From Risk to Opportunity: Insurer Responses to Climate Change

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Lawrence Berkeley National Laboratory

Casualty Actuarial Society Annual Meeting
Quebec City
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Ceres
Our atmosphere is as thin -- in proportion to the Earth’s diameter -- as a film of condensation on a steel ball.

Roadmap

• Why insurance & climate change?

• State of knowledge on climate
  – fingerprints
  – forecasts

• Relevance for the insurance community
  – changing business environment
  – expectations from stakeholders
  – emerging risks

• Opportunities
For Insurers, Climate Change is an Emerging Risk to be Managed...

Insurers are....
- messengers
- integrators
- risk assessors
- risk managers

but...
- vulnerable
- flying partly blind
- selective

and....
- part of the solution

Climate Change is Integral to Mainstream Insurance Issues

- Customer retention
- Corporate governance, investor relations, & disclosure
- Balance sheet strength & solvency
- Competitiveness
- Emerging markets
- Reputation & trust
- Modeling weaknesses: Past vs future
- Regulation
- Insurability: availability & affordability
IPCC Fourth Assessment Report
Co-Recipient of the 2007 NOBEL PEACE PRIZE

http://www.ipcc.ch

“Warming of the climate system is unequivocal.”

- Change is accelerating
- Nearing danger zone
- Solutions possible (and affordable)
- Must adapt and reduce emissions

Our confidence in climate change is about like that of human evolution or health effects of smoking

The Climate System

Human-induced Greenhouse Gas Emissions

Source: Intergovernmental Panel on Climate Change, Fourth Assessment Report, WGI (2007)
Climate Modeling Has Become Far More Precise

1990 Far
1995 SAR
2000 TAR
2005 AR4

25x improved resolution!

Source: Intergovernmental Panel on Climate Change, Fourth Assessment Report, WGI (2007)

The most important human influence is fossil fuel combustion ...
... but there are others

Other GHG’s already above highest levels in 650,000 years
... The second most important human influence is deforestation

Deforestation for soy growing in the state of Mato Grosso, Brazil

Source: Moutinho and Schwartzman, 2005

Key Gases

Carbon Dioxide

Peak natural variability over the previous 650,000 years

Methane

Nitrous Oxide

Source: Intergovernmental Panel on Climate Change, Fourth Assessment Report, WG I (2007)
Net effect of cooling + warming influences...

...is warming

Source: Intergovernmental Panel on Climate Change, Fourth Assessment Report, WG1 (2007)

FINGERPRINTS...
Recent Indicators of Climate Change

Global average temperature (accelerating)

Global average sea level

Northern hemisphere snow cover (accelerating)

Mars
Thin atmosphere
(All CO₂ in ground)
Average temperature: -50°C

Earth
0.03% of CO₂ in the atmosphere
Average temperature: +14°C

Venus
Thick atmosphere containing 96% of CO₂
Average temperature: +420°C


Warming during the Industrial Era
Positive Feedbacks

Temperature > beetles

Ice > albedo

Windstorm-downed trees > carbon

Wildfire > carbon

Permafrost thaw > carbon

Erosion > carbon

Net effect is accelerated warming

FINGERPRINTS ... Floods

Photos: Cedar Rapids “500-year” flood (June 2008)

Major floods events per decade, 1950-2000

There’s a consistent 50-year upward trend in every region except Oceania.
FINGERPRINTS ... Drought

Proportion of land area in extreme drought predicted to increase from 1-3% to 30% by 2090s.

Drought duration expected to increase 6-fold.


FINGERPRINTS ... Glaciers

Loss Accelerating since early 1990s

FINGERPRINTS... Greenland

Greenland's Melting Ice Sheet

U.S. Sea Level Trends 1900-2000

Galveston, TX
New York, NY
Baltimore, MD
Key West, FL
San Francisco, CA
Sitka, AK
Sea-level Rise = 10 feet = half of Greenland melting

(Source: Harvard University)
FINGERPRINTS ... Polar ice


6.74 M square km  5.32 M square km  4.13 M square km

The difference between median minimum arctic ice coverage and the extent on Sept. 16, 2007 is equal to the area of Alaska and Texas combined (2.61 M sq. km or 1 M sq. miles). http://nsidc.org/news/press/2007_seaiceminimum/20070810_index.html

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North Slope Exploration Season

Figure 1 - Length of the winter tundra travel season, as determined by the DNR Division of Lands, Northern Regional Office
Permafrost Disintegration
Settlement of *several meters* is possible

Electric Transmission, Pipelines, Bilbino Nuclear Station

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If we don’t alter course, we’ll end up where we’re headed

Global average surface temperature is an index of the state of the climate – and it’s heading for a state not only far outside the range of variation of the last 1000 years but outside the range experienced in the tenure of Homo sapiens on Earth

Source: John Holdren, after IPCC (2007)
Range of Predicted Warming: By Scenario and Timeframe

Source: Intergovernmental Panel on Climate Change, Fourth Assessment Report, WGI (2007)

Climate on the Move:
Changing Summers in the Midwest

Source: Based on data provided by K. Hayhoe and D. Wuebbles.
Examples of global impacts projected for changes in climate

Source: Intergovernmental Panel on Climate Change, AR4-WG2, Technical Summary (2007)

Projected Changes in Strong Non-Tropical Storms (Northern Hemisphere)
Projected Change in Precipitation Intensity
Based on the Models Used in the IPCC Fourth Assessment Report

Changes in Severe US Heatwaves
**Direction and magnitude of change of selected health impacts**

<table>
<thead>
<tr>
<th>Negative impact</th>
<th>Positive impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very high confidence Malaria: contraction and expansion, changes in transmission season</td>
<td></td>
</tr>
<tr>
<td>High confidence</td>
<td>Low costs and increased access to healthcare</td>
</tr>
<tr>
<td>Increase in malnutrition</td>
<td></td>
</tr>
<tr>
<td>Increase in the number of people suffering from deaths, disease and injuries from extreme weather events</td>
<td></td>
</tr>
<tr>
<td>Increase in the frequency of cardio-respiratory diseases from changes in air quality</td>
<td></td>
</tr>
<tr>
<td>Change in the range of infectious disease vectors</td>
<td></td>
</tr>
<tr>
<td>Reduction of cold-related deaths</td>
<td></td>
</tr>
<tr>
<td>Medium confidence</td>
<td>Increased economic opportunities</td>
</tr>
<tr>
<td>Increase in the burden of diarrhoeal diseases</td>
<td></td>
</tr>
</tbody>
</table>

Source: Intergovernmental Panel on Climate Change, AR4-WG2, Technical Summary (2007)

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**Human Health Impacts**

- Injury from disasters
- Respiratory disease
  - Pollen
  - Mold
  - Smoke and particulates
  - Urban air pollution
- Heat stress
- Food poisoning
- Water quality
- Environmental contamination
- Infectious diseases

*WHO estimates 150,000 human mortalities each year due to current climate change*
**US Catastrophe Losses: 1980 to 2005**

- **Not weather-related**
- **Privately insured: weather related**
- **Federal insurance: flood**
- **Federal insurance: crop**

- **Northridge Earthquake**
- **"9/11"**


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**CATs Profoundly Influence Profitability (US P&C)**

Note: CATs having increased influence on overall profitability

Source: A.M. Best & Co.
Extremes Shift *More Than Avg’s.*

Small changes in averages...

![Graph showing temperature distribution and frequency over time, with a shift in the distribution towards higher temperatures.](image)

- 1901-1978
- 1979-2003

... but extremes are becoming normal....

... and “tails” are getting longer

Source: Alexander, et al, J. Geophysical Research, 2005

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Rare Extremes Cause Most of the Damages & Insured Losses

**The European heat wave of Summer 2003**

<table>
<thead>
<tr>
<th>June</th>
<th>1993</th>
<th>2002</th>
<th>2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Insurance Losses:
  - wildfire/property
  - crop
  - power sales
  - health/mortality

Event was “six-sigmas” outside of norm. 16°F above average in France and Germany, was a 1-in-10,000 event to 1-in-46,000 event

Change in Frequency of Extreme European Heat Waves

Change in Risk is 4x

Under Human-Induced Climate Change (1.6°C above 1960-1990 mean)

Number of occurrences per thousand years

Source: IPCC AR4, Corresponds to 1.6°C change in mean

Small-scale Losses: Soil Subsidence

Subsidence claims increase with drought: UK 1975-1999

Source: Association of British Insurers
**Small-scale Losses: Lightning**

Lightning-related claims accelerate with temperature.

Source: Hartford Steam Boiler Inspection and Insurance Co.

**Small-scale Losses: Power Outages**

Weather- and Non-Weather-Related
110 million customers affected

U.S. economy total cost: ~$80B/year
Average cost to utilities $49 million/storm; max. $890 million (EEI)
RMS Scenario: $2.7B for NY

Power outages were a factor in slowness of draining New Orleans following Hurricane Katrina.
Small-scale Losses: Floating Ice

Water Quality: California
Correlated Impacts

Drought stress

Wildfire

Mudslide

Insect Infestation

Emerging Risk: Liability

Oil spill following Hurricane Katrina - LIFE

BEST’S REVIEW

D&O Heats Up

Climate change—a rapidly emerging insurance risk—has reached the world’s boardrooms.

> 30 climate law suits pending as of 1/2008
“We’d be out of our minds if we wrote weather insurance on the opinion global warming would have no effect at all.”

Warren Buffett
2006 annual Shareholder meeting

Temperature of Public Opinion

- In 2007, twice as many people believed climate change is here than did in 2004

- But public opinion lags scientific certainty by a significant margin

Insurance Customers Impacted

Top Concerns: Survey of 139 Insurance Executives in 21 Countries

<table>
<thead>
<tr>
<th>Rank</th>
<th>Concern</th>
<th>Source: Centre for the Study of Financial Information and PricewaterhouseCoopers survey: 2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Too much regulation</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Natural catastrophes</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Management quality</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Climate change</td>
<td></td>
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<tr>
<td>5</td>
<td>Managing the cycle</td>
<td></td>
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<tr>
<td>6</td>
<td>Distribution channels</td>
<td></td>
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<tr>
<td>7</td>
<td>Long-tail liabilities</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Actuarial assumptions</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Longevity assumptions</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>New types of competitors</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Investment performance</td>
<td></td>
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<tr>
<td>12</td>
<td>Managing technology</td>
<td></td>
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<tr>
<td>13</td>
<td>Equity markets</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Risk-management techniques</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Back office</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Political shocks and pressures</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Pricing new risks</td>
<td></td>
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<tr>
<td>18</td>
<td>Terrorism</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Complex instruments</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Retail-sales practices</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Pollution</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Interest rates</td>
<td></td>
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<tr>
<td>23</td>
<td>Corporate governance</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Demographic trends</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Contract wording</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Capital availability</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Security of reinsurance</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Availability of reinsurance</td>
<td></td>
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<tr>
<td>29</td>
<td>Business continuation</td>
<td></td>
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<tr>
<td>30</td>
<td>Fraud</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Mergers and acquisitions</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>Too little regulation</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Asbestos</td>
<td></td>
</tr>
</tbody>
</table>
Climate Change is #1 Risk, According to >70 Insurance Industry Analysts

1. Climate change
2. Demographic shifts in core markets
3. Catastrophic events
4. Emerging markets
5. Regulatory intervention
6. Channel distribution
7. Integration of technology with operations & strategy
8. Securities markets
9. Legal risk
10. Geopolitical or macro-economic shocks

Shareholder Climate Resolutions (United States)

Source: 2000-2006 Data: ISS 2007; 2007 Data (as of 02.06.07); Corus 2007 & 2008
Carbon Disclosure Project

Annual questionnaire on business risks and opportunities presented by climate change and greenhouse-gas emissions data from the world's largest companies.

Run by Institutional Investors:
$57 Trillion under management
(major holdings in insurance)

Started in 2000, the CDP now has 385 signatory investors, including Merrill Lynch, Goldman Sachs, Morgan Stanley, AIG Investments, Barclays and HSBC are among current signatories.

Currently polling 3800 companies

Source: http://www.cdproject.org/

Insurance Regulators Recognize the Problem

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

Michael Kreidler
Washington Insurance Commissioner

Tim Wagner (deceased)
Nebraska Insurance Commissioner

Investment by Type

Investment by Technology

* Sylvie Lemmet, Division of Technology, Industry and Economics, UNEP.

Risks Are Also Associated with Responses to Climate Change

- Green buildings
- Nuclear power
- Renewable energy
- Hydrogen
- Carbon capture & storage
- Carbon offsets/trading
- Geo-engineering
- Adaptation projects

*Comparative risk assessments needed*
Insurance Paradigm Shift

From Risk ... to Opportunity

30 strategies; 422 examples
~190 parties; 26 countries ... and counting
New Insurer Business Units

- **AIG**
  - “Office of Environment & Climate Change”
  - “Advanced Energy Solutions”
- **Allianz**
  - “Climate Solutions”
- **Aon**
  - “Agri-Fuels Group”
- **Chubb**
  - “Green Energy Team”
- **Travelers**
  - “Core Business Climate Change Project”
- **Zurich**
  - “Climate Change Advisory Council”

Understanding the Problem: CAT+Climate Modeling

- Trade Associations
  - III [CAT Modeling Forum]
- Insurers
  - AIG
  - Travelers
  - Lloyds
- Reinsurers
  - Swiss Re
  - Munich Re
- Brokers
  - Willis
- CAT Modelers
  - RMS
  - AIR

![Expected increase in annual loss in Europe](chart)
**Improved Land-use Planning**

*Association of British Insurers* - modeling studies

**UK Urban Flood Losses under Climate Change**

- High Emission Scenario
- Low Emission Scenario

Without Adaptation With Adaptation

CEA Report: 13 of 18 countries have >10% penetration of commercial flood insurance

Source: Modeling results for London. Adapted from Association of British Insurers, “Financial Risks of Climate Change” c. 2000s

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**Improved Building Practices**

- **FM Global** - hurricane-resistant building guidelines
- **Institute for Business and Home Safety’s** “Fortified... for safer living” stds.
  - Wind-resistant rigid foam panel walls and multi-glazed windows
  - Ice-dam resistant
  - Mold resistant
  - Water-resistant insulation

*Some insurers giving premium credits for compliant homes*
Promoting Loss Prevention: Wetlands Restoration

- **Tokio Marine Nichido**: has reforested 12,200 acres of mangroves in Indonesia, Thailand, Philippines, Myanmar and Vietnam

  Company states that 2005 Tsunami did less damage in these areas

  Source: http://www.tokiomarine-nichido.co.jp/english/index.html

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Paperless Insurance

- **Progressive**: Tree Planting

  More Than a Quarter of a Million Trees to be Planted on Behalf of Car Insurer’s Customers

  Progressive plants trees in national forests and offers a discount on rates — to thank customers who choose to do business electronically versus with paper
Co-benefits

Drive Green
Safe Driving Is Green Driving.

If you're curious about Allstate auto insurance, you can get a ballpark car insurance estimate or get the inside scoop on car insurance with [Bumper to Bumper Basics](#). When you buy car insurance and choose [Drive Green](#), you can save a little green and help the environment.

You can also start a green driving habit. Many activities we do as safe drivers can reduce emissions and thereby help the environment:

- Drive the speed limit. It saves gas, reduces emissions, and may also reduce the risk of accidents.
- Tune up your car. Regular auto maintenance, including tune-ups and filter changes, allows cars to run cleaner and more efficiently and can also reduce the risk of breakdowns.
- Drive better. Most safe driving techniques, such as accelerating slowly and smoothly (and avoiding rapid starts and stops), also improve gas mileage, which reduces emissions.
- Check your tires. When you keep your tires properly inflated, you can save 300-700 pounds of carbon dioxide per year while also helping to keep you safer on the road.
- Choose a gas sipper. The next time you buy a car, choose a car that gets more miles per gallon (MPG). Plus, if your household has two cars, use the car with the highest MPG for commuting and shorter errands around town (of course, combine trips whenever possible).

Aligning Terms & Conditions with Risk-reducing Behavior

- Insurance discounts of up to 40% for low mileage:
  - Aioi
  - Axa
  - GMAC
  - Hollard
  - Milemeter
  - Norwich Union
  - Polis Direct
  - Progressive
  - Rheinland
  - Sompo
  - Tokio Marine Nichido
  - Unigard
  - Versicherungen

250,000 policies in Europe as of 2007; $700M revenues projected by 2010

General Motors Acceptance Corporation (GMAC) PAYD discount schedule.

<table>
<thead>
<tr>
<th>Miles/year</th>
<th>Discount offered</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – 2,500 miles</td>
<td>40%</td>
</tr>
<tr>
<td>2,501 – 5,000</td>
<td>33%</td>
</tr>
<tr>
<td>5,001 – 7,500</td>
<td>28%</td>
</tr>
<tr>
<td>7,501 – 10,000</td>
<td>20%</td>
</tr>
<tr>
<td>10,001 – 12,500</td>
<td>11%</td>
</tr>
<tr>
<td>12,501 – 15,000</td>
<td>5%</td>
</tr>
<tr>
<td>15,001 – 99,999</td>
<td>0%</td>
</tr>
</tbody>
</table>

Some use GPS → stolen-vehicle recovery; avoids reporting fraud
Aligning Terms & Conditions with Risk-reducing Behavior

- **TrygVesta:**
  - Free one-month bus pass while damaged car is being repaired
  - Repair claims will not be paid for cars built before 1989 and with high emissions

Hybrid Discounts

5-15% premium discounts to hybrid drivers

- AXA
- Berkshire/GEICO
- Cooperative
- Desjardins General
- Farmers
- Hybernia
- SECURA
- St. Paul-Travelers
Fuel Economy & Risk

- Risk (driver fatalities/mile) of compact cars is 1/2 to 1/3 that of trucks, and lower than SUVs
- Crossover SUVs have 1/2 the risk of standard SUVs and are 17% more fuel-efficient

Source: Tam Wenzel and Marc Ross, Lawrence Berkeley National Laboratory

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Carbon Offsets

- Allianz, AXA, Cooperative,
- Insurance Australia Group:
  Car and travel insurance bundled with offsets

[Image of insurance website]
Changing Risk Profiles

The world is changing. We’re changing how we insure it.

Innovative Products

- **Fireman’s Fund**: first-ever U.S. commercial “Green-Buildings Insurance”
  - 5% premium credits for existing green features
  - Rebuild to LEED after loss
  - Commissioning
    - ~500 policies sold in first year (2007)
    - Premiums > $35M in ‘07; Doubling quarterly

- **AIG (Lexington)**: Commercial, and first-ever U.S. residential “Green-Buildings” insurance
  - Rebuilding to LEED (or next-higher LEED level) after loss; LEED design and registration fees
  - Rewards use of EnergyStar-labeled equipment
  - Low-emission materials; IAQ testing
  - Solar “revenue loss” if downtime

- **AIG Environmental**: Sustain-a-Build environmental liability premium credit for green commercial buildings
Innovative Products for Energy Performance

- **Energy Production:**
  - Munich Re - geothermal, Sompo - wind, others...

- **Demand reduction:**
  - AIG, Zurich and others...

Coverage for Under-served Market Segments

- **Lockton Risk Services:**
  - Group liability coverage for home energy auditors, if members of RESNET

Coverage for Under-served Market Segments

- **Swiss Re**: Drought/Crop micro-insurance for 400,000 farmers in Ethiopia, Ghana, Kenya, Malawi, Mali, Nigeria, Rwanda, Senegal, Tanzania and Uganda.
Carbon Risk-Management Services: Project Risk

- **AIG, Marsh, Zurich, others**: offering carbon project risk-management consulting services; benchmarking, and insurance


Direct Investment

- **Allianz**: $15 million in the European Carbon Fund; plans to invest between $400 and $650 million in renewable energy

- **Gerling**: Sustainable Development Project operates a $100 million venture capital fund

- **ING**: Green finance - $1.16 billion

- **Sompo Japan**: $100 million green fund

- **Swiss Re**: $429 million “clean energy” venture fund; $320 million in individual investments

"2008 CERA study predicts $7 trillion investment in "clean-energy technologies.""
Direct Investment

- **AIG**: Atlantic Station
  - Brownfields redevelopment
  - 8 million square feet LEED registered

Among institutional investors, U.S. life insurers hold 22% of all commercial real estate

Financing Emissions-reduction Projects

- **AIG**: $300 million lending facility for efficiency and clean energy
- **Fortis**:
  - Preferential lending rate for energy-efficiency upgrades +10% premium discount
  - $106 million “Green Bank” loans
- **HSBC**: $45 million for wind projects in India
- **Mitsui Sumitomo**: Loans for building-integrated solar systems
- **TrygVests**: $10k financing for “climate-friendly home energy upgrades” after loss.
Funding Innovation

- **Progressive** $10-million “X-Prize for Ultra-fuel-efficient cars

Building Awareness & Participating in Public Policy

- **American Insurance Association**: endorses public transportation; reduced speed limits; telecommuting based on win-win benefits to insurers

- **Insurance Institute for Highway Safety**: supports tightened CAFE standards

- **Firemen’s Fund, IBHS, ICLR**: have endorsed energy-efficient building codes
Building Awareness & Participating in Public Policy

- ClimateWise announced Sept 17, 2007 -- 41 insurers and trade allies pledged to lead the way in:
  - "Analysing and reducing risks"
  - Support climate awareness amongst our customers;
  - Incorporate climate change into our investment strategies
  - Inform and engage in public policy debate
  - And reduce the environmental impact of our businesses.”

Additional signatories as of 11 June 2008: ACE, Amlin, ARK, Beazley, BiBA, Catlin, Chaucer, Diagonal Underwriting, Equity Group, Hardy’s Underwriting, Heritage, Hiscox, Legal & General, Marketform, Navigators, NFU Mutual, Prudential, QBE European Operations, RJ Klin, RMS, Spectrum, Standard Life, UNUM, XL

Source: [http://www climatwise org uk/](http://www.climatwise.org.uk/)
Carbon Risk Disclosure

**Carbon Disclosure Project:** Annual Global Survey by Institutional Investors ($57 Trillion under management)

113 Insurer responses: 2003-2006
- AIG, Allstate, Aon, Chubb, Marsh, MBIA, Safeco, St. Paul Travelers, Unum Provident, Munich Re, others...

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

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Leading by Example

**Insurer CO₂ Emissions Intensity**
(20 companies reporting to CDP5)

![Graph showing CO₂ emissions intensity vs. number of employees. Median point is highlighted.]
Carbon-neutral Insurers

- AIG
- Aviva
- Bradford & Bingley
- Folksam
- Fortis
- FP Marine
- HSBC
- Independent Insurance Services
- ING
- Insurance Australia Group
- Munich Re
- Royal & Sun Alliance
- Rutherfoord
- Solar Group
- Specialized Broking Associates
- Storebrand
- Swiss Re
- Tokio Marine Nichido
- Xelerator

Untapped Opportunities

- Customer segments: agriculture, commercial auto, shipping, high-tech
- Upgrading after loss: shipping, industrial...
- Value-added services
  - benchmarking or carbon-footprint at renewal
  - climate risk modeling
  - Training: operations, loss control, QA
  - Board coaching (esp. re: liability)
  - Disclosure support
- Tailored products, services for green startups (bonds, letters of credit, etc.)
Roles for Actuaries

1. Help your management make sense of the science and its business implications

2. Understand the risk profiles of climate change responses

3. Push for inclusion of climate change in CAT modeling

4. Participate in the development of innovative products & services

“When the winds of change blow, some build walls … others build windmills.”

- Chinese Proverb

http://insurance.lbl.gov
emills@lbl.gov