carbon Disclosure Project
Liberty Mutual	"Side-A" Directors and Officers liability coverage extension to include climate change							
Lockton Risk Services				Group Liability coverage for residential energy-improvement professionals				
Marsh						Advisory services for carbon projects (including liability risks)	Climate change awareness training for more than 200 corporate board members	Investor members of Carbon Disclosure Project
McGriff, Seibels & Williams		Placement of liability insurance for carbon capture and storage (CCS) projects						
Munich Re			Munich Re's Kyoto Multi-Risk Policy includes political risk insurance				Workshop	
RMS						Developing new types of models to help insurers evaluate climate-liability risks		Investor members of Carbon Disclosure Project
Sompo								Investor members of Carbon Disclosure Project
Swiss Re	Queried direct D&O customers on their proactive climate change risk-management activities							Investor members of Carbon Disclosure Project
Zurich	"Side-A" Directors and Officers liability coverage extension to include climate change	Liability insurance policies for carbon-capture-and-storage projects from design over operational phases through to closure and post-closure events at the geologic storage sites	Political risk cover for Clean Development Mechanism projects					Investor members of Carbon Disclosure Project

IV. The Intrinsic Role of Regulators

Nearly anything that is insured—property, crops and livestock, business operations or human life and health—is vulnerable to weather-related events.... State insurance regulators are aggressively moving forward to influence greater industry attention and action relative to climate change-related risk (NAIC 2008b).

~ **Sandy Praeger,**
President, National Association of Insurance Commissioners

Insurance 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 (*Mills et al. 2006*), we focus here on their role in enabling the types of traditional and innovative responses described in this report (*Mills 2007*).

Regulators have a responsibility to see that rates are adequate and that state-operated insurance pools have sufficient 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 demonstrate to regulators that there will be an offsetting reduction in losses. 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 (*IDNR 2000*). In the United States, 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.

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, or purchased for in-house use (*Farenthold 2008*). The quality and completeness of carbon accounting by insurers (and most other industries) is very uneven; regulators might play a role in improving the procedures used.

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 also can 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.

Many regulators have held symposia in their states or established working groups to analyze climate risks and develop policy. These include California, Connecticut, Kansas, Maryland, Pennsylvania, and Washington. 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. In June 2008, they issued a major “White Paper” with the following key findings:

1. Insurers across all business lines face risks from climate change;
2. Insurer investments are a source of considerable concern as insurers might see the losses they underwrite escalate even as their assets decline in value from climate impacts;
3. Insurance regulators play a critical role in understanding this evolving risk, ensuring that insurers have adequate liquidity, capital reserves and reinsurance to meet the expected increase in catastrophic loss, educating consumers about the changing risks, and forwarding risk-reduction activities to maintain a viable insurance market, and engaging with other policymakers to advance aggressive climate legislation.

V. Toward Best Practices

Climate change, and the global political and public response to it, presents a range of threats and opportunities for corporations in terms of their risk management, growth strategies and brand positioning. The issue is shifting from a peripheral corporate social responsibility concern to a topic for strategic deliberation among executives and investors worldwide (RMS 2008).

~ Dr. Celine Herweijer
Director, RMS Climate Change Practice

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 their business position 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.

Placing priority on increasing the resilience of insurance customers to climate risks, and simultaneously taking steps to reduce climate change itself, will go the furthest toward 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 large 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 achieved what we would consider a comprehensive response, but many are well on the road in that direction. Many promising strategies have not been tried at all (**Figure 4**).

Generalized guidelines exist to help companies and asset managers manage climate risks (*Anderson and Gardiner 2008*) and identify opportunities posed by climate change. Best practices more tailored to insurers could follow the following 10-point approach:

1. Improve the theory and practice of modeling (and other methods of analyzing climate-change risks, where CAT models do not suffice) and climate science. Particular effort should be made to conduct “what-if” stress tests over a range of plausible scenarios, rather than limiting their investigations to predictive point estimates.
2. Make concerted efforts to restore and maintain the insurability of extreme weather events. This might require partnerships with governments, e.g., in the cases of improved land-use planning and enforced building codes.
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, services, and financing offerings to facilitate maximum customer utilization of climate-friendly technologies and practices, especially in cases where they yield loss prevention co-benefits. Craft disaster-resilient approaches that are sustainable and sustainability strategies that are disaster-resilient.
5. Rebalance investment portfolios to recognize climate-related risks to investments and capitalize on opportunities for emerging industries that will participate in climate change solutions.

6. Actively participate in emerging markets for carbon-free energy and carbon trading, both as investor and risk manager.
7. Lead by example, by achieving carbon-neutrality. This includes addressing the climate impacts of real estate owned by the insurer, as well as the “carbon footprint” of business operations and supply chains, 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 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 roadway safety.

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 (*Green 2003*); many of these claims trace back to poor design and application of energy-related systems. The growing insurance risks associated with electricity reliability (*Mills 2001*) 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. 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. As a case-in-point, State Farm chose to re-enter the Louisiana coast market after the state agreed to tighten building codes (*F&C Investments 2007*). 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 (*Avery et al. 1998*).

It is important to anticipate and avoid inadvertent adverse side effects of carbon-reduction strategies (Mills and Knoepfel 2007). A well-worn example is degraded indoor air quality from the 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 (Ross and Wenzel 2002). Concerning energy-supply issues, questions have arisen (Wilson et al 2003; Wilson et al 2006) about unquantified liabilities associated with proposals to capture carbon dioxide at the point of production and inject it, hopefully safely and permanently, into the Earth or seabed. The insurance sector might be unwilling to insure a rebirth of nuclear power, argued by some to be an 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.

Getting Started

The longest journey begins with a single step.

~ attributed to Lao-tzu (c. 604–531 B.C.)

The preceding “best practices” discussion sets out achievable yet lofty goals, which can require significant dedication and resources to attain. Companies wishing to develop innovative responses to climate change must juggle these aspirations with the press of everyday business, and the need to develop revenues in the near term. Yet, while strategic thinking can be dismissed as a luxury, it is in reality critical to remaining competitive. Nonetheless, insurance companies can rightfully ask: “Where do we start?” We offer the following checklist of initial steps that innovative insurers have taken in order to establish and embed a corporate platform from which longer-range best practices can be pursued:

- (i) **Approach climate change as an enterprise-risk management (ERM)* issue** (CAS 2003). ERM improves decision-making and creates value by managing hazard, financial, operational, and strategic risks and opportunities across business units and stakeholder groups. ERM provides a portfolio framework for managing risk in a holistic manner and elevates the practice to higher levels within organizations.
- (ii) **Establish a “climate champion” from the company’s Board.** This will help mobilize internal resources, keep the issues on the company’s radar, and enable a crosscutting effort including underwriting, operations, asset management, and corporate governance rather than a piecemeal approach limited to specific “silos” within the company.
- (iii) **Appoint a point-person on climate.** This person helps to develop corporate position on climate change, assists with internal fact-finding and education efforts, and serves as liaison to the Board. The climate champion also should track trends and developments in the outside public science and policy domain, and make the company visible as deemed appropriate. This person also can take the lead on voluntary or mandatory climate reporting and disclosure. Ideally, this person will be resourced to assemble a broader climate-management team.

* The Casualty Actuarial Society defines Enterprise Risk Management as follows: “ERM is the discipline by which an organization in any industry assesses, controls, exploits, finances, and monitors risks from all sources for the purpose of increasing the organization’ short- and long-term value to its stakeholders.” For insurers, ERM includes issues such as physical risk, regulatory risk, competitive/market risk, asset management, liquidity, capital needs, and reserves.

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- (iv) **Develop a written corporate position on climate change.** These can be “evergreen” documents that evolve along with the company’s strategy. Such statements prove useful for internal education and communicating with external stakeholders, and respond to disclosure requests.
 - (v) **Prepare annual environmental report.** Such reports can be used to establish and benchmark baseline performance, set and track progress towards goals, catalog activities from across the organization, and communicate corporate initiatives to potential employees, shareholders, and other stakeholders. This might be integrated into a broader Corporate Social Responsibility report (if the company produces one).
 - (vi) **Model better.** Catastrophe modeling firms are now beginning to incorporate forward-looking climate factors, and their customers (insurers) should seek continuous improvement in this area.
 - (vii) **Listen to and support customers.** Customers are increasingly embracing “climate-friendly” technologies and practices, and are actively seeking insurance that fits these activities. In addition to meeting these stated needs, insurers can extend their traditional role in supporting customer-side risk management to incorporate existing and emerging climate risks, e.g. through improved construction technology and business-continuity planning. Meanwhile, insurers can add value by supporting customer desires to reduce their greenhouse gas emissions.
 - (viii) **Set priorities.** There is an overwhelming array of possible responses. Based on due-diligence conducted in the preparation of the corporate position paper, assessing company-specific risks, interactions with trade allies and other potential partners, and listening to customers, companies should identify and rank likely early measures and focus on doing a few things well rather than adopting a shotgun approach. Build on successes to expand the effort.
 - (ix) **Forge partnerships.** Insurers needn’t operate in a vacuum or otherwise “reinvent the wheel.” In particular, insurers can play a role in educating and enlisting the support of their agents and brokers on the issues, while at the same time listening to what brokers have to say about customer needs with respect to climate change. There are many natural allies outside the insurance arena as well—such as energy utilities, nongovernmental organizations, state and local agencies—with years of experience in this domain. These entities are constantly looking for partners to help deploy new initiatives.
 - (x) **Walk the talk.** Companies attempting to mount a climate-change initiative should learn through first-hand application of appropriate responses within their own organizations. This should include assessment of greenhouse gas emissions and implementing an emissions-reduction plan, as well as assessing the climate vulnerability of investments and real-estate holdings. All stakeholders will look to insurers to lead by example.

Outlook

To assume that the current financial turmoil has eclipsed the need for insurers to decisively prepare for climate change is akin to assuming that because one hurricane has hit, there is no need to prepare for a second (Climate Risk 2008).

~ Karl Mallon

Director of Science and Systems, Climate Risk Pty Ltd

As the implications of climate change come into sharper focus, insurers will devote increased attention and resources to the issue. Availability and affordability will continue to be a problem, and various parties will continue to seek climate-risk disclosure from insurers—both on the underwriting and asset management issue. High-stakes liability exposures will be an area of particular attention, and a wave of exclusions under traditional covers would not come as a surprise, Enterprise Risk Management will increasingly be seen as a valuable framework for addressing climate risks.

A new wave of green projects and services can be expected. Many coverage gaps remain, and there are entire customer segments to which no green products or services have been offered. All stakeholders—including customers, shareholders, and regulators—will continue to look for indications of the market penetration and materiality of insurers' burgeoning green initiatives.

New players will continue to enter the market, both from within and outside of the insurance sector. Insurance actuarial organizations made significant efforts in 2008 to engage in the issue, and their efforts are likely to expand considerably.* Non-insurance entities—governments, non-governmental organizations, energy companies, etc.—will continue to seek innovative partnerships in delivering climate-change solutions.

With increasing scale of insurer initiatives, the imperative to close knowledge gaps will become more visible. Insurers will need to engage more in the direction and conduct of research across a wide domain of topics. This includes the continued integration of climate modeling and catastrophe modeling, exploring the comparative risk profiles of “low-carbon” technologies to help inform underwriting as well as public policy. Across many lines (including liability), increasing recognition of potential gaps between promised and actual performance of green technologies, carbon offsets, etc., will create “pushback” against insurers' “greening” claims while spawning new and better products and services.

One of several “elephants in the room” is the disconnect between sustainability and disaster-resilience. In fact, one cannot exist without the other. The creation of technologies and services combining risk- and carbon-management analysis and remediation could prove to be a powerful and cost-effective formula for simultaneously reducing greenhouse gas emissions while bolstering disaster resilience. Land-use planning as well as codes and standards are also yet to adequately embrace this approach.

* The Institute of Actuaries of Australia identified climate change as a key issue as early as 2003 (Gale 2003). Actuary members of the General Insurance Research Organization (GIRO) examined the increasingly problematic status of flood insurance in the UK, noting the role of climate change (GIRO n/d). Two U.S. insurance actuarial organizations (CAS and SOA) have formed informal working groups on climate change.

The global financial crisis that emerged in late 2008 will certainly have repercussions for insurers and their climate change initiatives. It might be the case that corporate-level activities not tied directly to revenue generation will be curbed. However, much of the existing activity has become embedded in the operations of insurance companies, and if insurer statements about the significant customer demand and reception for new products and services hold, then prudent companies can be expected to stay the course and perhaps even ramp up their efforts more quickly to keep pace with competition and as consumers look for new value in insurance services. While there will be pressure in many regions to “get back to basics” and ensure that climate initiatives have business materiality, it also will become clear that vulnerability to climate change only increases when non-weather catastrophes such as the current financial turmoil serve to make society less resilient. Meanwhile the new Obama administration in the United States will no doubt advance legislation and urge insurers and the rest of the private sector to redouble their efforts to green the economy and prevail over the risks posed by global climate change.

Appendix A – Summary of Database

<i>The number of activities are indicated in each cell</i>	Country	Understanding the Climate Change Problem	Promoting Loss Prevention	Aligning Terms & Conditions with Risk-reducing Behavior	Crafting Innovative Insurance Products	Offering 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**
Berkshire Hathaway Life Insurance Company & GEICO	US			1					1		1
BGL	AU				1						
Blue Cross & Blue Shield	US									1	
Bradford & Bingley	UK									1	
Caitlin	UK	1							1		
Cathay Financial Holding	TW										1
CarbonRE AG	CH		1		3	2			1		
Chaucer Insurance	UK								1		
China Life Insurance	CN										1
Chubb	US		1		1	1				2	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	1	
Co-operators Group Limited	CA		1	1				1	1	1	
Sovereign General Insurance Company	CA				1						
Covea	FR			1							
Delta Lloyd Verzekeringsgroup NV	FR									1	
Developers Professional Insurance Company (DPIC)	US				1						
Desjardins General	CA			1							
Dexia Insurance	BE							1	1		
Diagonal Underwriting	UK								1		
Ecclesiastical	UK								1	1	
Environmental Insurance Agency	US				1						
Equity Insurance Group	UK								1		
Esurance	US					1			1	1	
Euler Hermes	NL										1
Eureko Re	NL				1						
F&C Investments	UK								1		1
First Treasury	CA				1						
FM Global	US	1	1							1	
Affiliated FM	US	1			1						
Mutual Boiler Re	US				1						
Folksam	SE								1		
Fortis	BE				1		3			1	1
FP Marine	HK									1	
Friends Provident	UK								1	1	1

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<i>The number of activities are indicated in each cell</i>	Country	Understanding the Climate Change Problem	Promoting Loss Prevention	Aligning Terms & Conditions with Risk-reducing Behavior	Crafting Innovative Insurance Products	Offering 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**
GMAC	US			1							
Garant Insurance	AU					1					
Genworth Financial	US								1		1
Grange Mutual	US								1		
Green Insurance Company	UK					2					
Groupama Asset Management	UK			1	1				1		
Hanover	US				1						
Hannover Ruckversicherung AG	DE										1
Hardy's Underwriting	UK								1		
Harleysville Mutual Insurance Company	US									1	
Hartford Financial Group	US									1	2
HBOS	UK						1		1	2	1
HDI Gerling	DE				1			1			
Helvetia Patria Versicherungen	CH								1		
Heritage	UK								1		
Hibernia	US			1							
Hiscox	UK								1		1
Holland	SA			1							
Real Insurance	AU			1							
HSBC	UK		1						1	1	1
Hyundai Marine and Fire Insurance Co.Ltd.	KR								1	1	
Independent Insurance	UK									1	1
ING Group	NL				1		3	1	1	2	
Insurance Australia Group	AU	1	1			1			1	2	1
NZI	NZ			2							
Intramercia Hellenic Life Insurance Company	GR								1		
ITT Hartford Group, Incorporated	US									1	
Jackson National Life	US									1	
Johnson & Higgins	US									1	
Kaiser Permanente	US									1	
KBC Bankassurance	BE							1		2	1
Kiln	UK								1		
KLP Insurance	NO										1
KPA AB	SE								1		
La Capitale General Insurance	CA				1						
Legal & General Group	UK				1				1	1	1
Liberty Mutual	US				2						
Lloyds of London	UK	1	2		3	1		1	1	1	1
Lloyd's TSB	UK				1					1	1
Manulife	CA								1		1
MAPFRE	ES			1							1

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<i>The number of activities are indicated in each cell</i>	Country	Understanding the Climate Change Problem	Promoting Loss Prevention	Aligning Terms & Conditions with Risk-reducing Behavior	Crafting Innovative Insurance Products	Offering 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**
Marketform	UK								1	1	
Massachusetts Auto Insurance	US				1						
MBIA	US										1
MetLife	US		1							1	1
Midwest Family Mutual	US									1	
Milemeter	US			1							
Milwaukee Insurance	US									1	
Minnesota Mutual Life Insurance Company	US									1	
Mississippi Windstorm Underwriting Association	US		1								
Mitsui Sumitomo	JP		1		2	1	1	2	1	2	1
Mobililar	CH					1					
Munich Re	DE	1	1		5	1	1	3	1	1	2
Nationwide Mutual Insurance Company, Inc.	US									1	
Allied	US			1	1						
Navigators Group	US				1				1		
Nedbank	SA			1		1					
New York Life Insurance & Annuity Corp.	US									1	
NFU Mutual	UK								1		
Nipponkoa Insurance CO.,Ltd	JP								1		
NRMA Insurance	AU		1		1						
Pakisama Mutual Benefit Association	PH				1						
OECO Capital Lebensversicherung AG	DE								1		
Pennsylvania Blue Shield	US									1	
Phoenix Home Life Mutual Insurance Co.	US									1	
Plymouth Rock Insurance Co.	US			1							
Polis Direct	NL			1							
Pool Espanol de Riesgos Medioambientales	ES								1		
Premier Underwriting	UK				1						
Presidio Excess Insurance Services	US									1	
Progressive Auto Insurance	US			1		1			1		1
Provident Life & Accident Insurance Co.	US									1	
Prudential Assurance	UK								1	1	3
Prudential Financial	US							1	1	1	2
QBE Insurance Group Ltd.	AU				1						

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Unigard	US			1							
RAS	IE										1
RBS Insurance	UK						1		1	2	
Reinland Versicherungen	DE			1							
Resolution	UK										1
Royal Maccabees Life Insurance Company	US									1	
RSA	UK	1		1	2	2			1	2	1
Safeco	US				1					1	1
SARA	IT			1							
Scor	FR										1
Secura Mutual	US			1							
SINAF	BR				1						
Sompo Japan Insurance	JP		1	1	4			3	1	2	1
Sorema Re	CA				1						
South Carolina Farm Bureau Mutual Insurance Company	US		1								
South Carolina Haii/Wind Pool	US		1								
Spectrum	UK								1		
Standard Life	UK								1		
State Compensation Insurance Fund	US		1							1	
State Farm	US		1						1	1	
State Farm Mutual Automobile Ins Co	US		1							1	
Storebrand	NO					1		1	1	2	
Sun Life Financial	CA							1			
Swiss Re	CH	1	1	1	3	2		3	1	3	2
North American Capacity Insurance Co.	US				1						
Employers Re	US	1									
T&D Holdings	JP										1
Tapiola	FI									1	
Tokio Marine Holdings	JP									1	
Tokio Marine Nichido	JP	1	1		2			1	1	2	2
The Travelers Companies	US		4	1	4				1	1	1
Trinity Life Assurance Company	TZ				1						
Tryggv-Hansa	SE							1			
TrygVesta	DK			1	1		1				
UNIPOL	IT			1							
United Insurance	BB				1						
USAA	US		1							1	
UNUM	US								1		1

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Harvard University, Center for Health and the Global Environment	US	1							1		
International Energy Agency	Int'l		1		1						
International Finance Corporation	Int'l								1		
Iowa Department of Natural Resources	US		1						1		
Lawrence Berkeley National Laboratory	US	1	1	1	1	1	1	1	1	1	1
London School of Economics	UK	1									
Millennium Promise	US				1						
Natural Resources Defense Council	US	1	1						1		
Northeastern University	US		1						1		
North Central Texas Council of Governments	US			1							
Pacific Gas & Electric Company	US								1		
Princes Rainforest's Project (Prince of Whales)	UK									1	
RAND	US	1	1								
RESNET	US					1					
Rockefeller Family Fund	US								1		
Roofing Industry Committee on Wind Issues (RICOWI)	US		1								
U.N. World Food Programme	Int'l					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 Bank	Int'l				1						
World Wildlife Fund	US	1	1						1		
Yale University	US								1		

Notes: Table summarizes examples enumerated in the text, based on survey, interviews, company publications, or third-party reports. Not all activities underway have necessarily been captured. Every effort has been made to utilize the latest company and subsidiary names. Some companies and activities might be inactive as of date of this publication. Totals should not be viewed as “points” or any other sort of weighted score. Country codes per http://en.wikipedia.org/wiki/ISO_3166-1_alpha-2

* For this column, a maximum of 1 is applied, as there is too much subjectivity in assigning multiple values.

** 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. To avoid double-counting, their tallies are not included in the total values.

Appendix B – Insurance Sector Responses to the Carbon Disclosure Project Surveys (as of Oct. 7, 2008). Source: <http://www.cdproject.net>

Key & Stats for All Years:		Total	%	US	US-%	Other	Other-%
Surveyed		400		120		280	
Answered Questionnaire	✓	222	56%	48	40%	174	62%
Declined to Participate	✗	31	8%	10	8%	21	8%
Provided Information	i	10	3%	4	3%	6	2%
No Response	0	85	21%	36	30%	49	18%
Not in given round of CDP	-						
Count total				162		494	
Count not surveyed				42		214	

Disclosure of responses	Total		Declined to disclose	
	US	Non-US	US	Non-US
US	48	21	44%	18%
Non-US	174	32	18%	

Response rate	2003	2004	2005	2006	2007	2008
US	19%	7%	23%	32%	58%	69%
Non-US	59%	64%	74%	47%	63%	65%
Total	42%	44%	58%	43%	62%	66%

Note: These tables generated as of Oct. 7, 2008, from queries of the website, which delivers inconsistent results. A number of past years' data have been revised in the current database.

Company—USA	2008	2007	2006	2005	2004	2003
Aetna Inc	✓	✓	✓	✓	0	-
AFLAC	✓	0	✗*	0	✗*	0
Allstate	✓	✓	0	0	✗	✓
Ambac Financial Group	✓	0	0	-	-	-
American International Group	✓	✓	✓	✓	✓	✓
Aon	✓	✓	✓	-	-	i
Berkshire Hathaway	0	0	0	0	✗	0
Chubb	✓	✗*	✗*	i*	0	✗
CIGNA	✓	✓*	i	-	-	0
Cincinnati Financial	0	✓	i	-	-	-
Genworth Financial	✓	✓	-	-	-	-
Hartford Financial Services	✓	✓	i*	0	✗*	✗
Humana	✓	✓	✓	-	-	-
Jefferson-Pilot	-	-	0	-	-	-
Lincoln National	0	✗*	✗*	-	-	0
Loews Corporation	✗	0	0	i*	i*	i
Marsh & McLennan	✓	✓	✓	✓*	0	0
MBIA	✓	✓	✓	-	-	-
Metlife	0	0	✗*	0	0	0
Progressive	✓	✓	✗	-	✗*	✗
Prudential Financial	✓	✓	✗*	✗*	✗*	✗
Regions Financial Corp.	0	✗	-	0	-	-
SAFECO	0	✓	✓	-	-	-
Torchmark	0	✗*	0	-	-	-
Travelers	✓	✓	✓	✓	✓*	✓
Unum Group	✓	0	✓*	-	-	-
XL Capital	✓	✓	0	-	✓*	✗
N-total (U.S.)	26	26	25	13	14	16
N-Answered questionnaire	18	15	8	3	1	3
% Answered questionnaire	69%	58%	32%	23%	7%	19%

* Content of response not made public

Grand Total (World)	2008	2007	2006	2005	2004	2003
Grand Total (World)	106	99	87	40	39	38
N-Answered questionnaire	70	61	37	23	17	16
% Answered questionnaire	66%	62%	43%	58%	44%	42%

Company—Non-U.S.		2008	2007	2006	2005	2004	2003	Company—Non-U.S.		2008	2007	2006	2005	2004	2003
ACE Limited	Bermuda	✓	✓	0	✓	✓	0	Insurance Australia Group Limited	Australia	✓	✓	✓	-	-	-
Admiral Group	UK	✓	i	✓	-	-	-	KBC Group	Belgium	✓	✓	✓	✓	✓	✓
Aegon	Netherlands	✓	✓	✓	i*	0	✗	Kingsway Financial Services	Canada	0	0	-	-	-	-
Alleanza Assicurazioni S.p.A	Italy	✓	✓	-	-	-	-	Kookmin Bank	South Korea	0	0	✗*	-	0	0
AGF	France	-	✓	✓	✓	-	✓	Legal and General	UK	✓*	✓	✓	✓	✓	✓
Allianz	Germany	✓	✓	✓	✓	✓	✓*	Liberty Life Group	South Africa	✓	0	-	-	-	-
AMB Generali Holding AG	Germany	✓	✗	0	-	-	-	Lloyd's TSB	UK	✓	✓*	✓	✓	✓	✓
Amlin	UK	✓	✓	✗	-	-	-	Manheimer AG	Germany	-	✗	-	-	-	-
AMP Limited	Australia	✓	-	✓	-	-	-	Manulife Financial	Canada	✓	✓	✓*	✓	i	i
April Group	France	0	0	0	-	-	✓	Metropolitan Holdings	South Africa	✓	-	-	-	-	-
Aviva	UK	✓	✓	✓	✓	✓	✓	Millea Holdings	Japan	✓	✓	✓	✓	✓	✓
AXA Asia Pacific Holdings Limited - AXA Group	Australia	✓	✓*	✓	-	-	-	Mitsui Sumitomo Insurance	Japan	✓	✓	✓	✓	✓	✓
AXA Group	France	✓	✓	✓	✓	✓	✓	Munich Re	Germany	✓	✓	✓	✓	✓	✓
AXA Konzern AG - AXA Group	Germany	✓	✓	✓	✓	✓	✓	Nipponkoa Insurance Co Ltd	Japan	✓	0	0	-	-	-
Baloise Holding	Switzerland	✓	✓	✓	-	-	-	Northbridge Financial	Canada	0	0	-	-	-	-
Beazley Group	UK	0	0	-	-	-	-	Nürnbergers-Beteiligungs-AG	Germany	0	0	✗*	-	-	-
Benfield Group	UK	✓	✓	0	-	-	-	PIIC Property and Casualty Company Limited	China	✗	-	-	-	-	-
Brit Insurance Holdings	UK	i*	0	0	-	-	-	Ping An Insurance	China	0	✗	0	-	-	-
Britt Financial Holding	Taiwan	0	0	0	✓*	✓*	-	Porto Seguro	Brazil	✓	✓	-	-	-	-
Catlin Group	UK	i*	i	i	-	-	-	Promina Group Limited	Australia	-	-	✗	-	-	✓
China Life Insurance	China	0	✗	✓*	-	-	-	Prudential plc	UK	✓	✓	✓	✓	✓	✓
Cnp Assurances	France	✓	✓	✓*	-	-	-	Obe Insurance Group Limited	Australia	✓	✓	✗	-	-	-
DBV-Winterthur Holding AG – see AXA Group	Germany	✓	✓*	-	-	-	-	RAS	Italy	-	-	✓	✓	✓	✓
Discovery Holdings	South Africa	✓	-	-	-	-	-	Resolution	UK	✗	✓	✓*	-	-	-
E-L Financial	Canada	0	0	0	-	-	-	Royal & Sun Alliance	UK	✓	✓	✓	-	-	-
ERGO Versicherungsgruppe AG – see Munich Re	Germany	✓	✓	-	-	-	-	Sampo	Finland	✗*	-	-	-	-	-
Euler Hermes	France	0	✓	✓*	-	-	-	Samsung Fire & Marine	Japan	0	✗	-	-	-	-
Fairfax Financial Holdings	Canada	✗	0	0	-	-	-	Sanlam	South Africa	✓	✓	-	-	-	-
Fondriaria-Sai	Italy	0	0	-	-	-	-	Santam	South Africa	✓	✓	-	-	-	-
Fortis	Belgium	✓	✓	✓	✓	✓	-	Scor	France	✓	✓	✓	-	-	-
Fortis	Canada	i*	0	0	-	-	-	Sompo Japan Insurance	Japan	✓	✓	✓	-	-	-
Friends Provident	UK	✓	✓	✓	-	-	-	Standard Life	UK	✓	✓	-	-	-	-
Generali	Italy	0	0	i	✗*	✗	-	Storebrand	Norway	✓	✓	-	-	-	-
Great West Lifeco	Canada	✗*	✗	✗*	0	✗*	-	Sun Life Financial	Canada	✓	✓	✓*	✓*	-	-
Hannover Rueckversicherungs AG	Germany	✓*	✓	✓	0	✗	✗	Swiss Life	Switzerland	✓	✓	-	-	-	-
HBOS	UK	✓	✓	✓	✓	✓	✓	Swiss Re	Switzerland	✓	✓	✓	✓	✓	✓
Helphire Group	UK	✓	✓	0	-	-	-	T&D Holdings	Japan	✓	✓	✓	-	-	-
Helvetia Group	Switzerland	✗	-	-	-	-	-	Topdanmark	Denmark	✗*	0	-	-	-	-
Hiscox	Bermuda	✓	✓	✓	✓	✓	✓	Tower Ltd	New Zealand	0	-	-	-	-	✗
HSBC	UK	✓	✓	✓	✓	✓	✓	Tryggesta	Denmark	✓	✓	✓	-	-	-
Hub International	Canada	✗	-	✗	-	-	-	Zurich Financial Services	Switzerland	✓	✓*	✓*	✓*	✓*	✗
Industrial Alliance Insurance & Financial Services	Canada	✓	✓	✗	-	-	-	N-total (non-U.S.)		80	73	62	27	25	22
ING Group	Netherlands	✓	✓	✓	✓	✓	✓*	N-Answered questionnaire		52	46	29	20	16	13
								% Answered questionnaire		65%	63%	47%	74%	64%	59%

* Content of response not made public

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