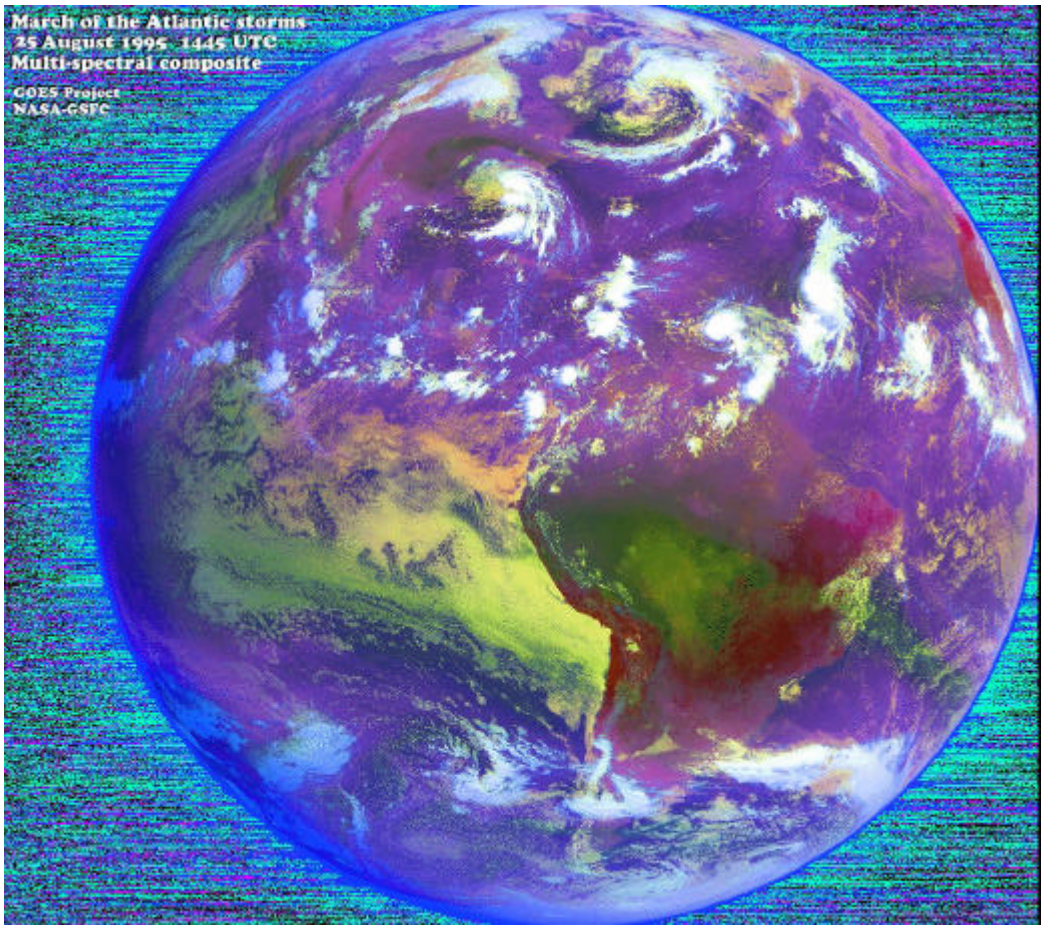


Climate Change and the Insurance Industry: Opportunities for Energy-Based Solutions

Joel N. Gordes
Environmental Energy Solutions
P.O. Box 101
Riverton, CT 06065
Ph/fax (860) 379-2430
JGordes@earthlink.net

Table of Contents

Executive Summary

In 1990 and again in 1992, The Intergovernmental Panel on Climate Change (IPCC) sponsored by the UN Environment Programme (sic) and the World Meteorological Organization issued consensus findings that[1]:

1) There is a natural greenhouse effect which already keeps the Earth warmer than it would otherwise be.

2) Emissions resulting from human activities are substantially increasing the atmospheric concentrations of greenhouse gases... these increases will enhance the greenhouse effect resulting in an additional warming of the earth's surface.

3) Under a business-as-usual scenario, global mean temperatures will increase about $.3^0$ ($.5^0$F) C per decade bringing them 1^0 C (1.8^0 F) higher by 2025 and 3^0 C (5.4^0 F) by the end of the next century. Indications show a 0.3^0 C degree to 0.6^0 C (1.08^0 F) increase over the last 100 years.

4) Less predictable regional changes in climate may take place.

5) The average rate of mean sea level rise will be approximately 6 cm (2.4 inches) per decade over the next century rising 20 cm (7.9 inches) by 2030 and 65 cm (25.6 inches) by the end of the century.

6) This warming is consistent with predictive climate models but may also fall within ranges of natural variability. **The unequivocal detection of the enhanced greenhouse effect from observations is not likely for a decade or more.**

In October of 1995, the IPCC issued it Second Assessment Report (SAR) which updated those findings to include among them the following[2]:

1) **Human activities are increasing the atmospheric concentrations of greenhouse gases**--- which tend to warm the atmosphere--and, in some regions, aerosols--which tend to cool the atmosphere. These changes in greenhouse gases and aerosols, taken together, are projected to lead to regional and global changes in climate and climate-related parameters such as temperature, precipitation, soil moisture and sea level.

---

[1] J. T. Houghton, G.J. Jenkins and J.J. Ephraums (eds.) "Scientific Assessment of Climate Change," Cambridge University Press, Cambridge, 1990.

[2] IPCC Working Group II Second Assessment Report Summary for Policymakers: Impacts, Adaptation and Mitigation Options. Washinton, DC. 24 October 1995. pp. 1, 4,9 11-15. Draft IPCC Synthesis Report. July 1995. pp. 10, 13, 14, 19, 22, 38.

2) It is projected that an increase in global mean surface temperature of about 1-3.5^0 C (1.8 to 6.3^0 F) will take place by the year 2100, and an associated sea level rise of approximately 15-19 cm (5.9 to 7.5 inches)

3) While reliability of regional-scale predictions is low, there is the potential for an increase of incidence of extreme high temperature events, floods, droughts and resultant consequences of fire, pest outbreaks, disease migration and ecosystem functioning.

4) **The property-casualty insurance industry is vulnerable to extreme climate events**. A higher risk of extreme events due to climate change, including the potential for tropical storm intensity, could lead to higher insurance premiums, withdrawal of coverage and conceivably to insolvency. This, in turn, could weaken of other economic sectors such as banking.

5) Detection will be difficult but unexpected (possibly rapid) changes cannot be ruled out.

6) Altering energy use patterns and utilizing new energy technologies offer one fertile "no regrets" mitigation strategy wherein benefits exceed the cost to society.

7) Where there are threats of serious or irreversible damage, **lack of full scientific certainty should not be used as a reason for postponing precautionary measures** to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects.

8) Further research and monitoring is essential.

Report Findings:

- The number of weather-related catastrophic property losses over the past eight years has raised speculation that early effects of enhanced global climate change may be playing a role.

- While there is no definite proof that is the case, even a low probability of risk over the sheer enormity of assets at stake warrants increased research as well as discussions and possibly early response among those in the property-casualty insurance industry.

- Discussions are already well underway in Europe where definitive positions have been taken by Lloyds of London, Munich Re and Swiss Re with some banks and investment firms also taking stands.

- Few discussions have taken place in the United States and have been precipitated by environmentalists and some industry leaders. The industry rank and file members do not appear to be investing large amounts of resources into research or to be overly supportive of the views of their leaders.

- There is agreement in the United States that a hurricane, similar in size and intensity to Hurricane Andrew in 1992, could hit an area far more populated and with greater monetary

assets. The cost of such a storm, in the worst case scenario, might approach $110 billion in insured liabilities.

- A $110 industry-wide loss would immediately wipe out a number of nationally known insurance firms, reduce industry surpluses by almost 2/3 and severely limit the industry's ability to take on further exposure.

- If this projected loss was compared to threats of a foreign enemy massing offshore to inflict comparable harm, the total resources of the nation would be made available to fortify against it. While less obvious than a security threat, the political consequences of a such an economic security threat are every bit as real and should be addressed.

- The difficulty of making such a long term process as potential climate change a political issue, is the very long term nature of it in a political environment increasingly driven by short term perceptions. There is also a reluctance by political leaders to take action when there is less than a very high degree of certainty that a climate change will occur or that it may present a threat.

- There are legitimate disagreements on climate change within the scientific community but there is also particularly well-financed special interests who counter even moderate arguments with misinformation to further confuse core issues.

- Discussions should take place in the United States and include both short-term and long-term policy alternatives such as a federal safety net for the insurance industry in the case of catastrophic losses as well as how investment shifts might be used by the industry to reduce suspected causal factors.

- Investment shifts should be considered which will deliver a "no regrets" or "least regrets" bottom line return on investment which is able to meet financial expectations of investors while mitigating generation of suspected emissions. Many investments, both technologies and practices, have already been identified which can satisfy both economic and environmental criteria.

- Delay in research, discussions and subsequent actions increases the risk of arriving at a "point of no return" where mitigation efforts, no matter how drastic, would not prevent elevated levels of greenhouse gases from accumulating. If this point is reached and a causative link to weather-related catastrophic damage is established, the further withdrawal of insurance from vulnerable areas will greatly limit many economic activities now taken for granted.

- Lack of readily available and affordable insurance could preclude the ability to obtain a mortgage, home equity loan or secure financing to start a business in storm-prone areas. In an economic respect, it would alter what Americans have come to know as "freedom."

Background

It was the early nineteenth century physicist Jean Fourier first formulated the theory that the earth's atmosphere functions like a giant greenhouse. Subsequently, the Swedish physical chemist and Nobel Prize winner, Svante Arrhenius proposed what has become popularly known as global warming. In 1896 Arrhenius demonstrated that atmospheric water vapor and carbon dioxide allowed the earth to warm more than 60^0 F higher than it might otherwise have been. He went on to postulate that a doubling of the amount of CO_2 in the atmosphere would lead to temperature increases approximating 8^0 F.[3]

Today there is no dispute concerning the basic theory or that carbon dioxide and other greenhouse gases have increased and most continue to increase. What is in contention is whether these gas concentrations will lead to higher global temperatures which alter established climate patterns in a climatologically brief period of time. Some very reputable meteorologists and climatologists contend that evidence of such change is already under way and may lead to increased weather-related catastrophic events such as hurricanes, cyclones, typhoons, windstorms, flooding and sea level rise as well as agricultural shifts and disease migrations. Other, equally reputable, scientists (Dr. William Sheets of the National Hurricane Center and Dr. Bill Gray of Colorado State University among others[4]) counter that such greenhouse gas induced heating does not and will not affect the climate due to the capacity of the oceans to moderate any drastic changes and the existence of negative feedback mechanisms to moderate it.

While scientific papers on the probable effects of greenhouse gas emissions on climate change have proliferated, the current debate concerning effects of climate change on insurers did not erupt until the occurrence of several costly events. These events took place in the late 1980's and, by 1990, precipitated articles in *Business Insurance*, a journal concerned with corporate risk.

In 1988 the United Nations Environmental Programme (sic) in conjunction with the World Meteorological Organization established the Intergovernmental Panel on Climate Change(IPCC) which is divided into three Working Groups to: 1) assess the scientific information available on climate change 2) assess environmental and socio-economic impacts of climate change and 3) formulate realistic responses to the issue. The group drafting the initial Assessment findings included 170 scientists from 25 nations with an additional 200 conducting peer review. Currently, there are at least 500 active IPCC authors engaged in studies with over 2000 additional experts offering peer review. This has been done to provide for a high degree of consensus.[5] Where no consensus can be

---

[3] James J. MacKensie, "Things to Come," Sanctuary, Massachusetts Audubon. September 1989, pp. 5 -7.

[4] Dr. Jeremy Leggett, "Climate Change and the Insurance Industry: Solidarity Among the Risk Community," Greenpeace, May 1993, p. 34.

[5] J. T. Houghton, G.J. Jenkins and J.J. Ephraums (eds.) "Scientific Assessment of Climate Change," Cambridge University Press, Cambridge, 1990.

reached, points of disagreement are identified and characterized. Although many uncertainties still exist, the October 1995 IPCC draft Second Assessment Report moves toward resolving certain key questions with confidence -- among them is the linkage between greenhouse gas emissions and climate change which is now more clear. What remains to be explored is the rate and magnitude of climate change as well as its impacts. Appendix A contains more information on the scientific debate concerning climate change.

The Second Assessment Report, published in late 1995, crossed a threshold in stating that greenhouse warming was definitely taking place and that it included anthropogenic (manmade) origins, notably the burning of fossil fuels.

Concurrent to scientific investigation, political steps were being considered to take preventative steps by proposing limits to greenhouse gas emissions. In 1988, a meeting of governments in Toronto proposed a 20% reduction in then-present day emissions by the year 2000 and a more comprehensive treaty by 1992. After a series of subsequent meetings, a gathering of 70 nations in the Netherlands dropped any specific mention of target goals under pressure from the United States, Japan and the then-Soviet Union. They left with a pledge to adopt an international treaty by 1992.[6]

By the time the Earth Summit in Rio De Janeiro took place in 1992, the lines had been drawn with the US framing its opposition to numerically targeted emissions reductions as "a conflict between jobs and the environment rather than as an opportunity for the United States to sell its most efficient and cleanest technology abroad."[7] One-hundred and fifty-three of the Summit's 178 participant nations (eventually including the US) did agree to general language which recommended curbing greenhouse gas emissions on a voluntary basis.

In October 1993, the Clinton Administration presented its Climate Change Action Plan, a compilation of approximately 50 action items, formulated to voluntarily meet the greenhouse gas reduction goals. This was a fallback position to attempts to a legislative proposal which would have taxed energy consumption; a proposal which was met with almost universal disdain by the public and elected officials.

The first Conference of the Parties after Rio met in Berlin in March, 1995 to mixed reviews. Governments were still split but new blocks did develop with the US still taking the conservative position while India, Brazil, Egypt, China and the Alliance of Small Island States arguing for more activist roles.

---

[6] "Global-warming Forum Drops Emissions Goals," form the Washington Post, The Hartford Courant, 8 November 1989.

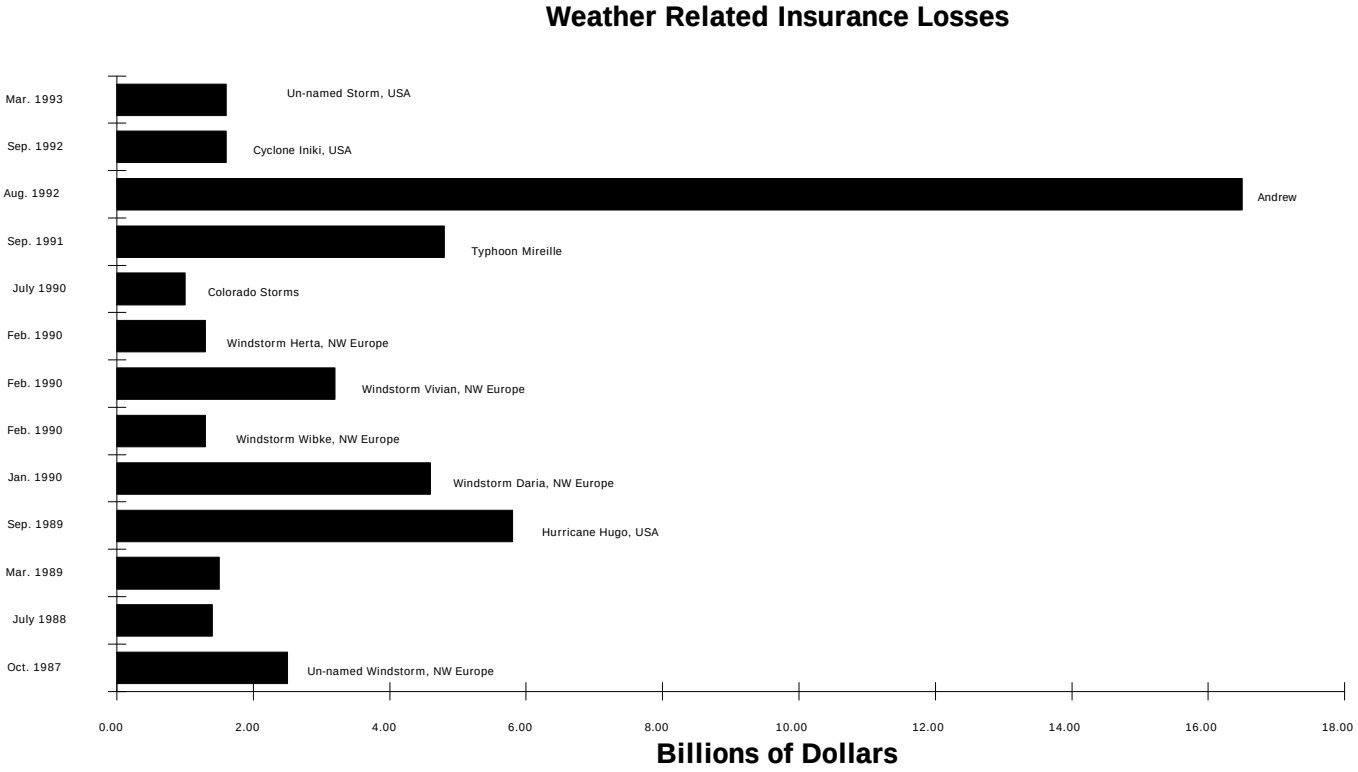
[7] Combined Wire Services, "Earth Summit Ends on Note of Optimism," The Hartford Courant, 15 June 1992.

While no new targets were set at the meeting, there was agreement to meet in 1997 in Kyoto Japan to sign a protocol which will, for the first time, include emission reduction goals and to consider adopting specific measures to that end. The controversial issue of "joint implementation" wherein developed nations could receive emission reduction credit for sharing technologies or undertaking activities with lesser developed nations was partially defused by not allowing these forms of credits until binding carbon limits are set.[8]

[8] Christopher Flavin, "Climate Policy: Showdown Berlin," Worldwatch, July/August 1995, pp. 8-9.
Donella H. Meadows, "If Ice Cracks in Antarctica," Lakeville Journal, 20 April 1995.

The Leggett Connection

In 1993 Dr. Jeremy Leggett, Scientific Director for Greenpeace International's Climate Campaign, published "Climate Change and the Insurance Industry: Solidarity Among the Risk Community?" In it, he postulated that some of the unprecedented losses suffered by the property-casualty insurance industry in the 1987 - 1993 timeframe might have been connected to early effects of enhanced climate change. During that period, 16 separate events lead to losses of at least a billion dollars apiece, eleven of them were directly weather-related. Prior to that time, the industry had never experienced a single event with a loss of over $1 billion.[9]



Monetarily, that represented a total of $44.2 billion lost as the result of windstorms. In 1992, global catastrophic losses ran $27.1 billion, up 87% from the previous year. Leggett noted that , "Swiss Re, in a 1993 report, found that both the size and frequency of the catastrophes seemed to be increasing. Munich Re, analyzing the 1992 record, listed more than 500 natural catastrophes compared to around 400 the previous years. The ten-year period 1983 to 1992 showed ten times the insured losses as the 1960's, **after adjustment for inflation.**"[10] [emphasis added] Nor did Dr. Leggett's paper ignore the fact that much of the increased loss was due to the "proliferation and concentration of values, of course: simply stated, with the increasing wealth of people seeking insurance and their increasing tendency to live in harm's way."[11]

---

[9] Dr. Jeremy Leggett, "Climate Change and the Insurance Industry: Solidarity Among the Risk Community," Greenpeace. May 1993, pp. 16-17.

[10] Ibid., 17.

[11] Ibid., 30.

Dr. Leggett's publication was punctuated by a growing body of opinion of some of the world's largest insurers and reinsurers reflecting a departure from previously held convictions regarding the near-term stability of climatological conditions.[12]

Swiss Re:

> There is a significant body of scientific evidence indicating that last year's [1990] record insurance losses from natural catastrophes was not a random occurrence. Instead it may be the result of climatic changes that will enormously expand the liability of the property-casualty industry. [13]

Munich Re:

> The present problems will be dramatically aggravated if the greenhouse predictions come true. The increased intensity of all convective processes in the atmosphere will force up the frequency and severity of tropical cyclones, tornadoes, hailstorms, floods and storm surges in many parts of the world with serious consequences for all types of property insurance.[14]

Lloyd' of London (statement of one anonymous syndicate):

> Somebody had got off the fence .. they said, if you're asking us, yes, there's a direct link, and this could have an affect on your business. .. We started to incorporate the statements that we had received and the areas we had been warmed about, into our whole rating base, which we are glad to say resulted in us reducing our commitments in areas like Florida.[15]

Tokyo Marine and Fire Insurance Co.:

> ...the recent large-scale disasters in Japan and abroad do not seem to be coincidental. It seems that behind these events are global-scale changes in climate patterns.[16]

Noticeably absent from the discussion were the American firms with the exception of American Re's general manager for Australia and New Zealand, where it was reported that he:

> echoes the views expressed overseas by the likes of Lloyd's of London's deputy chairman, Dick Hazell, that there is no reason to expect the recent spate of disasters was just bad luck or statistical oddity. The long term impact of global warming on the world's weather patterns and the incidence of disasters due to man-made constructions or industry pollution may both ensure that as significant number of large-scale catastrophes occur somewhere around the world each year.[17]

After thorough analysis of the weather trends and the reaction of insurers, Dr. Leggett summarized the options[18] open to the industry as:

---

[12] Ibid., 28-32.
[13] Ibid., 29.
[14] Ibid., 31.
[15] Ibid., 29.
[16] Ibid., 32.
[17] Ibid., 25.
[18] Ibid., 3-4.

1) Conduct business as usual and hope that these weather-related losses have been a passing anomaly.

2) Begin an overhaul in the way the insurance industry conducts business. This might include withdrawal of coverage for specific storm-prone areas, higher deductibles, use of coinsurance, higher rates and other loss reduction techniques.

3) Adopt an activist intervention role. Lobby government and all other economic players to reduce greenhouse gas emissions mostly through changing international energy use patterns.

He goes on to maintain that without a viable insurance industry, it would be impossible to maintain a healthy international economy which is dependent, in turn, on healthy populations and the ecosystems which support them.

Since that report, additional research on climate change has taken place and a number of events, both weather-related and institutional, have taken place.

Current European Insurance Company Perspectives

Since publication of Dr. Leggett's report, activity in the European insurance community has increased in a number of ways including symposia which have included sponsorship and participation by Greenpeace.[19]

In January of 1995, Munich Reinsurance (one of the largest reinsurers in the world):

> ....announced that the floods in Europe may be linked to global warming, and expressed fears that the worst is yet to come.[20]

Just prior to the meeting of the parties in Berlin in late March of 1995, Munich Re called for reductions in carbon emissions on a worldwide basis and Gerhard Berz, head of its Geoscience Research Group pronounced:

> There is no longer any doubt to us that a warming of the atmosphere and the oceans is causing an increased likelihood of storms, tidal waves, hailstorms, floods and other extreme events."[21]

Further European activity took place at the meeting of the parties. There, Lloyds of London, Munich Reinsurance and Swiss Reinsurance actively called for emission reductions. According to one report:[22]

> A chief Lloyd's underwriter, Richard Keeling, and other top European insurance executives made the rounds of leading delegations Wednesday in a newfound role as friends of the Earth.
>
> "The insurance business is in quite a bit of trouble, so we have to start acting now," Keeling said. ..Keeling said that climate experts that Lloyd's hired could not tell the insurer that global warming was to blame for the unusual severity of recent catastrophic storms, droughts and floods.
>
> "They told us, 'We can't prove there is global warming. But by the time we can, you chaps will be in real trouble,'" he said.
>
> So Keeling and executives of Munich Re and Swiss Re, two of the world's largest reinsurance companies, became lobbyists for reducing emissions...
>
> Unlike Keeling, US insurers have not taken the position that global warming is already occurring, Nutter* said. But they have been studying the issue intensely for two years, he said.

---

[19] Ariel Sabar, "Greenhouse 101," Whole Earth Review, Winter 1994. p.18.
[20] Jolene Anderson, "How Policy Makers Have Responded to Global Climate Change," Wisconsin Energy News, Vol. 16, No. 3, May - June 1995, p.6.
[21] Stefan Thiel and Bill Powell, "While the Earth Burns," Newsweek, 10 April 1995, p. 44.
[22] "Friends of Earth Getting Powerful New Allies: Insurance Executives," Associated Press, The Hartford Courant, 30 March 1995.
* Franklin Nutter is President of the Reinsurance Association of America.

Worldwatch Institute author and Berlin Conference observer Christopher Flavin reported that Swiss Re had issued a statement saying:

> ...human intervention in the natural system could accelerate global climate change to such an extent that society might no longer to [be able to] adapt quickly enough. [23]

The momentum that began in Berlin has continued with indications that the British industry is considering concrete actions to shift investment patterns for mitigation purposes. Sections of an industry report contained information that:

> 'global warming is probably taking place already" bringing an "increased likelihood of extreme climatic events". It adds "It is imperative for insurers to make every effort to mitigate their exposure...." The scientists and all the delegates for the various countries were unanimous in their belief that global warming was occurring and that an increased frequency of extreme climatic events was probable."[24]

Dr. Leggett expressed further optimism on how the issue is developing:

> ...in Europe it's getting very interesting now with the discussion[s] that are going on in the companies and this initiative that Uni Storebrand, a big Norwegian insurer is coordinating with a number of Swiss German British insurance companies to move forward on environmental interest in not just contaminated land but also the climate change issue and I'm privately optimistic that they're going to go so far as to get involved actively in the ongoing climate negotiations and in the same way as other business groups do and that we have a snowball situation developing really, which ultimately is going to lead to investment opportunities as well.[25]

Even more recently, two major events took place solidifying the European and Asian insurance company positions. During October, Swiss Re took out a full page ad in the *Financial Times* saying, among other things:

> ...stop and think: giant storms are triggered by global warming; this is caused by the greenhouse effect; which is, in turn, accelerated by man.[26]

A month later, fourteen insurance companies from around the world signed a "Statement of Environmental Commitment to incorporate environmental considerations into their risk management and to adopt best practices." The Statement's Preamble states:

---

[23] Christopher Flavin, "Climate Policy: Showdown in Berlin," Worldwatch, July-August 1995, p.9.

[24] Geoffrey Lean, "Insurers Urged to Go Greener," Independent on Sunday," (London) 7 May 1995.

[25] Dr. Jeremy Leggett interviewed by Joel Gordes, 8/15/95.

[26] Gary Stix, "Green Policies: Insurers Warm to Climate Change," Scientific American, February 1996. p. 27.

> The insurance industry recognizes that economic development needs to be compatible with human welfare and a healthy environment. To ignore this is to risk increasing social, environmental and financial cost. Our Industry (sic) plays an important role in managing and reducing environmental risk, in conjunction with governments, individuals and organizations. We are committed to work together to address key issues such as pollution reduction, the efficient use of resources, and climate change. We endeavor to identify realistic, sustainable solutions.[27]

It is notable that not one of the fourteen initial signatories, the six later signatories or another 26 who have indicated their intention to sign is from the US insurance industry.

Current US Insurance Company Perspectives

> About five years ago or so we were in the middle of a project to develop what we call a coastal hazards database and what this did was collect information on what coastal areas were especially susceptible to things like coastal storms and rising sealevel. At the same time we were compiling a global data base about the relative frequency and intensity of tropical storms along various coastal areas. I happen to be in Hartford for an unrelated meeting and made an appointment to visit one insurance company. I met with a corporate VP for research who was a meteorologist and I kind of discussed what I was doing and he said, "Well this is very interesting thing but I don't see that it's relevant to the insurance industry. Especially the coastal work. "Well," he said "if its a coastal storm then liability is with (what was seen as) the federal government somehow, not the insurance companies and certainly perspectives have changed over the years.[28]

One factor leading to the change in perspective is that, over the past few years, the United State's property casualty insurance companies have also suffered serious losses which have lead to reduced earnings. No matter the cause, the industry is deeply concerned with loss mitigation. Continued catastrophic loss lowers their reserves and threatens their very viability, let alone their profitability. There is some consensus that future losses from hurricanes could have severe repercussions:

> a potential $54 billion for a class five hurricane striking Miami and $51 billion for a class-four storm striking New Jersey, New York, Connecticut and Massachusetts. - Natural Disaster Coalition[29]

Conning and Company, a Hartford, Connecticut-based insurance firm in its study "Lighting Candles in the Wind: Industry Response to the Catastrophe Problem" was in close agreement on the outcome as it called for industry lobbying efforts for a federal disaster fund to act as an industry safety net:

---

[27] United Nations Environment Programme, Statement of Commitment by the Insurance Industry, 23 November 1995.

[28] Dr. Robert Cushman, Director, Carbon Dioxide Information and Analysis Center at Oak Ridge, TN interviewed by Joel Gordes, 8/4/95.

[29] Sabar, p.17.

> Major catastrophes "would seriously impair, if not destroy, the solvency of many insurers -- including some of the industries biggest names."
>
> A $50 billion storm in southern New England, for instance, would render Aetna insolvent by wiping out its surplus, or financial cushion, and would eat up 56.4 percent of ITT Hartford's surplus, the study estimates.[30]

Increased amounts of property in harm's way and inflationary pressures has prompted Eugene Lecomte, CEO of the Institute for Property Loss Reduction to comment:

> There is the potentiality for one or more $50 billion losses to occur within a close time proximity of one another. That potentiality would, if it became a reality, erode a significant portion the Industry's $180 billion surplus. The Industry would then lose the capital (surplus) needed to take on new risks thus, creating a severe property insurance availability crisis.[31]

While no one single company has unequivocally related losses or projected losses to early effects of global climate change, it can be inferred from some industry statements and activities that they are treating it as a serious subject. Franklin Nutter, president of the Reinsurance Association of America and one of the most outspoken in the industry has said:

> The insurance business is the first in line to be affected by climate change. It is clear that global warming could bankrupt the industry.[32]

Other research-related arms of the industry are also beginning to stimulate discussions among their members. In the paper, "Coastal Exposure and Community Protection: Hurricane Andrew's Legacy" jointly produced by the Insurance Institute for Property Loss Reduction and the Insurance Research Council, it is noted that:

> If the growth of coastal population and property exposed to hurricanes is not already enough to warrant concern about human safety and economic loss, there is growing uneasiness that global climate may be changing in ways that could increase hurricane frequency and severity...
>
> Some observers speculate that the string of major weather-related natural disasters since 1987 (e.g. Hurricanes Hugo, Andrew and Inike; California drought-related urban wildfires; and 500-year floods along the Mississippi River in 1993, California in 1995, and Germany in 1993 and 1995) are early signs of human-induced climate change.[33]

---

[30] Diane Levick. "Huge Catastrophe Could Endanger Insurers," The Hartford Courant. 20 December 1994, p. 1F.

[31] Letter of 27 November 1995 from Eugene Lecomte.

[32] Eugene Linden, "Burned by the Warming," Time, 14 March 1994, p.79.

[33] "Coastal Exposure and Community Protection: Hurricane Andrew's Legacy, Insurance Research Council and Insurance Institute for Property Loss Reduction, April 1995, p. 12.

Gregory Krohm, former Wisconsin Deputy Insurance Commissioner and presently editor of the Journal for Insurance Regulation states on the subject of industry comment on the linkage of losses to climate change:

> I think that's asking a lot right now. More applied research in determining how changes in atmospheric chemistry are affecting weather will be necessary before the industry gets involved proactively.[34]

Likewise, Wallace Hanson President of the Property Loss Research Bureau echoes Krohm:

> The industry mindset is: Is this part of a normal cycle? Or, as Greenpeace suggests, is it something that society is bringing on itself and will get worse? This is the fence companies are sitting on. I feel that fossil fuels may be the cause, but I'm afraid of throwing a whole lot of resources at it and finding out it's something completely different. And so it is critical that data gathering and the arrival at sound conclusions be accelerated.[35]

Agreement on the need for additional research has also come from the scientific community where Dr. Kerry Emanuel of MIT has presented a very salient point:

> Well, I think this is a self-serving remark. I don't make it lightly for that purpose. I think one of the best insurance policies is for society to promote more research on that because --and this is where it departs from the example of taking insurance out on your house -- in fact nobody can tell you any better ten years from now then today what the risk of your house burning down is but we're not in that situation in that the assessment of the risk can in fact become more and more accurate with time to the extent that the science progresses but in fact the level of effort the sheer number of people working on the scientific problem is tiny compared to other disciplines. [36]

In general, though, the consensus among interested observers is that the United States property-casualty insurance industry has been far more reticent and non-committal on the subject of climate change than its European counterparts.[37] It can best be summed up as climate researcher Dr. Stephen Schneider in parodying Mark Twain once quipped, "Nowadays, everybody is doing something with the weather, but nobody is talking about it."[38]

A possible exception to this is American Re. While not commenting directly on the climate change issue, its AM RE Services is well-positioned and has been forward

---

[34] Sabar. p. 18.
[35] Sabar. p. 18.
[36] Dr. Kerry Emanuel interviewed by Joel Gordes, 8/16/95.
[37] David Blecker of MSB Associates interviewed by Joel Gordes, 8/7/95.
[38] Dr. Stephen Schneider, Global Warming, Sierra Club Books, San Francisco, 1989, p. 200.

looking in its emphasis on technology investment and tranfer in environmental areas but with an eye on the bottom line:

> It makes sense that the insurance industry would work to reduce the potential for environmental loss and to control damages. American Re's technology transfer initiative provides our client's access to unique technologies that reduce long-term liabilities related to pollution. We believe that emerging environmental technologies will play an important role in managing financial exposures.[39]

Asked why there appears to be a lack of discussion in the American industry as compared to Europe, Mr. Nutter observed that, basic structural differences in make-up of European companies and their experiences may partially account for this:

> Some European insurers have scientific arms. I think that's it in part. I really don't know of any US insurers that have any on-staff scientists that look at climate or weather--the industry just isn't structured that way. Some companies in Europe actually have these resources and applied it to research in this area. I also think a number of companies in Europe have more of an international perspective on catastrophe exposures. The companies that have spoken out tend to be large international companies. US companies tend to be fairly domestic. They see the experience from hurricanes or tornadoes but they wouldn't necessarily have a bigger picture about the Far East or South America or Europe, certainly.
>
> I do think the industry will be looking more closely at the research programs and other government activity that analyze weather and climate. Hopefully insurers will provide support for those government programs because it appears that what is needed is more information about climate and changes to climate.[40]

Potential Political Significance

If climate change does lead to greater weather-induced catastrophic losses as Dr. Leggett has suggested, and no action is taken over the next ten to twenty years to stabilize emission levels, society may be faced with political ramifications not seen since the time of the great depression. This time it may be due to the inability of the nation to insure its assets. While it is taken for granted, the ability to insure is one basis for capital accumulation and the preservation of wealth. Loss of this ability could severely cripple the nation's capacity to carry out what are deemed the most elementary economic transactions such as owning a home or starting a business.

To explore these implications it is useful to examine the immediate and longer term effects which Hurricane Andrew has had on the ability of Floridians to obtain insurance and other less direct but no less important consequences.

Hurricane Andrew was only the second Category 5 hurricane to hit the United States mainland and made landfall at a relatively less dense area than the immediate Miami area. The $16 billion dollars of insured losses were incurred in a matter of hours and

---

[39] Lean.

[40] Franklin Nutter interviewed by Joel Gordes, 8/15/95.

wiped out approximately the previous 20 years of collected premiums. If it had hit a more populated area, it would have cost considerably more. Nonetheless, by December of 1992 nine insurance companies were out of business and the State of Florida, facing an insurance crisis, had to take political action to insure that homeowners would be protected even though their insurers had gone bankrupt. To pay $500 million in claims over five years, the legislature adopted a 2% surcharge on residential insurance policies held by Florida insurers.[41]

The repercussions did not stop at the Florida borders and by mid-1993, Hawaii (which had suffered high losses from Cyclone Iniki), Louisiana, Texas, New Jersey and New York were targets of insurers reluctant to renew or take on additional risks in states with coastal areas. Those continuing to insure storm-prone areas asked for significant increases with premiums up as much as 40%.[42]

Even after the immediate flurry of activity by the insurers, the pullouts have continued:

> To avoid paying claims if another big hurricane hits Florida, Allstate Corporation says it plans to cancel 20,000 homeowner policies in the Tampa bay area... Allstate estimates that it would have to pay $2 billion in claims if an Andrew-type storm hit the Tampa Bay area... The cuts come on top of 32,000 policies that Allstate canceled in south Florida since the 1992 storm.[43]

> CIGNA Corporation, one of the state's largest insurers for condominium associations has stopped writing new policies in South Florida to reduce its risk of claim losses. ..CIGNA's sales moratorium took effect Sunday, a month before the start of the Atlantic hurricane season... CIGNA was not required to tell the state Insurance Department of its policy change...But the change is worrisome because any limitation "represents another person or entity in Florida that's strapped" in their search for insurance... [44]

The fallout to other states has also been significant as the industry attempts to raise rates to what they believe to be more realistic levels. One innovation, which has already sparked political repercussions in its early stages, is the increasing reliance by the industry on computer models to predict future claims as a method by which to set current rates:

> Hurricane Andrew raged through Florida three years ago, but its echoes are just starting to rip through homeowners' insurance budgets along the rest of the East Coast. ... the insurance industry is using new computer methods to predict future hurricane claims and justify large rate increases from the Sunshine State right up to Connecticut.

---

[41] Leggett, p. 21.
[42] Leggett, p. 22.
[43] Associated Press, "Allstate Plans to Cancel 20,000 Florida Policies," The Hartford Courant, 5 January 1995.
[44] Staff and wire reports, "CIGNA Pullout," The Hartford Courant, 5 May 1995.

> ISO's increase for New Haven homeowners would be 39.1 percent; Bridgeport 37.9 percent; and Middlesex county, 41.3 percent.
>
> Florida, where rates have been rising sharply since Andrew slashed ISO's proposed 92 percent increase to homeowners' insurance to 49 percent.
>
> New York's insurance regulators in April launched an intensive review of the models, noting that insurers are using them to justify dropping coastal customers as well as to raise rates.
>
> Georgia's insurance commissioner this spring denied two Insurance Service Office requests that would have boosted rates 50 to 75 percent for homes along the coast, and 95 percent for some businesses.[45]

Aside from the increased and controversial reliance of the industry on computer generated loss projections to set rates, it has been the trend for the property-casualty businesses of multi-product insurance companies to lead the losses for the companies as a whole.[46] While much of this has been due to environmental pollution, asbestos claims and the Northridge earthquake, the winter storms of 1993/1994 as well as other weather-related losses have added to the figure. In at least two cases, environmental losses [mostly legal defense related costs] lead to an overall downgrading by national rating agencies.[47] In the case of Aetna Life and Casualty, one of the firms downgraded, there has been discussion on divestment of a portion of its "weakest link"[48] which was followed by a move boosting their reserves for pollution claims by $750 million which, "could help pave the way for -- but doesn't guarantee -- a sale of at least part of the Hartford-based insurer's property-casualty business." This was met by a response from two rating agencies to downgrade the insurer with the speculation that the increase in reserves might not be large enough.[49]

The rallying call of business for the latter part of the 1990's might well be, "When the going gets tough, the tough form mergers," and the second observation is that the property-casualty insurers are not immune from this trend. The explanation of this is:

> Analysts interpreted the merger craze as a sign that while most property-casualty insurers are, plodding along with disappointing earnings, the strong ones are taking advantage of a depressed market. "Strong and well-capitalized companies like American General and Lincoln National are in the process of

---

[45] Diane Levick, "Blown Away," The Hartford Courant, 4 June 1995, pp. B1-B2.
[46] Diane Levick, "Aetna May Sell Sizable Part of Weakest Link," The Hartford Courant, 9 June 1995, pp. F1-F2.
[47] Diane Levick,"Moody's Downgrades Ratings of CIGNA Corp," The Hartford Courant, 11 August 1994, pp. B1-B2.
"Insurers Get grades From Rating Agencies," The Hartford Courant, 28 June 1995.
[48] Levick, 9 June 1995.
[49] Diane Levick, "Aetna Bolsters Claim Reserves by $750 Million," The Hartford Courant, 13 July 1995, pp. F1-F2.

> adding to their portfolios when financial stocks are especially cheap. And good for them, "said Michael Smith an analyst at Lehman Brothers Inc.[50]

A major question is what this shake-out in the industry will mean both for consumers and the economic health of the industry itself. While each company may end up with larger assets, will there be fewer companies available to consumers from which to choose and if more withdraw from coverage of storm-prone areas to maintain those assets, will there be an insurance crisis in the offing, particularly in the commercial lines? According to Dr. Jack Nelson of the College of Insurance:

> On the commercial insurance side there are not that many players to start with. You know people are very specialized .. when the Home was collapsed into the Zurich you essentially lost a competitor because there are only so many companies that would write directors and officers liability [insurance], only so many companies that would write liability coverage for certain types of operations and when the Home dropped out, you had four or five options... if it was five it's down to four. So there is some consolidating. I think it's more impacting commercial buyers than it is personal lines buyers because you have lots of personal lines sellers ....[51]

A "World Without Insurance" Scenario

With that as a setting, it might be an interesting gaming exercise to imagine a scenario from Leggett's projected future of more frequent, high intensity storms, where, unlike Hurricane Andrew, the worst case does materialize and what the implications on the economic and social fabric of the nation might be:

A Category 5 hurricane (named Rush, the 17th storm of the season) has hit the US mainland but this time, after badly battering the Carolinas, drives up the coast into the New York/New England area where it devastates the coastal areas and destroys much of the infrastructure. Damage is estimated to be at least in the $75 to $110 billion range.[52]

Some major national insurers, including Aetna and The Hartford, are severely stressed to the brink of insolvency with many more local companies declaring outright bankruptcy. The loss of direct employment as well as the need for funding to rebuild the infrastructure and businesses precipitates emergency actions by the governors, state legislatures and congressional delegations of the affected states along the much of the East Coast as well as most of those from the Gulf Coast states who can see the handwriting on the wall. Most have sworn that reconstruction is the most important issue of the decade taking precedent even over deficit reduction or raising the defense budget again to meet all threats.

---

[50]Ann Colden, "Merger Rumblings Heard Within Insurance Industry," Dow Jones News Service, The Hartford Courant, 14 January 1995, pp.F1-F2.
[51] Interview with Dr. Jack Nelson, 8/10/95 by Joel Gordes.
[52] Diane Levick, "Huge Catastrophe Could Endanger Insurers," The Hartford Courant, 20 December 1994, p. F1.

Funds are appropriated to begin clean up efforts and a long-proposed public/private catastrophic loss safety net easily wins passage in the Congress with support from an alliance of East and Gulf Coast politicians, insurers and environmentalists.[53]

Amendments to the bill to sharply curtail the use of coal, a leading contributor to global warming gases suspected of inducing climate changes which could be responsible for the super storms were successfully challenged by Western and Mid-Western states as well as the fossil fuel industry. East Coast representatives repeatedly stated that without long term mitigation, they would all be back debating this issue again. More successful was an amendment by the insurance industry to establish a tax credit-driven national fund to finance state-of -the-art greenhouse gas mitigation technologies.

Other amendments prohibiting reconstruction on storm-prone sites were also defeated by special interests including realtors and counties and towns fearful of the consequences of loss to their local property tax base.

In the months to follow, remaining insurers withdraw coverage from coastal areas which have been redefined to cover those portions of a state within fifty miles of a coastline ocean.

Businesses, unable to obtain insurance, find it impossible to operate while those who have, are now paying such high premiums that they have become subject to severe competitive pressures.

Homeowners, wishing to rebuild residential dwellings, are put in much the same situation where, without the availability of reasonably priced insurance, they are unable to obtain mortgages or home equity loans from financial institutions. Those that do obtain insurance, are held to new and higher building standards which greatly escalate the cost of construction.

As what rebuilding as can be accomplished begins, a new storm is sighted in the Eastern Atlantic already packing winds of 120 mph.

While portraying the extreme, the ability to "game" provides insight into what could happen in a "world without insurance" and to play out some of the secondary repercussions that might result. It raises some serious doubts concerning the ability of the nation to recover from such a loss and, ***if a second storm were to hit after the withdrawal of coverage from storm-prone areas***, the very viability of some regions would be left in question. Many people might be faced with the choice of moving from such regions or attempting to find alternate methods of insurance -- if such exists.

---

[53] Fiona Gibson (ed.), "Companies Debate Hot Topic of Global Warming," Lloyd's List, 4 April 1995.

The lobbying activity in the scenario to set up an insurance safety net is founded in fact and well-premised that it will not be enacted "until another major catastrophe happens. ... It's not a question of whether; it's a question of where or when."[54] Neither is the inability of the environmental community to reduce CO_2 emissions, particularly from coal, which may precipitate such superstorms a fictional account. It will take at least ten if not twenty additional years of scientific research to forge what is currently no more than a tenuous link between a fossil-fuel-driven enhanced greenhouse effect and some of the extreme weather-related losses. Until then, it is doubtful that the nation will give up the use of its most plentiful and inexpensive indigenous energy form particularly when large amounts of public and private funds have been invested to increase the efficiency of coal plants while reducing their emissions.

The threats which any nation perceives to its security, be it national security or economic security, change over time. For the past fifty years, the basis for national security has always been found in the echo of the surprise attack on Pearl Harbor. The irony, lost on most Americans, is that when General Billy Mitchell warned of a growing Japanese air threat in the 1920's, his advice was almost totally disregarded[55]. Present attempts to warn of the potential for an equally devastating threat, this time to our economic security, face similar disregard in political circles if not derision in the popular press. Even if the probability of risk is extremely low, the enormity of the assets at risk should provide inducement enough to prompt serious discussions.

Policy Response Options

There are duel dangers in disregarding what only seems to be a distant threat. The first is that by delaying any action to a time when definitive proof is established that climate change is driving catastrophic weather, it may be too late to take meaningful mitigation steps. The second danger is the political inclination to be seen to be doing something which may prompt draconian actions after the fact which could bring greater disruption to the fossil energy industry than if a more gradual transition were adopted at an earlier point. This anticipation of policy measures has prompted Mark Mansley, former Chief Analyst and a Director of Chase Investment Bank in London to offer policy response scenarios for investors which include:

[54] Levick, 20 December 1994.
[55] Roger Burlingame, General Billy Mitchell: Champion of Air Defense, Signet Books, 1956, pp. 104-105.

Summary of Scenario Analysis[56]

Scenario	Low Impact	Best Guess	High Impact
Extent and impact of climate change	Low	Significant, in line with IPCC central forecasts	High
Policy measures	Modest (within 20 years)	'Rational', including: carbon tax, energy efficiency measures, etc.	'Panic', including high carbon tax, carbon fuel use limitations, etc.
Anticipated timescale of policy response	n/a	4-10 years	4-15 years
Impact on coal companies	Neutral	Negative	Strongly negative
Impact on oil majors	Neutral	Variable, negative	Negative
Impact on oil exploration companies	Neutral	Increasingly negative	Strongly negative
Impact on gas companies	Neutral	Neutral	Moderately negative

He notes that "While this 'low impact' scenario, which allows for business as usual, may be possible, it does not fit with the current level of understanding, and requires climate change to have only modest impacts. As such it is probably not the most likely scenario to consider."[57] On risks of unpredictable policy options he reiterates that, "The magnitude of the risk will increase, the longer serious decisions are delayed,[58]" and cautions:

> For the carbon fuel industry, the temptation is to resist policy measures to reduce CO2 emissions, as if the choice is between such measures and the absence of them. As Dr. Michael Grubb, of the Royal Institute of International Affairs pointed out to the petroleum industry conference on climate change, it is more probable that the choice is between gradual measures, brought in with time for industries to adapt, compared with panic measures brought in to drastically curb emissions, in ten to twenty years time. The latter case would be far more damaging to the oil and gas industry than the former, forcing the industry to write-off substantial amounts of capital. As Dr. Grubb put it, 'It would be prudent for the petroleum industries to reduce their future risks by calling upon governments to embark now upon steady, clear, and quantified step to reduce their carbon emissions.'[59]

[56] Mark Mansley, "Long Term Financial Risks to the Carbon Fuel Industry from Climate Change," The Delphi Group, November 1994. p. 6.
[57] Ibid., 10.
[58] Ibid., 12.
[59] Ibid., 12 -13.

Lending support to financial institution concerns over climate change is a memorandum sent by Peter Blackman, an Assistant Director of the British Bankers' Association to its members in September 1995[60]:

> Initially, we were extremely sceptical (sic) about the potential impact of climate change on the banking sector. However, we quickly learned that there are real threats. Firstly, on liability regimes, it is clear that once liability for past contamination and pollution has been decided, Governments will turn their attention to ensuring compliance with sustainable development and other similar programmes (sic) designed both to improve the environment and the economies. Thus, there are likely to be sanctions which could easily include liability for compensation and clean-up cost for those directly or indirectly undertake or enable processes and operations which are not in accordance with the environmental standards set out in the sustainable development programmes....
>
> The impact of climate change is the physical one. That is, as climate change takes place, it will have significant adverse effects upon the activities of the banks' customers; their operations will fail or become not viable. For instance, hurricanes in certain parts of the world are already destroying property, plant and machinery; temperature changes either way have a dramatic impact upon industrial processes; reduced air quality impacts upon both industrial processes and population factors and, rising sea levels lead to coastal erosion and flooding...

In the end analysis, official climate change policy response is a political issue where decisions based upon imperfect scientific knowledge must be made by decision-makers caught between conflicting and oftentimes powerful interest groups.

Put in a more simplistic way, however, the climate change situation can be likened to an airline pilot with a load of passengers on a transoceanic flight. Most pilots would take almost immediate corrective action if he or she received early, although uncertain, indications that higher than predicted headwinds increased the probability of risk that the fuel would not be sufficient to reach the destination. Corrective actions could be as conservative as changing altitude to a level where the winds might be more favorable, returning to base or landing at an alternate. While all of these options entail cost, it is considered minor compared to the potential but uncertain alternative.

By training, the pilot is taught that going beyond the point where "easy" options are still available -- the point of no return -- always holds less options and usually of a more drastic and disruptive nature.

Unfortunately, politicians do not receive the same training for piloting the ship of state and doing nothing at the point of early but uncertain indications of trouble is also an option. Only when a politician senses that the public perception will accept, if not

---

[60] Memorandum by Peter M. Blackman, Assistant Director, Bristish Bankers' Association, to Meeting of Officers, Oiso, Japan. 20-23 September 1995.

mandate, action will they take the political risk to act even if a decision made earlier in the process offers a greater degree of choice.

Insurance Industry Response Options

In the end analysis the primary question which must be answered for the insurance community concerns the monetary risk associated with increased global warming gases and what, if anything, should be done about it? To better understand how insurers' are likely to treat this heretofore uncalculated risk one financial textbook offers this guidance:

> The Oxford Dictionary includes in its definition of the word *risk* the following: "chance of bad consequences, . . . exposure to chance of injury or loss." Most people understand the concept -- risk refers to the possibility of an unpleasant outcome...
>
> Another approach is to apply probabilities to the possibility of loss. But if asked which was riskier, a 50 percent chance of a small loss or a 45 percent of a large loss, most investors would find the second riskier.[61]

Then it may follow that even if there is only a low probability of risk posed by global climate change, due to the tremendous amount of assets at risk, the insurance industry may be likely to take significant long term actions in addition to the short-term reductions to exposure already underway .

When they will be ready to do so remains an open question. Frank Nutter has unequivocally stated that :

> The insurance industry, generally, and this organization specifically, have not taken a position on CO2 levels. The industry does not engage in scientific research. While we have listened to presentations by scientists about the problems of climate change, and are concerned because of extraordinary claims for damaged properties, appropriate CO2 levels and emission controls are probably outside the scope of what the industry is dealing with.
>
> That still begs the question of the effect of global warming. Certainly, with respect to weather and climate, we seem to be seeing some fundamental changes. The issues are going to be whether catastrophe experience is due to natural variability or exacerbated by man. But the industry really has not --or at least not yet--chosen to take any position with respect to appropriate CO2 levels and I believe they're going to be gun-shy of doing that. [62]

Dr. Jeremy Leggett, in viewing the evolution of thought by European insurers has acknowledged:

---

[61] John L. Maginn & Donald L.Tuttle (editors,) Managing Investment Portfolios: A Dynamic Process, Warren, Gorham & Lamont, New York, 1983. p. 33.
[62] Franklin Nutter interviewed by Joel Gordes, 8/15/95.

> I may be completely wrong here but I would hazard a guess that you're in the States now where we were two, maybe three years ago in Europe and I've been working on this issue for six years -- but only about half that time with specific focus on the financial sector and as I progressively got solutions with the way that governments are facing up to the advice they were getting from their own technical community . So what we've seen here started off with very high level concern from folks ,for whatever reason, had been exposed to the problem. This is why Munich Re and Swiss Re are so important because they have technical , in-house technical expertise--world-class meteorologists there in headquarters. We've then gone from a situation where that concern proliferated downwards in companies and outwards into other companies and I think you going to see the same thing over the next couple of years in the States because the people who are concerned are the folks, who for whatever reason, have encountered the problem.[63]

Ann Deering of Environmental Technology and Telecommunications, Ltd., who consults to the insurance industry may have already observed such a change:

> ... the whole thing has taken a different focus since the February 1995 meeting with Vice President Al Gore on the issue of climate change --insurers are listening to it more -- they've had two meetings on climate change, insurance and energy efficiency. In one meeting which I attended in May 1995, they had on climate change, it was a different reaction from US insurers. The presentations by climate scientists were so convincing. Now insurers' reactions are, "at least let's take a look at it "[64]

Another observation from the same meeting which may best summarize the current position was:

> They sponsored that meeting in Washington back in June [1995] and a number of insurance companies were represented at that meeting to hear the various scientists and the European Insurance Industry...On one hand a couple of people there representing insurance companies are people, in particular, who are active in these kinds of discussions so I don't think they were surprised at all . And there were a couple of others there, one guy in particular I know , a VP of underwriting for one of the major stock companies; he told me that he found the discussion very interesting but where he takes it from there where he fits it into the corporation's response is to the discussion is an unknown he has no idea what to do with it. And I think being as conservative as they are, and as slow moving as they are, for the most part, it's going to take them more time and some more banging on the drum to get them to pay attention.[65]

According to some, that meeting, itself, may have been the watershed event. Sponsored by the Insurance Institute for Property Loss Reduction and the Reinsurance Association of America with cooperation from the Office of the Vice President and Dr. (formerly Senator) Timothy Wirth, Undersecretary for Global Affairs. It brought together from 20 to 30 members of the insurance industry with the scientific community and the European

[63] Dr. Jeremy Leggett interviewed by Joel Gordes, 8/15/95.
[64] Ann Deering interviewed by Joel Gordes, 8/9/95.
[65] Gary Kerney of Property Claims Service interviewed by Joel Gordes, 8/11/95.

insurance community to openly discuss the issue. It also appears to have led to a continuing forum where more specific actions concerning loss reduction, future study and updates on scientific findings will be undertaken.

No Regrets Technology Strategies

> Casualty insurance companies, like life insurance companies, have a quasi-fiduciary role; thus safety is the dominant consideration influencing investment policy. However, the risks insured by casualty companies are less predictable. In fact, for companies exposed to catastrophic events --such as hurricanes, tornadoes, and explosions -- the potential for loss can be significantly greater. Furthermore, casualty policies frequently provide replacement cost or current cost coverages; thus inflation adds to the degree of risk.
>
> Not surprisingly, then, the cash flow from casualty insurance operations can be quite erratic. Unlike the life companies, which traditionally have been able to project cash flow and make forward commitments, casualty companies must be prepared to meet operating cash gaps with investment income and/or maturing securities. Thus for the portion of the investment portfolio relating to policyholder reserves, the tolerance for loss of principal or diminished investment income is low. Predictability of investment maturities and investment income is necessary and operates as a direct offset to the unpredictability of operating needs.[66]

The IPCC's issuance of its initial findings in 1990 states that, "The unequivocal detection of the enhanced greenhouse effect from observations is not likely for a decade or more." This finding was reaffirmed again in 1992 and 1994 making it particularly difficult for the insurance industry and policymakers to formulate directive, long term actions. While the 1995 reports go much further in linkage of anthropogenic actions to climate change, there is still much uncertainty of whether this presents a threat or whether the scale of that threat is sufficient to alter established patterns of energy usage and investment. If a 99% certainty of linkage tied to negative effects is required before the financial community deems to take action, they may well find themselves at a point of no return. Then, even drastic actions will not be able to alleviate the lasting effects.

When only ambiguous information is available on which to make decisions, a strategy must be employed to balance the probability of risk, no matter how low, with protecting both insured assets numbering into the trillions of dollars and investment income sometimes used to offset losses. That strategy must be conservative enough to preserve those economic returns on investment demanded by the insurance industry, its stockholders and its clients yet protect those same players from potentially even greater risks on the loss side of the equation.

Many insurance companies have already taken action to reduce their direct liability by "stormlining" (geographic withdrawal from coverage) areas such as Florida[67], increasing

---

[66] Maginn and Tuttle, pp. 111-112.

[67] Staff & Wire Reports, "CIGNA Pullout," The Hartford Courant, 5 May 1994.
Associated Press, "Allstate Plans to Cancel 20,000 Florida Policies," The Hartford Courant, 5 January 1995.
"Heat on Prudential," The Hartford Courant, 3 March 1995.

premiums and deductibles, seeking coinsurance and calling for higher building standards. Beyond these short-term actions, there are still opportunities to reduce risks without jeopardizing short-term profits.

A two point strategy, already under discussion and, as evidenced by the Delphi Group's report, at least partly underway in Europe, mitigates risk while maximizing investment returns:

1) Lobby national and international bodies for reduction of emissions suspected of enhancing global climate change such as Lloyds of London, Swiss Re and Munich Re already have at the Berlin meeting of the parties.

2) Consideration of a "no regrets" or "least regrets" strategy by Europeans which would shift investment from fossil fuels into technologies and projects which are able to minimize generation of greenhouse gases. Simply stated, these strategies (sometimes referred to as a tie-in strategy) entail mitigation activities which provide tangible and positive economic and other returns *even if it is determined that greenhouse gases present no threat*. These returns would be greater or equal to alternate investments which would not aid in mitigation. As a report by the Chartered Insurance Institute Society concluded:

> The industry has a limited breathing space in which to gather its wits, and plan in a truly long-term timeframe... all investment managers should modify their investment policies to take account of the potential direct and indirect effects of global warming.[68]

In the same article he reports that Swiss Re advised:

> ...there is no shortage of practical suggestions, especially with regard to a drastic reduction of greenhouse gases.

One obvious example would be investment into new electric power sources. In his book The Ecology of Commerce, author Paul Hawken contends that only through the power of big business and market forces will we be able to overcome environmental problems.[69] With large financial assets available to them, the insurance companies might find a profitable, long-range strategy would be to invest in technologies that have the ability to produce energy in the most efficient and cost-effective way. Currently, for electrical production, this would be the gas turbine, a jet engine that is capable of burning a variety of fossil and renewable fuels at efficiencies of over 40% and projected to be at 55% by

---

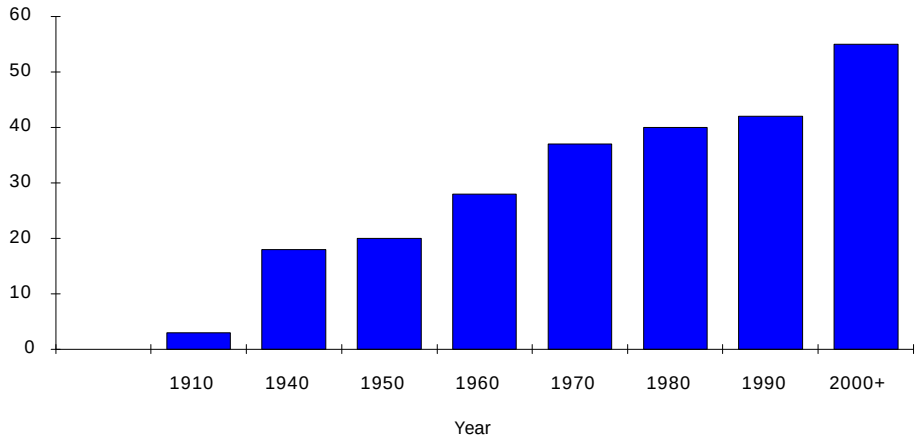
[68] Dr. Jeremy Leggett, "Taking Bearings in the Greenhouse," Global Reinsurance, June-August 1995, p.33.

[69] Paul Hawken. The Ecology of Commerce. Harper Business Books. NY, NY. 1993.

the end of the decade.[70] This represents a 25% to 65% increase over the efficiencies of most operational plants.

One way in which this investment might take place is for the insurance industry to provide loans or loan guarantees to those prospective customers who are in the market for new power plants. Even loaning the differential cost between an inefficient and efficient plant at a lower interest rate might induce the shift toward efficiency. Insurance companies are not strangers to investment in

Growth in Efficiency of Gas Turbines[71]



power plants with such industry notables as Prudential, Allstate, Aetna, John Hancock and CIGNA already counted as players.[72] They currently invest because they see it as a sound business which meets their requirements for return on investment. What could conceivably take place is an increase in the magnitude and focus of their investments to produce worldwide market shifts to the most efficient forms of energy production.

If climate change does present a serious problem and some way to finance efficient choices in energy on a large scale is not found, other solutions may be moot. This is due to countries like China and India who are in the process of enormous electrification projects. This tremendous increase in electrification will bring about a much-hoped for rise in the standard of living for those parts of the world. At the same time, though, since the fuel of choice will largely be coal, the most polluting of the fossil fuels, it could

[70] Michael Totten. Energywise Options for State and Local Goverments -- A Policy Compendium. Washington, D.C.: Center for Policy Alternatives, September 1990 p. 79

[71] William W. Bathie. Fundamentals of Gas Turbines. New York, NY: John Wiley & Sons, 1984. pp. 3 -17. Additional communications with George Opdyke, a recognized expert in gas turbine technology.

[72] John L. Anderson. "Gaining Strength" Independent Energy. March 1994. pp. 14 - 19

negate the mitigation efforts of the rest of the globe and accelerate the warming process.[73]

A number of investment mechanisms might be employed to accelerate development of a new generation of super-efficient turbines now being proposed by the Collaborative Advanced Gas Turbine (CAGT) project. CAGT is a consortium of 17 electric and gas industry, government and international organizations under the auspices of the electric power research institute (EPRI) working on accelerating the commercialization of what are termed intercooled, aeroderivative gas turbines The product is heralded to be super efficient, super clean and low in price. [74] It brings together the potential customers with the sellers so that the final product represents what the user group will buy and provide market assurance required by manufacturers prior to making large investments in development. In this way, financial risk is mitigated for all stakeholders. It can use a variety of fuels including nartural gas, gasified coal, gasified biomass and other feedstocks making it suitable for use in most places in the world.

Another method would be to provide direct financing to the prospective customers. Even if just the differential cost between inefficient and efficient units were financed at favorable terms, it might be possible to affect a market shift towards efficiency. An interesting mechanism which might be used is the Critical Industries Development Fund which has has been developed in Connecticut.

The most salient points are that it sets up a fund to be administered by a quasi-public instrumentality of the State which may accept contributions from various sources. Corporations which contribute would receive a modest tax credit for the invested funds. These funds may be loaned out to meet financing needs of customers of Connecticut-built nondefense products if the project meets due diligence requirements. The loan is then repaid to the investors through the quasi-public agency. (See diagram of operation on the following page.) One provision allows contributions to the account as a whole or dedicated to a specific project or type of technology. This may be appealing and helpful to certain "green" technologies other than high efficiency gas turbines such as fuel cells, biomass projects and photovoltaics.

In its present form, it is, by no means, optimal and will most likely require enhancements such as: 1) raising the tax incentive level to a level high enough to attract corporate investors 2) extending the tax incentive to individual investors and/or 3) exempting the interest paid to the investor from taxation and 4) providing for the sale or trade of the tax credits to allow untaxed investors (pension funds) to transfer credits to taxable entities. Still, in present form it is a basic structure which may be built upon to attract insurance

[73] Petesch, Patti L. "New Energy Agenda for Developing World" Forum. Volume Eight, Number Three. Fall 1993. p. 55.
[74] Hollenbacher, Ralph. Collaborative Advanced Gas Turbine Program: Phase I Report. Results workshop in Arlington, VA on April 20, 1994.

company investment into technologies which mitigate global climate change. Jeremy Leggett sees such a model as adaptable for use on a national or even an international scale should mitigation efforts warrant such investment.

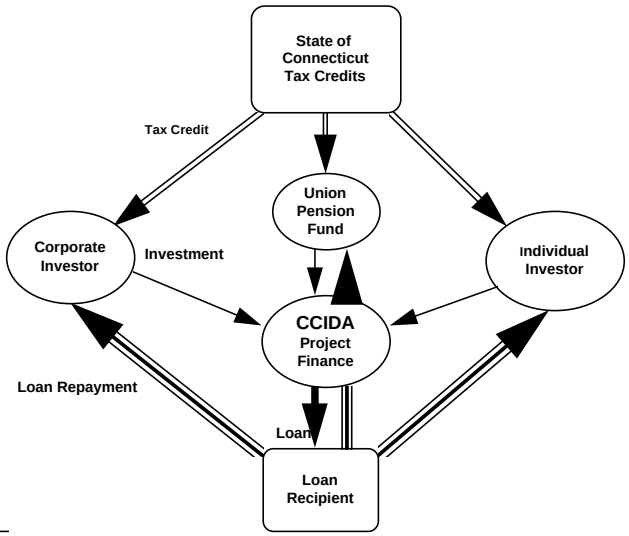
Connecticut Critical Industries Development Account

1) An account is established into which any person, corporation or pension fund can contribute on a purely voluntary basis.

2) Qualified investors will receive a tax credit for the invested funds on the front end.

3) The fund will loan money to both foreign & domestic projects which meet due diligence and use Connecticut-built products.

4) The investors also receive the loan repayment



- Investment
- Tax Credits
- Loan
- Loan Repayment

Future Enhancements

1) Allow individual investors to receive a tax credit

2) If the amount of the tax credit does not attract investment, raise it to a point where it does but limits fiscal loss to the State

3) Allow the interest portion of the loan to be tax exempt

4) Allow nonprofits (pension funds) to sell or trade tax credits

A variation on a no regrets strategy, which could be a candidate for early implementation, would be for the insurance industry to invest in certain technologies which can also reduce their own bottom line operational costs. In the next several years, all building owners will have to make some major decisions concerning the systems used to cool their buildings. This is due to the phase out of present day systems using chlorofluorocarbons (CFC's) and at a later point, hydrochlorofluorocarbons (HCFC's) which have been linked to depletion of the ozone layer and are, themselves, potent global warming gases. Rather than merely replace the cooling system itself, there is now a twice in a lifetime opportunity (the first was at initial building design) to redesign the systems for smaller loads saving on new chiller capacity and continuing cost of operations. A suggested integrated approach begins with reducing all associated cooling loads in the building before sizing a new system.

This would entail examining such energy-consuming systems as lighting, computers, pumps, motors and fans, all of which, through choice of efficient models, have the potential to reduce not only their own operational cost but to lower the cooling cost of the building at large. In some areas, local utilities may aid in procurement and rebates for efficient systems since it lowers their requirements for future generation needs and reduces their air emissions.[75]

In the United States, another less obvious investment is into timberland holdings through pension funds. While not consciously done as a greenhouse gas mitigation strategy, it has nonetheless provided John Hancock Financial Services a 20-30% annual return on investment. It also continues to sequester carbon through responsible forest management.[76] Depending upon the amount of waste wood available from the forestry operations, there is the future option of adding a small, high efficiency gas turbine (possibly intercooled such as the CAGT project) to the operation. In this way they would be able to use gasified biomass as its fuel to further enhance the overall value of the investment. The sale of electricity generated by this method would be highlighted by its renewable source, possible zero net CO_2 production and a somewhat stable price as important aspects of its marketability.

This same biomass resourcemight find value as a feedstock for production of ethanol, an alcohol which may be used with gasoline or straight. Through new methods such as the simultaneous sacrifcation and fermentation (SSF) technology developed at the National Renewable Energy Laboratory, the economics of production are vastly improved. Such blended fuels produce less CO_2 and will increase in value as conventional sources of oil become more scarce or politically insecure.

---

[75] Chris Robertson, Jay Stein et. al. "Turning the CFC Phase-out Into Energy and Dollar Savings," Source Tech Memo 93-3, June 1994.

[76] Jeff Smith, "Pension Funds Take to the Woods," Maine Telegram, 22 January 1995. 1F,4F.

Another promising technology is the fuel cell, a device which uses air and any number of fuels to produce electricity at a high efficiency. The device is characterized by its modularity, no noticeable emissions (it has blanket siting certification in California) and quietness. Because of its high initial capital cost, it may find initial applications in several niche markets. Among these are their use to supplant expensive and increasingly difficult to site transmission and distribution upgrades required by the utility grid. In many cases the addition of the fuel cell in what is termed as "distributive generation" may be less problematic and, thus, less expensive.

Fuel cells might also find wide application in information intensive industries which require a high quality, high reliability source of electricity at all times. In some industries, the loss of power from the grid for a day or more could result in economic losses which make the economics of fuel cell back up cost-effective. In that capacity, they have the ability not only to replace uninterruptable power sources (UPS) and other emergency back-up systems but to actually reduce the electric cost on an ongoing basis.

The soundness of these electric power investments is further underscored by the rapidly approaching shift of the electrical generation industry from monopolistic investor owned utilities to a competitive atmosphere. Largely driven by the emergence of the new technologies, it is only a matter of time until consumers can purchase their electricity from the vendor of their choice. This may drive the sale of even more gas turbines, fuel cells, wind systems and energy conservation services. While some utilities appear to be positioning themselves mostly in terms of lowest first cost, corporations more astute in marketing recognize the value-added attributes associated with system quality, reliability and conservation services.

Insurance companies might also capitalize on their power of aggregation to take advantage of these emerging competitive electric structures as their realization increases that they are not merely in the insurance business but, rather, the total financial security business. USAA Insurance already markets a telephone service plan with Sprint which reduces cost to USAA customers by an additional 5%. Much the same could be done by insurers who act as a bulk purchaser (or generator) of electric power for their customers not only bringing down the cost of electricity to those customers but also exerting greater influence on the choice of generation mix to mitigate climate change.

Ice Dam Mitigation: A Possible Modest Starting Point

One case in point why incentives to install insulation may make immediate economic sense to insurers is to prevent claims payments in cold climates due to ice dams. Ice dams are build ups of ice at the edge of roofs which can eventually allow water to enter the home causing damage to walls, ceilings and possessions. Ice dams are due to a number of reasons but the two primary ones include lack of adequate ceiling insulation and lack of ventilation of the attic above that insulation. The result of these two deficiencies is an accumulation of warm air in the attic which melts the snow from the underside which proceeds to run down the roof until it contacts the unheated eaves where

it freezes. The repeated flow and freeze is what builds up the ice dam at the edge until pooled water can work up under the shingles and gain entry to the interior of the home. The resultant damage is often paid for by insurers to their policy holders.

While most of the news coverage of ice dam prevalence in the winters of 93/94 and 95/96 discussed the shortage of snow rakes to take snow off the roof or electric wires to melt the ice, these merely treat the symptoms and, in themselves, create their own hazards (one elderly man died when he fell off the roof while shoveling it.) The proper treatment lies in two major steps:

1) Installation of insulation to bring it to at least an R-30 to R-38 level.
2) Proper ventilation to clear any heated air from the attic above the insulation.

While other aspects such as roof orientation, roof angle, shingle color, eaves length and even topographical features have an impact, these two measures appear to significantly reduce most losses. In addition, they concurrently provide additional tangible benefits:

1) Reduction of overall winter energy use with additional reduced hazards associated with combustion system firing times and/or space heater use.
2) Reduced use of summer air-conditioning needs.
3) Elimination of electric resistance wires on the roof with associated hazards.

Less tangible benefits, but important in discussions of climate change, include:

1) Reduced furnace/boiler CO_2 emissions from reduced firing times and modest reductions in utility CO_2 emissions from reduced fan/circulator usage.
2) Reduced utility CO_2 emissions from lower air-conditioning usage.
3) Reduced utility CO_2 emissions from electric resistance roof cables for ice melting.

While this would be an extremely modest example for mitigating insurance losses while also mitigating CO2 buildup, it could provide one step for finding common ground through mutually positive actions[77]. Another positive attribute of such a program might be that if it were properly designed, there would be a high probability that local gas and/or electric utilities would pay a portion (maybe even a majority) of the cost and contract for the delivery of services. This would require no heavy investment into an administrative infrastructure since most of it already exists.

Most utilities in the Northeast and many others in other northern climes already operate demand side management programs (DSM-conservation measures) which provide such energy saving measures as compact fluorescent bulbs, insulation, efficient hot water tanks, heat pumps, etc. Their reason for doing so is to reduce customer demand to forestall any new expensive plant construction (although many now have a surplus) and to reduce cost of operations as well as SOx/NOx emissions. They already employ

[77] The Insurance Institute for Property Loss Reduction is currently considering this proposal.

energy service companies (ESCO's) to actually go out and install conservation measures. Also, if the utility has begun to think at all clearly about meeting the challenge of a competitive market they could use such a program as a portion of their customer retention strategies and possibly form alliances with insurers for electric and other energy service delivery as previously mentioned.

Precautionary Principal: Beyond a "No-Regrets" Strategy

A "no-regrets" strategy relies upon economics which provide favorable returns on investment. Benefits would outweigh the cost to society but would stabilize climate change gas build ups only as a side effect. Other strategies have been proposed which go beyond "no regrets." Some environmentalists have characterized efforts requiring no regrets or even less active "wait and see" strategies as "prudent recklessness." Their arguments generally rely upon lack of information on how enhanced global climate change might produce positive feedback mechanisms which would exacerbate any changes. These changes might accelerate the entire process to a point of no return since, the feedback portions would be outside simpler, more gradual controls presently available.

While gentler in syntax, the IPCC's 1995 Second Assessment Report cautioned that,

> The parties should take precautionary measures to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects. **Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing such measures**, [emphasis added] taking into account that policies and measures to deal with climate change should be cost-effective so as to ensure benefits at the lowest possible cost. To achieve this, such policies should take into account different socio-economic contexts, be comprehensive, cover all relevant sources, sinks and reservoirs of greenhouse gases and adaptation, and comprise all economic sectors. Efforts to address climate change may be carried out cooperatively by all parties.[78]

Fortunately, the precautionary principal is not a foreign concept to insurers. Carlos Joly, Senior Vice President of UNI Storebrand, Norway's largest insurer points out that:

> The precautionary principal is built into insurance practice and into the way we measure it. We are prepared to invest into loss prevention programs today that will give results several years down the line.[79]

It is also important to realize that the insurance industry actually has two distinct sides to it. One is the liability side which insures our property, health and lives but the other,

[78] Draft IPCCSynthesis Report. 29 July 1995. P. 22.

[79] Jeremy Leggett. Climate Change and the Financial Sector. Gerling Akademie Verlag. 1996. P. 191.

equally important operation, is that which manages the financial investments. Observing this Joly continues:

> Ironically, however, this precautionary recognition has not been part of the culture of insurance company money management operations. The insurance managers and the money managers rarely communicate. It is two different worlds. This is true in every insurance company I know.

Indeed, it would be possible for the investment portion of the company to actually be working against the interest of the liability side of the same company.

Aside from understanding the precautionary principal, it is also fortunate that the insurance industry is no stranger to financing power projects. Firms such as Prudential, CIGNA, John Hancock, Aetna, Allstate and others have been active in power markets due to PURPA. They are skilled in the language and evaluation of risk in this sector and that is a crucial starting point. The renewable energy industry must gain a better understanding of their bottom line requirements and work toward satisfying them.

Where might it lead if the $1.4 trillion insurance industry begins to slowly shift investment patterns from fossil fuels into renewables to lower emissions as some have speculated? In the end analysis, as legislative and regulatory expert Kevin Guernier has observed:

> Should the insurance industry enter the fray opposite the fossil fuel industries and call for emission reductions, it will be a true example of market-driven regulation.[80]

[80] Discussion with Mr. Guernier by Joel N. Gordes in January 1996.

Appendix A

Recent Studies

While scientific papers on the probable effects of greenhouse gas emissions on climate change have proliferated, the current debate concerning effects of climate change on insurers did not erupt until the occurrence of several costly events. These events took place in the late 1980's and, by 1990, precipitated articles in *Business Insurance*, a journal concerned with corporate risk.

The Intergovernmental Panel on Climate Change (IPCC) under the UN Environment Programme and World Meteorological Organization continues to be the one authoritative overbody pursuing climate change in the scientific realm. It is a consensus-driven organization including over 500 authors with as many as 2000 additional experts offering peer review. Still, there are numerous players outside the bounds of the consensus views. Some very reputable meteorologists and climatologists contend that evidence of such change is already under way and may lead to increased weather-related catastrophic events such as hurricanes, cyclones, typhoons, windstorms, flooding and sea level rise as well as agricultural shifts and disease migrations. Other, equally reputable, scientists (Dr. William Sheets of the National Hurricane Center and Dr. Bill Gray of Colorado State University among others[81]) counter that such greenhouse gas induced heating does not and will not affect the climate due to such factors as the capacity of the oceans to moderate any drastic changes and the existence of negative feedback mechanisms to moderate it.

While heated debate on a variety of subjects is not uncommon within the scientific community, few recent issues have evoked the degree of visceral reaction as enhanced global climate change.

The weather-related events from 1987 to 1993 added fuel to the fire as the popular press first picked up on the issue and, just as quickly, dropped it in favor of stories having shorter term impacts if not significance. But, as climatologists on both sides of the issue caution, extreme regional weather events such as those in the summer of 1988 do not necessarily signal climate changes and short term blips on the screen provide incomplete if not perverse information for long term assessment.

Even within the community which does support evidence in favor of an enhanced greenhouse effect there is disagreement on what forms of evidence are relevant versus being merely anecdotal information muddying up the signal to noise ratio. Dr. Stephen Schneider of the National Center for Atmospheric Research in Boulder has cautioned:

> Univariate measures have been used to determine whether significant anthropogenic climate change has been detected, but a number of researchers have suggested that such

[81] Dr. Jeremy Leggett, "Climate Change and the Insurance Industry: Solidarity Among the Risk Community," Greenpeace, May 1993, p. 34.

> measures, especially globally averaged surface air temperature, should be replaced with multivariate methods, which they call fingerprints. These researchers have argued that general circulation models (GCMs) produce regionally heterogeneous maps (for example, some regions get dryer while others get wetter and these patterns vary with season) of projected climate change given some scenario of increases in CO2. Thus, they reason that a much more reliable measure than global temperature of detection of a climate signal would be to compare such seasonally and regionally heterogeneous model forecasts with seasonally and regionally heterogeneous observations of recent climatic trends. This approach would add many additional data points as compared to a single times series of globally averaged surface air temperature and should, they reason, make signal detection occur sooner.
>
> However, such fingerprints have little practical utility currently and can neither validate most model projections because the model experiment is typically performed in an equilibrium CO2-doubled GCM. Such a model does not match the global change "experiment" that the Earth is currently undergoing, in which greenhouse gases and other anthropogenic forcings have been changing over time in a nonuniform way.[82]

On the other hand, other credible scientists[83] point to "events" in multiple disciplines as secondary evidence of climate change. Due to the sensitivity of certain ecosystems, they maintain that subtle changes may be able to act as a "canary in the mine" and provide forewarning of events as opposed to efforts to strictly measure global air temperatures to finer degrees.

Dr. Kerry Emanuel of MIT noted:

> I think probably people are moving toward measures of climate change which are directly relevant to society... What they [people] do care about is the temperature locally, rainfall, storminess; that sort of thing and it's about time the scientists start trying to understand how those measures change with climate and stop focusing because, after all, there can be severe climate -- hypothetically strong climate changes-- even though the global mean temperature is left alone. That is not impossible, the climate can change and become rainier in some places, dryer in others, warmer in some places and colder in others without the mean temperature changing at all. It's a poor measure and it's poor not only from the standpoint of society but it's also poor from the standpoint of measurement; it's actually a very hard quantity to put your finger on. People really are going to start moving away from it. [84]

---

[82] Dr. Stephen Schneider, "Detecting Climate Change Signals: Are There Any Fingerprints"? Science, Vol. 263, 21 January 1994, p. 341.

[83] Donella Meadows, "Is Late Frost an Indicator of Climate Change?" Lakeville Journal, 20 October 1995.

Meadows, 20 April 1995.

David Mazie, "Current Warm-up May Pose Future Threat," Register Citizen (Torrington), 16 may 1995.

Phil Mintz, "Scientists Watching Waves for Clues to Climate Changes," The Hartford Courant, 18 May 1995.

[84] Dr. Kerry Emanuel interviewed by Joel Gordes, 8/16/95.

Dr. Emanuel went on to say that he thought some of the most credible evidence is going to come from left field and the left field in this case is a brand new field of research that which tries to relate strong storminess to past climate change going back as far as 100,000 years. He says that understanding how storminess in the past might have been related to climate change in general may provide a big leg up in trying to understand how future storminess might be related to future climates. The work is based on a kind of deposit on the sea floor called a tempestite. By examining cores and analyzing sediments, they hope to determine how storminess varied in the past. Dr. Emanuel believes the results of that research will probably be more informative than anything that's been done so far theoretically.

All parties hold loose agreement that certain basic advances have made important contributions to a better understanding of the many cycles which must be accounted for to separate the signal from the noise.

Once such advance came from AT&T Bell Lab's Dr. David Thomson who was engaged in temperature research when he noticed irregularities in specific patterns. This he traced to precession of the Earth's axis which takes place over a 26,000 year cycle.

> When he took the wobble into account, some of the anomalies in the temperature record disappeared --but a disturbing new puzzle emerged. In the middle of this century, just when greenhouse-driven global warming may have begin to take hold, the timing of the seasons was disrupted. "Either something [natural] is happening that is very unusual, "he says, "or we're the reason."
>
> ...In the first 300 years of a record beginning in 1659 in central England, Thomson found that winter set in 1.4 days later each century, just what precession should be causing. ...Until around 1945 or 1950 in the central England record, the seasons changed in time with precession but then the rate of delay shot up. In the last fifty years the seasons in central England have been delayed 4.5 days, as much as in the previous 300 years.[85]
>
> The analysis indicates that "the effects of increasing greenhouse gases may be worse than previously thought," Dr. Thomson reports in the journal Science.[86]

In 1976, the CLIMAP study indicated that during the past 3 million years the Earth had gone through a number of glacial periods with warmer interglacial periods between. An exception to this was found in tropical areas which appeared to stay at much the same temperature regime. New evidence found in ice-age ground water from Brazil now appears to indicate that tropical areas were subject to cooling periods which has lead to numerous speculations including Paleoclimatologist Thomas Crowly of Texas A & M to note:

---

[85] "The Seasons of Global Change," Meeting Briefs, Science, Vol. 267, 6 January 1995, p. 27.

[86] Jerry Bishop, "Long-Ignored Cycle in Climate Suggests Worse Greenhouse Effect Than Thought," The Wall Street Journal, 11 April 1994, p. B5.

> But if paleothermometers like Brazilian ground waters are accurate, he says, the most alarming projections of greenhouse warming may be the right ones. [87]

Launched in August 1992, the Topex/Poseidon satellite is a joint US-French venture to collect the most accurate data yet available on global sea level. It is estimated to be 30% more accurate than use of tidal gauge stations previously used for this purpose and could provide more solid long term evidence of whether the Earth is undergoing global climate change related to carbon dioxide generation.

> Dr. Fu and other participants in the project acknowledge that two years of observations cannot prove the existence of long-term climate change trends. Nevertheless, these observation corroborate the trend of sea level measurements made over the last century using tide gauges. The mean rate of sea level rise determined by the satellite is roughly what would be expected from global warming, Dr. Nerem said.
>
> Global warming is thought to cause rising seas for two reasons: the thermal expansion of liquid water and the melting of glaciers and polar ice. Approximate measurements over the decades have shown a strong correlation between estimates of global sea level and global temperature. Although some scientists have challenged such estimates as possibly short-term aberrations rather than long term trends, evidence has mounted in recent years that a long-term warming trend is in progress.[88]

Two recent studies confirm that approximately 20% of the solar radiation assumed to have reached ocean surfaces in climate change computer models, in fact, is absorbed within the clouds.

> Some of the energy we thought was going through the atmosphere and reaching the surface isn't; it's being absorbed by the clouds," says climate modeler Jeffrey Kiehl of the national Center for Atmospheric research (NCAR) in Boulder, a co author on both papers.
>
> ...Much more atmospheric heating could take place without the evaporation, ascent of moisture-laden air, and the precipitation that researchers had previously assumed. And that change in the heat engine has some "fairly dramatic" effects on climate models, says Kiehl.
>
> ...In a simulation of present climate, they found that the modified model generates "a climate that's significantly different than what we had -- it is warmer, precipitation is less, surface winds are weaker, and the circulations are slower," says Kiehl. "In general, it compares better with observations than the previous version of the model."[89]

NASA reported that El Nino, the periodic warming trend in the Pacific ocean, was twice as strong in 1994 as it was in the previous year. The TOPEX/Poseiden satellite provided

---

[87]Richard A. Kerr, "Chilly Ice-Age Tropics Could Signal Climate Sensitivity," Science, Vol. 267, 17 February 1995, p. 961.
[88]Malcolm W. Browne, "Most Precise Gauge Yet Points to Global Warming," New York Times, 20 December 1994.
[89]Richard A. Kerr, "Darker Clouds Promise Brighter Future for Climate Models," Science, Vol. 267, 27 January 1995, p. 454.

information confirming a rise in sea surface elevation which indicates warmer water temperatures.

> The satellite's radar images show the tropical Pacific is about 4 inches to 8 inches higher than normal, project scientists said.
>
> During the 1992-93 El Nino, it was 2 inches to 4 inches above normal, Fu said
>
> That earlier El Nino "was a significant event that caused large changes in the jet stream over the Pacific and North America through May 1993," said Gerald Bell, a meteorologist with the National Weather Service Climate Analysis Center in Camp Springs, MD. "California got pummeled with rainfall that ended a long term drought. South Africa got hot and dry. The El Nino was an indirect contributor to the Midwest floods.[90]

> Another weather service official pointed to the unusually strong El Nino phenomenon this winter as consistent with global warming projections.
>
> "In the greenhouse effect warming, we would expect more frequent episodes of El Nino conditions," said Vernon Kousky, also with the Climate Analysis Center.

But a leading critic of global climate change alarmism last week threw cold water on such speculation.

> The 20th century's temperature record does not correspond with the predictions of global climate change "theory" computer models, said Patrick Michaels, associate professor of environmental science at the University of Virginia.
>
> ..Michaels also downplayed the unusually strong El Nino phenomenon this winter. The El Nino record goes back 100 years, showing a cycles (sic) of high frequency and low frequency El Nino years, he said.[91]

A study by Accu-Weather located in College Station, PA, "Changing Weather? Facts and Fallacies about Climate Change" for the Global Climate Coalition, an industry backed group, disputes that severe weather-related disasters are becoming more common, more severe or are rooted in global climate change. Authored by Norman J. Macdonald and Dr. Joseph P. Sobel, the report says:

> The slight increase in average climate temperature that has occurred during the past century falls well within the limits of natural climate variability and does not signal a man-made "greenhouse" crisis.
>
> Severe storms such as tornadoes and hurricanes have not shown any tendency to occur more frequently today than they have in the past.
>
> The heavy January rains in Southern California are not unprecedented

---

[90]"El Nino Twice as Strong as in '92-93," The Hartford Courant, 25 January 1995.
[91]"Near-Record Temperatures for 1994 Consistent With Warming, Officials Say," The Energy Report, 23 January 1995.

> Record high temperatures are not occurring more frequently now than they have at other times in the past 100 years.[92]

They attribute much of the apparently increased activity to:

> advances in technology used to detect and record weather data, not the least of which are global satellite systems.
>
> Second, the electronic media efficiently gather and report dramatic weather information from around the world. In the age of instant communications, enterprising television networks can bring severe storms right into your living rooms as they are happening.
>
> Yet another factor in the perceived increase in catastrophic weather is the fact that more people are living in coastal areas. This increases the likelihood that when storms strike, property damage will be great.[93]

[92] Norman J. Macdonald and Joseph Sobel, "If the Globe is Warming, You Can't Prove it by the Weather," The Hartford Courant, 5 March 1995, pp. C1,C4.
[93] Macdonald and Sobel.

Landfill gas

PV-emergency systems, use in Virgin Island areas etc instead of rebuilding grid.

Integrated into building design

If a strategy of lobbying for emission reductions is successful, it would tend to increase the value of the investments made in the mitigation technologies. From a purely economic standpoint, this might be seen to be self-serving but such enlightened self-interest is no stranger to the world of business. It is analogous to insurance companies lobbying for mandatory seat belts in automobiles to reduce their accident liabilities.

Lipin, Steven. "GE Unit, Soros Form Venture to Build Power facilities in Emerging Nations." The Wall Street Journal. January 31, 1994.