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LIMITING LIABILITY IN THE GREENHOUSE: INSURANCE RISK-MANAGEMENT STRATEGIES IN THE CONTEXT OF GLOBAL CLIMATE CHANGE

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I. INTRODUCTION

Emitters of greenhouse gases externalize the true costs of their contribution to climate change. Efforts to recover these costs, which manifest both through the costs of impacts and the costs of efforts to prevent impacts, can take the form of insurance claims as well as legal remedies. The most widely discussed insurance-related consequences of climate change are the impacts of property damage from extreme weather events. However, there is increasing awareness of the relatively subtle but equally important dimension of liability. Liability insurance risks—risks to insurers from claims of third-parties who allege injury or property damage that may be the fault of the insured—are rising as scientific uncertainty surrounding climate change declines. This Article explores three major dimensions of the issue: (1) sources of climate-change-related legal liability to third

parties and their nexus with insurance and law, (2) new liabilities associated with potential technological *responses* to climate-change, and (3) potential roles for insurers, reinsurers, and other industry actors in proactively managing climate change-related liability insurance risks for themselves and their customers. Because the insurance sector is the world's largest industry,[1] the response of insurers to the broader climate-change challenge will no doubt be key to the ultimate success of society's overall response.

The relevant broad categories[2] of insured liability include:

- Commercial general liability claims, which include negligence, personal injury, and third-party business interruption via disruptions in supply chains, transportation, utility services, and communications;
- Product liability claims associated with materials or products that contribute to climate change;
- Environmental liability claims for emitters of greenhouse gases based on various impacts of climate change itself, or, secondary consequences associated with toxic releases, mold, and other consequences of the physical impacts of climate change;
- Professional liability claims, e.g., corporate directors and officers liability for those involved as emitters or arising from failure to safeguard shareholder value from the impacts of climate change;
- Political risk liability claims triggered by new government policies (e.g., carbon levies); and,
- Personal and commercial vehicle liability claims from increased roadway accidents related to adverse weather.

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[1] EVAN MILLS & EUGENE LECOMTE, FROM RISK TO OPPORTUNITY: HOW INSURERS CAN PROACTIVELY AND PROFITABLY MANAGE CLIMATE CHANGE 14 (2006) *available at* http://www.ceres.org/pub/docs/Ceres_Insurance_Climate_%20Report_082206.pdf

[2] There are many specific insurance contract types that more tightly define the types of liabilities covered or not covered by insurance. These include: Absolute Liability, Active Malfunction Product Liability, Advertising Injury, Atomic Energy Reinsurance, Bodily Injury Liability, Broad Form Nuclear Energy Liability Exclusion Endorsement, Business Liability, Completed Operations, Directors and Officers Liability, Errors and Omissions, Farm Liability, General Liability, Legal Expense, Limited Pollution Liability, Malpractice, Mutual Atomic Energy Reinsurance Pool and Radioactive Contamination Insurance, Pollution Liability, Professional Liability, Property Damage Liability, Public Liability, Special Multi-Peril, Umbrella Liability, Water Damage Legal Liability, and Wrap-Up Liability.

Theories of legal liability that could be associated with these types of insurance liability include:

- Product liability claims;
- Claims based on negligent conduct relating to greenhouse gas emissions or failure to prepare or respond to the impacts of climate change;
- Nuisance claims based on harmful impacts of greenhouse gases;
- Claims based on statutory duties of corporate officers or directors under federal securities laws;
- Claims of breach of fiduciary duty by corporate officers or directors;
- Misrepresentation-related claims against purveyors of misinformation on climate change;
- Tort, breach of contract, and related claims resulting from impacts of business interruptions on third parties; and,
- Claims based on environmental liability statutes (e.g., CERCLA) or common law for contamination resulting from climate change-related impacts.

Climate-change outcomes resulting in liability insurance claims will not in all cases result in litigation. Conversely, not all litigation related to climate change will have an insurance dimension. As this Article focuses on the nexus of liability insurance, law, and climate change claims, there are legal theories that we do not cover here but will no doubt receive attention in the courts. These could stem from public international law, violations of federal obligations under statutes such as the Endangered Species Act and the National Environmental Policy Act, and human rights law.

Society's responses to climate change, be they in the realm of adaptation or mitigation, will also entail liabilities for insurers and their customers. We will consider liabilities associated with responses focusing on fortifying human infrastructure against climate change impacts, existing and new energy technologies, and emerging market-based carbon-reduction strategies such as trading or offset schemes. Responses to climate change, particularly in the energy sector, can be distinguished by their potential for enhancing or reducing liability. Some potential responses, especially a revival of nuclear power, are likely not to be viewed as commercially insurable given historical

experience and current uncertainties about their risk characteristics. Most responses, however, will have the effect of reducing overall liability exposure.

We find that the insurance industry faces material liability exposures to both the causes and consequences of climate change and the costs of adaptation. Many of these exposures have already begun to materialize. These exposures can be direct, a function of insurers' handling of shareholder and customer interests, as well as indirect, when insurers are payers of claims faced by others. Some of these claims, such as environmental liability claims, will be adjudicated in courts of law while others, such as vehicle liability claims from increased roadway accidents related to adverse weather, will be resolved in the regular course of business.

Building on our assessment of the risks, the primary goal of this Article is to identify practical risk-management strategies that will allow insurers and other businesses to preemptively mitigate their exposure to climate-change liability. Indeed, the specter of climate-related litigation reflects a market failure that can be avoided, at least in part, by adequate regulation, proactive reductions of greenhouse gas emissions, and adaptive strategies to prevent damages from climate change. In Part II, we provide background on how liability from climate-change-related events can affect the insurance sector. In Part III, we discuss specific impacts of climate change and how legal liability stemming from those impacts may affect various lines of liability insurance. In Part IV, we evaluate the effects on liability insurance of responses to climate change impacts. And in Part V, we discuss and recommend actions the insurance industry can take to proactively reduce liability insurance risk relating to climate change, providing real-world examples of how insurers have begun to apply their expertise in proactive risk management towards helping their customers avoid liabilities and other types of insured losses.

II. BACKGROUND ON CLIMATE CHANGE-RELATED LIABILITY AND THE INSURANCE SECTOR

Impacts of climate change on the insurance sector are likely already manifesting and are projected to become enormous over time.[3] Exhibit 1: IPCC evidence of impacts resulting from changes in

[3] Evan Mills, *Insurance in a Climate of Change*, 308 SCIENCE 1040 (2005) [hereinafter Mills, *Insurance*]; Pier Vellinga et al., *Insurance and Other Financial Services*, *in* CLIMATE CHANGE 2001: IMPACTS, VULNERABILITY AND ADAPTATION. CONTRIBUTION OF WORKING GROUP II TO THE

extreme climate events, and associated insurance implications summarizes the insurance sector's climate change burden. The insurance sector, which we define in this Article as insurers, reinsurers, brokers, and other trade allies, serves as a national and increasingly global integrator of climate-related costs across all sectors of the economy, as well as a messenger of these impacts through the terms and price signals it projects to its customers. The insurance sector provides a critical function within the global economy by helping create the certainty that businesses need in order to invest and grow.[4]

The latest report of the Intergovernmental Panel on Climate Change (IPCC), considered the definitive scientific assessment of climate science,[5] has substantially narrowed the uncertainties about the human role in climate change. The report's top-level findings on the underlying science are quoted in Exhibit 2.[6] Subsequent IPCC reports forthcoming in 2007 will address observed and anticipated impacts as well as options for reducing emissions. Regardless of the details, it is clear that rising weather-related losses are expected.[7] These losses will have adverse impacts on insurance affordability and availability, as well as associated impacts on insurer revenues and profitability.[8] The physical impacts of climate change affecting the insurance industry include, but are not limited to, damage from rising sea levels, windstorms, ice storms, droughts, heat waves, increased lightning, soil subsidence, and wildfires. Additionally, there are a host of public health concerns relevant to the life-health insurance lines (which represent about half of insurance revenues

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THIRD ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (James J. McCarthy et al. eds., 2001).

[4] *The Role of NAIC in Responding to Climate Change: Testimony to the National Association of Insurance Commissioners, Climate Change & Global Warming Task Force* (Dec. 8, 2006) (testimony of Evan Mills).

[5] Intergovernmental Panel on Climate Change, *Climate Change 2007: The Physical Science Basis, Summary for Policymakers* (2007) [hereinafter IPCC, *Summary for Policymakers*] This report, the first of three to be released in 2007, was produced by some 600 authors from forty countries. Over 620 expert reviewers and a large number of government reviewers also participated. Representatives from 113 governments reviewed and revised the Summary line-by-line during the course of the week before adopting it and accepting the underlying report.

[6] *See infra* Exhibit 2: Key 2007 Findings of the Intergovernmental Panel on Climate Change Working Group 1 (The Physical Science Basis).

[7] *See infra* Exhibit 1: Examples of Impacts Resulting from Projected Changes in Extreme Climate Events, and Associated Insurance Implications.

[8] EVAN MILLS, RICHARD J. ROTH JR. & EUGENE LECOMTE, AVAILABILITY AND AFFORDABILITY OF INSURANCE UNDER CLIMATE CHANGE: A GROWING CHALLENGE FOR THE U.S. 2 (2005), *available at* http://www.ceres.org/pub/docs/Ceres_insure_climatechange_120105.pdf.

globally).[9] In addition to underwriting risks, both sides of the industry (Property-Casualty and Life-Health) have enormous investments in the real estate and the capital markets, some of which are subject to climate-change risks.

The business community needs to embrace climate change considerations for three reasons: financial risk from liabilities, investing opportunities in "green" technologies, and rising public concern. This view has been espoused by insurance industry executives.[10]

Private losses from catastrophes in the United States have been rising faster than premiums, population, and economic activity, and are correlated with a rising rate of impairments, or conditions where insurers' liabilities exceed their assets.[11] In Florida and Louisiana alone, more than 600,000 homeowners' property policies were cancelled or not renewed in 2005.[12] The U.S. residual markets—state-mandated pools where commercial markets otherwise fail—contain about three million customers today, and the number is rising.[13] If the situation is left unchecked, even more of the burden will shift to consumers and governments and growth of the insurance sector itself could be slowed.[14]

Unfortunately, the driving factors linked with climate change are compounded by other dimensions of human behavior, such as proliferating settlement in high-risk areas, increased urbanization, and aging populations. As a result of these factors, populations are even more vulnerable to climate change.[15]

U.S.-based insurers' knowledge of climate-change impacts has been largely focused on property and casualty (P&C) insurance lines. Even within P&C, the focus is almost singularly on damage to fixed

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[9] THE CENTER FOR HEALTH AND THE GLOBAL ENVIRONMENT, HARVARD MEDICAL SCHOOL, CLIMATE CHANGE FUTURES: HEALTH, ECOLOGICAL AND ECONOMIC DIMENSIONS 119 (Paul R. Epstein & Evan Mills eds., 2005), *available at* http://www.climatechangefutures.org/pdf/CCF_Report_Final_10.27.pdf.

[10] Peter Bohan, *Wall Street Eyes Heart of Darkness: Global Warming*, WASH. POST, Dec. 13, 2006, *available at* http://www.alertnet.org/thenews/newsdesk/N11331109.htm (quoting Win Neuger, chief executive at AIG Global Investment Group).

[11] Robert P. Hartwig, Senior Vice President and Chief Economist, Presentation Before the Insurance Information Institute: CPCU, Liability Trends, Issues and Jury Verdicts: Liability & Excess Casualty Markets in the Post-Katrina World (Oct. 20, 2006), *available at* http://www.iii.org/media/presentations/liabilitytrends.

[12] MILLS & LECOMTE, supra note 1, at 7; *See* Mills, *Insurance*, *supra* note 3, at 1040–44.

[13] MILLS & LECOMTE, *supra* note 1, at 2.

[14] *Id.*; Mills, *Insurance*, *supra* note 3, at 1040–44.

[15] IPCC, *Summary for Policymakers*, *supra* note 5 (outlining climate change factors with human patterns of development which will compound future climate change losses).

structures. Much less consideration has been given to other lines such as auto, marine, business interruption, and crop loss. Even less consideration has been given to health and life exposures.

If extreme weather events increase in frequency and/or severity, conventional arrangements for the insurance sector will be challenged. Insurance markets may have insufficient capital to cover continued increased losses,[16] especially if their investments are over-weighted with climate-vulnerable industries. Regulators may use their risk-based capital rules to effectively require more capital per unit of underwriting risk assumed. In addition to straight property losses, the common "all risk" rider of business interruption (BI) coverage can significantly increase exposure.[17] The long indemnity period (time to refit plants or operations to restore their functionality) associated with business interruption insurance, which can range from twelve months to several years, could substantially increase exposure to insurers.[18]

While climate change will clearly affect insurers as policyholders suffer damage from extreme weather events, climate change will also implicate insurers in other ways as climate-related liability risks increase. Liability insurance risks, broadly stated, are risks to insurers from claims of third-parties who allege injury or property damage that may be the fault of the insured. Even "climate contrarians," those who believe that the physical impacts of climate change may not cause observable insurance losses for some time, must admit that liability-related claims are already being made and are imposing material costs on insurers. While the examples in this Article pertain largely to liability considerations in the United States, much of the discussion can be generalized. Liability claims related to climate change have already emerged in Australia, Germany, New Zealand, the United Kingdom, and perhaps elsewhere.[19]

For an example of increasing concern about climate change in the insurance industry, one need look no further than the cover of *Business Insurance*, one of the industry's leading trade journals, on the eve of the release of the 2007 Intergovernmental Panel on Climate Change (IPCC) assessment of global situation. The headline reads:

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[16] CLIMATE RISK MANAGEMENT LIMITED, FINANCIAL RISKS OF CLIMATE CHANGE 8 (2005) *available at* http://www.abi.org.uk/Display/File/Child/506/Technical_Annexes_climatetechnical.pdf.

[17] Dan Hoffman, Business Interruption, 3 (unpublished article on file with author).

[18] *Id.* at 2

[19] Paul Q. Watchman & Nicholas Rock, Presentation to the Insurance Industry Forum: Climate Change and Insurance: Risks and Opportunities (Nov. 21, 2006) (on file with author).

"U.N. Climate Report Stirs Liability Fears."[20] The article quotes the managing director for Aon Environmental Services Group, who stated that "[w]e are talking about an aggregation of liabilities that span years . . . and emissions have been going on literally since the start of the industrial revolution."[21] The Aon executive further noted that claims would extend back to the period before insurers inserted pollution exclusions into their liability policies.[22] The editors also took the occasion to write an unprecedented editorial echoing their concern about the climate-liability link.[23] This is unwelcome news because the liability segment is consistently less profitable, at least under current climate conditions, than many other "lines" of the industry. In fact, the major liability lines of concern took in less money than they paid out for claims and expenses between 1995 and 2005.[24]

The insurance sector is faced with the most (1,700 annually), and also the largest, lawsuits of all sectors in the United States.[25] As further evidence of the industry's enormous exposure to legal actions, the average U.S. insurer spent $36 million in litigation defense costs in 2005.[26]

Total premium revenues in 2005 for potentially climate-sensitive commercial liability insurance were $157 billion.[27] The combined ratio (roughly equal to the ratio of underwriting expenses to income) has averaged about 110 over the past decade. With payouts already exceeding premium income, any further increases in liability losses will move the core business deeper into unprofitability.

Parties that disproportionately contribute to the impacts of climate change are not required through any statutory or regulatory scheme to internalize the costs of those impacts. This constitutes a massive, uncorrected market failure.

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[20] Robert Ceniceros, *U.N. Climate Report Stirs Liability Fears*, BUS. INS., Feb. 5, 2007, at 1.

[21] *Id.*

[22] *Id.*

[23] Editorial, *Rising Temperatures May Boost Liabilities*, BUS. INS., Feb. 5, 2007, at 8.

[24] *See* Hartwig, *supra* note 11 (stating that the ratio was 1.10:1 for commercial auto; 1.76:1 for product liability, and 1.16:1 for other liability lines (including Directors and Officers coverage)).

[25] Meg Green, *Study: Insurers Facing more Lawsuits Than Any Other Sector*, BEST'S REV., Jan. 1, 2007, at 74.

[26] *Id.*

[27] INSURANCE INFORMATION INSTITUTE, INSURANCE FACT BOOK 2007, 44–45 (2007). This includes coverage protecting against legal liability resulting from negligence, carelessness or failure to act; product liability; and vehicle liability. Losses stemming from weather extremes, or other types of claims linked to climate change could trigger claims under these particular insurance lines. *Id.*

In addition to the impacts of extreme events, efforts to adapt or otherwise preempt losses will generate their own costs. Compensation schemes have been proposed for costs of adaptation,[28] with legal and insurance implications. Others may seek compensation for the rising costs of insurance, or costs of self-insurance where commercial insurance becomes unavailable. Compensation schemes including liability for greenhouse gas emissions may force potential polluters to pay for the damage they have caused through other mechanisms.[29] For now, the tort system is the most likely mechanism for allocating such liability. The core question is whether, and under what circumstances, emitters of greenhouse gases and others may be held liable for the impacts to third parties from their contribution to global climate change.

Lacking international, federal, and local political steps, and in the absence of loss-prevention efforts, litigation becomes an avenue of last resort, which, in turn, can trigger constructive responses. This Article is intended to flag "upstream" risk management measures that can help insurers reduce the need for compensation by making the market work better in the first place.

A. *Why Would Insurers Care about Climate Change Liability?*

To answer this question, one need go no farther than Goldman Sachs' statement that carbon emissions could create corporate liability comparable to that caused by asbestos impacts.[30]

Insurers are vulnerable to climate change liability resulting from damage caused by extreme-weather events (worldwide insured losses in 2005 from such weather-related property loss events approached $80 billion, or four times those from 9/11), to potentially adverse impacts on their investments, and to corporate officer liability for responsible management practices.[31] In addition to facing liability exposure from policies sold to carbon-intensive operations, insurers

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[28] *See* Daniel Farber, *Basic Compensation for the Victims of Climate Change*, 155 U. PA. L. REV. (forthcoming 2007) (giving an intriguing examination of possible mechanisms for compensation).

[29] ACCA SOUTH AFRICA & KPMG SOUTH AFRICA, ENVIRONMENTAL LIABILITIES: PAYING FOR THE PAST, PROVIDING FOR THE FUTURE 26 (2002), *available at* http://www.accaglobal.com/pubs/publicinterest/activities/library/sustainability/sus_pubs/paying_past.pdf (reporting on environmental liabilities in South Africa).

[30] *See* MILLS & LECOMTE, *supra* note 1, at 7.

[31] Doug Obey, *Backers of CO_2 Curbs Eye Liability Relief to Bolster Industry Support*, INSIDE EPA, Sept. 21, 2006; PIERRE H. DUVAIR, CAL. ENERGY COMM'N, CLIMATE CHANGE AND CALIFORNIA 15 (2003), *available at* http://www.energy.ca.gov/reports/2003-11-26_100-03-017F.PDF.

themselves could also face liability claims for not adequately disclosing their own exposures to climate change or by insuring carbon-intensive operations. Will liability claims (legal and insured) be leveled against insurers or other parties by homeowners and businesses that lose access to insurance or see price increases attributable to climate change?

Two recent rulings on insurance compensation for damages related to Hurricane Katrina illustrate some of the uncertainties surrounding the insurance sector's response to extreme-weather events, and may likely signal further litigation for insurers. Storm surge is defined as a flood event, and not a wind event, e.g., a hurricane event. Flood events are only covered under federal flood insurance and not under standard homeowners' insurance policies.[32] A Mississippi U.S. District Court recently ruled that a water surge caused by a hurricane is defined as a "flood" and upheld the application of a private insurance contract's flood exclusion to storm surge.[33] This ruling could cost policyholders tens of billions of dollars in unpaid claims for the year 2005 alone. According to the Insurance Information Institute, six hurricanes making landfall in the United States in 2005 (including Hurricane Katrina) produced more than three million insurance claims and $57.7 billion in insured damages.[34] The end result of the strong sentiment that storm surges are inextricably linked to hurricane damages, coupled with the magnitude of homeowner damages sustained during the 2005 hurricane season, will be significant litigation costs to the insurance sector.[35] Increasing risk of flooding due to climate change will be a factor that translates into increasing insurance premiums.[36]

A contrasting ruling was subsequently made by a federal court in New Orleans. The court denied a motion to dismiss plaintiffs' allegations that flood damages arising out of the levee breaches in

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[32] Rick Cornejo, *Katrina's Next Wave: Agents' E&O Coverage Could Become the Next Liability Target Nationwide*, BEST'S REV., Jun. 1, 2006, at 22.

[33] Leonard v. Nationwide Mut. Ins. Co., 438 F.Supp.2d 684 (S.D. Miss. 2006).

[34] Insurance Information Institute, Catastrophic Hurricane Claims and Losses, in the United States, 1999–2005, http://www.iii.org/media/facts/statsbyissue/hurricanes/ (last visited March 8, 2007).

[35] Kathleen Day, *Storm Surge Is Flood, Judge Says, Standard Insurance Won't Cover Damage*, WASH. POST, Aug. 16, 2006, at D1.

[36] *See generally* Myles Allen, *Liability for Climate Change: Will it ever be possible to sue anyone for damaging the climate?*, 421 NATURE 891, 891–92 (2003) (discussing the ways in which climate change is clearly a factor in flooding and other weather-related impacts, and the likelihood of increased insurance premiums and lower housing values as a result, and noting difficulties in establishing the cause of climate change-related impacts with sufficient precision to allocate responsibility effectively and fairly).

Hurricane Katrina's aftermath should be covered because this type of flooding is not specifically excluded in their policies. *In re Katrina Canal Breaches Consolidated Litigation*[37] saw policyholders of several major insurance companies argue that the levee failure was caused by "negligent design, negligent maintenance and/or inadequate materials" and that flood exclusions did not apply to the failure of "virtually all man-made structures containing navigable Waters of the United States . . . due to negligent conduct beyond plaintiffs' control."[38] The ruling, applying Louisiana state law that construes policy exclusions strictly, stated that despite water damage exclusions contained in most policies, ambiguities in some homeowner policies left open the possibility that flooding connected with man-made acts could be covered.[39]

Efforts to connect the issue of mandatory greenhouse gas emissions controls to an explicit relief from liability have been predominantly limited to the insurance sector. It is possible that federal approval of mandatory emissions curbs could preempt legal claims under federal common law for climate damages. In spite of this, the potential remains for nuisance claims to be filed under state laws. Although federal controls under a carbon regulatory regime could subdue the political pressure driving lawsuits, potential legal exposure for companies may well persist.[40]

Addressing climate change with litigation is both inefficient and expensive, compared with alternatives.[41] In light of barriers to using common law nuisance theory as a basis for suing corporations that emit greenhouse gases, it remains to be seen whether litigation is an effective means to control U.S. greenhouse gas emissions.[42] However, whether or not climate change lawsuits are successful and greenhouse gas emitting companies are ultimately held liable for

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[37] *In re* Katrina Canal Breaches Consolidated Litigation, 466 F.Supp.2d 729 (E.D. La. 2006).

[38] *Id.* at 768–69 (citing plaintiffs' complaint).

[39] *Id.* at 756–63.

[40] Obey, *supra* note 31, at 2.

[41] *Id.* at 4.

[42] *See* Conn. v. Am. Elec. Power Co., 406 F. Supp. 2d 265 (S.D.N.Y. 2005) (dismissing as non-justiciable the claims of states that power plants' contributions to climate change constitute a public nuisance); Thomas W. Merrill, *Global Warming as a Public Nuisance*, 30 COLUM. J. ENVTL. L. 293 (2005) (identifying challenges associated with nuisance application to climate change litigation); Jennifer Rohleder & Jillian Button, *The Legal Dimensions of Climate Change: Conference Report*, 6 SUSTAINABLE DEVELOPMENT LAW & POLICY: CLIMATE LAW SPECIAL EDITION, Winter 2006, at 57 (outlining general hurdles to climate change litigation and questions of litigation's effectiveness in controlling GHG emissions), *available at* http://www.wcl.american.edu/org/sustainabledevelopment/2006/sdlp_winter_2006.pdf?rd=1.

their emissions, significant litigation costs will likely be incurred by the defendants.[43] From insurers' vantage point, liability exposures will of course include legal defense costs, irrespective of whether defendants are ultimately held liable for damages or whether those damages are defined in economic or other terms.[44]

B. *Business Atmosphere*

There are discernable trends toward a carbon-constrained business environment that are related to the rising business risks associated with greenhouse gas emissions.[45] This is most recently evidenced by a joint statement from the Global Roundtable on Climate Change (GROCC) and its approximately 100 signatories from among the world's largest companies and most significant emitters of greenhouse gases.[46] Because of the climate-change risk to which nearly all business sectors are exposed, commercial interests are increasingly coming to the conclusion that they must incorporate climate-change considerations in their business and risk management strategies. Sensitivity to climate change has expanded from the insurance sector (which includes companies that were among the first to address climate-change risks because of the industry's enormous exposure to extreme-weather events) to other businesses, as shareholders' concern about business liability grows. Hidden risks have been associated with these emissions, including the costs resulting from future regulatory regimes and litigation, increased

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[43] *See* Insurance Information Institute, The Insurance Industry's Contribution to the Legal Services Industry, http://www.economicinsurancefacts.org/economics/industries/legal/. In this table, the insurance industry's trade association compiled information from the National Association of Insurance Commissioners' database of insurers' annual statements, showing that over the period 2003–2005, defense and cost containment expenses (including legal fees, costs of investigation, costs of engaging expert opinion, and other related litigation and pre-litigation expenses) averaged over 54% of all insurers' expenses in products liability lines, over 42% in the liability portion of commercial general peril lines, and over 25% in general liability lines. Thus, independent of insurers' indemnity obligations, litigation and pre-litigation defense costs are extremely significant to liability insurers' bottom line in fields where litigation is prevalent. *Id.*

[44] *Id.*

[45] CARBON DISCLOSURE PROJECT& INNOVEST STRATEGIC VALUE ADVISORS, CARBON DISCLOSURE PROJECT REPORT 2006, GLOBAL FT500: ON BEHALF OF 225 INVESTORS WITH ASSETS OF $31 TRILLION (2006), *available at* http://dynamiccities.squarespace.com/files-documents/climate-change-papers/Carbon%20Disclosure%20Project_report2006.pdf [hereinafter CARBON DISCLOSURE PROJECT 2006].

[46] Global Roundtable on Climate Change, The Path to Sustainability: A Joint Statement by the Global Roundtable on Climate Change 4–12 (Feb. 20, 2007) (providing the organization's joint statement and a list of signatories), *available at* http://www.earthinstitute.columbia.edu/grocc/documents/GROCC_statement_2-27_1.pdf.

transportation costs for global companies, property loss, as well as risk to reputation and brand damage.[47] Conversely, good environmental risk management has been correlated with sound financial management (e.g., competitiveness, profitability, and share price performance).[48] Exhibit 3: Business Atmosphere, illustrates components of company risk management to address for climate change considerations.

1. *Increasing desire for full disclosure of a company's environmental liability.*

In the post-Enron environment, where investors are wary of undisclosed risks, there is an increasing desire for the full disclosure of a company's environmental liability risks.[49] Investment research companies have warned that nearly all industries are exposed to risks associated with climate change.[50] A trend toward increasing shareholder resolutions calling on companies to disclose or reduce greenhouse gas emissions has gained momentum in both numbers and support since 2000, though climate-related shareholder resolutions first emerged in 1990 but were low in number and support through the 1990s. Over the last seven proxy seasons, climate-change resolutions filed by shareholders have increased from six in 2001[51] to a record forty-two filed in the first two months of

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[47] *See* INVESTOR RESPONSIBILITY RESEARCH CENTER & INTERFAITH CENTER ON CORPORATE RESPONSIBILITY, 2003 SHAREHOLDER PROXY SEASON OVERVIEW: SOCIAL AND CORPORATE GOVERNANCE RESOLUTION TRENDS at 1–3 (2003), *available at* http://www.sriadvocacy.org/files/proxy_season_overview_2003.PDF; INVESTOR RESPONSIBILITY RESEARCH CENTER & SHAREHOLDER ACTION NETWORK OF THE SOCIAL INVESTMENT FORUM FOUNDATION, TOWARDS A SHARED AGENDA: EMERGING CORPORATE GOVERNANCE AND SOCIAL ISSUE TRENDS FOR THE 2002 PROXY SEASON AND 2001 ISSUES REVIEW (2002); Charles J. Bennett & Richard P. Wells, *Global Climate Change: Fact or Fiction? It Doesn't Matter – The Issue Is Here To Stay* 23 EXECUTIVE ACTION at 1 (2002); Ricardo Bayon, *US Investors Enter Climate Change Fray*, ENVTL. FIN., May 31, 2002, *available at* http://www.newamerica.net/publications/Articles/2002/us_investors_enter_climate_change_fray.

[48] CERES SUSTAINABLE GOVERNANCE PROJECT & INNOVEST STRATEGIC VALUE ADVISORS, VALUE AT RISK: CLIMATE CHANGE AND THE FUTURE OF GOVERNANCE (2002); Bennett & Wells, *supra* note 4747, at 3.

[49] INVESTOR RESPONSIBILITY RESEARCH CTR. & S'HOLDER ACTION NETWORK OF THE SOC. INV. FORUM FOUND., *supra* note 47, at 5, 9, 12.

[50] Vellinga, *supra* note 3 (outlining climate change implications on insurance risk to all industries); INNOVEST STRATEGIC VALUE ADVISORS, CARBON DISCLOSURE PROJECT: CARBON FINANCE AND THE GLOBAL EQUITY MARKETS, at 1 (2003) [hereinafter CARBON DISCLOSURE PROJECT 2003]; Evan Mills, *The Coming Storm: Global Warming and Risk Management*, RISK MGMT., May 1998, at 20.

[51] Telephone interview with Douglas Cogan, Deputy Director, Social Issues Service, Institutional Shareholder Services (Feb. 6, 2007) (outlining trends in climate change related shareholder resolutions filed from 1990 to 2007).

2007.[52] During the 2007 proxy season, climate change-related resolutions were filed with companies in the electric power, oil and gas, coal, automotive, banking and finance, building and retail, and insurance sectors.[53] Notably, shareholder resolutions were filed with four insurance companies during the 2007 proxy season (ACE, Chubb, Hartford, and Prudential), requesting these companies to disclose their strategy and actions on climate change.[54] Exhibit 4: Climate-Change Shareholder Resolutions Filed during the Period, 2000 to 2007, outlines the trend.[55]

There is growing concern about the cost of compliance with regulations and the potential damage to a company's reputation if it is perceived as contributing to climate change. Potential future shareholder losses also include penalties and cleanup costs due to violation of environmental laws.[56]

The Carbon Disclosure Project (CDP) noted that most active proxy filers have typically been umbrella organizations, faith- or issues-based groups, and socially responsible investors. There has been a significant shift in those filing shareholder resolutions: some of America's most powerful institutional investors, including the Teachers Insurance and Annuity Association College Retirement Equities Fund (TIAA-CREF) and the California Public Employees' Retirement System (CalPERS) are becoming increasingly active on environmental and social issues.[57]

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[52] CERES ET AL., INVESTOR NETWORK ON CLIMATE RISK CHART: 2007 PROXY SEASON CLIMATE-RELATED RESOLUTIONS (2007); Goodwin Procter LLP, *Assessing SEC Requirements after Kyoto*, ENVTL. L. ADVISORY, Feb. 2005, *available at* http://www.goodwinprocter.com/PublicationSearch.aspx; News Release, Social Investment Forum, Social Investment Forum: 2006 Environmental, Social Shareholder Proxy Resolutions Up from 2005, with Emphasis on Global Warming, Toxics and Political Donations, (Apr. 25, 2006) *available at* http://www.socialinvest.org/2006ShareholderProxySeasonPreview.htm.

[53] Press Release, Ceres, 2006 Proxy Season Produces Positive Results on Climate Change (July 14, 2006) *available at* http://www.ceres.org/news/news_item.php?nid=209.

[54] CERES ET AL., *supra* note 52.

[55] Interview with Cogan, *supra* note 51; telephone interview with Rob Berridge, Program Manager, Investor Programs, Ceres, Boston, Mass. (Feb. 19, 2007)

[56] INVESTOR RESPONSIBILITY RESEARCH CTR. AND S'HOLDER ACTION NETWORK OF THE SOC. INV. FORUM FOUND., *supra* note 47 (outlining rising shareholder concern of cost of compliance with regulations and clean up costs associated with violating environmental laws).

[57] CARBON DISCLOSURE PROJECT 2003, *supra* note 50 (outlining shift of environmental resolutions filed from issues-based groups to pension fund investors).

2. *Securities regulation and enforcement of securities laws.*

Various provisions of U.S. law require disclosure of risks relevant to publicly-traded companies' financial condition. Most of these requirements are enforced by the Securities and Exchange Commission (SEC). Disclosure of climate change-related risks will increasingly be necessary as these risks affect companies' bottom lines.[58]

Several SEC regulations deal directly or indirectly with environmental risk disclosure. First, Regulation SK Item 101 requires disclosure of the material effects of costs of compliance with environmental laws may have on its financial affairs.[59] Second, Regulation SK Item 103 mandates the disclosure of material financial issues, comprising potential monetary sanctions imposed by governmental authority greater than $100,000 or legal proceedings where claims may exceed ten percent of a company's value.[60] Finally, Regulation SK Item 303[61] requires a management's discussion and analysis (MD&A) that discloses "currently known trends, events, and uncertainties that are reasonably expected to have material effects."[62]

In addition, the Sarbanes-Oxley Act of 2002 has dramatically expanded the scope and the timeliness of company information that must be disclosed. Sarbanes-Oxley governs corporate governance, disclosure and financial accounting. Specifically, Section 302 requires that responsible corporate officers personally certify the accuracy of quarterly and annual financial statements and disclosures.[63] Sarbanes-Oxley may render CEOs and CFOs ultimately liable for the accuracy of disclosure of environmental-related liabilities in company financial filings, including climate change. Rulemaking under Sarbanes-Oxley has been far-reaching in scope; for example, in late January 2003, the SEC adopted a rule applying

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[58] For a thoughtful discussion of environmental risk disclosure trends and obligations, see Ann Johnston & Angeles T. Rodriguez, *Environmental Disclosure: Come Clean in the Green Wave or Face the Heat*, 20 WTR NAT. RESOURCES & ENV'T 3 (2006).

[59] 17 C.F.R. § 229.101 (2007).

[60] 17 C.F.R. § 229.103 (2007).

[61] 17 C.F.R. § 229.303 (2007).

[62] Concept Release on Management's Discussion and Analysis of Financial Condition and Operations, Exch. Act Release No. 6211, 52 Fed. Reg. 13,715, 13,717 (Apr. 26, 1987). *See* Jeffrey A. Smith & Matthew Morreale, *Disclosure Issues*, *in* GLOBAL CLIMATE CHANGE AND U.S. LAW 453, 458–68 (Michael B. Gerrard ed. 2007) (providing a detailed discussion of SEC disclosure issues and climate change).

[63] Sarbanes-Oxley Act of 2002, § 302, 15 U.S.C.A § 7241 (2007).

these disclosure requirements to include investors' proxy voting policies and activities.[64]

Several problems surround the regulation and enforcement of securities laws, including lax enforcement of existing mandatory disclosure standards by the SEC, piecemeal accounting of environmental liabilities (one of the biggest loopholes in environmental reporting), and inadequate material environmental disclosure. Though the SEC has clear authority, it lacks the necessary resources to effectively enforce its regulations.[65] The resulting lack of transparency makes it difficult for shareholders to ensure that businesses are minimizing climate-related risks. Though a 1998 U.S. Environmental Protection Agency report found that seventy-four percent of companies failed to report environmental-related governmental proceedings that could have resulted in monetary sanctions greater than $100,000,[66] the Government Accountability Office reported in 2004 that only five times in the last thirty years had the agency taken action to enforce the disclosure of environmental liabilities.[67] Nonetheless, the fact that over ninety percent of the largest publicly traded utilities have addressed climate change in recent filings reflects increasing understanding that climate change-related liability is a material risk. This increase in reporting highlights the growing awareness of climate change as an environmental liability because the SEC does not specifically require reporting on greenhouse gas emissions and climate change.[68]

There is growing pressure on the SEC to require discussion of climate where it is material to a company's current and future

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[64] Disclosure of Proxy Voting Policies and Proxy Voting Records by Registered Management Investment Companies, 68 Fed. Reg. 6563–85, 6563 (Feb. 7, 2003).

[65] William Baue, *Companies Skirt Disclosures of Environmental Liabilities*, SOCIALFUNDS, Apr. 8, 2002, http://socialfunds.com/news/Article.cgi/Article815.html; U.S. GOV'T ACCOUNTABILITY OFFICE, ENVIRONMENTAL DISCLOSURE: SEC SHOULD EXPLORE WAYS TO IMPROVE TRACKING AND TRANSPARENCY OF INFORMATION (2004) (questioning SEC's obligation in improving its enforcement of environmental disclosure), *available at* http://www.gao.gov/new.items/d04808.pdf.

[66] SUSAN B. GOODMAN ET AL., THE ENVIRONMENTAL FIDUCIARY: THE CASE FOR INCORPORATING ENVIRONMENTAL FACTORS INTO INVESTMENT MANAGEMENT POLICIES (2002) (examining fiduciary responsibility of environmental disclosures).

[67] U.S. GOV'T ACCOUNTABILITY OFFICE, *supra* note 65; LeBoeuf Lamb, Greene & MacRae LLP, *SEC Enforcement Action Against Ashland Inc. Has Implications on Environmental Reporting Requirements*, Dec. 22, 2006, at 1 *available at* http://www.llgm.com/files/Publication/5e9fad95-e9b5-4ff2-8837-01955e2a88e8/Presentation/PublicationAttachment/4269b3af-6dfc-4a2c-a203-0d790f3e3a17/5089.pdf.

[68] David J. van Hoogstraten & James W. Rubin, *U.S. Companies Are Feeling the Heat on Climate Change*, INDUS. W., Oct. 4, 2006, at 1, *available at* http://www.industryweek.com/ ReadArticle. aspx?ArticleID=12765.

performance.[69] In 2001, the World Resources Institute (WRI) and the Calvert Group called on the SEC to clarify and bolster the enforcement of existing rules, as well as issue disclosure guidelines for companies. Dr. Julie Fox Gorte of the Calvert Group stated that their research showed "that companies with significantly different environmental performance and risks are often indistinguishable from each other when evaluated by their annual reports. This lack of transparency could pose a heightened risk for investors."[70] WRI and Calvert contended that the SEC was not thoroughly enforcing Item Regulation S-K, which requires companies to disclose any known risks or uncertainties that are likely to affect future financial performance.[71]

In 2004, the Senate called on the SEC to strengthen enforcement of environmental disclosure regulations.[72] In late 2006, the SEC took an enforcement action against a major chemical company, which led to a settlement order that did not impose fines but will result in significant costs. The SEC found that the company materially understated its environmental reserves (by improperly reducing its remediation estimates without documentation) and overstated its net income. It has been speculated that this enforcement action may be an indicator of the SEC's growing scrutiny on environmental liability reporting.[73] This recent enforcement action may also be a signal of the SEC's increasing willingness to hold companies accountable for failure to adequately disclose material environmental risks.[74]

Shareholders are taking action as well. In February 2006, the Carbon Disclosure Project, a group of 211 institutional investors with assets under management of $31 trillion, sent questionnaires to 1,900

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[69] *See* J. Kevin Healy & Jeffrey M. Tapick, *Climate Change: It's Not Just a Policy Issue for Corporate Counsel—It's a Legal Problem*, 29 COLUM. J. ENVTL. L. 89, 105–14 (2004) (providing a discussion of these risks and responses); *see also* David Monsma & Timothy Olson, *Muddling Through Counterfactual Materiality and Divergent Disclosure: The Necessary Search for a Duty to Disclose Material Non-Financial Information*, 26 STAN. ENVTL. L.J. 137, 185–90 (2007) (arguing that climate change risks must be disclosed and providing a thoughtful discussion of best practices for corporate officers and directors to ensure that their businesses are responding appropriately to these risks).

[70] Philip Johansson, *SEC Asked to Enforce its Environmental Disclosure Rules*, SOCIALFUNDS, Feb. 1, 2001, *available at* http://socialfunds.com/news/Article.cgi/Article487.html.

[71] *Id.*

[72] William Baue, *Senate Calls on the SEC to Enforce Environmental Disclosure Rules*, SOCIALFUNDS, July 16, 2004, at 1, *available at* http://www.socialfunds.com/news/Article.cgi/Article1467.html.

[73] *Id.*

[74] *SEC Enforcement Action Against Ashland Inc. Has Implications on Environmental Reporting Requirements*, *supra* note 67, at 3.

of the largest quoted companies in the world in terms of market capitalization. These companies were asked to publicly disclose their emissions, describe actions taken to minimize them, and indicate how that affects their bottom line. The response rate has been high.[75]

Changes in accounting treatment of climate change may have a significant impact on business practices. An initial signal of the magnitude of this shift in accounting practices is that auditors are beginning to assess whether "climate-intensive" clients have properly evaluated the off-balance sheet risks related to climate.[76] James E. Copeland, Jr., the Chief Executive Officer of Deloitte & Touche LLP stated, "[t]he real driver of change in the post-Enron environment is intense scrutiny—and an investing public that is demanding stricter enforcement of the law."[77] He further identified that a company's lack of response to climate change could have a material bearing on financial performance and shareholder value.[78] Climate change disclosure practices of U.S. insurers stand in stark contrast to those of most other U.S. business sectors.

Climate risk reporting rates remain comparatively low in the insurance sector, with only four of the largest twenty-seven property and casualty insurers reporting to the SEC, or fifteen percent.[79] Similarly, only thirty percent of U.S. insurers fully responded to the Carbon Disclosure Project (CDP) survey, as compared to sixty-two percent of their peers in other countries.[80] The pattern of responses for each CDP survey held between 2002 and 2005 is shown in Exhibit 5: Insurance sector responses to the Carbon Disclosure Project surveys.

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[75] CARBON DISCLOSURE PROJECT 2003, *supra* note 50 (examining response information to 2006 CDP survey).

[76] SUSTAINABILITY, THE CHANGING LANDSCAPE OF LIABILITY: A DIRECTOR'S GUIDE TO TRENDS IN CORPORATE ENVIRONMENTAL, SOCIAL AND ECONOMIC LIABILITY 19 (2004) *available at* http://www.eldis.org/static/DOC16882.htm.

[77] *Financial Reporting Value Chain Must Restore Trust to Meet Challenges Of Post-Enron Environment, Says Deloitte & Touche CEO Copeland*, Institutional Shareholder (date unavailable) *available at* http://www.institutionalshareowner.com/news/release.cgi?sfArticleId=1672.

[78] *Id.*

[79] MICHELLE CHAN-FISHEL, FOURTH SURVEY OF CLIMATE CHANGE DISCLOSURE ON SEC FILINGS OF AUTOMOBILE, INSURANCE, OIL & GAS, PETROCHEMICAL, AND UTILITIES COMPANIES (2005).

[80] *See infra* Exhibit 5: Insurer Response Rates to Carbon Disclosure Project (CDP) Survey: 2006

3. *Fiduciary responsibility.*

The financial relevance of climate change depends more on the sophistication of company risk management than on the prevailing regulatory environment.[81]

Approximately $7.4 trillion in financial assets are currently under the control, and thus under the legal responsibility, of company directors and institutional investors in the United States. A substantial portion of this capital could be at direct or indirect risk from climate change-related impacts. Based on historical emissions of greenhouse gases, anthropogenic climate change will continue for many centuries.[82] Implanted climate risk is a crucial long-term threat to the preservation of investment value.[83] It has been argued that such social and environmental considerations fall within the purview of fiduciary responsibility of board members, as long as they follow their legal mandate to maximize returns concomitantly.[84] Moreover, it is likely that failing to consider climate change will erode financial returns over the long run. As a recent report by Ceres found, "[t]he more information on climate-related damage accumulates, the more the refusal to examine these risks carries the potential for breach of fiduciary duty."[85] In many industry sectors, environmental performance has been established as a key value driver; therefore fiduciaries should put systems in place to monitor environmental performance in both active and passive portfolios.[86] Some insurance companies have implied that they may even withdraw Directors and Officers liability coverage from those companies that do not have adequate risk management policies developed for climate change.[87]

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[81] CARBON DISCLOSURE PROJECT, *supra* note 50, at 1.

[82] IPCC 2007, *Summary for Policymakers*, *supra* note 5, at 17.

[83] Martin Whittaker, RESEARCH BRIEF: CLIMATE CHANGE AND INVESTMENT RISK (2001) (identifying climate change risk in investments).

[84] ROSE FOUNDATION FOR COMMUNITIES AND THE ENVIRONMENT, THE CASE FOR INCORPORATING ENVIRONMENTAL FACTORS INTO INVESTMENT MANAGEMENT POLICIES (2002) (examining fiduciary duty for investments that could be impacted by climate change risk) [hereinafter ROSE REPORT] *available at* http://www.rosefdn.org/images/EFreport.pdf. *See* J. Kevin Healy & Jeffrey M. Tapick, *supra* note 69, at 102–07; Jeffrey A. Smith & Matthew Morreale, *The Fiduciary Duties of Officers and Directors*, *in* GLOBAL CLIMATE CHANGE AND U.S. LAW 497, 497–529 (Michael B. Gerrard ed. 2007) (providing a more comprehensive discussion of fiduciary responsibilities in the context of climate change)..

[85] CERES SUSTAINABLE GOVERNANCE PROJECT, *supra* note 48, at 1.

[86] ROSE REPORT, *supra* note 84 (examining fiduciary duty for investments that could be impacted by climate change risk).

[87] WHITTAKER, *supra* note 83, (identifying climate change risk in investments); *see also* Audrey Schulman, *Insured Destruction: Global Climate Change Threatens the Insurance Industry*, E:

Similar concerns exist for pension funds. The federal Employee Retirement Income Security Act (ERISA) establishes rules for pension programs and requires a fiduciary to ensure that investment-related decisions must further the purpose of the plan.[88] Pension fund holdings represented 22.9% of global equity market capitalization in 1999.[89] The globalization of U.S. pension funds, evident in the percentage of equity investments in non-U.S. company securities tripling between 1990 and 2000,[90] clearly requires investment managers to take into account climate change policy and regulatory requirements throughout the world.

Lastly, pension fund investment managers should consider macroeconomic and trans-boundary factors, such as climate change, which could impact markets in which the funds of beneficiaries' pensions are invested. Failing to take into account climate change through fund risk management practices could be deemed a breach of fiduciary duty.[91] Furthermore, if the investment goals of the pension plan (or foundation or charitable trust) include environmental health or sustainability criteria, the fiduciaries must make certain that their investment-related decisions further environmental health or sustainability.[92] This logic spurred the Connecticut State Retirement Plans and Trust funds, with some $20 billion in assets, to be the first U.S. pension plan to put forth a climate change resolution.[93] In April 2005, CalPERS was among a group of funds (overseeing assets of $3 trillion) that pledged and subsequently made an investment of $1 billion in companies that reduce greenhouse gas emissions.[94]

THE ENVIRONMENTAL MAGAZINE, July/Aug 2002, at 1, *available at* http://findarticles.com/p/articles/mi_m1594/is_4_13/ai_90191337.

[88] 29 U.S.C. § 1104 (2007).

[89] CERES SUSTAINABLE GOVERNANCE PROJECT, *supra* note 48, at 11.

[90] *Id.* at 6.

[91] *Id.* at 53; ROSE REPORT, *supra* note 84 (examining fiduciary duty for investments that could be impacted by climate change risk).

[92] CERES SUSTAINABLE GOVERNANCE PROJECT, *supra* note 48, at ii.

[93] Bayon, *supra* note 47, at 31.

[94] Kim Chipman, *The Heat is on: Rita and Katrina Left Even Wall Street Worried About Global Warming. Now the Pressure is on George W. Bush to Deal with Climate Change*, CALGARY BUS., Oct. 9, 2005, at 3.

4. *Negative impacts on company value caused by ignoring climate change.*

Failing to establish standards or to take proactive measures to reduce greenhouse gas emissions could expose companies to reputation and brand damage, as well as regulatory and litigation risk.[95] As evidence of the reputation and brand damage that can be associated with greenhouse gas emissions, the five largest carbon dioxide (CO_2) emitters among U.S. electric power companies, American Electric Power (AEP), Southern Company (SO), Xcel Energy, Inc. (XEL), TXU Corporation (TXU), and Cinergy Corporation (CIN), were dubbed "the filthy five" in 2003 by a coalition of institutional investors.[96] Subsequently, these utility companies faced increased global-warming and other pollution-related shareholder resolutions. They were also requested to present to their shareholders comprehensive assessments of the economic risks on past, present and future greenhouse gas and mercury emissions, as well as of the economic benefits of committing to substantial reductions of those emissions and how they plan to address them.[97]

The potential liabilities associated with coal-fired power no doubt factored into the subsequent sale of TXU and the cancellation of construction of eight of eleven coal-fired power plants that the company had sought to build before the establishment of carbon caps. Instead, the investors pledged to invest $400 million in new energy efficiency initiatives and to increase renewable power purchases as clean alternatives to new generation.[98]

There is strong precedent for utility regulators determining that imprudent investments in power plants should be borne by shareholders rather than ratepayers. Portions of power-plant costs have been disallowed (even years after construction) based on determinations that market information available at the time was not adequately utilized by utility managers to minimize costs. This issue can be expected to arise again regarding both the costs of retrofitting power plants to enable carbon capture and storage technology, and

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[95] Bennett & Wells, *supra* note 47, at 2; William Baue, *Global Warming Shareowner Resolution Filed at "Filthy Five" Electric Companies*, SOCIALFUNDS, Jan. 17, 2003, at 1 *available at* http://www.socialfunds.com/news/article.cgi/1008.html.

[96] Baue, *supra* note 95, at 1.

[97] INVESTOR RESP. RES. CTR. & INTERFAITH CTR. ON CORP. RESP., *supra* note 47 (outlining climate change shareholder resolutions).

[98] George Lobsenz, *TXU "Earthquake" to Shake Climate Change Debate, Power Supply Choices*, ENERGY DAILY, Feb. 27, 2007, at 1.

the rush to complete such plants before seemingly inevitable regulation is established.[99]

C. *Legal Atmosphere*

Currently, both producers and large emitters of greenhouse gases externalize the true costs of their contributions to climate change, which are then left for the victims to bear. Consequently, applying tort law to climate change harm could be consistent with tort law's basic goals of reducing the societal costs of human activities, compensating those who are harmed unduly by those activities, and providing corrective justice.[100] Providing corrective justice may support the transfer of climate change costs onto companies with responsibility for impacts and compensate those who have been harmed by others' negligent or morally dubious actions.[101] Although in many contexts in the United States, regulatory law provides the means by which negative externalities are internalized, current regulatory structures do not deal effectively with the costs imposed by greenhouse gas emissions. The tort system may therefore have a role to play in ensuring that these risks are not simply allocated by default to the victims of climate change, and in providing incentives for efficient allocation of resources to minimize overall societal costs of climate change.[102]

Government agencies and private parties may be successful in bringing tort-based lawsuits to seek remedies for some of the impacts of climate change. There is increasing interest and activity in the application of tort law to hold fossil fuel companies, as well as some of their associated industries, liable for some of the harm caused by

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[99] Michael Dworkin, Shanna Vale, & Ellen Crivella, Letter to the Editor, *Coal-Fired Power Plants: Imprudent Investments?*, 315 SCIENCE 1791, 1791 (2007).

[100] *See* Albert C. Lin, *Beyond Tort: Compensating Victims of Environmental Toxic Injury*, 78 S. CAL. L. REV. 1439, 1444–53 (2005). Lin argues that the tort system is ill-equipped to accomplish its basic goals in the context of environmental harms and proposes an alternative administrative compensation system to address these harms. Lin points to the often-latent nature of environmental harms, as well as to difficulties in establishing causation—including the difference between the meaning of "causation" in science and in law—as evidence that the tort system does not meet its objectives. *Id.* at 1444–52.

[101] David A. Grossman, *Warming Up to a Not-So-Radical Idea: Tort-Based Climate Change Litigation*, 28 COLUM. J. ENVTL. L. 1, 5 (2003).

[102] *Cf.* Albert C. Lin, *supra* note 100, at 1452–53 (proposing alternative compensation mechanisms for environmental harms); *see also* Farber, *supra* note 28 (discussing administrative compensation systems to handle climate change-related harms).

climate change.[103] Climate change harms caused by businesses implicate the central concern of tort law, allocation of the costs of harm caused by human activity. Nonetheless, defenses based on lack of standing, preemption of common law or state statutory remedies, and lack of sufficient proof of causation may be formidable.[104] The difficult task of assigning responsibility for greenhouse gas emissions will also open up an area of opportunity.[105] The issue of apportionment will also be difficult: Deciding who is to blame and for how much of the damages caused by climate change based solely on CO_2 emissions is particularly difficult because although central to the global warming equation, CO_2 is only one of the greenhouse gases.[106] Examining greenhouse gas emissions as undisclosed sources of company liability illustrates well the controversy over discounting and establishing risk premiums, the cost of capital of risk.

Litigation is just one climate change risk to which U.S. companies are exposed. Others include the cost of complying with a regulatory regime, as a mandatory national cap-and-trade system is likely inevitable. Additionally, businesses will bear the direct and physical effects of climate change on their operations.[107]

III. SOURCES OF CLIMATE CHANGE-RELATED LIABILITY, AND THEIR NEXUS WITH INSURANCE

Greenhouse gases, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulfur hexafluoride (SF_6), water vapor, and ozone (O_3), are trace gases in the atmosphere that absorb and emit infrared radiation (IR).[108] Greenhouse gas cycles and the global

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[103] *But see* Merrill, *supra* note 42 (outlining arguments in favor of and against viewing climate change as a public nuisance and expressing skepticism that public nuisance lawsuits addressing climate change impacts will prevail in court).

[104] *See id.*; Bradford C. Mank, *Civil Remedies*, *in* GLOBAL CLIMATE CHANGE AND U.S. LAW 183, 184–99 (standing), 200–06 (causation), 206–08 (various other defenses) (Michael B. Gerrard ed. 2007).

[105] Simone Bastianoni, Federico M. Pulselli & Enzo Tiezzi, *The Problem of Assigning Responsibility for Greenhouse Gas Emissions*, 49 ECOLOGICAL ECON. 253 (2004) (outlining the challenges associated with assigning responsibility for greenhouse gas emissions). *See also* Allen, *supra* note 36, at 891–92.

[106] Tom Walsh, *Climate Change: Business Risks and Solutions*, RISK ALERT (Marsh Inc., New York, N.Y.) Apr. 2006, at 12, *available at* http://www.pewclimate.org/docUploads/Marsh%20–%20Climate%20Change%20Risk%20Alert%20(April%202006).pdf.

[107] Rohleder & Button, *supra* note 42, at 59.

[108] Jerry D. Mahlman, *Uncertainties in Projections of Human-Caused Climate Warming*, 278 SCIENCE 1416, 1416 (1997).

climate are intimately related.[109] A variety of human activities release greenhouse gases into the atmosphere, the most significant of which is the burning of fossil fuels for producing electrical energy, transportation and heating. Other major contributing human influences include agricultural burning, fertilization, and deforestation. Since 1750, anthropogenic emissions have exacerbated the greenhouse effect.[110] Carbon dioxide is the principal greenhouse gas emitted from anthropogenic activities.[111] Carbon dioxide is a persistent, long-lived gas and can remain in the atmosphere for centuries.[112]

There is overwhelming international scientific consensus that human-induced (anthropogenic) climate change is occurring.[113] Climate science continues to confirm and reduce quantitative uncertainties associated with the rising anthropogenic contribution to the greenhouse effect that has resulted—in addition to the gradual and millennial changes of Earth's climate systems—in unprecedented global warming and associated climate changes.[114] An anthropogenic signal has emerged in the climate record; since 1750 carbon dioxide (CO_2) has increased by 35%, methane (CH_4) by 148%, and nitrous oxide (N_20) by 18%.[115] Present rising atmospheric CO_2 concentrations have been measured at 379 parts per million by volume.[116] These concentrations are 27% higher than the highest recorded level during the last 650,000 years.[117] Additionally, further research outlines the alarming possibility that human activities may lead to abrupt climatic change that drastically alters Earth's weather and sea levels in very short timeframes.[118] It is important to note that some of the impacts are not contingent on the uncertain timeframes of the level of climate change. The "carbon-fertilization" of plants causes increased pollen output, a key contributor to respiratory disease and allergies, and rising carbon dioxide levels are affecting

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[109] Edward J. Brook, *Tiny Bubbles Tell All*, 310 SCIENCE 1285, 1285 (2005).

[110] *Id.* at 1285; Virginia H. Dale, et al., *Climate Change and Forest Disturbance*, 51 BIOSCIENCE 723, 724 (2001) (outlining anthropogenic sources of GHG emissions).

[111] THOMAS E. GRAEDEL & BRADEN R. ALLENBY, INDUSTRIAL ECOLOGY 318 (2d ed. 2003).

[112] SONIA SHAH, CRUDE: THE STORY OF OIL 111 (2004).

[113] IPCC 2007, *Summary for Policymakers*, *supra* note 5 (examining anthropogenic contributions to climate change).

[114] Brook, *supra* note 109, at 1285; Mahlman, *supra* note 108, at 1416–17.

[115] IPCC 2007, *Summary for Policymakers*, *supra* note 5, at 3.

[116] *Id.* at 2.

[117] Brook, *supra* note 109, at 1285.

[118] Richard B. Alley et al., *Review: Abrupt Climate Change*, 299 SCIENCE 2005, 2009 (2003).

the chemistry of the oceans, which is expected to have adverse impacts on fisheries and other parts of the ocean ecosystem.

A. *Climate Change Impacts and Associated Liability Insurance Triggers*

Potential triggers of liability insurance coverage associated with climate change could include property damage and other business-related or personal losses, increasing incidences of respiratory illness and other public health impacts, and damages to public amenities such as public natural resources. Exhibit 6: Climate change triggers, insurance and legal liabilities & risk management solutions outlines the links between climate change triggers with their applicable legal and insurance frameworks and risk management solutions to minimize these liabilities.

1. *Impacts on private property and liability.*

Climate change has the potential to affect virtually all segments of the property-casualty insurance business, including those covering damages to property, crops, and livestock; business interruptions; supply chain disruptions, or loss of utility service; equipment breakdown arising from extreme temperature events; and data loss from power surges or outages. Where there are third party impacts from these damages and disruptions, liability insurance will come into play.

Liability triggers may arise from industry sectors directly at risk from the physical consequences of climate change impacts on natural resources that are raw materials to some industries (e.g., forestry, fisheries, grazing, agriculture) and prerequisites for others (e.g., tourism and the ski industry).[119] For commodity and manufacturing businesses, additional costs associated with climate change will impact the economics of supply chains.[120] For some high impact industry sectors (e.g., energy and electric utilities), as much as 15% of the total

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[119] *See* THE CTR. FOR HEALTH AND THE GLOBAL ENV'T, *supra* note 9, at 65–86; Andrew Dampf, *Ski Industry Facing Meltdown?*, CBS NEWS, Dec. 3, 2003, *available at* http://www.cbsnews.com/stories/2003/12/03/tech/main586554.shtml?source=search_story; Mark Landler, *Global Warming Poses Threat to Ski Resorts in the Alps*, N.Y. TIMES, Dec. 16, 2006, at A3, *available at* http://www.nytimes.com/2006/12/16/world/europe/16austria.html.

[120] CARBON DISCLOSURE PROJECT 2003, *supra* note 50, at 19.

market capitalization of major companies could be threatened by climate change-driven risks to shareholder value.[121]

2. *Business interruption.*

Extreme weather events can result in significant business interruptions. For example, a major portion of the $20.8 billion in total insured commercial losses from Hurricane Katrina were due to business interruptions.[122] Risks to business income and operations associated with a climate change event can include supply chain disruption as well as access to utility services, transportation, and telecommunications.[123]

The prospect of business interruptions due to weather-related power outages is particularly significant. Losses from power outages can include various forms of business interruptions, property losses from consequent fires,[124] data loss, equipment damage and loss of perishable refrigerated products from power surges, and liability for power suppliers deemed to have been able to avert the loss.[125]

For example, Ford Motor Company stated that more than half of its forty-four plants in North America were shut down by the power outages of 2003, and others (outside of the area of the outage) were adversely impacted by disruptions to supply lines. All other major car manufacturers in the Detroit area were also shut down.[126] In Auckland, New Zealand, the largest heat wave since 1868 drove up peak air conditioning demand, which, in turn, contributed to the collapse of electricity supply in 1998 after one of two major transmission cables was compromised.[127]

Power outages are an emerging insurance risk for end users as well as energy suppliers. This was witnessed by the 2003 outage in

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[121] CERES SUSTAINABLE GOVERNANCE PROJECT, *supra* note 48, at 10.

[122] Rebecca Mowbray, *Business Interruption Insurance Claims Could Account for Half of the Commercial Losses from Katrina, but Many Owners Are Still Struggling to Get Payments WORLD, INTERRUPTED*, THE TIMES-PICAYUNE, Sept. 17, 2006, at 1, *available at* http://www.nola.com/business/t-p/index.ssf?/base/money-1/1158480493165140.xml &coll=1.

[123] Watchman & Rock, *supra* note 19.

[124] During the 2003 blackout in the northeast U.S. there were sixty-one more fires than normal.

[125] *See generally* JOSEPH ETO ET AL., SCOPING STUDY ON TRENDS IN THE ECONOMIC VALUE OF ELECTRICITY RELIABILITY TO THE U.S. ECONOMY (2001) (outlining economic value trends in the reliability of electricity in the U.S.).

[126] Michael Bradford, *Blackout Shuts Down Cities*, BUS. INS., Aug. 18, 2003, at 1.

[127] MUNICH REINS. GROUP, FAILURE OF PUBLIC UTILITIES: RISK MANAGEMENT AND INSURANCE 7 (2003), *available at* http://www.munichre.com/publications/302-03810_en.pdf.

North America that left fifty million people without power, resulting in up to $10 billion in total losses[128] and insured "utility service disruption" losses of about $3 billion.[129] In addition to such business-interruption claims, insurers may also see liability claims against utilities for not ensuring reliable power supply in the face of more frequent and severe natural disasters. Between 1982 and 2002, 62% of the outages on the wholesale grid were attributable to weather-related events.[130] In 1999, a single lightning strike put eighty million people in darkness in Brazil. A survey found that power outages cost half of the companies surveyed $50,000 per hour of downtime, and over $250,000 for the top quartile.[131] Italy experienced an even larger outage in 2003, with other major outages in London and parts of Scandinavia.[132]

As an example of the scale of the potential impact, the New Orleans-based subsidiary of the electric utility Entergy was rendered insolvent due to a combination of physical damages ranging in cost from $0.5 to $1.1 billion from Hurricane Katrina and the subsequent protracted lost revenues.[133]

Oil and gas producers also face considerable business interruption risks in the face of weather-related catastrophes. With $10 billion in insured losses in the wake of the 2005 hurricane season, including the destruction of 116 oil platforms, and 56 more severely damaged by 2004–2005 hurricanes,[134] offshore oil producers saw insurance price increases of up to 500% and considerable shrinkage of the insurance capacity available to pay for future losses.[135] The U.S. Mineral Management Service reported that 44 % of the daily output of natural gas and oil was still offline three weeks after Hurricane

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[128] Meg Fletcher, *Industry Bullish on Asia as Market Barriers Lower*, BUS. INS., Aug. 18, 2003, at 9.

[129] MUNICH REINS., *supra* note 127, at 15.

[130] MILLS, ROTH, & LECOMTE, *supra* note 8, at 19.

[131] *Reducing Electrical Risk*, RISK MGMT. MAG., Aug. 2003, at 10.

[132] Jared Wade, *Are You Afraid of the Dark?*, RISK MGMT. MAG., May 2004, at 12.

[133] Associated Press, *Entergy New Orleans files for bankruptcy protection*, USA TODAY, Sept. 23, 2005, *available at* http://www.usatoday.com/money/industries/energy/2005-09-23-entergy_x.htm.

[134] MUNICH REINS. GROUP & AMER. REINS. COMP., HURRICANES: MORE INTENSE, MORE FREQUENT, MORE EXPENSIVE 29 (2006), *available at* http://www.munichre.com/publications/302-04891_en.pdf?rdm=20000.

[135] Robert Hartwig, Senior Vice President & Chief Economist, Insurance Information Institute, Presentation at the Insurance Information Institute: Hurricane Season of 2005: Impacts on US P/C Insurance Markets in 2006 and Beyond (Mar. 2006), *available at* http://server.iii.org/yy_obj_data/binary/744130_1_0/katrina.pdf.

Katrina.[136] Damage to coastal support facilities impeded efforts by the energy industry to resume production of Gulf platforms, pumps, and pipelines following Hurricane Rita.[137] Escalating energy prices resulted, combined with inflation, and added to the economic rippling effects to the rest of the country.

3. *Impacts on human health.*

A wide range of human health impacts of climate-change-related events have been identified.[138] There are at least nine major categories of anticipated health impacts with implications for insurance. These include:

1. Infectious disease vectors range from mosquitoes carrying malaria or West Nile Virus, to ticks carrying Lyme Disease,[139] to rodents carrying Hantavirus
2. Heat stress: few in the U.S. are aware that upwards of 35,000 people died in excess of the norm due to the European Heat Wave of 2003
3. Respiratory and coronary disease are linked with elevated levels of aeroallergens such as pollen, smoke, dust, and elevated temperatures
4. Waterborne diseases are exacerbated by temperature and water quality, or overwhelmed water treatment infrastructure after floods
5. Physical injury from extreme events and natural disasters, such as flooding, and the tendency for disease outbreaks to cluster around extreme weather events,[140] such as "Katrina Cough"
6. Effects of toxic materials released and distributed by extreme weather events
7. Food poisoning: there is a strong correlation between Salmonella outbreaks and temperature

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[136] Bhushan Bahree & Russell Gold, *Oil Prices Rise as Gulf Storm Looms*, WALL ST. J., Sept. 20, 2005, at 1.

[137] *What's News: Business and Finance*, WALL ST. J., Sept. 12, 2005, at A1.

[138] *See* THE CTR. FOR HEALTH AND THE GLOBAL ENV'T, *supra* note 9.

[139] One case study projects a four-fold increase in the suitable range for Lyme disease in North America by the year 2080. *Id.* For the original research, see John S. Brownstein et al., *Effect of climate change on Lyme disease risk in North America*, 2 ECOHEALTH 38, 38–46 (2005).

[140] Paul Epstein, *Climate and Health*, 285 SCIENCE 289, 347–48 (1999).

8. Post-event mental health problems
9. Health consequences of malnutrition and water shortages in developing countries[141]

Climate-change factors can interact to exponentially increase risk to human health. This is illustrated by the cascading repercussions of low stream flow resulting from increased temperature, changes in precipitation, earlier spring arrival and rising snowline.[142] Low stream flow (linked to drought) leads to increased concentrations of pesticides, mercury, salt and other pollutants, thereby deteriorating water quality. Mercury converts to methyl mercury, which then accumulates in fish. Humans, in turn, ingest methyl mercury-contaminated fish. High doses of methyl mercury have been shown to cause cerebral palsy, mental retardation and impaired neurological development.[143]

Perhaps the greatest climate-related health challenge in the United States is that the combination of more airborne allergens, rising temperatures, greater humidity, more particulate matter from wildfires,[144] more dust, particulates, and mold may considerably exacerbate upper respiratory disease (rhinitis [hay fever], conjunctivitis, sinusitis) and cardiovascular disease (e.g., due to reduced oxygen and increased carbon monoxide during fires). In a study of fifty Eastern U.S. cities, summer days under climate change are projected to experience increased ground-level ozone formation: The average number of days per summer exceeding the 8-h regulatory standard is projected to increase 68%. This, in turn will lead to an increase in total, cardiovascular, and respiratory mortality; hospital admissions for asthma; and hospital admissions for chronic obstructive pulmonary disease and respiratory causes for older populations.[145] Studies from Harvard Medical School indicate levels

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[141] *See* CTR. FOR HEALTH AND THE GLOBAL ENVT., *supra* note 9 (discussing the factors enumerated in this list); *see also* Ronald C. Kessler et al., *Mental Illness and Suicidality after Hurricane Katrina*, 84 BULL. OF THE WORLD HEALTH ORG., Dec. 2006, 930, at 933; Associated Press, *Mental Health Crisis Strains New Orleans*, Nov. 8, 2006.

[142] REDEFINING PROGRESS, CLIMATE CHANGE IN CALIFORNIA: HEALTH, ECONOMIC AND EQUITY IMPACTS 19–21 (2006).

[143] IPCC 2007, *Summary for Policymakers*, *supra* note 4 (outlining public health impacts from climate change).

[144] According to The Center of Health and the Global Environment, hospital admissions for heart and lung ailments increased significantly at the height of the wildfire season, most notably in Ravalli County. Admissions for respiratory disease increased 90% and admissions for heart problems increased by 57%. MILLS, ROTH, & LECOMTE, *supra* note 8, at 28.

[145] Michelle L. Bell et al., *Climate Change, Ambient Ozone and Health in 50 US Cities*, CLIMATIC CHANGE, at 3.4 (2006).

of key pollens could increase by as much as 60% in parts of the United States by the middle of the twenty-first century due to the so-called "carbon fertilization" of the atmosphere.[146] For related reasons, cases of asthma, already causing a greater impact than Alzheimer's disease in the United States, can be expected to sharply increase under climate change. Ground-level ozone, exacerbated by warming temperatures in cities, is another cause of respiratory stress. The baseline cost of asthma was $13 billion per year in the United States alone as of the mid-1990s (half of which are direct healthcare costs). If a 30% increase in this cost took place in the United States, it would result in an incremental cost of nearly $4 billion a year, which is equivalent to an additional large hurricane each year.[147]

4. *Impacts on natural resources.*

Climate change is expected to adversely impact the health of non-human systems that can, in turn, cause economic and insured losses.[148] The health of forests, crop systems, wildlife, livestock, and marine life links directly to industries and the "health of their assets" (timber, agriculture, poultry, and fisheries; to investors and insurers), as well as to public health via deterioration of life support systems. The water industry alone is expected to face $47 billion of extra costs annually by 2050.[149]

B. *Risks Associated with Common Liability Insurance Lines*

The increasing frequency or severity of liability triggers will in turn elevate the risks of climate change litigation. Shareholder lawsuits could be focused on a company's performance suffering due to negligent planning by corporate directors for climate change risk. Once a future regulatory regime is established in the United States, companies not found in compliance with emissions regulations may face fines from regulatory agencies, or allegations of having violated

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[146] The issue is reviewed in THE CTR. FOR HEALTH AND THE GLOBAL ENV'T, *supra* note 9, at 29. *See also* Peter Wayne et al., *Production of allergenic pollen by ragweed (*Ambrosia artemisiifolia *L.) is increased in CO_2-enriched environments*, 88 ANNALS OF ALLERGY, ASTHMA AND IMMUNOLOGY 279, at 279–82 (2002), and L.H. Ziska et al., *The Potential Influence of Rising Atmospheric Carbon Dioxide (CO_2) on Public Health: Pollen Production of Common Ragweed as a Test Case*, 8 WORLD RESOURCE REV. 449–57 (2000).

[147] THE CTR. FOR HEALTH AND THE GLOBAL ENV'T, *supra* note 9, at 100.

[148] *Id.* at 29.

[149] Whittaker, *supra* note 83, at 1 (identifying climate change risk in investments).

them in court. Mass tort claims, as class action suits or consolidated plaintiffs from regions experiencing human or economic damage from climate change, may utilize the court system to hold large emitters of greenhouse gases liable for their emissions contribution to climate change.[150]

Broad liability insurance products exist in the form of "umbrella," "excess liability," or "multi-peril" contracts, each of which can be written to include a wide variety of claim types or to provide excess coverage beyond that provided by the primary policy.[151] Many specialized variations of liability insurance exist, which are used to infill points otherwise excluded by broader forms of coverage such as Commercial General Liability. Moreover, while most "personal lines" insurance contracts (e.g., homeowners and personal automobile) are in highly standardized contract form, in the commercial sector policies are often "manuscripted," or customized to the insured's exposures, risk-management practices, and desired extent of coverage. Individual state-level insurance commissions may also impose special conditions on contract formulation.

Insurance policies under all major liability insurance lines may cover risks relating to their insureds' climate change-related liability. Examples include:

- Commercial general liability claims, which would include negligence, personal injury, and third-party business interruption via disruptions in supply chains, transportation, utility services, and communications;
- Product liability claims associated with materials or products that contribute to climate change;
- Environmental liability claims for emitters of greenhouse gases based on various impacts of climate change itself, or, secondary consequences associated with toxic releases, mold, and other repercussions of the physical impacts of climate change;
- Professional liability claims, e.g., corporate directors and officers liability for those involved as emitters or arising from

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[150] Walsh, *supra* note 106, at 23.

[151] Most insurance glossaries, such as those offered by trade organizations, are quite cursory. The Wisconsin Insurance Commission offers a guide to liability insurance terminology and contract types. *See* Office of the Commissioner of Insurance, State of Wisconsin, *Consumer's Guide to Commercial Liability Insurance* 8 (2006), *available at* http://oci.wi.gov/pub_list/pi-045.htm.

failure to safeguard shareholder value from the impacts of climate change;
- Political risk liability claims triggered by new government policies (e.g., carbon levies); and
- Personal and commercial vehicle liability claims from increased roadway accidents related to adverse weather.

1. *Commercial general liability.*

The standard Commercial General Liability insurance line ("CGL") covers a range of risks that businesses impose on third parties, including negligent conduct and other conduct that poses risks to others' health, life, business operations, or property. As with all liability policies, the CGL policy obliges the insurer to pay legal defense costs.[152] Because, as noted below, businesses that contribute to climate change are vulnerable to legal claims based on nuisance, negligence, and other tort theories, including negligent misrepresentation, CGL coverage will likely be a significant factor in insurers' climate change-related risk. Moreover, to the extent that older CGL policies do not exclude risks such as environmental contamination, a wide range of legal claims based on past conduct may be covered by CGL policies.[153]

The bulk of liability under the CGL line comes from defending and indemnifying policyholders faced with negligence claims forms. Where an insured breaches a legal duty by failing to exercise reasonable care and causes injury to a third party, the insured will be liable for damages incurred.[154] As with all liability insurance, the insurer's duty to defend claims is broad and financially significant, independent of the insurer's duty to indemnify policyholders' liability.[155]

In the context of climate change, it is likely that some of those who are harmed by climate change's impacts will contend that a business's emission of greenhouse gases, or other conduct relating to climate change, negligently caused them harm, either as individuals

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[152] *Id.* at 4.

[153] *See* Melody A. Hamel, *The 1970 Pollution Exclusion in Comprehensive General Liability Policies: Reasons for Interpretations in Favor of Coverage in 1996 and Beyond*, 34 DUQ. L. REV. 1083, 1086–88 (1996). *See also* Editorial, *Rising Temperatures May Boost Liabilities*, BUS. INS., Feb. 5, 2007, at 8.

[154] RESTATEMENT (THIRD) OF TORTS §§ 3 & 6 (proposed).

[155] *See* The Insurance Industry's Contribution to the Legal Services Industry, *supra* note 43.

or as a class.[156] Such a claim would be novel and challenging to sustain, as it would require a court to conclude that a reasonably prudent person would not have taken the action taken by the defendant business, and that the business's actions have proximately caused the plaintiffs' damages.[157] Nonetheless, insurers would have the burden of paying the costs to defend fact-intensive cases on this front. At issue might, for example, be the degree to which other business practices could reasonably have been employed to reduce greenhouse gas emissions, as well as the degree to which the company was aware of its contribution to the harm. It is also possible that insurers may have to defend claims that insured businesses have engaged in negligent misrepresentation, by concealing facts about climate change, or about their businesses' contributions to climate change that might have impacted choices made by others and caused them harm.

More worrisome for insurers is the likelihood of claims that an insured's negligent failure to prepare adequately for the impacts of climate change has harmed third parties. Business interruptions, failures to deliver goods and services, and other harms could give rise to negligence claims if a plaintiff could show that the insured's actions did not exhibit reasonable care. Insurers will have to defend, and in some cases indemnify, CGL policyholders named as defendants in such actions.

2. *Environmental liability.*

Because coverage for environmental contamination and related harms was typically excluded from CGL policies written since the early 1970s, with increasingly broad exclusions adopted in subsequent decades,[158] separately-underwritten Environmental

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[156] It is unclear to what extent policy language that excludes pollution-related harms from CGL coverage will encompass greenhouse gas emissions. The United States Supreme Court recently held, in *Mass. v. EPA*, 549 U. S. __ (2007), that greenhouse gases are "air pollutants" within the meaning of the Clean Air Act's definition of that term. *Id.*, slip op. at 25–30; *see* 42 U. S.C. §7521(a)(1). Although policy language does not necessarily track the Clean Air Act's definition of pollutants, it is possible that in some cases this decision may bolster insurance companies' contentions that CGL coverage does not cover damages from releases of greenhouse gases. Even if this is so, such damages may still be covered by environmental liability coverage, as discussed below in Section III.B.2, or by older CGL policies.

[157] RESTATEMENT (THIRD) OF TORTS, *supra* note 154.

[158] *See* Hamel, *supra* note 153, at 1086–88. The article provides a good overview of the history of pollution exclusions from CGL coverage and advances an argument that courts should construe the standard pollution exclusion in effect from approximately 1970 to 1986 narrowly. In general, older CGL policies with weaker or no pollution exclusions are more

Liability coverage is applied to most contamination-related risks. As with the CGL insurance line discussed above, Environmental Liability coverage generally covers risks relating to nuisance, negligence, and other tort legal theories. This coverage, however, specifically insures against liability for pollution-related risks not covered by CGL.

Coverage may be triggered either by common-law environmental legal claims such as nuisance or negligence, or by statutory claims under laws such as CERCLA that fix legal liability for releases of pollution. Coverage usually includes bodily injury, property damage, and cleanup costs as a result of a pollution event. Many environmental liability policies restrict coverage to damage caused by "pollution," a term that can be narrowly defined.[159] While insurers may argue that their current policies do not cover various climate-change-related risks, courts may disagree. Moreover, some climate change-related harms, including toxic releases resulting from climate-change-induced weather events, will fall well within typical Environmental Liability policy language.[160] Examples include spills of chemicals, sewage, or agricultural/livestock wastes.[161] According to the National Oceanic and Atmospheric Administration (NOAA):

> As a consequence of Katrina and Rita, more than a thousand pollution reports have been received along the

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likely to cover risks from environmental contamination, while more recent CGL policies' exclusion of such coverage mean that for more recent occurrences of contamination, environmental liability policies will generally be the focus of insurance coverage for such contamination.

[159] Gary Guzy, *Insurance and Climate Change*, *in* GLOBAL CLIMATE CHANGE AND U.S. LAW 541, 554–55 (Michael B. Gerrard ed. 2007) Guzy notes that to the extent state and federal statutory definitions of "pollution" include carbon dioxide, insureds may have stronger coverage claims. *Id.* The recent United States Supreme Court decision in *Mass. v. EPA*, 549 U. S. ____(2007), holding that greenhouse gases are "air pollutants" within the meaning of the Clean Air Act's definition of that term, *id.*, slip op. at 25–30, may thus lend weight to policyholders' arguments that carbon dioxide releases are covered by environmental liability policies.

[160] *See* John A. Hannah, *The U.S. Environmental Liability Insurance Market–Reaching New Frontiers* (May 2000), *available at* http://www.irmi.com/Expert/Articles/2000/Hannah05.aspx (discussing typical risks covered by various types of environmental insurance policies, including "[a]ll sudden and gradual pollution releases (including legacy liabilities)"); Guzy, *supra* note 159, at 555. Guzy notes that insurers are likely to assert that in the absence of proof of causation—particularly, tying a particular insured's activities to a particular, measurable harm—coverage will not apply. *Id.* Nonetheless, an insurer that denies a defense based on this position will risk a bad-faith coverage lawsuit. In such cases, the scope of the insurer's duty may not be conclusively determined until after discovery, since the causation issues raised in the coverage disputes may overlap considerably with the underlying legal issues relating to the insured's liability. Thus, contesting coverage in such cases will often be a risky strategy for insurers.

[161] *See, e.g.*, Anna Maria Cruz, Laura J. Steinberg & Ronaldo Luna, *Identifying Hurricane-Induced Hazardous Material Release Scenarios in a Petroleum Refinery*, NAT. HAZARDS REV., Nov. 2001, at 203–10.

> coastal waters of Alabama, Mississippi and Louisiana. This includes five designated as major (spills greater than 100,000 gallons) and five classified as medium (spills between 10,000 and 50,000 gallons). Prioritizing oil spills in the region is vital. It is likely that the long-term affects to the heavily populated Gulf Coast will be tremendous. [162]

One recent example that may foreshadow significant exposure by carriers is a class action lawsuit regarding leakage of a large quantity of oil from a Murphy Oil refinery in Meraux, Louisiana after a storage tank rupture occurred during Katrina-related flooding. Several thousand homes were damaged.[163] The plaintiffs alleged, among other things, that Murphy Oil was negligent in its construction or maintenance of the tank, in its alleged failure to take actions to prevent or lessen the likelihood of a tank rupture.[164] State law causes of action in which a class was certified by the court included negligence, absolute liability, strict liability, nuisance, trespass, and groundwater contamination.[165] The court approved a class settlement of $330,126,000.[166] This settlement is intended to cover acquisition of properties, remediation of damage, and compensation for losses incurred by the plaintiff class members.[167]

Public nuisance may be an effective theory for public entity plaintiffs. Where a business unreasonably interferes with a right held by the public in common, a court may find the business's conduct to constitute a public nuisance.[168] There is a long tradition of using the nuisance doctrine to compensate victims of pollution and to abate pollution-related harms. As one possible trigger in this case, the effects of climate change on the hydrological cycle and sea-level are also expected to result in contamination of freshwater supplies through salt-water intrusion.

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[162] National Oceanic & Atmospheric Admin., *Hazmat Challenges from Hurricanes Bring Strong NOAA Response* (Oct. 6, 2005), *available at* http://www.noaanews.noaa.gov/stories2005/s2517.htm.

[163] Turner v. Murphy Oil USA, Inc., 472 F.Supp.2d 830, 846 (E.D. La. 2007).

[164] Class Action Complaint, Turner v. Murphy Oil USA, Inc., No. 05-2406, 2005 WL 5249245 (E.D. La. Sept. 9, 2005).

[165] *See* Turner v. Murphy Oil USA, *supra* note 163, at 837.

[166] *Id.* at 838.

[167] *Id.* at 838–39.

[168] RESTATEMENT (SECOND) OF TORTS: PUBLIC NUISANCE § 821B (1979). *See also* Mank, *supra* note 104, at 213–14 (giving a good, short summary of public nuisance law's application to climate change).

Nuisance law is gaining favor with public agencies as a means of allocating responsibility to private actors that have caused significant harm to the public. In a case pursued by the Rhode Island Attorney General's Office, a court recently held paint manufacturers liable in nuisance for current impacts from long-past activities involving sale and distribution of lead-based paint, requiring the companies to abate lead-based paint at a predicted potential cost of over $1 billion.[169] The court rejected the defendants' contentions that the impracticality of abatement, the contributions of other parties to the nuisance, and other factors should have barred recovery.[170]

Because the majority of climate change's impacts affect inherently public rights involving health, safety, and use of property, the public nuisance legal theory may be well-suited to address climate change.[171] Potential claims for damage could include sea-level rise and permafrost-melt. A nuisance plaintiff can seek injunctive relief, such as a change in business practices, or damages to compensate victims for harms or for the costs incurred to adapt to changed conditions.[172] Moreover, states will incur significant planning and adaptation costs as a result of the changing climate and may seek damages.[173]

Diminished property tax revenues and lower property values can also harm governmental entities such as states and municipalities. So, for example, in the aftermath of Hurricane Katrina, governments lost revenue from a decline in property taxes, taxes on interrupted business activity, on sales of petroleum products from disrupted refineries, and other sources.

States as plaintiffs have very significant time horizons and represent large geographic areas in which damages could occur. The aggregation of harms over increased time and spatial scales facilitates ruling out confounding factors that would negate injury claims, since

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[169] Eric Tucker, *R.I. Judge Orders Cleanup by Former Lead Paint Manufacturers*, INS.J., Feb.28, 2007, *available at* http://www.insurancejournal.com/news/east/2007/02/28/77269.htm?print=1; R.I. *ex rel.* Lynch, v. Lead Indus.Ass'n, Inc., C.A. No. PC 99-5226 (R.I. Super. Ct. 2007).

[170] R.I. *ex rel.* Lynch, *supra* note 169, at 172–80.

[171] Grossman, *supra* note 101, at 52.

[172] *Compare* Complaint in *Conn. v. Am. Elec. Power Co.*, 406 F. Supp. 2d 265 (S.D.N.Y. 2005) (No. 04 Civ. 5669(LAP)) (seeking injunctive relief including changes in business practices) *with* Complaint in *Cal. ex rel. Lockyer v. Gen. Motors Corp.,* No. C06-05755-MJJ (N.D. Cal., Sept, 20, 2006) (seeking damages).

[173] *See* Complaint in *Cal. ex rel. Lockyer v. Gen. Motors Corp.*, at 1–3, 9–14 (describing alleged costs of adaptation and related damages to California from climate change), *available at* http://ag.ca.gov/newsalerts/cms06/06-082_0a.pdf.

more climate change-related harm data points increase the level of confidence that normal climatic variations and cycles have not caused the injury. Thus, state plaintiffs may be better situated to establish current harm from climate change based on a broader geographic and temporal range of causal incidents.[174]

States have filed two significant climate change-related public nuisance lawsuits to date. In the first, *Connecticut v. American Electric Power Co.*,[175] the plaintiffs, several states, and environmental groups, alleged that coal-fired power plants' operations, including 174 plants that in total emit 650 million tons of carbon dioxide per year, or ten percent of total U.S. CO_2 emissions, constituted a public nuisance.[176] The plaintiffs further alleged that these companies failed to utilize "practical, feasible and economically viable options" to reduce carbon dioxide emissions.[177] Rather than seek monetary compensation, the states sought mandatory injunctions requiring emission cuts of a specified percentage each year for at least the next decade. Though this case was dismissed by the trial court as nonjusticiable under the political question doctrine,[178] it is being appealed by the plaintiffs.[179] The second lawsuit was brought in 2006 by the State of California against six major automobile manufacturers (Ford, GM, Toyota, Chrysler, Honda North America, and Nissan). The suit argues that vehicle emissions have contributed significantly to climate change and harmed California's resources, infrastructure and environmental health.[180] The lawsuit seeks damages for the State's costs to study, plan, and adapt to the changing climatic conditions.[181]

Private nuisance lawsuits are another potential risk to insurers. A private nuisance suit could be filed against large emitters of greenhouse gases by an individual injured by the physical impacts of climate change. A 2004 study estimated that over half of the risk of

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[174] Grossman, *supra* note 101, at 59.

[175] *Conn. v. Am. Elec. Power Co.*, 406 F.Supp.2d at 268.

[176] *Id.* at 267–69; *see also* JUSTIN R. PIDOT, GEORGETOWN ENVIRONMENTAL LAW & POLICY INSTITUTE, GEORGETOWN ENVIRONMENTAL LAW CENTER, GLOBAL WARMING IN THE COURTS: AN OVERVIEW OF CURRENT LITIGATION AND COMMON LEGAL ISSUES, 15–16 (2006), *available at* http://www.law.georgetown.edu/gelpi/current_research/documents/GWL_Report.pdf (discussing *Conn. v. Am. Elec. Power Co.*).

[177] Complaint at 2, Conn. v. Am. Elec. Power Co., 406 F. Supp. 2d 265 (S.D.N.Y. 2005) (No. 04 Civ. 5669(LAP)).

[178] *Conn. v. Am. Elec. Power Co.*, 406 F.Supp.2d at 270–74. .

[179] Watchman & Rock, *supra* note 19, at 11.

[180] Complaint in *People ex rel. Lockyer v. Gen. Motors Corp.*, No. C06-05755-MJJ (N.D. Cal., filed Sept. 20, 2006)

[181] *Id.* at 1–3, 9–14.

the European heat wave of 2003 was due to anthropogenic influences.[182] If further research determines similar risk estimations of natural catastrophes with higher confidence levels,[183] plaintiffs will be more likely to succeed with claims for private nuisance based on personal harms due to climate change impacts. Damage could result in private nuisance litigation by property owners in low-lying coastal areas[184] as well as litigation against insurers. Presently, insurers are caught in the middle of trying to prove wind or flood damage in the wake of coastal storms. The maximum coverage limit for flood policies is $250,000. [185] Hence, policyholders with expensive coastal homes, likely worth more than the maximum flood coverage, would much rather their property loss be determined from wind than flood. The middle ground between policyholders and insurers in the flood versus wind debate has been described by insurers as a "haven for attorneys."[186]

In general, harms from environmental contamination and associated insurance exposure will increase as a result of climate change's impacts. Contamination is routinely associated with extreme weather events.[187] Examples include spills of chemicals, sewage, and agricultural/livestock wastes.[188] The effects of climate change on the hydrological cycle and sea-level are also expected to result in contamination of freshwater supplies through salt-water intrusion.[189] Contamination could give rise to claims in negligence, nuisance, trespass, groundwater contamination, and other common law tort causes of action.

Statutory liability for environmental contamination risks also will increase as climate change's impacts become manifest. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA),[190] the Clean Water Act,[191] the citizens' suit

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[182] Peter A. Stott, D.A. Stone & M.R. Allen, *Human Contribution to the European Heatwave of 2003*, 432 NATURE 610, 612 (2004).

[183] Myles R. Allen & Richard Lord, *The blame game – Who will pay for the damaging consequences of climate change?*, 432 NATURE 551, 551 (2004).

[184] PIDOT, *supra* note 176, at 4.

[185] Cornejo, *supra* note 32, at 26.

[186] *Id.*

[187] Cruz, Steinberg & Luna, *supra* note 161, at 204.

[188] *Id.*

[189] CAL. DEP'T. OF WATER RES., PROGRESS ON INCORPORATING CLIMATE CHANGE INTO MANAGEMENT OF CALIFORNIA'S WATER RESOURCES IV (2006), *available at* http://baydeltaoffice.water.ca.gov/climatechange/cfm.

[190] Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. §§ 9601–75.

provision of the Resource Conservation and Recovery Act (RCRA),[192] and other federal statutes may create liability for contamination of soil, groundwater, and water bodies, and in the case of CERCLA, for damages to natural resources such as wildlife as well.[193] Liability risk under various statutes includes potential litigation by governmental agencies as well as private parties. State statutes also add liability risks.[194]

Overall, insurers' exposure under environmental liability insurance will likely rise significantly as climate change impacts exacerbate existing contamination and result in new releases.

3. *Professional liability.*

Professional Liability insurance covers a broad range of errors and omissions or other conduct of business entities and their officers and directors. Perhaps the most important form of professional liability coverage in the context of climate change is that of corporate directors and officers, so-called "D&O" insurance. Professional Liability insurance, including Directors' and Officers' liability coverage (D&O), covers the actions of officers and directors of corporations and other business entities for their conduct.[195] Directors and officers' actions (or lack thereof) in managing climate change risks may depress shareholder value, and their disclosures about climate change risks are governed by specific federal laws that may subject them to personal liability.[196] Moreover, ignoring climate change or, worse, misrepresenting its risks can result in exposure to litigation risk that may be covered by professional liability insurance. As a result, climate change is likely to impact claims filed under this coverage.

Statutes and common law impose duties on directors and officers of entities, including publicly-held corporations and pension funds, to act in the best interests of shareholders who may suffer

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[191] Clean Water Act, 33 U.S.C. §§ 1251.

[192] Resource Conservation Recovery Act, 42 U.S.C.A. § 6972 (allowing a citizens' suit against a party "who has contributed or who is contributing to the past or present handling, storage, treatment, transportation, or disposal of any solid or hazardous waste which may present an imminent and substantial endangerment to health or the environment").

[193] 42 U.S.C. § 9607(a)(4)(C); 42 U.S.C. § 9611(b)(1).

[194] *See, e.g.*, Turner v. Murphy Oil USA, 472 F. Supp. 2d at 837 (certifying class action causes of action under Louisiana state statutes).

[195] *See* Smith & Morreale, *supra* note 84, 513–14.

[196] *Id.*; Smith & Morreale, *supra* note 62, at 458–68.

financial harm as a result of climate impacts.[197] One trigger of D&O liability would be a breach of the duty of care where a company director or board member has not considered climate change risk in making decisions. A pension fund fiduciary that failed to consider how global investments would be impacted by world climate change policies and regulatory regimes, or how the macroeconomic impacts of climate change could affect markets in which the fund has invested, would be vulnerable. Corporate board members would be similarly vulnerable. Even a lawsuit against a pension fiduciary responsible for its investment decisions alleging that the investments did not properly reflect the purposes of the pension fund (for example, if pension fund purpose implied environmental health and sustainability and investments were made in carbon-intensive operations) would be conceivable. Another trigger of D&O liability would be a situation in which shareholders have filed shareholder resolutions with their company to address climate change risk, and minimal or no concrete improvements were made by the company as the business lost value while ignoring or discounting climate change considerations.[198] Finally, misrepresentation of climate change impacts or risks could trigger D&O liability, as a breach of directors' duty of good faith.[199]

In addition to generating and considering important information, publicly-held corporations must publicly disclose information as well, as discussed above in Part II.B.2. A recent survey found that 53% of the largest 500 publicly held companies are doing a poor job of disclosing climate risks to investors, and are thus at risk of shareholder lawsuits.[200] Investors will rightfully ask whether lack of disclosure reflects lack of effort to mitigate climate-change risks. As a result, potential liability for breach of the duty of care will grow.

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[197] *See* Smith & Morreale, *supra* note 84, at 510–12. While the "business judgment rule" generally protects directors from liability for the results of any reasonably informed decision-making, failure to consider reasonably available, material information may be considered grossly negligent or even reckless and may open the door to liability. *Id.* at 498–502. *See also* Healy & Tapick, *supra* note 69, at 102–06 for a discussion of the business judgment rule's application to directors' behavior in the context of climate change.

[198] *See* Smith & Morreale, *supra* note 84, at 516–29 for a provocative discussion of the ways in which climate change-related risk may affect the responsibilities of officers and directors. The authors conclude that "a prudent board of directors cannot remain significantly ignorant of, should as best practice actively consider, and may soon be obliged to consider, five significant bodies of information," including emergent climate change science, the relevance of the science to their business, the position of stakeholders on climate change, management responses to climate change-related opportunities, risks, and shareholder initiatives, and the consequences of all this in the company's capital markets. *Id.* at 528.

[199] *Id.* at 504–05.

[200] Sally Roberts, *Companies Not Disclosing Climate Liabilities: Survey*, BUS. INS., Feb. 5, 2007, at 21.

Allegations of fraud and misrepresentation by corporate officials may factor into litigation about the impact of climate change, if there is evidence that officials may have covered up or ignored material information. D&O liability coverage will in some cases require insurers to defend and indemnify corporate officers against such claims, most likely based on breach of the duty of good faith.

Finally, while they need to be attentive to their customers' D&O liabilities, insurers themselves will also be directly vulnerable. As can be seen from Exhibit 7: Insurance sector responses to Carbon Disclosure Project Survey, 2006, insurers—particularly in the United States—have been reluctant to disclose their climate-related risks, as indicated by a 30% response rate to the Disclosure Project.

Overall, climate change's potential impact on professional liability coverage is significant. This insurance line is already rising in cost as insurers respond to increased exposure due to factors outside the climate change domain. D&O insurance has gone up by 300% to 500% since 1999 in the United States.[201] Insurance rates, where insurance can be written, have reportedly risen to $35,000 per year per million of coverage, especially in sectors designated as high risk, such as energy, telecommunications, pharmaceuticals, chemicals, and financial services. Central to D&O liability litigation will be disclosure of, or the failure to disclose, material information.[202]

4. *Products liability.*

The Products Liability insurance line defends and indemnifies policyholders against losses arising out of the manufacturing, selling, handling, or distributing of a product. This line of insurance will often be invoked to defend against products liability claims based on design or manufacturing defects, creation of abnormally dangerous products, and other product-related legal claims. Three kinds of product-related defects can result in tort liability: manufacturing defects, warning defects, and design defects.[203] While climate change-related product liability would be a novel legal theory, there is a possibility of a climate change plaintiff successfully suing utilities or automobile manufacturers with a design defect claim. It might be argued that the unnecessary production of large amounts of

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[201] CARBON DISCLOSURE PROJECT 2003, *supra* note 50, at 35.

[202] Walsh, *supra* note 106, at 23.

[203] Mank, *supra* note 104, at 214–15 (2006).

greenhouse gases was an avoidable power generation and automotive design "defect," which then led to plaintiff's harm from climate change.[204] An analogous argument might be brought against consumer products with low energy-efficiency where better design options were available and cost-effective. As part of federal appliance and equipment efficiency standards development, a wide array of such improvements have been identified across a range of products, and persuasive arguments have been laid out concerning the economic and environmental rationale for making improvements, and the beneficial consumer impacts of doing so.[205]

Because there is a significant argument that most or all such "defects" would not be attributable to a shoddy manufacturing, a design flaw, or lack of warning based on federal standards, such a legal theory would be at the cutting edge of existing doctrine, and thus it is unclear whether it could prevail. At a minimum, however, insurers are likely to have to spend resources defending such litigation under the products liability coverage.

5. *Political risk.*

Political-risk insurance is purchased by entities with overseas operations or other forms of cross-border exposure, either in the form of political or economic risk. Examples of the former include civil unrest, expropriation of assets, government frustration of contracts, or regulatory changes (and associated compliance costs). Examples of the latter include exchange-rate risk or inability to repatriate currency.

There are several ways in which political-risk insurance policies may experience claims as a result of climate change. Political risk insurance is broad, and could cover issues ranging from costs imposed as a result from regulatory changes or expropriation of assets or investments made in projects aimed at reducing greenhouse gas emissions.

The Kyoto Protocol was established with the goal that participating countries would commit to reducing their greenhouse

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[204] Grossman, *supra* note 101, at 39–46

[205] U.S. Department of Energy, Appliances and Commercial Equipment Standards, http://www.eere.energy.gov/buildings/appliance_standards/ (last visited Apr. 10, 2007).

gas emissions to below 1990 levels.[206] Adopted in 1997, and effective in 2005, the Protocol sets legally binding limits for greenhouse gas emissions of the industrial nation signatories. The United States and Australia alone, from some thirty-five industrialized countries, have not ratified the Protocol. Marsh warned in its Risk Alert report, *Climate Change: Business Risks and Solutions*, that if U.S. companies have operations in countries that have ratified the Kyoto Protocol, they will be affected by it.[207] Additionally, the Carbon Disclosure Project warned that under GATT rules, which entitle refusal of imports of goods on public policy grounds, the European Union may have a strong case to restrict U.S. imports or to impose a carbon levy.[208]

6. *Personal and commercial vehicle liability.*

Vehicle Liability insurance indemnifies drivers for damages or injuries to others as a result of vehicle accidents. As of 2004, the average U.S. personal auto insurance premium was 60% liability, with the balance associated with physical damage. The liability portion of losses for personal auto incurred in the year 2005 totaled $60 billion (with an additional $12 billion for commercial vehicles). Liability losses were 61% of the total for personal auto and 76% for commercial vehicles.[209]

While not necessarily entailing legal consequences, losses involving this form of liability insurance have a significant weather-related component. Extreme weather (temperatures, moisture, ice, and fog) are correlated with increases in roadway accidents. The National Research Council estimates that 1.5 million roadway accidents involving 800,000 injuries and 7,000 fatalities (15% of the total) in the U.S. each year are attributable to adverse weather. Climate change can be expected to cause these totals to rise, as the number and severity of accidents for which insurers will have to defend and pay liability claims will raise as drivers are unable to adapt effectively and immediately to the changing weather conditions.

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[206] United Nations Framework Convention on Climate Change, June 12, 1992, 1771 U.N.T.S. 107, *available at* http://unfccc.int/essential_background/kyoto_protocol/status_of_ratification/items/2613.php.

[207] Walsh, *supra* note 106, at 7.

[208] CARBON DISCLOSURE PROJECT 2003, *supra* note 50, at 17.

[209] Insurance Information Institute, Facts and Statistics: Auto Insurance, http://www.iii.org/media/facts/statsbyissue/auto/ (last visited Feb. 22, 2007).

The legal issues associated with vehicle liability coverage differ significantly from those associated with the other coverages discussed above, in that the risks will not be tied to particular businesses' practices. No change in business practices or in coverage will reduce this liability. Rather, insurers will be able to minimize these risks only through a combination of working to reduce climate change so that extreme weather will be less of a factor, and educating drivers more effectively about the increased hazards they face.

C. *Potential Sectors Vulnerable to Legal Risks and Impacts Associated with Climate Change*

Although climate change will affect all sectors of the global economy, associated legal liability risks will not affect all industries equally. The sectors most vulnerable to climate change-related legal risks include: those industries that emit the most carbon dioxide in energy production; the automobile industry, since it creates products that uniquely contribute to carbon dioxide emissions; and industries whose practices are particularly vulnerable to climate change's impacts in ways that may result in harm to third parties.

Over the past twenty years, approximately three-quarters of anthropogenic emissions of CO_2 have been from fossil fuel burning.[210] Some of the most significant contributors of CO_2 emissions are the utilities, oil, and automobile industries in the United States. Globally, eighty percent of greenhouse gas emissions are from the electric utilities sector—both international and North American—the metals, mining and steel industries, and the integrated oil and gas sector.[211] Courts may apportion the liability of fossil fuel companies, electric utilities and automobile manufacturers according to their products' carbon content or market share.[212] Most of the balance of emissions arises from deforestation, some of which is conducted by large commercial interests.

Globally, the electric utility sector emits approximately 40% of greenhouse gases.[213] The electric power industry was responsible for 41% of total U.S. energy-related CO_2 emissions in 2000, over 80% of which were from coal. Electric utilities rely on coal for over half of

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[210] IPCC 2007, *Summary for Policymakers*, *supra* note 5.

[211] CARBON DISCLOSURE PROJECT 2006, *supra* note 45, at 6.

[212] Grossman, *supra* note 101, at 32–33.

[213] CARBON DISCLOSURE PROJECT 2006, *supra* note 45, at 26.

their energy requirements. Generation of electricity results in 29% of total U.S. greenhouse gas emissions, more than any other activity.[214] Electric utility companies opting to install conventional coal-fired power plants—which create more CO_2 emissions per unit of electricity produced—instead of other less carbon-intensive technologies, could be found in future litigation to be acting irresponsibly.[215] Industry sectors in which climate change shareholder resolutions are being filed may be defendants in climate change lawsuits. During the 2006 proxy season, climate change-related resolutions were filed with companies in the electric power, oil and gas, building, and retail sectors.[216]

It would be prudent for greenhouse gas-emitting companies and their insurers to be concerned about climate change. Efforts to connect the issue of mandatory emissions controls to an explicit relief of liability, similar to that sought in the case of the tobacco industry,[217] have been predominantly limited to the insurance sector. [218] The liability issue has been discreetly acknowledged on Capitol Hill as a possible means with which to augment support for federal regulation of greenhouse gas emissions. Proponents of greenhouse gas regulation have reportedly considered a potential barter of providing industry liability protection from climate change lawsuits in order to gain backing for mandatory emissions limits. It is possible that federal approval of mandatory emissions curbs could preempt legal claims under federal common law for climate change damages. However, it would still be possible for nuisance claims to be filed under state laws. And though federal controls under a carbon regulatory regime could subdue the political pressure driving lawsuits, potential legal exposure for companies would remain.[219]

The question of liability for past emissions is legitimate due to the long lifespan of greenhouse gases, and the fact that past emissions are current contributors to climate change.[220] In order to avoid the inequity of damages assigned to companies for past emissions to which they had no connection, courts may require apportionment of

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[214] Grossman, *supra* note 101, at 29.

[215] Obey, *supra* note 31, at 3.

[216] Press Release, Ceres, 2006 Proxy Season Produces Positive Results on Climate Change (July 14, 2006) *available at* http://www.ceres.org/news/news_item.php?nid=209

[217] *See* Michael Givel & Stanton A. Glantz, *The 'Global Settlement' With The Tobacco Industry: 6 Years Later*, 94 AMER. J. OF PUB. HEALTH 218 (2004) (outlining tobacco industry settlement).

[218] Obey, *supra* note 31, at 4.

[219] *Id.* at 2.

[220] IPCC 2007, *Summary for Policymakers*, *supra* note 5, at 12–15.

liability.[221] Because carbon dioxide is a well-mixed greenhouse gas, a different approach to apportionment is needed to ensure an equitable distribution of the burdens associated with climate liability. It has been suggested that "an equitable settlement would apportion liability according to emissions with some discounting over time to allow for the lifetimes of carbon dioxide anomalies in the atmosphere."[222] In order to correspond with each defendant's contribution to global climate change, apportionment could include a damage allocation based upon the defendants' market share and the greenhouse gas emissions associated with their products that is properly reduced to account for past emissions.[223]

All business sectors (include those responsible for greenhouse gas emissions) will be vulnerable to climate change impacts of higher electricity prices, higher transportation prices, and higher water prices. A limited list of examples of industry-specific risk from climate change impacts follows (and additional examples can be found in Exhibit 1).

Agriculture/Livestock/Food/Fisheries

- Disruption to crop irrigation; increase in operational costs (materials, fuel) and food prices in U.S.;[224] threatening food supply in some parts of the world;[225]
- Wine industry in California, Oregon and Washington are particularly at risk to temperature and precipitation.[226] California wine industry represents a $45 billion economic contribution to the state;[227]
- Crop pests and diseases pose a major economic threat;[228] and

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[221] Grossman, *supra* note 101, at 32.

[222] Allen, *supra* note 36, at 892.

[223] Grossman, *supra* note 101, at 32–33.

[224] A.V. Krebs, *California Wine Industry Threatened by Global Warming*, AGRIBUSINESS (2004).

[225] Gabriel Metcalf, *The Ecological Footprint of Energy*, SPUR NEWSLETTER, Aug. 2003, at 6, available at http://www.spur.org/documents/030801_article_03.shtm.

[226] Gregory V. Jones et al., *Climate Change and Global Wine Quality*, 73 CLIMATIC CHANGE 319 (2005); Gregory V. Jones, *Climate Change in the Western United States Grape Growing Regions*, 689 ACTA HORTICULTURAE 41 (2005) (discussing the impact of climate change on grape cultivation in Washington, Oregon, and California); M.A. White et al., *Extreme Heat Reduces and Shifts United States Premium Wine Production in the 21st Century*. 103 PROC. OF THE NAT'L ACAD. OF SCI.11217 (2006) (discussing how climate change modeling indicates eighty-one percent of productive wine-growing regions in the United States will be unsuited to that purpose by the end of the twenty-first century).

[227] White et al., *supra* note 226, at 11217.

[228] Epstein & Mills, *supra* note 9, 28–29, 36.

– Fisheries[229]

Energy Production, Refining, and Distribution

– Multiple factors (see Part III.A.2 and elsewhere in this Article) ranging from effects of drought on hydroelectric production, to extreme weather damages to infrastructure, to reduce electric grid reliability during temperature extremes

Real Estate

– Through a wide range of property damages due to extreme weather events and sea-level rise described in Section III.A.1[230]

Healthcare

– See Part III.A.3

Semi-conductors

– U.S. semiconductor industry may be at risk from potential disruptions to crucial components from Taiwan, where weather-induced water shortages are jeopardizing chip manufacture[231]

Forest Products

– Vulnerability to increased wildfire frequency and severity[232]
– Water quality can also degrade due to increased sediment runoff, thereby reducing yields and economic output[233]
– Vulnerable to super-infestations of beetles[234]

Tourism/Ski Resorts

– Snowcap reservoirs, decrease by 90%—precipitation will fall as rain, not snow[235]
– Destruction of coral reefs will adversely impact tourism in many parts of the world[236]

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[229] Wil Burns, remarks at the Stanford Law School Spring 2007 Symposium: Climate Change Liability and the Allocation of Risk (Feb. 24, 2007), notes available at http://sjil.stanford.edu/Schedule_files/WilBurns.doc.

[230] Vellinga, et al., *supra* note 3 (outlining physical climate change impacts and their subsequent impacts on the insurance industry).

[231] CARBON DISCLOSURE PROJECT 2003, *supra* note 50 (outlining industries at risk from climate change impacts).

[232] Jeremy S. Fried, Margaret S. Torn & Evan Mills, *The Impact of Climate Change on Wildfire Severity: A Regional Forecast for Northern California*, 64 CLIMATIC CHANGE 169–91 (2004); Margaret S. Torn & Jeremy S. Fried, *Predicting the impact of climate change on wildfire*, 21 CLIMATIC CHANGE 257–74 (2004).

[233] Joel B. Smith, Richard Richels & Barbara Miller, *Potential Consequences of Climate Variability and Change for the Western United States*, *in* CLIMATE CHANGE IMPACTS ON THE UNITED STATES: THE POTENTIAL CONSEQUENCES OF CLIMATE VARIABILITY AND CHANGE 220–40 (2001), *available at* http://www.gcrio.org/NationalAssessment/8WE.pdf.

[234] Epstein & Mills, *supra* note 9, at 65–69.

[235] Whittaker, *supra* note 83 (outlining climate change investment risks).

Water

– Intrusion of salt water into drinking supplies is expected to accompany sea-level rise and storm surges. [237]

Insurance and Reinsurance

– World's largest industry with $3.5 trillion per year in revenue, is expected to see rising payouts for weather-related losses in the property, liability, life, and health market segments[238]
– Claims against insurers themselves could arise in response to impacts on availability and affordability

The Emerging Carbon Management Industry

– Ironically, biological projects developed to offset carbon are themselves vulnerable to climate change. Climate change impacts on agriculture and forests cited above can mean remobilization of carbon and consequent loss of the economic value of associated carbon-trading or offset contracts. The carbon-trading market has already reached a volume of $30 billion per year.

Irrespective of whether climate change lawsuits are successful and greenhouse gas-emitting companies are held liable for their emissions, significant litigation costs will likely be incurred by defendants in sectors that emit significant greenhouse gases or that are particularly vulnerable to climate change's impacts.[239]

IV. LIABILITY CHARACTERISTICS OF POTENTIAL RESPONSES TO CLIMATE-CHANGE

Responses to climate change, be they in the realm of adaptation (decreasing vulnerability) or mitigation (decreasing emissions), may also entail liabilities for insurers and their customers, although others will serve to reduce liabilities.[240]

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[236] Epstein & Mills, eds., *supra* note 9, at 77–79.

[237] CAL. DEPT. WATER RES., *supra* note 189, at 339.

[238] Vellinga, et al., *supra* note 3 (outlining climate change impacts on the insurance industry).

[239] Legal Services Industry, *supra* note 43, and text accompanying the note.

[240] Elements in this section are adapted from Evan Mills, *Synergisms Between Climate Change Mitigation and Adaptation: An Insurance Perspective*, *in* MITIGATION AND ADAPTATION STRATEGIES FOR GLOBAL CHANGE: SPECIAL ISSUE ON CHALLENGES IN INTEGRATION MITIGATION AND ADAPTATION RESPONSES TO CLIMATE CHANGE (forthcoming Aug. 2007).

On the one hand, plaintiffs can seek as damages the costs associated with adaptation to climate change's impacts.[241] On the other hand, as was learned in the wake of Hurricane Katrina (and in many prior disasters), adaptation strategies such as levees and water-pumping systems may themselves create new risks or induce risk taking. This represents what might be called a "maladaptation" problem insofar as these strategies can provide a false sense of security and thus encourage complacency. When adaptation strategies are implemented by governments, insurance-related liability considerations will often be negligible, but when private entities are involved they must be aware of the consequences in the event that their systems fail. In fact, local government officials often carry liability insurance to protect against claims stemming from their decisions. Public entities also often purchase commercial reinsurance layers, thereby transferring some of this risk to the private sector.

Maladaptation can also come into play when water supplies are extended, or crop types changed, in an effort to preempt the impacts of a changing climate. Such strategies may suffice for mild or near-term climate changes, but they can prove disastrous under more extreme climate change owing to the exposure and investment induced by an insufficiently robust solution.

Some responses will also have unintended downsides that may exacerbate climate change. For example, there is increasing interest in water desalination plants in an effort to cope with dwindling fresh water supplies and saltwater intrusion into aquifers caused by sea-level rise. These systems, however, are energy intensive, thus contributing to further greenhouse gas emissions and increasing vulnerability to coastal hazards or weather-related disruptions in the electric power grid.

Emerging technologies brought onto the market prior to being time-tested could prove more harmful than helpful. In the energy arena, liability considerations for existing and new energy technologies vary, both on the supply- and demand-side of the equation. Liability risks associated with market-based carbon reduction strategies such as trading or offset schemes are uncertain and likely highly variable.

Supply-side energy choices that may be made to reduce the carbon-intensity of energy services have their own distinctive liability characteristics. For example, switching to lower-carbon electricity

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[241] Farber, *supra* note 28; Complaint at 1–3, 9–14, California *ex. rel.* Lockyer v. Gen. Motors Corp.No. C06-05755-MJJ (N.D. Cal. filed September 20, 2006).

generation technology based on thermal power plant technology (e.g., by substituting natural gas for coal) results in systems that are still heavily dependent on water resources for cooling. The Electric Power Research Institute has documented considerable risks to traditionally cooled power generation systems as a result of climate change-induced droughts.[242] Similarly, "zero-emissions" hydroelectric generating systems are also sensitive to rainfall patterns.

The services provided by centralized energy systems are particularly vulnerable to disruptions because a single disruption to a power plant or refinery could affect a very large population of end users and because damage on the transmission or distribution side can isolate an otherwise functioning central facility from end users. The European winter storms of 1999 caused 2.5 billion of equipment damages to the French electric utility.[243] Soil subsidence caused by the melting of permafrost, a less dramatic but equally worrisome phenomenon, is a risk to gas and oil pipelines, rail lines carrying fuels, electrical transmission towers, nuclear power plants, and natural gas processing plants throughout the Arctic.[244] Ice storms can cause electrical system disruption, as occurred in the northeastern United States in 1998, an El Niño year.[245] This event was also the most costly in the history of the Canadian insurance sector, primarily as a result of electric power disruptions.[246] Reduced water availability in certain regions, a likely effect of climate change, could hamper hydroelectric as well as thermal power generation, as occurred in Brazil in 2001–2002 when the driest summer in seventy years and prolonged drought threw the country's hydroelectric power sector into acute shortage conditions.[247] Drought in Ghana in 1982 led to reduced hydroelectric output, which, in turn resulted in the shutdown of an aluminum smelter. Economic costs were estimated at $557 million, a significant sum for such a poor country. [248] Elevated temperatures also reduce the efficiency of power transmission, due to

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[242] Denis Albrecht, Electric Power Research Institute, Presentation: Climate Impact on Water Availability for Electricity Generation (April 11, 2006) (presentation slides associated with the Electric Power Research Institute).

[243] MUNICH REINS. GROUP, *supra* note 127, at 13.

[244] Frederick E. Nelson, Oleg A. Anisimov & Nikolay I. Shiklomanov, *Subsidence Risk from Thawing Permafrost*, 410 NATURE 889 (2001).

[245] Eugene L. Lecomte with Anna W. Pang & James W. Russell, *Ice Storm '98*, 1–2 (Institute for Catastrophic Loss Reduction Research Paper Series – No. 1, 1998) *available at* http://www.iclr.org/pdf/icestorm98_english.pdf.

[246] MUNICH REINS. GROUP, *supra* note 127, at 5.

[247] *Id.* at 14.

[248] *Id.* at 31.

increased "I^2R" losses, resulting in lost revenues to utilities. Elevated water temperatures reduce the efficiency of power plants, and the discharge of cooling water can lead to unacceptable environmental impacts and trigger plant closures.[249]

There have been calls for a resurgence of nuclear power as part of a strategy for addressing climate change.[250] While it is conceivable that nuclear power could serve as one of many "wedges"[251] in a comprehensive strategy for reconstructing the energy sector, the question of liability remains unresolved (as do the underlying technical issues such as safety and weapons proliferation). The private sector has historically found nuclear power to be largely uninsurable, forcing the government to step in as liability insurer of last resort under the Price Anderson Act, which limits nuclear plant owners' liability.[252] There is no indication that a resurgence of nuclear power development would change this situation. Meanwhile, nuclear generating facilities are highly water dependent, as demonstrated by the shutdown of reactors across in eight European countries during the great heat wave of 2003.[253] In France alone, an entire "reactor year" of capacity was lost due to excessive heating of cooling water in local rivers, rendering the plants unable to operate.[254]

There has also been a recent wave of interest in capturing carbon dioxide at the point of production and storing it, hopefully safely and permanently, via injection into the earth or seabed. The risks are many, as illustrated in Exhibit 8: Risks of geologic storage of carbon dioxide,[255] but the liabilities of this largely untested

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[249] United Nations Environment Programme, *Impacts of Summer 2003 Heat Wave in Europe*, 2 ENV'T ALERT BULL. 3 (2004), *available at* http://www.grid.unep.ch/product/publication/download/ew_heat_wave.en.pdf.

[250] *See* Press Release, Department of Energy, Department of Energy Releases Global Nuclear Energy Partnership Strategic Plan (Jan. 10, 2007), *available at* http://www.gnep.energy.gov/gnepPRs/ gnepPR011007.html.

[251] Steven Pacala & Robert Socolow, *Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies*, 305 SCIENCE 968, 969 (2004).

[252] Atomic Energy Act of 1954, 42 U.S.C. §§ 2011•23 (2006), *as amended by* Price-Anderson Act, 42 U.S.C. § 2210 (2006). For more information, see U.S. GOV'T ACCOUNTABILITY OFFICE, NUCLEAR REGULATION: NRC'S LIABILITY INSURANCE REQUIREMENTS FOR NUCLEAR POWER PLANTS OWNED BY LIMITED LIABILITY COMPANIES (2004), *available at* http://www.gao.gov/new.items/d04654.pdf.

[253] MUNICH REINS. GROUP, TOPICSGEO: ANNUAL REVIEW: NATURAL CATASTROPHES 2003, 23 (2004), *available at* http://www.munichre.com/publications/302-03971_en.pdf?rdm=6512.

[254] Amelia Gentleman, *France Faces Nuclear Power Crises*, GUARDIAN, Aug. 13, 2003, *available at* http://www.guardian.co.uk/international/story/0,3604,1017262,00.html.

[255] *See* Exhibit 8: Risks of Geologic Storage of Carbon Dioxide (CO_2).

sequestration technology remain essentially unquantified.[256] There is evidence that leakage, for example, can pose a serious threat to public health and the environment: for example, a natural carbon dioxide leak at Lake Nyos in Cameroon in 1986 killed at least 1,700 people and 3,000 cows.[257] Politicians have already taken steps to shield providers of these services from liability, raising serious public policy concerns.[258] Sequestration could pose potential risks particularly in the developing world, where it will be most needed due to the relatively high growth in coal-based power generation, and may generate significant liabilities, including hazards to public health, if quality control is relaxed during construction or operation of these complex facilities.

Hydrogen energy systems also have unknown liabilities. Over twenty-two percent of hydrogen accidents associated in industrial settings have been caused by undetected leaks. These accidents occurred in spite of occupational safety and health measures in place, including standard operating procedures, special training, personal protective equipment, and provision of electronic flame and gas detectors to a limited number of hydrogen workers.[259]

The liability insurance lines that may be affected by new technologies include those discussed above in Section III.B. In particular, new technologies are likely to spawn claims either in negligence, or in strict liability for product defects, depending on the type of technology.

While arguably not as "brittle" as centralized thermal power systems, even renewable energy systems can have their own vulnerabilities. Windstorm is a hazard for most renewable systems (whether centralized or distributed), particularly wind-power systems, which are intentionally placed in the greatest wind corridors.[260] Conversely, wind resources could shift geographically, thereby stranding prior investments. Hydroelectric power systems are clearly dependent on precipitation, runoff conditions, and limited siltation

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[256] Elizabeth J. Wilson & Mark A. de Figueiredo, *Geologic Carbon Dioxide Sequestration: An Analysis of Subsurface Property Law*, 36 ENVTL. L. REP. 10114 (2006); Elizabeth J. Wilson, Timothy L. Johnson, & David W. Keith, *Regulating the Ultimate Sink: Managing the Risks of Geologic CO2 Storage*, 37 ENVTL. SCI. & TECH. 3476 (2004).

[257] George W. Kling et al., *The 1986 Lake Nyos Gas Disaster in Cameroon, West Africa*. 236 SCIENCE 169 (1987).

[258] Obey, *supra* note 31.

[259] Russell Moy, Letter to the Editor, *Liability and the Hydrogen Economy*, 301 SCIENCE 47 (2003).

[260] UNITED KINGDOM CLIMATE IMPACTS PROGRAM, BUILDING KNOWLEDGE FOR A CHANGING CLIMATE: THE IMPACTS OF CLIMATE CHANGE ON THE BUILT ENVIRONMENT (2003).

rates, and may thus be impacted by changing climatic conditions, such as flooding. Biomass-based systems are vulnerable to loss or interruptions of fuel supply due to drought, wildfire, flooding, infestations or disease, and other hazards impacting fuel distribution or growing areas. Nonetheless, while these new technologies will pose risks to the insurance sector, the risks are less than those from continuing past practices.

From a risk and liability perspective, the most "inherently safe" strategy for reducing greenhouse gas emissions is to increase energy end-use efficiency, which almost universally serves to maintain or even reduce baseline levels of liability. For example, so-called "green building" strategies are widely documented to have a beneficial effect on indoor environmental conditions, thus reducing the likelihood of sick-building syndrome, absenteeism, or other events that could trigger liability insurance claims or business interruptions.[261] In rare cases, such strategies can inadvertently introduce new risks and liabilities, e.g., through creating moisture problems by inappropriately tightening buildings.[262] These problems can be almost universally avoided through proper design, engineering, and monitoring. For example, despite the conventional wisdom that automobile safety is correlated with weight, light cars exist that are as safe as or safer than much heavier SUVs.[263] Improved inflation of vehicle tires saves energy while enhancing road safety. A remarkable assessment by the U.S. Government Accountability Office concluded that about 1% of U.S. automobile fuel use (1.2 billion gallons per year) could be saved simply by properly inflating tires. In 1999, under inflated tires contributed to 247, or 0.8%, of 32,061 fatalities and 23,100, or 0.8%, of almost 3 million injuries, plus 41 vehicular deaths each year.[264]

Carbon-trading schemes intended to underpin many of the supply- and demand-side investments in addressing climate change will also face performance- and contract-related liabilities.[265] These

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[261] Evan Mills, *The Insurance and Risk Management Industries: New Players in the Delivery of Energy-Efficient Products and Services*, 31 ENERGY POL'Y 1257 (2003).

[262] *See* EVAN MILLS & IVO KNOEPFEL, ENERGY-EFFICIENCY OPTIONS FOR INSURANCE LOSS–PREVENTION, at 9, 12 (1997), *available at* http://eetd.lbl.gov/emills/PUBS/no-regrets.html.

[263] MARC ROSS & TOM WENZEL, AN ANALYSIS OF TRAFFIC DEATHS BY VEHICLE TYPE AND MODEL, U.S. Dep't of Energy, LBNL Report No 49675 (2002), *available at* http://eande.lbl.gov/EA/teepa/pdf/LBNL-49675.pdf.

[264] *See* Letter from Katherine A. Siggerud, Director, Physical Infrastructure Issues, U.S. Government Accountability Office, *Underinflated Tires in the United States* (Feb. 9, 2007), *available at* http://www.gao.gov/new.items/d07246r.pdf.

[265] Exhibit 9: Carbon Offset and Trading Risks.

could stem from a range of potential liability triggers, including engineering risks as well as economic, regulatory, and political risks. Exhibit 9: Carbon offset and trading risks outlines the issues surrounding the carbon-based trading market.

Overall, responses to climate change, particularly in the energy sector, can be distinguished by their potential for either enhancing or reducing liability. Some appear not to be commercially insurable, given current uncertainties about their risk characteristics. This raises significant public policy questions, especially given the observed ineffectiveness of other government insurance schemes such as the National Flood Insurance Program.

V. ROLES FOR INSURERS, REINSURERS, AND OTHER INDUSTRY ACTORS IN PROACTIVELY MANAGING CLIMATE CHANGE LIABILITIES FOR THEMSELVES AND THEIR CUSTOMERS

Following are suggestions for roles that the insurance sector can take on to manage climate change liabilities in order to preemptively mitigate their exposure to climate change litigation. This is presumably the preferred scenario for all parties.

A. *Improved Analysis, Disclosure, and Reporting of Climate Change Related Risk*

Based on the information obtained in the Carbon Disclosure Project survey of 2,400 of the world's largest companies,[266] very few financial services companies have developed systematic, portfolio-wide information pertaining to both absolute and relative levels of company-specific risk. [267] From a fiduciary perspective, this is a significant concern. Poor or nonexistent disclosure of environmental liabilities has its own inherent risks: shareholder value will not only be limited once these liabilities are ultimately disclosed, with their true cost driving down corporate value, but trust will be undermined,

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[266] The Carbon Disclosure Project (CDP) provides a secretariat for the world's largest collaboration of institutional investors regarding the business implications of climate change. CDP represents an efficient process whereby many institutional investors collectively sign a single global request for disclosure of information on Greenhouse Gas Emissions. More than 1,000 large corporations report on their emissions through this web site. According to http://www.cdproject.net/, on February 1, 2007 this request was sent to over 2,400 companies.

[267] CARBON DISCLOSURE PROJECT 2003, *supra* note 50 (outlining poor assessment of climate change-related risk by the majority of financial companies that filed with the CDP).

thereby complicating future attraction of capital.[268]

In order for climate change-related risk management in the United States to reach the level of sophistication now present in Europe, insurers and investors could demand SEC enforcement of material environmental disclosure; encourage use of standardized reporting formats in order to provide shareholders with adequate information to spot problems early on as an initial step in illuminating corporate "climate beta"; capture growth of emerging environmentally-beneficial technologies; and, create an environmental watch list of companies whose value would be enhanced by improved environmental performance. Additionally, the SEC could reduce companies' confusion about how to estimate environmental liability by adopting guidelines for estimating and reporting environmental risk developed the American Society for Testing and Materials (ASTM). These currently voluntary guidelines describe specific methodology for the reporting of environmental risks and liabilities of the climate change problem. Furthermore, the adoption of ASTM guidelines would close one of the biggest environmental disclosure loopholes: the piecemeal accounting of environmental liabilities.[269]

Businesses adopting a single, strict, global environmental standard have been found to have much higher market values than those that default to less stringent or poorly enforced host-country standards.[270] For passively managed portfolios (e.g., indexes), voting proxies in support of shareholder resolutions calling for increased environmental disclosure is a cost-effective mechanism to encourage companies to improve their environmental performance. For actively managed portfolios, in addition to the basic exercise of proxy voting and insistence upon uniform, transparent material environmental disclosure, fiduciaries could encourage voluntary disclosure of environmental performance, tabulation of savings due to environmental initiatives (e.g., manufacturing processes, energy efficiency, and recycling), and adoption of Ceres Principles and Reporting Requirements. These policies benefit shareholders

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[268] ROSE REPORT, *supra* note 84 (examining fiduciary duty for investments that could be impacted by climate change risk).

[269] *Id.*

[270] Glen Dowell, Stuart Hart, & Bernard Yeung, *Do Corporate Global Environmental Standards Create or Destroy Market Value?*, 46 MGMT. SCI. 1059 (2000) (finding higher market value associated with companies that adopt a single strict global environmental standard while developing countries with less restrictive environmental regulation may attract poorer quality and less competitive companies).

because they require the articulation of environmental vision for the company, outline environmental programs to support that vision, and assess environmental performance on a yearly basis.[271]

In specifically addressing the liabilities associated with greenhouse gas emissions, corporate officers and directors could require executives to assess current and probable risk exposure, disclose company greenhouse gas emissions and climate risk exposure to shareholders, benchmark the company against industry peers, announce and implement a strategy to decrease emissions on a clear timetable, and link executive compensation to the company's performance on that strategy.[272] Companies that reduce carbon emissions could lower costs, become less vulnerable to energy supply fluctuations and energy price volatility, and enhance their ability to capitalize on competitive opportunities created by greenhouse gas regulation.[273]

Swiss Re provides an interesting case study in identifying risk factors relating to climate change. Late in 2002, Swiss Re acknowledged that climate change exposures were not among the many criteria it used to evaluate its exposures under corporate D&O policies. These exposures can include regulatory risks and the costs of compliance, non-disclosure of investment risks, and reputational risk. Swiss Re recognized that shareholder actions could precipitate D&O liability losses. To begin its process of assessing risks, Swiss Re reviews responses of potentially exposed companies to the Carbon Disclosure Project (CDP). For customers not responding to the CDP, or if Swiss Re concludes that there is insufficient disclosure on potential carbon risks, customers are requested to respond to a questionnaire covering the following:[274]

- Countries/jurisdictions of company operations;
- Accounting/reporting system in place for greenhouse gas emissions;

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[271] ROSE REPORT, *supra* note 84 (examining fiduciary duty for investments that could be impacted by climate change risk)

[272] CERES SUSTAINABLE GOVERNANCE PROJECT, *supra* note 48; MICHAEL TOTTEN, GETTING IT RIGHT: EMERGING MARKETS FOR STORING CARBON IN FORESTS (1999) (outlining carbon storage markets), *available at* http://pdf.wri.org/ftcarbonbro.pdf.

[273] Interview with Ivo Menzinger, Head of Sustainability & Emerging Market Risk, Swiss Reinurance, in Zurich, Switz. (Nov. 17, 2006); and Interview with Mark Way, Head of Sustainability Issues Management and Reporting, Swiss Reinsurance, in Zurich, Switz. (Jan. 8, 2007).

[274] *Id.*

- Gases which are accounted for in the greenhouse gas reporting system identified;
- Outline of company intentions to address potential liabilities from emissions reduction related regulation (e.g., the Kyoto Protocol or the European Union Emissions Trading scheme);
- If available, report of data: (1) Gross greenhouse gas (GHG) emissions; (2) GHGs/$ gross revenues; (3) GHGs/$ EBITDA; (4) GHGs/$ current assets; (5) GHGs/$ long-term debt; and (6) GHGs/$ outstanding market cap (Swiss Re 2006).

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

Corporate directors and officers could confront the liabilities associated with greenhouse gas emissions by assessing current climate change risk and probable risk exposure in conjunction with disclosing corporate emissions and climate risk exposure to shareholders. Corporations could benchmark company performance against industry peers and create and implement greenhouse gas emissions reduction strategies. If businesses take these steps, both insurers and the business community will reduce their exposure to climate change-related financial risk over time.

B. *Incorporation of Climate Considerations in Rating Risk*

Businesses benefit from reducing environmental liabilities and from working to reduce their overall environmental impacts. Corporate environmental practices have been positively linked with company share prices.[275] The creation of new mutual funds whose stock selection is oriented towards companies with lower climate risk and superior strategic positioning has demonstrated benefits in both marketing and financial performance.[276]

Businesses are finding that what is initially perceived as a cost of implementing energy-efficiency measures in order to reduce greenhouse gas emissions results in company profits through

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[275] WORLD RESOURCES INST., THE BUSINESS CASE FOR CORPORATE GREENHOUSE—GAS MANAGEMENT (2004) (examining business opportunities for GHG management programs).

[276] CERES SUSTAINABLE GOVERNANCE PROJECT, *supra* note 48, at 5.

decreased energy expenditures and increased worker productivity.[277] BP made a corporate commitment to maintain CO_2 emissions at 1990 levels through 2010, implying a 50 million ton reduction from projected 2010 emissions.[278] BP met its goal in 1998, which equated to a net savings of $650 million in the following two years.[279] As a result, new markets have opened up to BP, resulting in BP's ability to sell emissions credits in the British market at an auction price of $76 per ton.[280]

Development and application of a corporate "climate beta"—the climate risks of a particular company relative to its sector, or the market as a whole—may be one way for insurers to operationalize and recognize the relative climate risks of its customers. The "climate beta" metric will demonstrate the significant differences in future threats to shareholder value among same-sector companies. In order to anticipate the impacts on the valuations of debt and equity securities, these differentials need to become more transparent to the financial markets.[281] Studies have found that company risk, even within the same sector, can vary as much as sixty-fold.[282] It has been suggested that portfolios of carbon-intensive industries (e.g., electric utilities, transportation and heavy industrial sectors) are currently overvalued by the financial markets because the risk to the equity price of greenhouse gas-emitting companies is inadequately discounted when anticipated emission policy shifts that will create a carbon-constrained business environment are taken into account.[283] When evaluating energy programs, some companies have established a "shadow price" of $5 to $15 per ton of carbon in order to account for potential emissions, while others have established internal markets for carbon emissions reductions.[284]

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[277] *See* du Vair, *supra* note 31, at 14.

[278] Bennett & Wells, *supra* note 47, at 5.

[279] *Id.*

[280] *Id.*

[281] CARBON DISCLOSURE PROJECT 2003, *supra* note 50, at 1.

[282] CERES SUSTAINABLE GOVERNANCE PROJECT, *supra* note 48 (outlining climate change industry risks); WORLD RESOURCES INSTITUTE, *supra* note 275 (examining business opportunities for GHG management programs).

[283] TOTTEN, *supra* note 272, at 11.

[284] Bennett & Wells, *supra* note 47, at 6.

C. *Tightened Terms and Conditions*

Insurers may elect to redesign the terms and conditions of insurance contracts to address the increased risks associated with climate change, though such action is less proactive than the strategies discussed above. As noted earlier in this Article, insurance markets (and certainly specific companies) may have insufficient capital to cover continued increased losses from extreme weather events.

Other changes to insurance products could include increasing premiums for insurance lines that would be exposed to climate change events, as well as increasing deductibles, lower limits, and applying full exclusions for losses linked to climate change.

The crisis in insurance availability and affordability witnessed after Hurricane Andrew has highlighted the social and political undesirability of widespread contraction of insurance coverage.[285]

To help manage risks, insurers could, for example, stipulate the development and implementation of business-continuity management (BCM) procedures as a prerequisite for adding on business interruption coverage to a company's property insurance. The BCM plan could include:

- identification of the direct and indirect risks climate change poses to the company's operations and assets, as well as financial and reputation perception;
- updating corporate preparedness plans to be based on climate change risk (e.g., risk management controls, communication capabilities, critical suppliers and vendors, potential sales impacts, human resources policies and public image); and
- assessing supply chain risks.

A primary goal of BCM is to be one of the first to reestablish operations during the aftermath of a disaster.[286] Proper BCM procedures integrated throughout a company's business plan could not only minimize indemnity periods, thereby substantially reducing

[285] MILLS, ROTH & LECOMTE, *supra* note 8, at 2.
[286] Walsh, *supra* note 106, at 16–18.

climate change exposure to insurers, but also give significant financial and reputational competitive advantages.

D. *Introduction of Innovative Insurance Products and Services*

Climate change presents business opportunities for insurers to offer innovative products and services that maximize incentives for energy efficiency while minimizing risk.[287] For example, it is possible that a market could emerge for insurance coverage of climate change-related lawsuits related either to the direct costs of damage or the costs of adaptation to changed conditions. Companies that decline such coverage could pay a corresponding premium on their long-term capital cost.[288]

In order to manage liquidity problems following a series of large claims, as well as to diversify their capital, insurers are developing alternative risk transfer mechanisms such as catastrophe bonds.[289]

A vanguard of insurers and their trade allies have begun to take concrete actions that generate profits while maintaining insurability and protecting their customers from extreme weather-related losses, as well as reducing greenhouse gas emissions. Many of these strategies are already in practice in various nations, providing benefits and savings for insurers and their customers. (See Exhibit 10: Types of opportunities for insurers and selected examples for an illustrated compilation of 216 real-world examples, provided by 127 insurers, brokers, and insurance organizations from 16 countries.[290]) More than half the examples come from U.S. companies. In addition to offering new products and services, these insurers are leading by example with in-house energy management programs, investments in the clean-technology sector, and climate change risk disclosures. They are also participating in the process of enhancing scientific understanding of climate change's impacts, building public awareness, and participating in the public policy process. Insofar as these strategies are profitable for insurers, they represent "no-regrets"

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[287] *See* van Hoogstraten & Rubin, *supra* note 68, at 1.

[288] Allen, *supra* note 36, at 892.

[289] CLIMATE RISK MANAGEMENT LIMITED, *supra* note 16, at 9.

[290] Exhibit 10: Types of Opportunities for Insurers and Selected Examples. Update of EVAN MILLS & EUGÈNE LECOMTE, FROM RISK TO OPPORTUNITY: HOW INSURERS CAN PROACTIVELY AND PROFITABLY MANAGE CLIMATE CHANGE (Ceres, 2006) *available at* http://insurance.lbl.gov/Insurance-opportunities.html.

opportunities irrespective of their climate-related benefits. Examples include:[291]

- Insurer-initiated hurricane loss prevention methods employed at nearly 500 locations insured by FM Global avoided $500 million in property losses from Hurricane Katrina, after customer investments of only $2.5 million. These customers sustained eight-times less property damage than those choosing not to implement the recommendations.
- Premium credits are being offered by Fireman's Fund Insurance Company to owners of loss-resistant green-buildings, as are options for building design upgrades to the popular LEED (Leadership in Energy and Environmental Design) standards following a loss. Anticipated benefits range from enhanced energy efficiency to reduced indoor air pollution.[292]
- Pay-as-you-drive insurance products, which encourage drivers to lower the risk of being involved in an accident by reducing miles driven, are being promoted by GMAC and other insurers with insurance discounts of up to 50%.[293]
- Mangrove forest restoration programs operated by Tokio Marine Insurance are helping to reduce wind and storm-surge risks in coastal Asia, while sequestering enough carbon to eliminate Tokio Marine's own carbon footprint and more.
- A variety of insurance mechanisms that manage contractual and engineering risks associated with carbon trading are being offered by AIG, Marsh, Swiss Re, and others, which helps increase the attractiveness of investments in carbon-offset projects and allows more companies to participate in emerging carbon-emission trading markets. Swiss Re, Marsh, and others have encouraged customers to disclose climate-change vulnerabilities as a means of managing professional liability insurance exposures.

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[291] Items in the following list are from MILLS & LECOMTE, *supra* note 1.

[292] Evan Mills, *The Insurance and Risk Management Industries: New Players in the Delivery of Energy-Efficient Products and Services*, 31 ENERGY POL'Y 1257–72.

[293] Studies suggest that pay-as-you-drive insurance reduces miles driven by 10% to 15%, potentially resulting in significant climate change and energy security co-benefits.

- Munich Re is piloting a new product that insures geothermal energy project performance.[294]
- Aon has created an Agri-Fuels Risk Management Group in order to address risk management considerations and insurance requirements for the expanding renewable fuels industry.[295] Aon will be placing environmental impairment liability insurance for ethanol and biofuels projects to manage risks such as storage tank ruptures to soil or water, leaking from lagoons to soil or water, as well as process-related emissions to the air.[296]
- Energy-savings insurance products offered by Lloyds of London and a number of other insurers are stimulating improved quality control in energy retrofit projects, and the associated guarantee of savings is enabling lenders to offer more favorable financing for such projects.
- Lockton Risk Services has created a new group liability insurance product for providers of residential energy efficiency audits and retrofits. Historically, this group of service providers has often gone uninsured.[297]
- 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 increased funding for public transportation, which not only reduces roadway liability risks but also conserves energy and thereby reduces greenhouse gas emissions.[298] AIA has also endorsed telecommuting as a means of reducing roadway congestion and energy use.[299]

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[294] Thomas Arnoldt, *Drilling for Geothermal Energy in Unterhaching – Claims-Free Productivity Risk Insurance*, *in* MUNICH RE GROUP, PERSPECTIVES: TODAY'S IDEAS FOR TOMORROW'S WORLD 29 (Andreas Armus et al., 2004).

[295] Press Release, Aon, Aon Establishes New Agri-Fuels Group to Manage Renewable Fuels Industry Risks (Jan. 31, 2007), *available at* http://www.aon.com/about/news/press_release/pr_00697117_Agri-Fuels_Man.

[296] Interview with Richard L. Shanks, National Director, Aon Agribusiness and Foods System Group, in Kansas City, Kansas (Feb. 6, 2007).

[297] Claudia Brovik, *New Insurance Benefit for RESNET Members*, HOME ENERGY MAGAZINE, July/August 2006, at 5.

[298] AMER. INS. ASS'N, PROPERTY-CASUALTY INSURANCE AND THE CLIMATE CHANGE DEBATE: A RISK ASSESSMENT (1999) (examining risk assessment considerations in the context of P&C insurance).

[299] AMER. INS. ASS'N, POTENTIAL AREAS OF FOCUS FOR THE OECD WITH REGARD TO GLOBAL CATASTROPHE MITIGATION (2000).

Although these forward-thinking initiatives have provided an encouraging start, their enormous potential and opportunity remains largely untapped. Most insurers have yet to even experiment with these novel ideas, presumably because many companies have not yet examined the underlying question of climate change. No one insurer has developed what we would consider a comprehensive portfolio of best-practice strategies, nor are adequate resources being invested in these endeavors. In the United States, for example, the insurer-funded Institute for Business and Home Safety's budget for relatively traditional approaches to loss prevention is only 0.003% of associated national property and casualty insurance premiums, despite the demonstrated impact of loss prevention strategies in reducing insured losses.[300] However, momentum is rapidly building toward a transformation within the industry that would embody the notion that business and sound environmental management go hand in hand.

E. *Recommended Best Climate-Protection Practices for Insurers*

An insurer that has integrated best practices for climate liability loss reduction into its business will implement the following strategies. It should be noted that some of these points help reduce insurers' own liabilities (e.g., claims against their own directors and officers), while others are oriented towards reducing their customers' liabilities (and hence claims paid).

- Make concerted efforts to restore and maintain the insurability of extreme weather events. This may require partnerships with governments, e.g., in the cases of improved land-use planning and enforced building codes.
- Improve the modeling and other methods of analyzing risks associated with climate change.
- Utilize terms and conditions to foster loss-preventing 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.

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[300] MILLS, ROTH & LECOMTE, *supra* note 8, at 16.

- Develop new products and services to facilitate maximum customer utilization of climate-friendly technologies and practices, especially in cases where they yield loss-prevention co-benefits, and take steps to minimize liabilities.
- Rebalance investment portfolios to (a) recognize climate-related risks to investments and (b) capitalize on opportunities for emerging industries that will participate in climate change solutions.
- Actively participate in carbon markets, both as investor and risk manager.
- Lead by example in minimizing the insurer's own "carbon footprint." This includes minimizing the climate impacts of real estate owned by the insurer, as well as emissions associated with business operations, and analyzing and disclosing exposures to climate change.
- Take an active role in the education of customers about climate-related risks and opportunities for minimizing them.
- Actively engage in public policy discussions about appropriate responses to climate change.

Insurers should consider withdrawing from markets or increasing insurance prices only if insuring the risks remains unviable after all these best practices have first been exercised to their fullest cost-effective potential.

Exhibit 6: Climate Change Risks: Triggers, Insurance and Legal Liabilities, and Risk Management Solutions summarizes the types of climate change-related liability claims that could arise and the types of insurance affected, the triggers for those claims, and examples of proactive strategies for managing those risks.

Insurers can support businesses' development and implementation of cross-cutting liability risk-management strategies. For example, movement towards greenhouse gas emissions targets and regulations can help remove ambiguities that could otherwise trigger litigation. Adaptive capacity for climate change (and hence liability reductions) may be enhanced in the energy sector by strategically placed distributed power generation and renewable energy systems and in the land management sector by better agricultural and forestry practices. Similarly, increases in energy efficiency at the point of end-use decrease average and peak demands on electricity grids, while averting the cluster of liabilities that

accompany avoidable expansions in energy supply. The ability for energy-efficient strategies to both reduce emissions and reduce vulnerability to the types of power outages that may be caused by climate change have been treated in some depth elsewhere.[301] As a case in point, Californians reduced electricity usage by 6% and monthly peak demand by 8% in response to the impending power outages of summer 2000, and even more the following summer. [302] This demand response, which translated into 50 to 155 hours of avoided rolling blackouts, contributed to avoiding an estimated economic loss as high as $20 billion.[303]

VI. CONCLUSION

Based on the rising costs of an increasingly carbon-constrained business environment, the climate change risk to which all economic sectors are exposed, and the hidden risks associated with greenhouse gas emissions, all businesses today need to be concerned with climate change.

The insurance sector is uniquely positioned between the two ends of the climate-change spectrum—the causes and impacts. Insurers insure carbon-intensive industries as well as homes, autos, and pollution-emitting airplanes that are some of the primary causes of anthropogenic greenhouse gas emissions. Many of these insured businesses will bear the brunt of the cost of climate change impacts.[304] At the same time, insurers and their trade allies expose themselves to the liabilities faced by customers of these insured businesses, and to "in-house" liabilities potentially arising from their own actions in responding to the challenge.

The insurance sector faces material liability exposures to both the causes and consequences of climate change, many of which have already begun to materialize. Responses to climate change, particularly in the energy sector, can be distinguished by their

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[301] Evan Mills, *Climate Change, Buildings, and the Insurance Sector: Technological Synergisms Between Adaptation and Mitigation*, 31 BUILDING RES. AND INFO. 257–77 (2002), *available at* http://eetd.lbl.gov/EMills/PUBS/Mitigation_Adaptation.html.

[302] Charles A. Goldman, Galen L. Barbose, & Joseph H. Eto, *California Customer Load Reductions during the Electricity Crisis: Did They Help to Keep the Lights On?*, 2 J. INDUSTRY, COMPETITION & TRADE, June 2002, at 113.

[303] *Id.*

[304] ALLIANZ & WORLD WILDLIFE FEDERATION, CLIMATE CHANGE & THE FINANCIAL SECTOR, AN AGENDA FOR ACTION 25–30 (2005), *available at* http://www.allianz.com/images-2006-12-13/pdf/saobj_847265_allianz_wwf_climate_change_study_2005.pdf.

potential for enhancing or reducing liability. Some of the more technologically risky responses appear not to be commercially insurable, given current uncertainties about the nature and manageability of their risk characteristics.

As they have begun to do in the case of property insurance risk management, some insurers have begun to apply their expertise in risk management towards helping their customers avoid liabilities, while others have taken a more reactive approach by tightening terms or excluding potential impacts altogether. Proactive approaches are likely to yield a "win-win-win" situation, in which insurers, policyholders, and third parties affected by climate change-related externalities will all benefit from decreased risk. The insurance industry, perhaps more than any other institution, has the power to set the stage for enduring and significant contributions to solving the problem of global climate change. In doing so, liability insurance considerations could prove to be as important as the more widely studied property insurance consequences of climate change.

Exhibit 1: IPCC Evidence of impacts resulting from changes in extreme climate events, and associated insurance implications

Changes in Extreme Climate Phenomena	Probability of Observed Trend in late 20th Cen. / Human Contribution	Probability of Change 21st Cen. Due to Human Activity	Representative Examples of Projected Impacts	Peril or Hazard	Insurance-sector Impacts ("+" = increased losses "-" = reduced losses)							Potential Insurance Customer Impacts		
					Property (structures; industrial)	Property (autos/ marine/ aircraft)	Liability	Crop	Health	Life	Public Insurance/Assistance	Pricing	Exclusions	Availability
Warmer and more frequent hot days and nights over most land areas	>90% / >66%	>99%	Increased hospitalizations over broad demographic range; incidence of death and serious illness in older age groups and urban poor	Heatwave			+		+	+	+			
			Increased heat stress in livestock and wildlife	Heatwave			+	+			+			
			Increased risk of damage to a number of crops	Heatwave			+	+			+			
			Increased soil subsidence	Subsid-ence	+		+				+			
			Decreased ice in northern maritime shipping lanes	Float ice		-								
			Increased roadway accidents (slower reaction time)	Road conditions		+	+							
			Increased electric cooling demand and reduced energy supply reliability	Power Outage			+				+			

Changes in Extreme Climate Phenomena	Probability of Observed Trend in late 20th Cen. / Human Contribution	Probability of Change 21st Cen. Due to Human Activity	Representative Examples of Projected Impacts	Peril or Hazard	Insurance-sector Impacts ("+" = increased losses "-" = reduced losses)							Potential Insurance Customer Impacts		
Warmer and fewer cold days and nights over most land areas	>90% / >66%	>99%	Decreased cold-related human morbidity and mortality	Coldwave					-	-	-			
			Decreased risk of damage to a number of crops, and increased risk to others	Heatwave			+	-			-			
			Extended range, reproduction, and activity of some pest (e.g. pine beetle) and disease vectors	Infestation	+		+	+	+	+	+			
			Increased avalanche risk	Avalanche	+		+							
			Increased permafrost melt	Subsidence	+		+				+			
			Increased incidence of lightning	Lightning	+	+	+	+			+			
Heavy precipitation events. Frequency (or proportion of total rainfall from heavy falls) increases over most areas	>66% / >50%	>90%	Increased flood, landslide, avalanche, and mudslide damage	Flood, landslide, avalanche, mudslide	+	+	+				+			
			Increased soil erosion; mudslides	Rain			+				+			
			Increased flood runoff could increase recharge of some floodplain aquifers	Flood				-			-			
			Increased roadway accidents (driving conditions, visibility)	Road conditions		+	+		+	+				

Changes in Extreme Climate Phenomena	Probability of Observed Trend in late 20th Cen. / Human Contribution	Probability of Change 21st Cen. Due to Human Activity	Representative Examples of Projected Impacts	Peril or Hazard	Insurance-sector Impacts ("+" = increased losses "-" = reduced losses)							Potential Insurance Customer Impacts		
Area affected by droughts increases	>66% (many regions)v/ >50%	>66%	Decreased crop yields	Drought			+	+			+			
			Increased damage to building foundations caused by ground shrinkage	Subsidence	+		+							
			Decreased water resource quantity and quality	Drought			+	+	+		+			
			Increased risk of wildfire	Wildfire	+	+	+	+	+	+	+			
Intense tropical cyclone/hurricane activity increases	>66% (many regions) / >50%	>66%	Increased risks of property damage, business interruption, loss of human life, infectious disease epidemics	Wind, disease	+	+	+	+	+	+	+			
			Increased coastal erosion and damage to coastal buildings and infrastructure	Tidal surge			+				+			
			Increased damage to coastal ecosystems such as coral reefs and mangroves	Wind, tidal surge	+	+	+	+	+	+	+			
Increased incidence of extreme high sea level (excludes tsunamis)	>66% / >50%	>66%	Storm surge damages	Tidal surge	+	+	+	+	+	+	+			

* Columns 1-3 refer to the IPCC Fourth Assessment Report (2007) unless noted that the reference is to the Third Assessment (2001).

Exhibit 2: Key 2007 Findings of the Intergovernmental Panel On Climate Change Working Group 1 (The Physical Science Basis)*

"The understanding of anthropogenic warming and cooling influences on climate has improved since the Third Assessment Report (TAR), leading to *very high confidence*† that the globally averaged net effect of human activities since 1750 has been one of warming, with a radiative forcing of +1.6 [+0.6 to +2.4] W m^{-2}."

"Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level."

"At continental, regional, and ocean basin scales, numerous long-term changes in climate have been observed. These include changes in Arctic temperatures and ice, widespread changes in precipitation amounts, ocean salinity, wind patterns and aspects of extreme weather including droughts, heavy precipitation, heat waves and the intensity of tropical cyclones."

"Paleoclimate information supports the interpretation that the warmth of the last half century is unusual in at least the previous 1300 years. The last time the polar regions were significantly warmer than present for an extended period (about 125,000 years ago), reductions in polar ice volume led to 4 to 6 metres of sea level rise."

"Most of the observed increase in globally averaged temperatures since the mid-20th century is *very likely* due to the observed increase in anthropogenic greenhouse gas concentrations12. This is an advance since the TAR's conclusion that "most of the observed warming over the last 50 years is *likely* to have been due to the increase in greenhouse gas concentrations". Discernible human influences now extend to other aspects of climate, including ocean warming, continental-average temperatures, temperature extremes and wind patterns."

"Analysis of climate models together with constraints from observations enables an assessed *likely* range to be given for climate sensitivity for the first time and provides increased confidence in the understanding of the climate system response to radiative forcing."

"For the next two decades a warming of about 0.2°C per decade is projected for a range of SRES emission scenarios. Even if the concentrations of all greenhouse gases and aerosols had been kept constant at year 2000 levels, a further warming of about 0.1°C per decade would be expected."
"Continued greenhouse gas emissions at or above current rates would cause further warming and induce many changes in the global climate system during the 21st century that would *very likely* be larger than those observed during the 20th century."

"There is now higher confidence in projected patterns of warming and other regional-scale features, including changes in wind patterns, precipitation, and some aspects of extremes and of ice."

"Anthropogenic warming and sea level rise would continue for centuries due to the timescales associated with climate processes and feedbacks, even if greenhouse gas concentrations were to be stabilized."

* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE. CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS (2007).
† IPCC uses the following terms to indicate the assessed likelihood, using expert judgment, of an outcome or a result: *Virtually certain* > 99% probability of occurrence, *Extremely likely* > 95%, *Very likely* > 90%, *Likely* > 66%, *More likely than not* > 50%, *Unlikely* < 33%, *Very unlikely* < 10%, *Extremely unlikely* < 5%.

Exhibit 3: Business Atmosphere

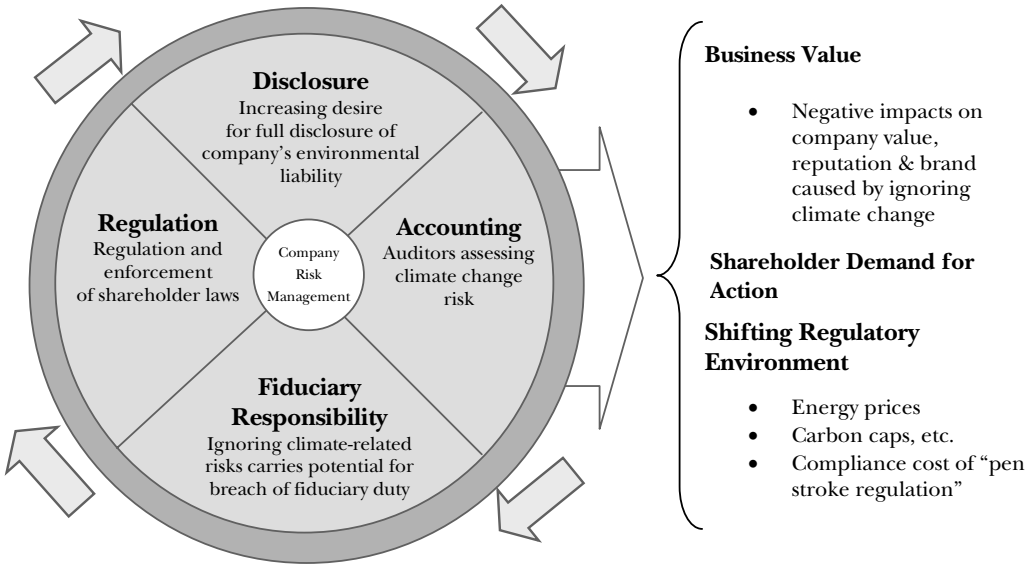


Exhibit 4: Climate change shareholder resolutions filed during the time period, 2000-2007

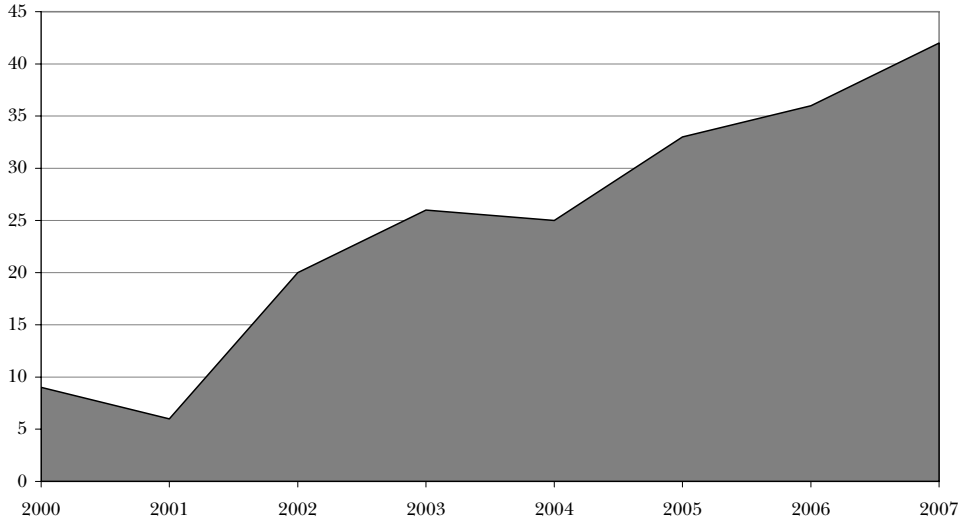


Exhibit 5: Insurance sector responses to the Carbon Disclosure Project surveys

Insurance Company - USA		**2006**	**2005**	**2004**	**2003**
ACE	USA	***0***	-	•	***0***
Aflac	USA	***X***	***0***	***X***	***0***
Allstate	USA	***0***	***X***	***X***	•
Ambac Financial Group	USA	***0***	-	-	-
American International Group	USA	•	•	•	•
Aon	USA	•	-	-	***i***
Berkshire Hathaway	USA	***0***	***0***	***X***	***0***
Chubb	USA	***X***	***i***	***0***	***X***
Cincinnati Financial	USA	***i***	-	-	-
Hartford Financial Services	USA	***i***	***X***	***X***	***X***
Jefferson-Pilot	USA	***0***	-	-	-
Lincoln National	USA	***X***	-	-	***0***
Loews Corporation	USA	***0***	-	***X***	***0***
Marsh & McLennan	USA	•	•	***0***	-
MBIA	USA	•	-	-	-
Metlife	USA	***X***	***0***	***0***	***0***
Progressive	USA	***X***	***X***	***X***	***X***
Prudential Financial	USA	***X***	***X***	***X***	***X***
Safeco	USA	•	-	-	-
St. Paul Travelers	USA	•	•	•	***0***
Torchmark	USA	***0***	-	-	-
UnumProvident	USA	•	-	-	-
XL Capital	USA	***0***	***X***	•	***X***

Key & Stats for 2006:		US-N	US%	Other-N	Other-%
Surveyed		23		52	
Answered Questionnaire	•	7	30%	32	62%
Declined to Participate	***X***	6	26%	7	13%
Provided Information	*i*	2	9%	2	4%
No Response	***0***	8	35%	11	21%
Not in given round of CDP	–				

Source: http://www.cdproject.net

* = had promised a reply, but none submitted

Insurance Company - Other		**2006**	**2005**	**2004**	**2003**
Admiral Group	UK	•	-	-	-
Aegon	Netherlands	•	***i***	***0***	***X***
AGF	France	•	•	-	-
Allianz	Germany	•	•	•	•
AMB Generali Holding AG	Germany	***0***	-	-	-
Amlin	UK	***X***	-	-	-
AMP Limited	Australia	•	-	-	-
April Group*	France	***0***	-	-	-
Aviva	UK	•	•	•	•
AXA Asia Pacific Holdings Limited - AXA Group	Australia	•	-	-	-
AXA Group	France	•	•	•	•
AXA Konzern AG - AXA Group	Germany	•	-	-	-
Benfield Group	UK	***0***	-	-	-
Brit Insurance Holdings	UK	***0***	-	-	-
Cathay Financial Holding	Taiwan	•	•	•	-
Catlin Group LD Coms	UK	***i***	-	-	-
China Life Insurance	China	•	-	-	-
Cnp Assurances	France	•	-	-	-
E-L Financial	Canada	***0***	-	-	-
Euler Hermes	France	•	-	-	-
Fairfax Financial Holdings	Canada	***0***	-	-	-
Friends Provident	UK	•	-	-	-
Generali	Italy	***i***	***X***	***X***	***X***
Great West Lifeco	Canada	***X***	***0***	***X***	-
Hannover Ruckversicherung AG	Germany	•	-	-	-
Helphire Group	UK	***0***	-	-	-
Hiscox	UK	•	-	-	-
Hub International	Canada	***X***	-	-	-
Industrial Alliance Insurance	Canada	***X***	-	-	-
Insurance Australia Group Limited	Australia	•	-	-	-
Kingsway Financial Services	Canada	***0***	-	-	-
Legal and General	UK	•	-	-	-

Insurance Company - Other		2006	2005	2004	2003
Manulife Financial	Canada	•	•	*i*	*i*
Millea Holdings	Japan	•	•	•	-
Mitsui Sumitomo Insurance	Japan	•	•	-	-
Munich Re	Germany	•	•	•	•
Nipponkoa Insurance Co Ltd	Japan	*0*	-	-	-
Nürnberger Beteiligungs-AG	Germany	*X*	-	-	-
Ping An Insurance*	China	*0*	-	-	-
Promina Group Limited	Australia	*X*	-	-	-
Prudential plc	UK	•	•	•	•
Qbe Insurance Group Limited	Australia	*X*	-	-	-
RAS	Italy	•	•	•	•
Resolution	UK	•	-	-	-
Royal & Sun Alliance	UK	•	-	-	-
Scor	France	•	-	-	-
Sompo Japan Insurance	Japan	•	-	-	-
Sun Life Financial	Canada	•	•	*X*	*X*
Swiss Re	Switzerland	•	•	•	•
T&D Holdings	Japan	•	-	-	-
Tower Ltd	New Zealand	*0*	-	-	-
Zurich Financial Services	Switzerland	•	•	•	*0*

Exhibit 6: Climate Change Risks: Triggers, Insurance and Legal Liabilities, and Risk Management Solutions

Trigger	Liability Insurance	Legal Theory	Risk Management Solution
Increased climate change as a result of products that emit greenhouse-gases	Products Liability; Environmental Liability	Strict Liability; Nuisance; Negligence	**Mitigation:**[305] Energy-efficient or otherwise low-emissions product design; emission-offset activities. **Adaptation:** N/A

[305] "Mitigation" refers to responses that involve reductions of greenhouse gases; "Adaptation" refers to responses that reduce damages.

Trigger	Liability Insurance	Legal Theory	Risk Management Solution
Increased erosion, landslides, sinking of ground surface, disruption and damage to buildings and public utilities or other infrastructure caused by global warming impacts	Commercial General Liability	Nuisance; Negligence; Environmental Liability Statutes (such as CERCLA)	**Mitigation:** Reduction of greenhouse-gas emissions; emissions-offset activities. **Adaptation:** land-use planning; coastal protection; flood management; disaster preparedness
Impacts to public lands or resources that detract from public goods such as recreation or ecosystem services	Commercial General Liability	Nuisance; Negligence; Environmental Liability Statutes	**Mitigation**: Reduction of greenhouse-gas emissions; emissions-offset activities. **Adaptation:** Climate change adaptation measures (e.g. flood defenses).
Increasing incidences of respiratory illness, heat mortality, and other public health impacts associated with climate change	Commercial General Liability	Nuisance; Negligence; Environmental Liability Statutes (such as Clean Air Act)	**Mitigation**: Reduction of greenhouse-gas emissions; emissions-offset activities. **Adaptation:** Public health early-warning and prevention programs; disaster preparedness
Impacts to private lands or resources that detract from commercial uses such as recreation, e.g. loss of use of property used for skiing, tourism based on coral reefs, or terrestrial wildlife	Commercial General Liability	Nuisance; Negligence; Environmental Liability Statutes	**Mitigation:** Reduction of greenhouse-gas emissions; emissions-offset activities. **Adaptation:** snowmaking; natural resource conservation efforts that account for climate change
Impacts to agriculture, including decrease in agricultural water supplies, lower water quality, increase in agricultural operational costs (fuel, pesticides, fertilizers), and increase in food prices in the U.S.	Commercial General Liability	Nuisance; Negligence; Environmental Liability Statutes	**Mitigation** Reduction of greenhouse-gas emissions; emissions-offset activities. **Adaptation:** Zero-tillage or other agricultural practices that improve water retention in soils; crop engineering; water conservation
Impacts to lands or resources that detract from resource-consumptive uses (e.g., timber production)	Commercial General Liability	Nuisance; Negligence	**Mitigation:** Reduction of greenhouse-gas emissions; emissions-offset activities. **Adaptation**: Improved land management (e.g. drought-resistant agricultural practices); changes in crop selection towards more resilient species

Trigger	Liability Insurance	Legal Theory	Risk Management Solution
Reduction in fishery stocks, shifting of fisheries across national and international borders	Commercial General Liability	Nuisance; Negligence	**Mitigation:** Reduction of greenhouse-gas emissions; emissions-offset activities.
Mobilization of chemical wastes, sewage, petroleum products by natural disasters. Post-event mold after flood events	Environmental Liability (possibly also contractors' liability for building-related mold problems); Commercial General Liability	Claims based on environmental liability statutes (e.g., CERCLA); negligence; nuisance; strict liability	**Mitigation**: Reduction of greenhouse-gas emissions; emissions-offset activities. **Adaptation:** Improved siting and safeguarding of hazardous materials; improved land-use planning and more rapid response to flood/water damages; disaster preparedness
Poor financial performance or other consequences of businesses' failure to reduce carbon emissions or to reduce risks attributable to climate change	Professional Liability (Directors and Officers insurance)	Claims of breach of fiduciary duty by corporate officers or directors; Claims based on securities laws that place disclosure duties on corporate officers or directors	**Mitigation**: Taking steps to appraise customers of climate change risks, facilitating risk management measures to minimize the associated losses, disclosing risks to investors, reduction of carbon emissions, rebalancing ("de-carbonizing") asset portfolios to reduce vulnerability of investments to severe weather losses. If, for example, a group of coal-burning electric utilities were sued as a group, before-the-fact risk management could include fuel switching (e.g. to natural gas) as well as demand-side energy management to reduce a given utility's share of emissions with respect to the group. **Adaptation:** not applicable.
Interruptions to operations, communications, transportation, or supply chains due to failure to prepare for extreme weather events	Commercial General Liability	Tort claims (such as negligence) resulting from impacts of business interruptions on third parties	**Mitigation**: Reduction of greenhouse-gas emissions; emissions-offset activities. **Adaptation:** Development and establishment of business-continuity management (BCM) procedures as a prerequisite

Trigger	Liability Insurance	Legal Theory	Risk Management Solution
			for adding on business interruption coverage to a company's property insurance.
Economic losses to businesses due to failure to prepare for weather-related disruptions of energy, water, or other utility services	Commercial General Liability	Tort claims (such as negligence) resulting from impacts of disruptions on third parties	**Mitigation**: Electric service is particularly vulnerable, and so efforts to switch to other energy carriers could be prudent, and these carriers often also result in less greenhouse-gas emissions per unit of activity. **Adaptation:** Demand-side energy management coupled with on-site power generation and/or storage to reduce susceptibility of business processes to utility disruptions.
Weather extremes involving changes in precipitation, ice, temperature, or visibility have impacts on vehicle accident incidence, which, in turn, includes a component of liability insurance losses [personal or commercial vehicles]	Personal and Commercial Vehicle Liability	Negligence claims relating to vehicular operations	**Joint Mitigation/Adaptation**: Reduction of speed limits, increased public transportation, and telecommuting. Pay-as-You-Drive insurance rewards reduction of discretionary driving
Claims by injured parties that disinformation led to decisions (or lack thereof) that resulted in more climate-related damage than would otherwise have been the case	Professional Liability; Commercial General Liability	Misrepresentation-related claims	**Mitigation**: Reduction of greenhouse-gas emissions; emissions-offset activities. **Adaptation:** Scientific responsibility; peer-review of documents and communications related to climate change hazards; good-faith information disclosure.
Increased need for disaster preparedness and other climate change adaptation by private parties	Commercial General Liability; Professional Liability	Tort claims resulting from impacts of business interruptions on third parties	**Mitigation:** Reduction of greenhouse-gas emissions; emissions-offset activities. **Adaptation:** not applicable

Trigger	Liability Insurance	Legal Theory	Risk Management Solution
Cross-border economic damages arising from new regulations or taxes, appropriation of facilities or industrial plant	Political Risk	International Law	**Mitigation.** not applicable. **Adaptation**: Reducing exposure to energy price shocks or emissions-regulations by minimizing emitting activities through improved supply or end-use efficiency. Also extends to land management practices that result in net emissions of greenhouse gases (e.g. in agriculture or forestry).
Cross-border risks associated with host-country policy on carbon markets. Diversity of triggers, including engineering risks, financing risks, regulatory risks, weather risks, noncompliance risks, legal risks, and political risks	Political Risk	International law	**Mitigation:** not applicable. **Adaptation**: Quality assurance on the engineering side, and new insurance products, such as carbon emission credit guarantees; Contingent cap forward for emissions reduction trades.
Risks associated with supply-side energy measures to reduce greenhouse-gas emissions, e.g. from use of nuclear power, hydrogen, or carbon capture and storage.	Environ-mental Liability, Commercial General Liability, Products Liability, Professional Liability, Political Risk	Negligence; Nuisance; Claims of breach of fiduciary duty by corporate officers or directors; Claims based on securities laws that place disclosure duties on corporate officers or directors; Misrepresentati on-related claims; Environmental liability statutes for contamination	**Mitigation**: Develop new understanding of the risks associated with climate change responses. New technologies and business practices will be employed. Analyses should be performed of positive and negative risks associated with nuclear power, carbon capture and storage, hydrogen energy, and renewable energy systems as well as enhancements to energy efficiency at the point of end use. Investments in end-use efficiency or improved land management to sequester carbon can be expected to carry far less liability than supply-side investments. **Adaptation:** conventional risk management; disaster preparedness

Exhibit 7: Insurer Response Rates to Carbon Disclosure Project (CDP) Survey: 2006

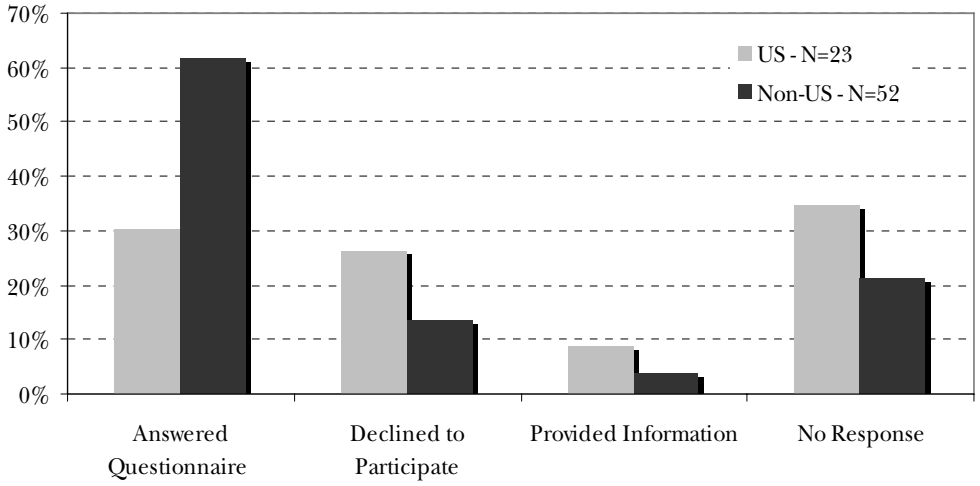
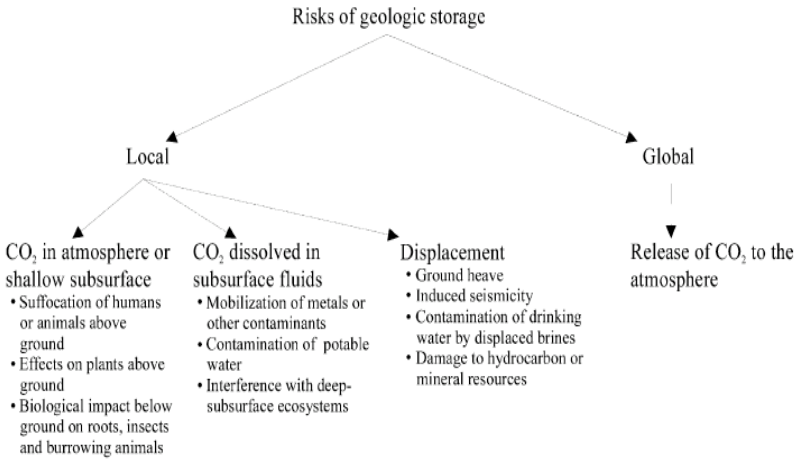


Exhibit 8: Risks of Geologic Storage of Carbon Dioxide (CO2)[306]



[306] Note: these risks may be viewed as uncertainties in the effectiveness of CO2 containment. The risks arise from three processes: (1) elevated CO2 concentrations associated with the flux of CO2 through the shallow subsurface to the atmosphere, (2) the chemical effects of dissolved CO2 in the subsurface, and, (2) effects that arise from the displacement of fluids by the injection of CO2. Diagram from Elizabeth J. Wilson, Timothy L. Johnson, and David W. Keith, *Regulating the Ultimate Sink: Managing the Risks of Geologic CO2 Storage*, ENVTL. SCI. & TECH. 3476-83 (2003).

Exhibit 9: Carbon offset and trading risks

The market for carbon credits under the Kyoto Protocol's CDM and JI mechanisms provides additional opportunities and risks for companies that attempt to develop carbon credits under these programs. As emissions-trading markets grow and mature, a number of risks related to the EU ETS and the CDM/JI projects can be expected to arise, including:

- carbon-regulatory risks, such as those associated with host-country and international policies governing emissions-reduction projects such as project approval, validation, and verification;
- host-country investment and political risks that could alter climate change policies and obligations, such as host-country instability, expropriation of credits, contract frustration, credit confiscation, and more;
- technology-performance risks associated with operational aspects of the project activity;
- carbon-financing risks, including an inability to secure financing based on projected carbon-revenue streams;
- carbon-performance risk associated with variability in the generation, permanence, and ownership of emissions reductions;
- counterparty credit risks, including the failure to deliver credits as contracted;
- volumetric-related weather risks that adversely affect earnings;
- noncompliance risks, such as fines and other sanctions resulting from missed targets;
- price and liquidity risks, such as volatility in energy and carbon prices;
- legal liabilities, such as those stemming from legal action by shareholders, investors, or third parties;
- resource supply risks, such as possible fluctuations in fuel and resource supplies; and
- appropriateness of existing insurance policies—such as property and business interruption—and their ability to deal with the inclusion of CO2 allowances and related improvements in profits and contingent losses and liabilities.

Exhibit 10: Types of opportunities for insurers and selected examples[307]

Type of Activity	Insurance Industry Participant	Description
Promoting Loss Prevention		
Traditional risk management	Institute for Business and Home Safety	Promoting best practices for hazard resistance in buildings through its "fortified … for safer living" program
Integrating energy management and risk management	FM Global	Replaced fire-hazardous halogen light fixtures in student dorms at Northeastern University with ENERGY STAR fluorescent fixtures, achieving 75% lighting energy savings while eliminating the fire hazard.
Better management of forestry, agriculture, and wetlands	Tokio Marine	Mangrove protection
"Rebuilding Right" following losses	Fireman's Fund	Forthcoming products to pay for post-loss reconstruction upgrades to "green" building standards and commissioning to ensure energy savings
Crafting Innovative Insurance Products and Services		
New products for energy service providers	Locton Risk Services	Group property and liability insurance for RESNET-member building energy auditors
Energy savings insurance	Lloyds of London	Insurance for predicted energy savings or renewable energy technology performance
Renewable energy project insurance	Munich Re	Geothermal exploration risk insurance
Green-buildings insurance	Fireman's Fund	Forthcoming products to provide premium credits for green building features
Pay-as-You-Drive insurance	GMAC	Mileage-based insurance discounts for customers using OnStar global

[307] EVAN MILLS & EUGENE LECOMTE, FROM RISKS TO OPPORTUNITIES (2006).

Type of Activity	Insurance Industry Participant	Description
		positioning systems
Climate risk management services	AIG/Solomon Associates	Range of services for identifying carbon-reduction opportunities and risks
Participating in Carbon Markets		
Facilitating carbon trading	Aon	Assessment of risks associated with participating in carbon trading markets
Managing risk for Clean-Development Mechanism (CDM) projects	Swiss Re	Kyoto-CDM Risk Insurance
Enabling customers to purchase carbon offsets	Insurance Australia Group	Web-based calculator with option to purchase offsets to compensate for passenger car emissions.
Aligning Terms and Conditions with Risk-Reducing Behavior and Capitalizing on the "Halo Effect"		
Assigning Directors & Officers liability	Swiss Re	Indications that the company may exclude climate change impacts from policies
The "Halo Effect"	Travelers	10% insurance premium credit to drivers of the Toyota Prius hybrid passenger car.
R&D and Direct investment in Climate Change Solutions		
Research & Development	Allstate	Roofing Industry Committee on Wind Issues, working to analyze the mechanisms of roof failures during windstorms.
Investments	Swiss Re	Investment in new solar photovoltaic technology
Climate-responsive funds	Gerling	"Gerling Select 21" fund
Building Awareness and Participating in the Formulation of Public Policy		
Consumer information and education	USAA Insurance Company	Published a detailed guide to energy efficiency for homeowners, including do-it-yourself audit tool and cost-benefit worksheets.

Type of Activity	Insurance Industry Participant	Description
Having a voice in public policy discussions on climate change	UNEP Finance Initiative	Insurers from around the world participating in climate change policy deliberations
Endorsing voluntary energy-saving policies	American Insurance Association	Advocacy for reduced speed limits, public transportation, and telecommuting as means for reducing driving-related insurance claims and greenhouse gas emissions by saving energy
Energy-efficiency codes and standards	Insurance Institute for Highway Safety	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
Leading by Example		
In-house energy management	AIG/Hartford Steam Boiler	The headquarters of Hartford Steam Boiler (now a subsidiary of AIG) was among the first buildings to receive the ENERGY STAR label for superior energy efficiency.
Reducing insurers' carbon footprint through improved operations	American Modern Insurance Group	Utilized solar-powered trailers to expedite claims handling in post-disaster situations where the electrical grid is not functional
Disclosing climate vulnerabilities and liabilities	Saint Paul Travelers	Provided submissions on climate change vulnerability and opportunities to the Carbon Disclosure Project