Beyond Rising Sea Levels

The Importance of the Insurance Asset in the Process of Accelerating Delivery of New Technology to Market to Combat Climate Change

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Climate Change Challenge – Insurance and New Technology

Climate change is causing much more than just rising sea levels. As noted in the companion to this article[1], climate change is changing the way we power a society that depends more heavily on power everyday; the way we transport ourselves; how we evaluate where we live and work; the way we interact with the environment; and the risk to which we are exposed in both our personal lives and in our businesses.[2] New and emerging technologies will support how we, as a society, adapt to much of this change.

Climate change adds a new dimension of risk to our already complex environment. Many experts suggest that new technology will be essential to the ability of humankind for adapting to climate change.[3] However, much of this technology has limited tenure and limited testing. In other words, the technology itself presents unique risks – including risks which the insurance industry is uniquely suited to evaluate, price and manage. To successfully adapt to climate change, we must reconsider the ways we manage risk, especially new technology risk, and leverage our capabilities – including insurance – to respond to these changes.

Risk management is the core competency of the insurance business. Insurers are experts in financing and hedging risk; the insurance sector is conditioned to anticipate the unexpected. In so doing, insurers deal with real events and their expected probabilities and frequencies. They have the professional resources and capacities to evaluate physical, technical, operational, legal, financial and other business risks, because they do so every day as part of the underwriting and risk management

[1] "Beyond Rising Sea Levels: Using the Insurance Asset to Manage Risk and Maximize Opportunity in the "Green" Economic Paradigm Shift," by Lindene Patton, European Business Review March / April 2008.

[2] A recent European example of the far-ranging risks associated with climate change is the reported migration of exotic and deadly communicable diseases into Italy as disease-carrying insect populations historically unknown there are enabled by climate shifts to move northward.

[3] Stern Review Final Report: The Economics of Climate Change, http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/stern_review_report.cfm; CERES 'From Risk to Opportunity: 2007 – Insurer Responses to Climate Change'October 2007. Source: http://www.ceres.org/pub/docs/Risk-to-Opportunity-2007.pdf, IPCC 2007. It is not the author's intention to endorse Stern's economic analysis, CERES' assessment of insurer response or IPCC's scientific analysis, but to suggest that prudent businesses will take the data and predictions very seriously.

process.

Insurance is best used as a preventative risk management tool. Yet many stakeholders tend to focus on insurance only in reaction to events that have occurred and resulted in conditions that exceed societal abilities to manage e.g., Hurricane Katrina and flood insurance, the anthrax scare and bioterrorism insurance, Enron and D&O warranties, etc. Such events may be infrequent and may not affect individuals directly – but in the aggregate, the frequency and severity can be substantial.[4] When such events occur is the point-in-time when an insured needs coverage, and when insurance must deliver. The application of insurance in general, and the inclusion of appropriately qualified insurers with necessary specialty skills, only on an ex post (after-the-fact) basis, tend to result in market distortions and adverse policy decisions. Insurance should be included in the public policy dialogue at the outset as part of the multidisciplinary group evaluating the risk and sustainability of policy choices designed to ensure an economically efficient recourse on climate change technologies. These policies must appropriately weigh costs and benefits within a comprehensive framework that accounts for economic and financial market implications, as well as the welfare of societies.[5]

While often taken for granted, insurance is the tool upon which business and individuals implicitly rely to mitigate their risk exposures. Insurance is an important economic shock absorber.

Insurance has a unique role to play in mitigating the risks of climate change. Insurers, like nowhere else in the public or private sector, have the data and professional skills necessary to evaluate and price risk. Insurers have the ability to help stakeholders navigate the unknown – areas of low-frequency but high-severity risks, such as those posed by climate change e.g., naturally occurring events (hurricane, flood, wildfire) potentially aggravated by human activity. Moreover, insurers have the ability to send price signals that inform policyholders and investors about the opportunity when the likely risk occurrence of a particular event is so high as to make other actions – such as change of building codes, land use restrictions or operational controls, in combination with or in lieu of pure risk transfer insurance – the most cost effective and economically viable solutions.

Insurers have a history of success in providing data to support the prove up of the appropriate use and deployment of life-saving, life-enhancing and environmentally protective technologies.[6] Climate change presents the same opportunity to leverage the insurance industry's capabilities, especially in the deployment of new technologies. **To ignore price signals sent by the insurance industry is to risk deployment of unsustainable or inefficient technologies in an effort to adapt to climate change.**

This article will discuss the current public dialogue with respect to the need for new technology to adapt to climate change, articulate the role of insurance in the process to improve efficacy and efficiency, and distill an underwriter's approach to, or considerations in evaluation of such technologies. Specific examples of an underwriter's approach to the insurability analysis for such new technologies will also be provided.

Current Public Dialogue About New Technology and Climate Change

The Need

The current public dialogue about climate change emphasizes the importance of getting new technology deployed to reduce greenhouse gas (GHG) emissions. The Stern final report[7], the Intergovernmental Panel on Climate Change report[8], the Electric Power Research Institute[9] and the International Energy Agency[10] all identify the importance of new technology in meeting the climate change challenge of bringing the Earth back from the "tipping point."[11]

[4] Insurance Information Institution states incurred losses for the P/C industry of $275 billion on average and $2.2 trillion in aggregate from 2000-2007, see "A Firm Foundation: The Insurance Industry and Its Contribution to Society" presented at St. Johns University, New York, New York, April 10, 2008..

[5] "Beyond Rising Sea Levels: Using the Insurance Asset to Manage Risk and Maximize Opportunity in the "Green" Economic Paradigm Shift", European Business Review March / April 2008.

[6] The Hotel Motel Fire Safety Act is fine example of how insurance and insurance premiums can play a critical role in advancing public policy, in this case improving public safety. Hotel and motel owners who installed sprinklers in response to the aforementioned law realized a savings in insurance premiums that fully offset the cost of installing sprinklers. The installation of sprinklers ultimately saves lives and money for the insured. Further, the insurance industry has developed products to insure a wide variety of environmental remediation technologies, and as environmental financial assurance pursuant to 40 C.F.R. § 264.140-146 (2007). Many other examples exist.

[7] http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/stern_review_report.cfm
It is not the author's intention to endorse Stern's economic analysis, but to suggest that prudent businesses will take the data and predictions very seriously.

[8] IPCC 2007. It is not the author's intention to endorse IPCC's scientific analysis, but to suggest that prudent businesses will take the data and predictions very seriously.

[9] "The Power to Reduce CO2 Emissions: The Full Portfolio", discussion paper prepared for the EPRI 2007 Summer Seminar Series, prepared by Evan Mill, Ph.D. for the EPRI Energy Technology Assessment Center.

[10] Statement to the 13th Conference of Parties to the UNFCCC, Mr. Nobuo Tanaka, Executive Director, International Energy Agency, December 2007.

[11] The need to cut GHG emissions in half by 2050 was articulated and posited as a "tipping point that could lead to intolerable impacts on human well-being…," by a "Confronting Climate Change: Avoiding the Unmanageable and Managing the Unavoidable," United Nations Foundation, Sigma Xi, the Scientific Research Society report. February 2007; see www.unfoundation.org/files/pdf/2007/SEG_ExecSumm.pdf http://www.usatoday.com/tech/science/2007-02-27-global-warming_x.htm and http://www.theaustralian.news.com.au/story/0,20867,21102081-601,00.html. It is not the author's intention to endorse these scientific analyses, but to suggest that prudent businesses will take the data and predictions very seriously.

The Risks

The public dialogue about risks of new technology tends to be superficial – overly simplistic and lacking in specificity. To assure efficiency and sustainability, the dialogue about the risks associated with new technologies must be improved and conducted at a more granular level. Only when sufficient granularity in the discussion of risks related to each new technology is achieved can appropriate risk management solutions and appropriate public policies (where necessary) be devised. Risks must be identified, categorized and analyzed with respect to the cause of loss in developing economically efficient solutions that are also reasonable, responsible and responsive.

If risk is not appropriately characterized, inappropriate policy solutions result, which ignore relevant market forces, create the potential for long-term dependency, foster economic inefficiency and aggravate the risk of environmental harm – all of which are unsustainable conditions. A possible framework for approaching such analyses might be to categorize risks by the damages which emerge if such events were to manifest:

1. Third-party bodily injury
2. Third-party property damage
3. First-party property damage
4. First-party economic loss

However, such a framework tends to be overly legal and not easily translated or linked to reality in terms of operational activities, experiential data or risk mitigation options. An alternate approach might be to organize risks with respect to operational activities:

1. Design risks
2. Supply-chain risks
3. Performance failure
4. Operational exceedances and failures
5. Operational interruptions (first-party property damages due to fire, wind, flood, earthquake and the like)
6. Financing risk / investment risk
7. Credit risk
8. Counter-party risk
9. Cross-border political risk
10. Regulatory / in country political risk

The above approach focuses on the operational aspects of risk but not on the cause of loss. Yet another approach to risk analysis might be to identify the exposed assets and the risk of loss. In fact, there are a multitude of options for approaching risk analysis, many of which are beyond the scope of this article.
Many approaches to risk analysis are possible. The key is to assure that the appropriate analysis is used for the technology under discussion, and the analysis itself is comprehensive and granular. Only when risks are parsed and defined appropriately can one determine what mechanisms are most effective and economically efficient to manage such risks. In the specific case of climate change, an objective of risk analysis should be to inform the policy debate and promote appropriate, sustainable technologies to reduce GHG emissions.

Insurability Analysis: Underwriting of New Technology

Many risks can be insured, for a price. At issue, however, is whether all risks warrant insurance. Sustainability dictates that the use of insurance as a risk management technique must be weighed carefully. Insurers should be careful not to assume risks aggravated by moral hazard (the incentive to act in a manner that created a risk of loss to gain the insured benefit or failure to act in a manner to mitigate such risk to gain the insured benefit).[12] As an example, one generally cannot insure a building for more than its value – as doing so may create the potential for the insured to gain as the result of a total loss and puts in place a moral hazard.

Proper risk analysis must focus on all relevant conditions – including activities under the control of the potential insured – as well as those externalities that are immutable and those imposed by the rule of law or the marketplace. As such, proper risk analysis of a new technology focuses not just on the technology itself, but upon the environmental and societal system into which it will be deployed.

[12] The insurance policy should not be structured in a manner such that the insured is in a better position in the event of loss than the insured would have been in the absence of loss, especially where the insured is in control of activities and conditions that could mitigate the risk of loss.

Issues of feasibility range from concept to execution – from the overall business plan, financing and pro forma cash flow to the dependence upon subsidies, any applicable regulatory environment and market analysis. Collectively, these considerations underpin the functionality of and life-cycle issues attendant to the technology itself.

Technology Risk

An underwriter will look to the fundamentals of the technology itself when undertaking risk analysis. Technical specialists are assigned (such as engineers, geologists, chemists or the like) to develop an understanding of the technology's functionality and its potential failure points.

The underwriter will ask for testing and performance data, including the conditions of performance – especially scale. In the area of technology, scalability presents substantial risk for many reasons, including – but not limited to – basic theory extensions, specific chemical or physical behavioral changes associated with volume or environmental factors (such as temperature or humidity) and supply-chain risks, to name a few.

Consideration must be given to what will happen if the technology does not perform as expected. Questions to consider include:

- Who might be injured or damaged if a performance failure occurs?
- What could be done to mitigate that injury or damage?
- What if the technology is used for an activity differing from its intended purpose?
- Is such an alternate use likely?
- Does the alternate use create risk – more or less risk than its originally intended purpose?
- Is there a warning against such use?

And, ultimately, with respect to the analysis of this technology in isolation, does the underwriter believe it is sufficiently reliable to put capital at risk on the technology? Specifically, are the risks associated with the technology truly fortuitous? Have reasonable risk mitigants been integrated within the technology process (including areas as simple as having sufficient cash flow to make adjustments in the technology to respond to local conditions or induced-performance issues), or are the risks associated with the technology and its performance so significant that the risks attendant therewith are, in fact, not fortuitous – but rather are certain.

Representation: Advertising and Warranty Risks

After the underwriter has a fundamental understanding of the technology, consideration must be given to the relationship between the technology and associated representations and warranties – to determine what part, if any, of that risk may be insured. Generally, warranty risks remain with the business,[13] while risks of advertising injury or misrepresentation may be insured to one degree or another. That said, risk transfer insurance is designed to respond to fortuitous events, not to known losses. As such, if the representations or warranties are overzealous or inconsistent with what the underwriter understands to be true about the technology or believes such verities are inconsistent, the underwriter will decline to insure the risk.

Supply Chain / Capacity and Surge Demand Concerns

The underwriter also must consider risks that could interrupt production and delivery – commonly referred to as business interruption – to the degree such risks are assumed by the insurance contract. In addition, the supply-chain risk may also manifest in a claim circumstance, when the new technology must be repaired or replaced after a policy-triggering event (such as a fire or storm).

The underwriter must look at the sales plan and the capacity of those in the supply chain and repair chain to determine what is possible under various scenarios. Key questions to be considered include:

- How can the technology be repaired?
- How many suppliers exist?
- How many pieces could be repaired or delivered new in the event of a catastrophic storm event?
- Can the insurer rely on the existing chain? Is any redundancy built in?
- Do special steps need to be addressed in the process of the applicant business or persons or by the insurer to mitigate this risk?
- To make the technology supply-chain risk worthy, what expense will be required and by whom should it be incurred?
- Is such mitigation possible with sufficient certainty to argue for putting capital at risk for this technology by the insurer?

[13] Warranties are generally contractual liabilities. Limited warranties provide specified remedies in the event of failure. Performance failure, which is the most prevalent risk associated with warranty, is the province of surety or financial guarantee – a core risk of the business itself; a contract liability, credit risk and / or investment risk – and is not the business of insurance.

Life-Cycle Issues

Disposal. Trash. Waste.

No one likes to think about their new technology generating waste, becoming trash or requiring disposal, but such considerations are critical to an underwriter. Further, in some jurisdictions and for particular types of technologies such considerations are mandatory.[14] The underwriter must determine if there is a challenge with the disposal:

- Can a damaged item be recycled?
- Where can disposal occur?
- During the process of damage or disposal, is pollution possible? Probable?
- Can that risk be insured, or must it be excluded?
- Can the insurance include coverage relevant to liabilities to recycling and disposal? Must an exclusion or other limitation be applied?

Risks Posed by Existing Laws: Risks of Consumer Protections, Prohibitions, Unrecognized Rights, Subsidy and Indemnity

Certain laws may create special standards of care or liability for delivery of specific products or services.[15] Similarly, in certain cases, the law may limit the liability for delivery of specified products or services.[16] Some laws may prohibit certain actions.[17] Much regulation and law is focused on the delivery of what are deemed "essential services" –including power, water and transit systems. They are deemed essential services precisely because the constant and consistent delivery of such services is essential to preserve the normal working order of advanced economies and social order.

In fact, most essential service delivery paradigms (business models) were designed around:

(a) the weather patterns prevalent at the time of design, including predictable changes at the time for 100-year periods; and
(b) continued reliance on fossil fuel.

Because many of the effects of climate change impact weather patterns, and because much of the new technology that is the focus of attempts to reduce GHG emissions is focused on alternative energy, essential services are impacted, and the current policy and regulatory structure present critical considerations of underwriting risk.

Many of the laws applicable to essential services are directed to consumer protection, especially pricing protection and safety. In the power area, fossil fuel pricing is the default basis (reference point) in most developed economies for these laws. Many of the new technologies are more expensive on a per-kilowatt-hour basis than the equivalent fossil fuel source. As a consequence, deployment of the new technologies may not be permissible under the rate approval process without legal change or subsidy. However, ill-crafted or overly broad subsidy structures can do more than merely provide price supports; they can unwittingly mask highly risky and / or unsustainable technologies.

Furthermore, because these essential services assume that fossil fuels – and the materials associated with that raw material chain – are central commodities of great importance for governments, businesses and citizens, the allocation of rights related to the energy services product chain is focused thusly. Rights related to mining of fossil fuels, related mineral rights and right-of-ways are well defined. The law currently does not address many rights related to other energy products and service supply and delivery chains. As such, the sustainability of a new technology dependent upon access to, or ownership of physical quasi-commodities – like sunlight, wind or wave action that are not now reliably defined as property rights - may be impacted by interference as others attempt to access these quasi-commodities under the laudable guise of mitigating the effects of climate change – with questionable redress. For example:

- A wind farm off the coast of waterfront property that clouds an otherwise unobstructed natural view may have the unintended consequence of devaluing the individual property asset, while fostering macro-societal benefits of mitigating climate change impacts.
- If a business places a turbine in front of another party's turbine and takes or alters the wind in front of the first turbine, has a right been violated?

[14] EU Directives 2002/95/EC and 2002/96/EC, Waste Electrical and Electronic Equipment.
[15] See generally, "Restatement of Law Third, Torts: Products Liability," American Law Institute, 1998.
[16] See specific municipal utility codes in the United States in general. See also "Utility Provider Liability for Electrical Power Failure: Implications for Interdependent Critical Infrastructure," Brown, Chang and McDaniels, The Electricity Journal, Vol 19, Issue 5, June 2006. However, limitations are not universal.
[17] Some utilities may be prohibited by their charter or other authorizing documents from providing services outside a specified geographic area. In the event of water scarcity, such restrictions could impede the ability to share resources in a way which is different from the sharing possible under the national power grid systems.

Subsidy will not mitigate either of these risks; only recognitions of the actual quasi-commodity as a property right in and of itself will mitigate this risk. Thus, the underwriter faced with these risks must determine what would happen to the business if such interference were to occur, claims for damages were lodged, and how such claims might impact the insured liability or property risks. In fact, much of the risk posed by the lack of property rights may be more important as an uninsurable first-party investment risk, with relevance only to consequential risks to insured first- and third-party risks.

Upon analysis of the types of legal conditions set forth above, the underwriter can decide whether to support the initial financing decision and put capital at risk.

Risks Posed by Public Policy Demands and New Laws

To address the unique challenges posed by the deployment of new and emerging technologies designed to reduce GHG emissions, the law in most jurisdictions must be amended to address the rights relevant to each technology. As noted above, property rights issues may require address, as may many other issues.

Much of the public debate surrounding the issue of technological advancements to mitigate the adverse impacts of climate change focuses on a single word: liability. Yet, few are willing to define what is meant by liability in the context of climate change. In fact, many technology purveyors and potential users assert that indemnity for third-party liability protection is essential before they can move forward. However, the dialogue fails to identify protection for what type of event or cause of loss must be addressed by insurance. Or, if the dialogue does focus on protection, the request is often for broad-form third-party liability protection with intimations of concern related to unlimited environmental liability that is, as yet, not clearly defined.

In fact, the discussion about needs for legal change would be much more valuable, and would result in a much greater likelihood of the promotion and success of sustainable new technology, if the discussion were more granular and involved appropriately qualified insurers to assist with such risk qualification. Without inclusion of the insurance community in these dialogues, the potential for price and liability supports (possibly in the form of subsidies) may yield the development and deployment of unsustainable technologies that likely will fail in the long-run or exist only at very high social and economic costs.

As an example, much is being said about "cleaner coal" technologies, such as carbon capture and sequestration (CCS), requiring governmental subsidy to move forward. The dialogue has proceeded as if all CCS are risk neutral on a relative basis – meaning that all CCS processes are the same and produce the same risk profile. In fact, not all CCS are created equal. Risk parsing can help identify which processes have substantial data available to evaluate environmental health and safety risks – and which have incomplete or unsubstantiated information. Some CCS approaches have substantial scale data through modeling and analogy, while others have little or none. Risk mitigation requirements to qualify for insurability may be different as a result of the specific technology and the specific physical conditions. Insurance premiums will reflect those costs – e.g., risk price indications. As such, the risks associated with certain types of CCS may make it more expensive than other types. Only when the granular analysis is done can a public-policy maker determine what, if any, type of incentive or subsidy is truly required to make delivery of this technology to the consumer most like the fossil-fuel baseline – not just in short-term kilowatt-hour pricing terms, but in terms of overall long-term risk.

The eventual structure and value of a price subsidy is also of concern to the underwriter. In theory, underwriters will generally find production tax credits to create less operational risk and greater sustainability than investment tax credits. Why? Production tax credits create incentives for owners to fix modest problems to assure the "lights stay on" so to speak – thus keeping the production operations going. By contrast, investment tax credits – depending upon their absolute monetary value – may disincline investors to infuse cash to fix modest operational problems and continue operations. In specific cases, the underwriter may find investment and production tax credits have no effect on risk profiles for the project. The devil is in the details, and to date the dialogues have been sorely lacking details.

Indemnity structures[18] generally send zero-dollar price signals to the indemnified party with respect to risk. In other words, the indemnified party is told to ignore the risk for which it is indemnified within the scheme and not to account for it or apply money to it in its business planning. As such, underwriters are very wary of indemnities, and generally do not like to put capital at risk where an indemnity could increase the risk or void economic incentive to mitigate such risk.

In all cases, subsidies may result in odd effects involving anything ranging from basic facility construction quality to safety to supply-chain risks, due to market forces and other externalities. As such, underwriters must decide whether to put capital at risk for the new technology in a subsidized environment.

In the case of new technologies designed to reduce GHG emissions, even those that are sustainable from an underwriting perspective may require some level of high attachment point, oftentimes very high attachment point, excess indemnity structures due to capacity or tenor limitations of the insurance industry. However, great care should be taken in the development of laws with indemnity, because such laws may result in the promotion of socially or economically unsustainable or inefficient technologies.

The above dialogue can be repeated for most new technologies in the climate change area. Risk must be considered in the development of supporting public policy, especially subsidies, to assure promotion of the most sustainable technologies – scientifically and economically speaking. The insurance industry has data and unique professional skills that should be included in the dialogue to ensure the most efficient, practical and effective result.

[18] Where no charge is made for the indemnity – or where the charge is artificially capped or bears no actuarially quantified relationship to the risk indemnified.

Practical Applications and Examples of Insurance for New / Green Technologies

Insurance is being used today, quietly in most cases, to actively facilitate delivery of so-called "green" technologies – those focused broadly on environmental sustainability, as well as those specifically focused on GHG emission reductions. The discussion below provides insight into the underwriting structure of selected technologies and processes.

Green Buildings – LEED Certifications

Insurers have been supporting the design and development of materials and the design and construction of buildings that have sustainability characteristics, and which foster "green" development. Specifically, the insurance community has evaluated risk and extended coverage for:

- Errors and omissions / professional liability for architects and engineers
- General liability
- Builder's risk
- Workers' compensation coverage for associated projects.

In fact, although these coverages have been offered as long as green buildings have been around[19] (because financiers of such projects and buyers will not loan funds or purchase the building without insurance coverage for the design and construction activities). The public has not made the link between these efforts and climate change until recently – with the associated frenzied interest in green buildings. With the recent public spotlight focused on green buildings, several insurers have announced the availability of coverages for related projects – in some cases, for the second time – because the time is now ripe and stakeholders are paying attention.

The insurance industry is moving toward green building wrap-up programs, which are analogues to traditional wrap-up programs. Essentially, wrap-up programs permit all parties to collectively procure insurance on a construction site and thereby derive associated risk management benefits (alignment of interests) and concomitant price efficiencies in the form of reduced premiums – as compared with likely higher premiums for independently procured insurance for each party.

The insurance industry works closely with design and construction industry professionals and building trades to evaluate the risks of each new design and associated materials, and agree upon risk mitigation techniques that are a predicate to coverage. To that end, the role of the insurance industry as a market-based tool to provide price indicators for risk is evident, and continues working today.

As an example, green roofs have been touted as a means for reducing storm water run-off, thus increasing energy efficiencies and creating urban wildlife refuges. While underwriters see all these benefits, they also realize the weight of such structures is significant and must be addressed during building design. Before insuring the projects, underwriters will confirm that structural compatibility has been evaluated and deemed safe.

The integrity of the roof is also dependent upon liners to keep moisture from seeping into the building. This structural component is also of interest to the underwriter. Why? Because liners leak. Experience with landfills confirms this fact. Even the best-lined systems have the potential to leak under fortuitous circumstances. As such, the underwriter may require certain construction components (secondary containment and / or collection systems) to be included in the structure as a risk-mitigation technique.

The underwriter recognizes that urban wildlife may populate the roof, but what some consider wildlife, others consider pests – whether plant or animal. As such, the underwriter must consider the possibility that someone operating the roof may at some point in time think about applying, or actually apply, herbicides or pesticides to the roof – risking pollution of storm water that escapes the system. To mitigate such risk, operating instructions to direct against use of such pesticides / herbicides might be appropriate and a condition to insurability, or the underwriter may choose to exclude pollution liability coverage altogether.

Where green buildings seek to incorporate alternative energy sources, subsidies are generally involved. As a result, adoption of such technology has been slow – due to price and business-model complexity resulting from the subsidies. (See following alternative energy section.)

The insurance industry is now moving toward and executing on green re-build extensions – products that permit rebuilding of, and payment for, damaged structures using building techniques and materials that would qualify for point award under the United States Green Building Council (USGBC) Leadership in Energy and Environmental Design (LEED) certification program. Some carriers have formally announced such coverage, while others have simply offered it without fanfare. In each case, great care is taken in evaluation of the associated techniques and technologies to assure the suite of sustainability and business risks are appropriately managed and addressed in deployment of such green programs.

Disaster Resilience – the Sleeping Giant of Sustainability

Disaster-resilient characteristics of building and community construction (and operation) are crucial in the context of climate change. In fact, disaster resilience confers the ultimate sustainability characteristic in the context of climate change – that is, better protection against the physical manifestations of increased frequency and severity of storms: high winds and lots of water. Disaster resilience includes activities as diverse as emergency preparedness, specialized roof attachment

[19] CERES 'From Risk to Opportunity: 2007 – Insurer Responses to Climate Change' October 2007. Source: http://www.ceres.org/pub/docs/Risk-to-Opportunity-2007.pdf

techniques and missile-resistant window coatings. Disaster resilience minimizes, and in some instances eliminates, property damage and tends to reduce morbidity, mortality and economic disruption.

Unfortunately, disaster resilience is not generally associated with being green, and has not been integrated to any great extent in the sustainability dialogue. However, it should be.

Disaster-resilient structures and communities survive stronger storms. Furthermore, in the event of disaster, emergency-preparedness plans strive to make recovery more organized and efficient, thus reducing the incident and materiality of damage claims and reducing the loss of life. If structures and communities are damaged less often, they are, by definition, more sustainable. They require fewer building materials (less to re-build) and fewer relocations, and benefit from lower morbidity and mortality rates. Such savings translate not only into less disruptive and more humane practices but also into true dollar savings –which the insurance industry can transmit as price signals in reduced premium charges. Greater disaster resilience should equate to lower premiums . . . which equates to financial savings for use in additional sustainability improvement efforts. The challenge is that disaster resilience is expensive. Infrastructure and building changes are costly. Community organization is expensive. Insurers are not the only beneficiaries of the risk reduction achieved by disaster resilience; the public and many uninsured activities are also protected. Thus because insurers are but one affected party and insurance cannot provide price reductions that cover the entire cost of the disaster resilience – because more than insured risks benefit.

The insurance industry is now working with non-governmental organizations to try to get disaster resilience recognized formally as a sustainability characteristic. But, what is really needed, because of the public benefit, is for public-policy makers to continue implementing changes to building codes and land-use plans to achieve true sustainability[20] – preferably in a manner that permits market forces to establish economic incentives without precluding such through regulation. Further research on the links between disaster resilience, energy savings and off-grid power systems might also help solve this conundrum with the most market-driven participation possible.

Alternative Energy

Energy systems and technologies using fuel sources other than fossil fuels have been around for decades – some much longer.

Wind power, solar power, hydropower, geothermal and biomass systems are being insured as this article is being written. Each alternative energy power process has different experience in the competitive market with fossil fuels. Some of these power systems have been the subject of subsidies of various types during various governmental administrations and under various sovereigns. The viability of each process has tracked directly with its competitiveness vis-à-vis fossil fuel, and the functionality of proffered price supports or subsidies.

Many challenges exist when evaluating risks for alternative energy. Generally, the technologies themselves perform the function of producing power. The core issues of risk and concern tend to be associated with subsidies, the price competitiveness of the technology as compared with fossil fuel options and the laws defining associated rights.

Today, wind power project commitments blow with the wind of tax subsidy. When subsidies near their legal term and require re-up, new project starts halt. Underwriters must weigh the possible risks of stoppage carefully with respect to consequential covered first- and third-party damages that can occur when disuse occurs. Wind rights are an emerging issue:

- What if someone builds a structure that blocks the wind necessary to run the turbine? Is that actionable?
- How can the underwriter assure that the risk of stoppage is mitigated and / or understood with respect to insured damages associated therewith?

Like wind, solar power benefits from a subsidy. Solar power remains more expensive than fossil fuel generated power. Risks are different, however, as most subsidies are investment tax credit-based (see earlier section). Solar rights present certain issues:

- What if someone or something blocks the sun necessary to drive the power system? Is that actionable?

[20] See www.disastersafety.org for information about the work of the Institute for Business and Home Safety.

• How can the underwriter assure that the risk of stoppage is mitigated and / or understood with respect to insured damages associated therewith?

Such questions must be answered before the underwriter will put capital at risk.[21]

That said, it is fair to say that the insurance industry is quite prepared to underwrite and is actually insuring these technologies today. Moreover, the insurance sector is well-prepared to support decentralization efforts that are considered of importance in the energy area – that is, supporting off-grid decentralized power to improve capacity, disaster resilience and sustainability.

In the area of alternative energy, decisions to decline specific types of technology are often driven by concerns related to the stability of the business model with respect to physical, legal and public policy externalities, rather than the technology itself.

Water Scarcity

The availability of plentiful water near existing population centers is a significant concern. The availability of clean and plentiful water is typically a highly regulated essential service in developed economies. Most developed economies choose to centrally manage water in areas of concentrated population using a public, quasi-public or highly regulated private utility.

Much of the technology response to water scarcity involves local management and treatment – e.g., storm water recovery and re-use, treatment at the tap, etc. These technologies are being insured now.

The risks of greatest challenge in this area are not the technology, but the regulation. Regulation may prevent transport of water outside of that respective authority's geographic boundary. In other words, water operates on a theory exactly reverse to that of a power grid. Furthermore, there are very real public health concerns related to letting individuals decide whether to treat locally – because a decision not to treat could have significant morbidity and / or mortality consequences that are both socially and economically disruptive.

Thus, although insurers are willing and able to insure storm water recovery and reuse programs with existing specialty products (primarily through pollution coverage products), the feasibility of implementation is affected by public-policy externalities. The underwriting qualifications for such programs are likely to be similar to those requirements that might be imposed by a regulator in controlling public-health risks.

Insurability of water treatment for potable water uses is also possible, and such technology is insured now under the currently centralized schemes in developed economies. Extension of such coverage to local and at-the-tap treatments systems in developed economies creates both technology and legal challenges. Water treatment technologies for use immediately prior to consumption exist and are insured today. Issues are present with respect to immediate scalability for deployment. Public policy decisions related to water scarcity and water management may well be a central component of our society's response to climate change. Experts note that drought is one of the most prominent features of past climatic changes. New technologies such as water reclamation at wastewater treatment facilities and desalinization projects will be critical in meeting these new water challenges, and insurance can and should play a role in sorting out the application of these technologies.

Cleaner Coal: Carbon Capture and Sequestration

Many see the continued use of coal as an economic reality and, in the light of climate change, believe it is important to focus on technologies that can reduce GHG emissions associated therewith. CCS is one of those technologies. However, as noted earlier, CCS is not one technology – it is a family of field practices employing certain technologies for underground injection of CO2 as a supercritical fluid derived from coal-fired power plant operations.

First and foremost, for underwriting purposes, one must understand the composition of the gas stream at the capture point, which varies by power plant production process. Then, the underwriter must understand the transportation risk, if any. Next, an understanding of the injection process, the locus of injection and placement, and eventual sequestration into a subsurface confinement zone are essential.

Some subsurface injection processes have substantial data available to evaluate environmental health and safety risks – while others have little information. Some CCS approaches have substantial scale data through analogy, while others have little or none.

[21] A full discussion of the risks associated with all types of alternative energy is far beyond the scope of this paper.

Much data exists as to the behavior of injected supercritical gases used in the enhanced oil recovery process (EOR). Such injections are made into petroleum reserves and have been made on moderate scale when compared with demand that will arise when used for sequestration of CO2 emissions streams from coal-fired power plants. Petroleum reserves present specific geo-chemical and strategraphic characteristics and behaviors.

However, for logistical and other reasons, use of other types of subsurface sequestration geology may be desirable for purposes of CCS – namely deep saline structures and unmineable coal seams. Unfortunately, little if any real, practical data is publicly available with respect to the performance of the latter two types of sequestration subsurface structures. As such, data that is not currently public must be made available to underwriters for analysis and / or publicly available data must be generated to permit a credible insurability analysis. However, if analogous systems behavior can be demonstrated, insurability qualification may be achieved.

As noted earlier, risk mitigation requirements to qualify for insurability may be different as a result of the specific technology and the specific physical conditions – and insurance premiums will reflect those costs – e.g., risk price indications.

Because public data is lacking and little or no loss analysis modeling has been performed with respect to specific emissions streams, some of the public is quite concerned about plans to store this supercritical CO2 underground. Many stakeholders discuss concerns about the potential pollution of groundwater and / or release of large volumes of CO2 above ground – which could cause asphyxiation or result in other natural disasters. These concerns lead to calls for assurances about safety. That dialogue has quickly turned to demands for financial assurance – in a non-specific form – for extensively long periods of time. It is unclear that demands for financial assurance bear any reasonable relationship to the actual risks presented by this technology. Further, the demands have escalated to terms of up to 1,000 or more years in tenor – essentially in perpetuity. These demands have quickly led to countervailing demands for indemnity of the designers, constructors and operators of such sequestration facilities. Proper risk analysis and market-driven risk management solutions should be used to break the impasse in a manner likely to result in the most efficient solution.

The dialogue with respect to IGCC and CCS has focused on the physical and tort liability risks associated therewith as part of an overall dialogue regarding the financial risks associated with developing and implementing IGCC and CCS. So far, in the process, we have learned that CCS is not appropriately addressed as a monolithic risk.

In fact, the actual geologic structure of choice for sequestration may result in a huge impact on the insurance industry's willingness to assume liability for damages. Because some types of geologic structures have a long-standing history of being able to retain gases in a stable manner, such structures may be immediately insurable, where other underwriting criteria are satisfied. The insurance industry has a proven history of insuring enhanced oil recovery (EOR) activities to which both technology and geological / physical asset analogies can be drawn for risk profiling purposes. By contrast, other types of geologic structures may not have such backgrounds; at least the data is not publicly available at this time for the history of successful operation as a sequestration structure. Consequently, while engineers may have considered both processes as viable opportunities for CCS, the underwriters cannot. The implications for insurance availability and natural advantage based upon physical asset ownership could be significant in determining the feasibility of further developments and implementing CCS technologies. The availability of insurance and other risk management tools for both CCS short- and long-term liability is essential in determining stakeholders' willingness to support development and implementation of this technology as a climate risk-mitigation tool.

Unfortunately, the demands for first-dollar indemnity could send a zero-dollar price risk signal to the purveyors and operators of such technologies and disincent innovation. If probabilistic risk analysis reveals liability risks with extreme tenor, then a combination of risk-transfer insurance, alternative risk management solutions and indemnity, or limitation of liability may be required – in addition to price subsidy to incent the responsible and sustainable deployment of CCS.

Conclusion

Insurance at its core is a risk-management tool. The insurance underwriting process is designed to analyze risks. To the extent that such risks are insurable, in part or in full, the insurance sector sends price signals about that risk in the form of premium charges. The underwriting process consequently allows for a risk-based differentiation of new technologies.

The provision of risk management solutions by private insurers is also firmly embedded in the structure of our market economy. Insurers deploy labor and capital to underwrite risks. They have to be mindful that the resources of production are scarce and must be allocated to their most efficient use. It would be economically wasteful – and ultimately not sustainable – to use insurance to foster excessive investments in new climate technologies. Insurance is a business. The profitability of insurance is the benchmark for its service to society –including when used to support new climate technologies through the process of underwriting.

Public-policy makers should endeavor to consider solutions that accelerate deployment of new technologies to combat climate change in a manner embracing the use of insurance and allowing insurance practitioners to send relevant signals regarding price and risk management options. Public-policy makers should consider insurance as a tool to accelerate responsible deployment of GHG emission reduction technologies. Public-policy makers should avoid subsidies that mask risk and can otherwise be parsed and managed effectively by private insurance. In so doing, society is assured of maximum true economic and technological sustainability in an environment of rising seas, increasing storm frequency and severity, and increasing water-distribution challenges – thus permitting and promoting efficient, effective technologies to mitigate the effects of climate change.

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