Energy-Efficiency Options for Insurance Loss Prevention

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Synopsis

Energy-efficiency improvements offer the insurance industry two areas of opportunity: reducing ordinary claims and avoiding greenhouse-gas emissions that could precipitate natural disaster losses resulting from global climate change.

Abstract

This paper argues that the insurance industry should support efforts to identify, improve and implement “no-regrets“ energy-efficiency options that would both reduce near-term business risks caused by insured losses while making a considerable contribution to long-term reductions in greenhouse-gas emissions which also threaten their bottom line. The short-term risk-reducing benefits would have distinct value to insurance companies and their customers irrespective of the timing or extent of future damages related to global climate change.

Our central recommendation is that the international insurance industry initiate a systematic activity to (a) identify technologies that contribute both to traditional loss-prevention and to reducing greenhouse-gas emissions, (b) promote the dissemination of information and the utilisation of such technologies in the cases where they have proven to contribute to loss prevention and are commercially available, e.g. “leading by example” by implementing in-house energy management programs in their own building stock, and (c) support research, development, and commercialization where promising technologies are not yet available in the marketplace. Once the loss-prevention benefits are sufficiently demonstrated, insurers can promote the use of the corresponding technologies and strategies by introducing risk-adequate insurance premium schemes.

1. Introduction

Natural disasters today represent 85% of large insured catastrophe losses globally, or $12.4 billion in 1995 (Swiss Re 1996). Average annual insured losses have increased considerably in the past fifteen years. For example, average annual insured losses from windstorms increased by twenty-fold between the 1960s and 1990s (Figure 1-1). Between 1966 and 1987 there were no disasters with insured losses of more than one billion 1990 U.S. dollars, whereas between 1987 and 1992 fifteen have been reported (Leggett 1993, 1994). According to the Reinsurance Association of America, nearly 50% of the insured losses from natural catastrophes during the past 40 years have been incurred since 1990 (Nutter 1994).

The increase in insured losses due to natural disasters is for the most part a result of demographic trends such as the increase of populations in disaster-prone areas and of a growing insurance penetration especially in those regions.

However, the world’s 2-trillion-dollar insurance industry is also concerned about the possibility of a linkage between climate change and the frequency and intensity of catastrophic windstorm, wildfire, hailstorm, mud-

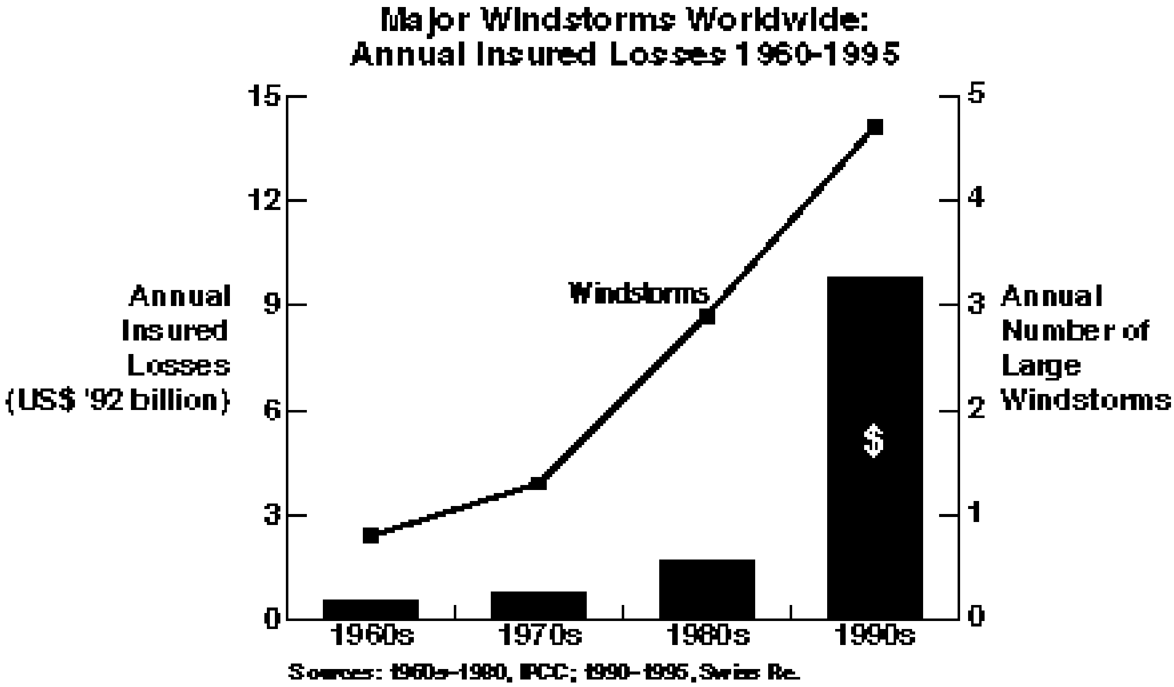

Figure 1-1. Annual number of large windstorms worldwide and related insured losses. Increasing insurance coverage and concentration of property and populations in areas at risk are major drivers of the increase in windstorm insured losses. Total losses (insured+uninsured) have increased 10-fold (from $2 billion/year to $20 billion/year), vs. the 20-fold increase in insured losses shown in the figure (IPCC 1995a). Population growth in at-risk areas (e.g. 40% in the US) does not in and of itself explain the trend. The specific role of climate-change has not been isolated from the overall trend.

slide, flooding and drought events (Doornkamp 1990; Kaufmann 1990; Munich Reinsurance Company 1990 and 1994; Swiss Re 1994; Intergovernmental Panel on Climate Change 1995), since it could considerably accelerate the future increase in insured losses. Insurance companies are also at risk from climate-change impacts on human health (IPCC 1995a,b; Watson 1996).

Since energy consumption is the largest contributor to global climate change, promoting energy efficiency is a promising response strategy for the insurance industry (Mills 1996; Mills 1997). In this paper we discuss energy efficiency measures in buildings that have the potential of reducing insurance losses involving property, health, or liability. Research aimed at better integrating energy efficiency with traditional loss-prevention procedures could lead to measures that simultaneously offer insurance benefits and contribute to reducing energy costs. In the buildings sector, efficiency measures of interest may reduce losses from: fire, ice, wind, and water damage; temperature extremes; business interruption; health risks; and equipment performance problems. We then discuss three specific implementation strategies, illustrated with early instances of their application: (1) supporting research, development, and commercialization, (2) spreading information to insurance customers, and (3) "leading by example" in managing insurance-industry-owned buildings more efficiently.

2. Climate Change Awareness and Initiatives by the Insurance Industry

During 1993, a series of headlines in major newspapers described a growing concern within the insurance industry. "Storm Loss New Blow to Insurers", proclaimed *The New York Times*. "Global Warming Makes Insurers Sweat", suggested *London's Financial Times*. "As Insurance Costs from Hurricanes Soar, Higher rates Loom", warned *The Wall Street Journal*. The headlines reflected a strong increase in insured losses from extreme weather events and a series of catastrophic events, including the most damaging storm in the history of the insurance industry, Hurricane Andrew, which led to insured losses on the order of $US 17 billion followed by rapidly increasing homeowner premiums and even the withdrawal of some insurers from region (Nelson 1996; Gordes n/d).

Insurers began to publicly voice their concerns about the threat of climate change. Franklin Nutter, President of the Reinsurance Association of America, summed up the industry's concern this way: “The insurance business is first in line to be affected by climate change; it could bankrupt the industry”. Swiss Re published a report in 1994 stating that “the phenomenon of climatic change is not some vague threat in the distant future but forms part of a process which has already been going on for millions of years [...] Human intervention in the natural climatic system could accelerate global climatic change to such an extent that society might no longer be able to adapt quickly enough to this development”.

While the scientific debates attract considerable attention in the popular media, many insurers take the position that any non-zero chance of climate change is an imperative for some level of action. Eugene Lecomte, President Emeritus of the US-based Insurance Institute for Property Loss Reduction (IIPLR), stated that “the scientific uncertainty surrounding climate change...does not relieve [insurers] of their responsibility to continue to protect people and their possessions” (Lecomte 1997).

By the mid-1990s the first insurers started to appear at the international climate negotiations. At the Berlin Climate Summit of April 1995, Munich Re, Swiss Re, Storebrand, Lloyd's of London, and the British Bankers Association sent participants or observers for talks with governments. A seminar for insurers, bankers and financial analysts took place on the eve of the Berlin Summit and led to the first book specifically on this subject (Leggett 1996). The Lloyd's of London delegation produced a report which advocated a stronger involvement by the industry in the intergovernmental negotiation process and concluded: “it is thus probable that the insurance industry is going to have to take some initiatives by itself, or along with the banking industry”.

Some insurers have been considerably more reticent and have avoided making any statements. “It's not a good practice to raise people's fears unless you have solid science; otherwise people don't believe you the next time”, was the message by Charles L. Kline, president of Centre Cat, a Bermuda based reinsurer. Others have taken a more proactive and precautionary approach.

One of the most prominent expressions of commitment to a precautionary policy in dealing with environmental and climate change risks is the Statement of Environmental Commitment by the Insurance Industry launched at the United Nations in Geneva in November 1995. By the end of 1996, the Statement had been signed by 62 insurance companies from 23 countries (UNEP 1995). Indeed, to the insurance industry, the absence of certainty is not synonymous with the absence of risk (Durand 1996). The industry is quite familiar with acting to reduce risks even before full information about them is available; this is the heart of the principle of insurance loss-prevention.

The publication of the Second Assessment Report (SAR) of the Intergovernmental Panel on Climate Change (IPCC) in June 1996 was a turning point in the debate on climate change, stating that “the balance of evidence suggests a discernible human influence on global climate”. The major sources of risks related to climatic change have been described in detail in the report. Human activities, including the burning of fossil fuels, land use change, and agriculture are increasing the atmospheric concentration of greenhouse gases, which tend to warm the atmosphere. The SAR also included a chapter authored by members of the insurance and finance industries (IPCC 1995a).

Human activities, according to the SAR, are projected to alter regional and global climate and climate-related parameters such as temperature, precipitation, soil moisture and sea levels. Additionally, some human communities have become more vulnerable to hazards such as storms, floods and droughts as a result of increasing population density in sensitive areas. Inadequate planning and construction also contribute to higher vulnerability in certain areas. The conclusions of the SAR have led to more active participation of insurance companies in the public debate on climate change. At the second Conference of the Parties of the Climate Convention in Geneva on 9 July 1996, for example, the companies of the UNEP Insurance Industry Initiative presented a position paper which states:

"The cost of [extreme weather events] could escalate dramatically as a consequence of the increased greenhouse effect due to human activities. The resultant climate change may alter the frequency and/or severity of extreme weather events and/or their regional distribution. The exact influence is not yet known, due to the limitations of today's understanding of the climate system. It is clear, though, that even small shifts of regional climate zones and/or storm patterns carry the potential of increased property damage, exacerbated by inadequate planning and construction in certain areas. [...] The property insurance industry is the financial sector most likely to be directly affected by climate change.[...] Changes in human health (e.g. spreading of diseases) may affect the life assurance and pension industries. Returns on long-term investments and capital projects may be affected by mitigation measures that alter the economics of whole industries".

The position paper also reiterates the group's commitment to take constructive steps to address the problem, calls for substantial reductions in emissions, and stresses that action should not be delayed in the name of attaining full understanding of all mechanisms involved in climate change (Figure 2-1).

Figure 2-1 Excerpts from United Nations Insurance Industry Initiative Statements (UNEP 1995; UNEP 1996).

"We are committed to work together to address key issues such as pollution reduction, the efficient use of resources, and climate change."

"We are convinced that it is not possible to quantify anticipated economic and social impacts of climate change fully before taking action. Research is needed to reduce uncertainty but cannot eliminate it entirely."

"We are convinced that the most efficient precautionary measure is substantial reduction of greenhouse gas emissions."

"We insist that negotiations for the Framework Convention on Climate Change must achieve early, substantial reductions in greenhouse gas emissions ... the position of the insurance and reinsurance sector must be represented when discussing or negotiating possible solutions."

The process of insurance-industry involvement in the climate-change issue is complicated in light of the multi-faceted nature of the industry. Potential climate changes will effect different insurance sub-sectors—property, life, health, etc.—quite differently. From a public policy standpoint, only a portion of the total societal costs of natural disasters are covered by insurers. As a striking illustration of this, the 30 largest natural disasters between 1970 and 1995 in terms of insured losses involved a combined cost of more than US$80 billion and the loss of 10 000 lives, while the 30 largest in terms of loss of life involved 1,1 million lives and "only" US$6 billion in losses (Swiss Re 1996). In the case of windstorm losses (see Fig 1-1), only about half of the total economic cost is insured.

The remainder of this paper presents specific and proactive strategies that can be employed by insurance companies wishing to address the climate change issue in ways that also support the day-to-day financial success of their core business.

3. Energy Efficiency as a No-Regrets Insurance Loss-Prevention Strategy

Energy-efficient technologies in many cases offer benefits beyond energy savings (Mills and Rosenfeld 1994). Energy-efficient windows, for example, also considerably reduce noise in buildings and improve thermal comfort. Many energy-efficient technologies also carry the potential of reducing or preventing insured losses caused by:

- fire
- ice, water, and wind

- theft and burglary
- health risks (“bodily injury”)
- business-interruption
- professional liability

Table 3-1 shows some of the potential beneficial links between energy efficiency and reduced insured losses (-Mills 1996). Some of these links are strong and have been demonstrated in practice, others are weaker and still need to be explored. A few examples are highlighted in Figure 3-1. Our central point is that the short-term loss-prevention benefits of these energy-efficiency measures would have distinct value to insurers and their customers irrespective of the timing or extent of additional losses related to global climate changes potentially avoided through the reduced use of energy and its associated greenhouse-gas emissions. Hence our use of the term “no-regrets”.

Table 3-1. Potential for energy-efficient technologies to prevent insured losses.

	Insured Risk Mitigated							
Energy Efficiency Measure	Fire & Wind Damage	Ice & Water Damage	Extreme Temperature Episodes	Power Failures	Professional Liability	Theft	Health & Safety (Lighting)	Health & Safety (IndoorAir)
Air Vest for spray booths								√
Building commissioning	√	√			√		√	√
Central heating controls								√
Compact fluorescent lamps							√	
Daylighting				√			√	
Demand-controlled ventilation	√			√				√
Economizer cooling					√			√
Efficient appliances	√			√	√			√
Efficient duct systems	√	√			√			√
Efficient outdoor lighting						√	√	
Efficient wall and roof framing	√	√	√		√			
Efficient windows	√	√			√	√		
Electrochromic glazings						√		
Electronic lighting ballasts	√						√	
Energy mg’t. & control system						√		
Energy audits & diagnostics					√		√	√
Extra interior gypsum board	√							
Heat-recovery ventilation		√						√
Insulated water pipes		√	√					
LED exit signs				√			√	
Light guides/Light pipes	√			√			√	
Light-colored roofs	√		√	√				√
Measurement & Verification	√	√			√		√	√
Natural ventilation				√				√
Radiant barriers	√							
Radiant hydronic cooling				√				√
Radon-resistant housing								√
Reduce indoor pollution sources					√			√
Reduced mercury in lighting							√	
Roof/attic insulation		√	√					
Sealed-combustion appliances	√				√			√
Thermal energy storage	√							
Torchiere light fixture with CFL	√							

Figure 3-1. Examples of Energy Efficiency Measures that also Contribute to Insurance Loss Prevention.

• Energy-efficient windows. During a fire, heat-stressed windows can shatter as a result of differential expansion near the frames, and the increased supply of air flowing through a broken window rapidly accelerates the spread of fire. Efficient windows may reduce the likelihood that fire will cause breakage (Berdahl 1995a). Efficient dual-pane windows or windows with retrofit films are also more resistant to breakage by thieves or windstorms (Howard 1989). In hot climates, selective window coatings also considerably reduce glass temperatures, thereby enhancing worker comfort (an important cause of professional liability claims in new buildings).

• Insulated water pipes. Frozen water pipes have been identified as an important cause of losses in Austria, France, Germany, Switzerland, and the U.K.; cold winters correlate to significant reductions in the profitability of pipe insurance (Swiss Re 1992). According to the Disaster Recovery Business Alliance, the U.S. insurance industry paid $4,5 billion in claims during a 10-year period for freezing pipes in 17 southeastern states (a region not normally expected to have significant freezes). Pipe insulation is a simple energy retrofit that saves energy and reduces the likelihood of freeze damage (IIPLR 1996a).

• Reduced heat losses through roofs. Ice dams are rooftop ice build-ups that result from repeated melting and refreezing of snow. Melting water collects behind the ice dams, damaging the roof. A single large blizzard in the U.S. in early 1996 was estimated to have resulted in 10 000 to 15 000 such water damage claims, with an average cost of $2 000 per home (Levick 1996). Ice dams form because of preventable ”thermal short-circuits“ caused by air leakage, insufficient insulation levels, or leaky heating ducts (Fisette 1996; IIPLR 1997). Adding to the energy liability are the widely-used electric heating elements often installed along rooflines, intended to melt the ice.

• Urban heat island mitigation. Lowering urban air temperatures by increasing the reflectances of roofs and roads and planting urban trees has been shown to reduce air-conditioning costs by up to 50% (Rosenfeld et al. 1995). Light-colored materials for walls and roofs can be designed to increase fire resistance (Berdahl 1995b). Reducing urban airshed temperatures also has the side benefit of reducing smog, which in turn reduces health insurance claims.

• Weatherization of multifamily buildings. Analysis of top-floor apartments typical of Chicago show that lightening roofs, insulating attics, and utilising natural ventilation would have greatly reduced the likelihood of heat deaths during the heatwave of 1995, while achieving considerable energy savings (Huang 1996).

• Torchiere lighting efficiency measures. According to the Consumer Products Safety Commission, halogen torchiere uplighter fixtures are one of the primary causes of lighting-related fires in homes (Calwell 1996). Compact fluorescent lamp replacements have been shown to yield 90% energy savings while completely eliminating the fire hazard (Siminovitch and Page 1996). College student dormitories are good candidates for insurance industry intervention; Stanford University and others are already moving to ban halogen torchieres and incentivize energy-efficient alternatives (Calwell and Mills 1997).

• Aerosol duct sealing. Eliminating duct leaks can help avoid dangerous pressure imbalances in a home (Modera et al. 1996), which can lead to fire risks caused by flame roll-out or health and life risks from carbon monoxide backdrafting from gas appliances and radon entry from surrounding soils. Leaky ducts located in attics are also a precursor to ice dam formation.

• Promotion of residential building code compliance. Energy and safety-related performance targets set by codes are often not met in the field, an issue of concern to the insurance industry. A recent survey of California homes ostensibly built to meet the mandatory energy code showed a 50% noncompliance rate (Wang 1996). Improved education of builders and code-enforcement officials can help ensure that building performance objectives are attained.

• Building commissioning. A major cause of litigation and contractor call-backs in buildings is improper performance of heating and cooling systems. A reemerging practice called commissioning aims to: increase quality control during the design, construction, and start-up phases; conduct formal functional testing and inspection of energy-using equipment to ensure that intended performance (and energy savings) are achieved; and provide for operator training. Case studies of the correction of 73 deficiencies in 16 real buildings yielded an additional electricity savings of 41% (24%, excluding one large high-saving project) at costs ranging from $0,7/m2 to $6/m2, with average cost-benefit ratios (commissioning costs vs. energy savings) of approximately 1,0 (Piette et al. 1995; Piette and Nordman 1996). A large professional liability insurer of U.S. architects and engineers, DPIC, has taken a keen interest in promoting commissioning as a loss-prevention strategy and cites heating, ventilating, and air conditioning cases as the largest source and cost of claims for the company (Brady 1995). Legal experts have cited commissioning as a way to decrease the likelihood of professional liability lawsuits pertaining to indoor air quality problems and other results of malfunctioning equipment (Tyler 1995). Other non-energy benefits that may correlate with reduced insurance claims include improved occupant comfort, avoidance of extreme premature equipment failures, and reduced contractor call-backs or change orders. Current insurance industry efforts to improve quality control to prevent earthquake, wind or fire damage could be enhanced by verifying proper installation and performance of energy-saving equipment.

A systematic analysis of energy-efficient technologies from an insurance loss prevention perspective is needed. Together, the energy efficiency and the loss prevention communities should work on identifying and improving such “no-regrets” options.

Energy efficiency cannot be discussed properly without considering indoor environmental quality (IEQ). Improperly applied efficiency measures can compromise IEQ, while properly applied ones can improve it, thereby amplifying the insurance-related benefits.

There are at least five linkages between human health, productivity, and the indoor environment: infectious diseases, respiratory diseases (allergies/asthma), acute sick building health symptoms, poor worker performance, and electronic equipment failures. Insured health care, lost-productivity, and professional liability costs resulting from indoor air quality problems are substantial (McGowan 1996; Fisk and Rosenfeld 1996). The largest SBS claim we have identified involved a $29,9 million settlement against Reliance Insurance Company for occupant respiratory-illness problems experienced at the Polk County courthouse in the U.S. There is a valuable body of research in a number of areas with implications for decreasing insurance costs: causes of Sick Building Syndrome (SBS), reducing indoor pollutant sources, identifying “high-radon” areas and designing radon-resistant homes, and minimizing the use of air recirculation (Mills 1996). (Failla n/d). Energy efficiency of course also reduces the emissions of potentially hazardous substances into the outdoor air, and other associated public health risks (Romm and Ervin 1996).

The insurance industry has yet to formally and systematically quantify the types of losses considered here, but a review of the energy and insurance literature has uncovered a cross-section of examples from several countries of losses that are partly associated with energy-using equipment (Figures 3-2 and 3-3). Some notable U.S. examples of property losses from structural fires that might be partially mitigated through energy efficiency include 157 000 fires, 735 deaths, and $2,5 billion in insured losses stemming from heating or electrical equipment in buildings. Some relevant U.S. examples for health and life insurance include 13 000 radon-related lung-cancer deaths annually, 1 500 carbon-monoxide deaths (and 12 000 poisonings), and 700 deaths from urban heat catastrophes. Table 3-1 suggests various energy-efficiency measures that could mitigate such losses.

Figure 3-2. Examples of Insured Property Losses that Can be Reduced by Proper Application of Energy-Efficiency and Indoor-Environmental-Quality Technologies and Practices.

PROPERTY LOSSES

Losses from ice damage to roofs (ice dams)
• US: $20 to $30 million from one storm in 1995 (total damages, including ice dams).1

Losses from frozen water pipes
• US (1985-1995): $450 million/year.2
• CH (1988): US$29 million/year (36 million Sfr.)—residential only.3
• D (1989): US$84 million/year (141 Million DM)—residential only.

Fires caused by heating equipment
• CH (1995): US$14 million (17.8 million sFr).4
• US (1993): 72 000 structural fires (15% of total), 385 fire-related deaths (10% of total), 2 142 injuries (9% of total), $551 million fire-related losses (11% of total).5 Residential buildings carry about 80% of the insured losses, and nearly all of the fires, deaths, and injuries.
• CA (1994): 5 331 structural fires (8% of total), 17 fire-related deaths (4.5% of total), 219 injuries (6.2% of total), $72 million fire-related losses [$97 million C$] fire-related losses (8,4% of total).6

Structural fires caused by electrical equipment and appliances
• US (1993): 85 000 structural fires (18% of total), 360 fire-related deaths (9% of total), 3 500 injuries (16% of total), $1,2 billion fire-related losses (25% of total).7 Residential buildings carry about 2/3 of the insured losses, and a considerably higher share of number of fires, deaths, and injuries.
• US (1995): 2 800 fires and 25 fire-related deaths from light fixtures.8
• CA: At least 10 fires from torchiere light fixtures.9
• UK (1995): $28 million (£ 46.6 million) from electrical equipment (of which 32% caused by electric lighting).10
• CH (1995): $57 million (71,1 million sFr) (of which 34% caused by cables/installation, 31% caused by appliances, 24% caused by incorrect use of appliances, 11% others).11
• CA (1994): 8 387 structural fires (13% of total), 17 fire-related deaths (5% of total), 394 injuries (11% of total), US$125 million ($168 million $C) fire-related losses (15% of total).12 [Includes electrical distribution equipment such as wiring; does not include cooking equipment].

Premature failure of electronic equipment caused by poor indoor air quality
• US: 20% of circuit board failures—$200 million per year in U.S. telephone switching offices.13
• D (West Germany) (1984): US$80 million computer premiums; US$240 million telecommunications and low-voltage equipment premiums.14
• CH (1984): US$10 million computer premiums.15

3.1. Anticipating and Mitigating Undesirable Efficiency-Loss Interactions

In the past, the sporadic debate between the “insurance” and “energy-efficiency” communities has often been limited to single applications (lacking a systematic approach) characterized by misunderstandings. From the example of insulation materials for residential buildings, it can be shown how the insurance industry was very concerned at an early stage that these materials would increase the fire risk. It took many years until these concerns and related misunderstandings were explained in part by the choice and design of materials. Halven (1983) cautioned against the use of insulation, asserting that it is a volatile fuel for fire, but goes on to note that it is in fact the improper *application* of insulation (i.e. too close to combustion appliances) that is the core problem. Thus, the issue shifts to one of poor code enforcement, rather than energy-efficiency *per se* In another example, some insurance groups believe that tight buildings are more vulnerable to pressure build-up and explosion during

Figure 3-3. Examples of Insured Health and Life Losses that May be Reduced by Proper Application of Energy-Efficiency and Indoor-Environmental-Quality Technologies and Practices.

HEALTH & LIFE LOSSES

Deaths from excessive heat or cold in houses

- US (1995): 700 summer heat deaths in Chicago.1 Swiss Re cites 805 total deaths nationally2
- US (1995): >46 dead caused by cold waves.3

Deaths or illness from carbon monoxide poisoning in homes4

- US Each year, about 1 500 deaths result from CO poisonings. Of these about 1 000 are from CO emissions caused by malfunctioning, incorrectly installed, or misused combustion appliances such as furnaces and gas ranges, by the improper indoor use of outdoor appliances like barbecues, and by operating automobiles or generators in garages. Centers for Disease Control in Atlanta suggests that the lifetime risk of unintentional fatal CO poisoning indoors is about one in 3 000. Malfunctioning indoor combustion appliances are the primary cause of CO posionings.

- US (1993): CO poisonings: More than 12 000 non-fatal carbon monoxide poisonings were reported to the American Association of Poison Control Centers in 1993, but the Association believes this represents only a fraction of the actual number of events; often, nonfatal poisonings are misdiagnosed as flu or other afflictions.

Deaths or illness from radon gas in homes

- US: 4 million homes (6%) above US Environmental Protection Agency safe levels; estimated 6 000 to 18 000 lung cancer deaths annually. Associated medical and life insurance costs not quantified.

Workers compensation losses caused by "sick building syndrome" or bad indoor air quality

- US: studies report that from 5 to 40% of workers report problems, cost estimated at $50 billion annually.5 Largest US insurance claim to-date is $29,9 million.

Health insurance costs of asthma (partially related to indoor air quality)

- US: $13 billion annually.6
- D: About 8 million German citizens suffer from asthma. Among children the asthma rate is 12 to 15 percent, and it is the most common chronic childhood illness. Since the end of World War II the number of children to suffer from asthma has increased 10 times. About 6 000 children die each year of asthma in Germany.7

intense windstorms, while others do not (IIPLR 1996b). In any event, these potentialities must be identified, analysed, and mitigated. In the future, enhanced dialogue, joint research and implementation projects between the energy efficiency and the insurance communities are needed.

While some legitimate problems no doubt exist, care should be taken to separate these from poorly reasoned or sensationalised concern. For example, the popular media has fomented public misconceptions about the connection between energy-efficiency and indoor air quality problems. The scientific record shows that while misapplications of efficient technologies can indeed contribute to indoor air quality (IAQ) problems, this is not a necessary consequence of energy efficiency. In fact, energy-efficiency strategies can also be synonymous with improved IAQ.

4. Potential Constructive Roles for the Insurance Industry

As suggested by the examples provided above, the insurance industry could encourage customers to employ technologies and practices that reduce the likelihood of insured health, property, and liability losses. This provides the insurance industry with a rare opportunity to help customers save money on energy bills and at the same time reduce the likelihood of insured losses. The technical measures we have identified are generally profitable to the consumer, i.e. the energy cash-flow savings amortise the capital investment in the course of a few months to a few years.

In the following sections we discuss three specific implementation strategies applicable to the insurance industry: supporting research and development, providing information to insurance consumers, and leading by example in managing buildings owned by insurance companies more efficiently.

4.1. Participating in the Research, Development, and Commercialisation of New Energy-Efficiency Technologies and Services

Little research has been done to identify and promote the market penetration of loss-preventing, energy-efficiency technologies. The insurance industry could participate in strategic research and development (R&D) and pre-commercial activities necessary to move new loss-reducing technologies into the marketplace. The founding of the Underwriters Laboratory early in this century stands as a precedent for such an enterprise. Insurers support research in other areas, such as medical technology or automobile-safety technology.

Most of the strategies discussed in this paper were supported by government-sponsored R&D programs now falling victim to widespread budget cutting in many countries. Difficult economic times have also led to reduced R&D within the traditional private sector firms. Further compounding the problem, the current trend toward utility deregulation has also caused many utilities to reduce their R&D activities. The insurance industry could serve a vital function by stepping into this growing R&D void, independently or in cost-sharing partnerships with existing R&D programs. This approach has been endorsed by the Reinsurance Association of America (Nutter 1996).

A unique example of such a partnership is a Cooperative Research and Development Agreement (CRADA) between various elements of the U.S. insurance and roofing industries and the U.S. Department of Energy's Oak Ridge National Laboratory. The private partner is the Roofing Industry Committee on Wind Issues, which includes all major roofing trade associations in North America and various insurance partners (the Insurance Institute for Property Loss Reduction, K2 Technologies, Risk Management Solutions, and Allstate). The aim of this cost-shared project is to analyse mechanisms of roof failure during severe windstorms and to identify specific ways in which energy-efficiency detailing can also enhance roof structural integrity in the face of such storms.

In an interesting variant on this theme, the American Reinsurance (Am-Re) company has created a Technology Transfer Department that specialises in offering clients emerging technological solutions for environmental risk mitigation (Goodman n/d). The focus is on providing financing and customers for start-up companies working to commercialise these new technologies. Their flagship project is with Molten Metals Technology (MMT), a firm that developed a method of recycling industrial wastes. One Am-Re insurance customer who generates such waste is now anticipating the profitable reuse of their wastes, and may even receive insurance premium rebates for doing so. U.S. insurers are beginning to examine a current energy-related opportunity along these lines. It involves supporting the commercialization and deployment of new fire-safe "torchiere" halogen uplighter fixtures, which have been associated with numerous fires and fire-related deaths (Ramstad 1997; Calwell and Mills 1997).

Examples of other promising R&D frontiers include development of energy-efficient and fire-resistant windows, paints, and light fixtures, and development of improved indoor air quality monitoring devices. While it is not technology development *per se*, there is a need for improved understanding of many fundamental building science issues such as ice dam formation and mitigation, and the causes of SBS. Other research opportunities include definitive studies on the connections between indoor environmental factors (air quality, lighting, thermal comfort) and worker productivity and health (Kroner et al. 1992).

Past experience in the energy sector could be a model for insurance industry R&D. The Electric Power Research Institute (EPRI) and the Gas Research Institute (GRI) spend more than $1 billion a year on technology and market research for energy utilities (less than 0,5% of revenues). They provide a common knowledge base for large and small energy companies and serve as an interface among the numerous energy utility companies, regulatory bodies, and providers of energy technologies. In the U.S., the Insurance Institute for Property Loss Reduction (IIPLR) is one venue where such research could take place. IIPLR's mission is to reduce deaths, injuries, and loss of property resulting from natural disasters.

In closing this discussion on R&D, it is important to add that basic *market*research must be carried out on the particular types of losses potentially addressed with energy-efficient technologies. There is currently a remarkable lack of data on specific loss categories of interest (e.g. fires caused by halogen light fixtures), with only generally relevant data such as that presented in Figures 3-2 and 3-3. We hope that in the future, new categories of insurance loss statistics are collected so that it may be easier to quantify the potential loss reductions from the types of measures described in this paper.

4.2. Providing Information to Insurance Customers

There are a host of ways in which insurance companies can help educate the public about energy efficiency. Where loss-prevention benefits are uncertain, the focus can be restricted to the direct cost savings or other known benefits. Potential forms of such assistance include the provision of energy-efficiency information, offering specialty audits and risk-management assistance, supporting building code compliance and quality assurance, and promote product labeling.

4.2.1. Provide Energy-Efficiency Information

Given their extensive contact with the public, insurance companies are in an excellent position to provide energy-efficiency information as a customer service. (This has been done extensively by energy utilities, e.g. through information provided with bills.) As an example, the USAA insurance company published a detailed 17-page handbook on energy efficiency for homeowners (The USAA Foundation 1992).

Some insurers in Massachusetts are offering 10% discounts to people who take a free six-hour course in weatherization, home repair and other subjects (Steitner 1996).

4.2.2 Offer Specialty Audits and Risk Management Assistance on a Fee-for-Service Basis

In the process of making its own buildings more efficient (see Section 4.3), the insurance industry can acquire considerable skill which could be offered to other property owners and managers. It is even possible that special in-house expertise and services could develop into new business lines in energy auditing, retrofit evaluation, and installation and management of energy-efficient systems, building commissioning, savings measurement and verification, and ongoing energy-management services. On the other hand, there are also many private specialty firms that could provide these services to insurance companies and/or partner with them in delivering services to third parties.

Instrumented energy audits help identify energy-related problems that can lead to insured losses. One tool used in this work is the infrared (IR) camera, which has long been used to detect electrical problems with motors, transformers, etc. that waste energy and can cause fires. Munich Re has recommended the use of IR cameras as a loss-prevention tool, citing the early detection of broken hot water pipes as an example of how to minimize water damage losses and save energy. IR cameras can also identify inefficient windows and gaps in insulation. Blower doors and pressure manometers are also valuable tools for energy audits, enabling a user to identify potentially dangerous pressure imbalances in a building that could lead to fire or health-related insurance losses if not remedied. Auditors can also perform indoor air quality measurements as a risk-management service.

In Germany, insurance companies are starting to offer environmental and technical risk management services to customers, typically also including appraisals of different energy systems and options. Often, separate consultancy companies are created as a spin-off of in-house risk management activities. This is seen as a good way of making money with existing know-how, as well as supporting loss prevention. Examples of companies that offer such external risk management services are: ARIS, Colonia/Nordstern Insurance Co., Hannover-Sicherheitstechnik Co., Gerling-Konzern Allgemeine Insurance Co., and Allianz Zentrum fŸr Technik.

4.2.3. Suppor t Building Code Compliance and Quality Assurance

Various organisations are working to improve compliance with energy codes. Several studies have found that half of new buildings do not meet mandatory energy standards (Wang 1996; Vine 1996). Insurance companies have a commensurate interest in compliance with safety codes. More than 75% of code enforcement officials failed a competency exam delivered by the U.S.-based Insurance Institute for Property Loss Reduction (IIPLR).

There are numerous loss-prevention synergisms between safety and energy code compliance. Examples include the protection of water pipes from freeze damage, minimizing the risk of ice-dams and heat deaths by maintaining the thermal integrity of roofing systems, and protecting occupants from fires or backdrafting from combustion appliances as a result of poorly installed duct systems. The insurance industry could join in efforts to train and provide education and incentives to code officials to improve compliance with both energy and non-energy elements of the codes. IIPLRÑwhich represents almost 75% of the US property/casualty insurance sectorÑhas recently endorsed energy code enforcement efforts (Lecomte 1997).

There is a new Insurance Services Office (ISO) rating system for communities, which rewards communities that enforce building codes (Steitner 1996). The program is resulting in up to 15% premium reductions by some insurers, and is now being used in Florida, South Carolina and North Carolina. In Massachusetts, homeowners taking a six-hour course on topics such as weatherization, home repair, and lead-paint hazards can receive 10% premium discounts from some insurers (Steitner 1996)

4.2.4. Pr omoting Pr oduct Labeling

Safety-related product labeling has existed in most industrialized countries for some time, and can be championed by insurance interests as exemplified by the Underwriters Laboratory labeling program. Various energy agencies around the world operate programs for energy-performance labeling of buildings and energy-using devices within them. IIPLR is now planning to introduce a comprehensive whole-building label to help consumers know when they have a particularly safe home. Where loss-prevention synergisms are sufficiently well known, energy-related features could be added to the list of criteria for receiving the label. An example of component-specific labeling would be to incorporate the fire-safety aspects of windows into the existing National Fenestration Rating Council labels for window efficiency.

4.3. Leading by Example: Implementing Energy-Efficiency in Buildings Owned by Insurance Companies

“Market Pull” strategies are one of the most innovative approaches to improving energy efficiency by harnessing the purchasing power of large energy users to steer entire markets toward increased use of efficient technologies. The Swedish government’s National Board for Industrial and Technical Development (Nutek) has been the world leader in this area, organising owners of large numbers of buildings (including insurance companies) to set standards for procurement of efficient energy-using products (Holm 1993). A U.S. consortium of government and non-government organisations is also very active in this area, as is the International Energy Agency (IEA). Several European insurance companies are now collaborating with members of an IEA project to use the purchasing power of large building owners to create new markets for energy-efficient copiers.

The insurance industry is one of the world’s most important owners of real estate. Our survey of the ten largest insurance companies globally identified assets in real estate (buildings, land, movables) amounting to $US 105 billion. The exact figure for the floor area of these buildings is not known, but we estimate it at about 100 million square meters based on a U.S. average value for MetLife. (For comparison, this exceeds the total US government ownership of buildings for civilian purposes (USDOE 1995)). At U.S. energy prices, this amount of floor area corresponds to an annual energy bill of $1,6 billion. U.S. life insurance companies own $50 billion worth of commercial real estate, 22% of all institutional holdings (Real Estate Research Corporation 1996; Institute of Real Estate Management 1991). Data on floor area available for the 250 largest US property owners show that the three largest insurance companies own 42 million square meters, equivalent to 10% of the U.S. total (i.e. institutional and non-institutional). The three companies (Equitable, Prudential, and MetLife) rank #1, #6, and #7 on the list, respectively (Reed 1996).

Given their considerable presence in the real estate marketplace, if insurance companies marshaled their purchasing power by adopting state-of-the-art practices for technology procurement and efficient building operations just in the buildings they own, they would make a significant contribution to reducing energy demand. High-visibility demonstration projects based on controlled experiments in insurance buildings could quantify the benefits of energy-efficiency measures and set a model for others. Non-energy benefits can also be of interest here. West Bend Mutual Insurance company reported a 7% increase in productivity (defined as numbers of files processed related to applications, endorsements, renewals, and quotes) following the implementation of a variety of energy- and non-energy-related worker environment improvement measures (Kroner et al. 1992). The energy measures included individually controlled heating and cooling systems in worker offices (responsible for one-third of the total productivity gain), high-frequency lighting ballasts, task lighting, and increased use of daylighting. The implemented energy-efficiency measures also achieved a 38% reduction in energy costs.

Various insurance companies have already embarked on in-house energy management programs. The 62 signatories of the UNEP Insurance Industry Initiative, mentioned above, have pledged themselves to manage their properties in a more environmental manner. A central barrier to be faced in this process is that the vast majority of real estate owned by insurers is leased to other occupants, rather than occupied by the insurer. Herein arises the proverbial “landlord-tenant” problem, wherein the owner who must finance most energy-efficiency improvements does not pay the energy bills. In the U.S. life insurance sector, for example, only 11% of all real estate owned is occupied by the owner companies, which is down from 20% in 1980 (American Council of Life Insurers 1995). Another potential barrier is that insurance-owned buildings are often operated by independent property-management firms, who will not ordinarily pursue energy-efficiency unless explicit guidelines are provided by their clients. In the US, for example, two-thirds of all office buildings are managed by these third parties.

Insurance companies can take advantage of existing voluntary energy-efficiency programs offered by energy utilities or government agencies. The U.S. Environmental Protection Agency’s Energy Star Programs (e.g. Green Lights) and the U.S. Department of Energy’s Rebuild America Program are two major examples.

4.3.1. Case Study: In-House Energy Management at Swiss Re

Environmental benefits, equally or even more important than economic benefits, were a driving force behind the founding of Swiss Re’s own in-house energy management program for its operations in Zurich, as evidenced by this excerpt from the company’s Energy Charter (Swiss Re 1995):

“The current energy consumption patterns of the world’s population may lead to irreversible climate change, and hence also to unforseeable harmful consequences. As a global reinsurance company, Swiss Re has an interest in the development of appropriate energy production and energy use strategies: these must be globally-oriented, ecologically sustainable, and also economically and socially acceptable.”

According to the Charter, by the year 2000 both heat and electricity use per square meter are to be reduced by an average of 10% from 1994 levels in existing buildings and by 30% in new buildings. New or renovated buildings owned by the company but leased to others are to comply with Switzerland’s SIA recommendation for energy-efficient design. An initial annual funding level of 1 million Sfr (~$US 800 000) has been made available for additional improvements.

Energy-conserving principles are to be applied to all major equipment procurement processes at Swiss Re’s headquarters. All photocopiers, PCs, and VDTs—be they leased or purchased—must carry the most recent Swiss “Energy 2000” label demonstrating compliance with strict energy conservation requirements.

The Charter also calls for adding environmental externality costs to the commercial price of energy when making cost-effectiveness calculations. Incentives are offered to employees who devise innovative energy-saving suggestions.

5. Conclusions and Recommendations

By supporting selected energy-efficiency options, the insurance industry could reduce near-term business risks while making a considerable contribution to long-term reductions in greenhouse-gas emissions which also threaten their bottom line. This represents an attractive and previously untapped "no-regrets" opportunity for the insurance industry, as the risk-reducing benefits offer distinct value irrespective of the timing or extent of damages related to global climate change.

Surprisingly little has been done to-date along these lines. While the insurance industry has historically been involved in basic research and development, it has yet to closely examine the types of loss-prevention technologies and strategies described in this paper. Basic market data (e.g. loss statistics) are also often lacking.

Our central recommendation is that the international insurance industry initiate a systematic activity to (a) identify technologies that contribute both to traditional loss-prevention and to reducing greenhouse-gas emissions, (b) promote the dissemination of information and the utilisation of such technologies in the cases where they have proven to contribute to loss prevention and are commercially available, e.g. by implementing in-house energy management programs in their own building stock, and (c) support research, development, and commercialization where promising technologies are not yet available in the marketplace. Once the loss-prevention benefits are sufficiently well demonstrated, insurers can promote the use of the corresponding technologies and strategies by introducing risk-adequate insurance premium schemes.

In this paper we have focused on the three specific implementation areas just listed. Additional strategies to be considered include: (1) financing customer efficiency improvements as a new business line, (2) establishing investment portfolios that support key energy-efficiency technologies and services, (3) forming customer-focused partnerships with energy utilities, and (4) exploring the issues and opportunities associated with the application of energy-efficient/loss-prevention concepts in the context of developing countries.

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