

# **The Power to Insure**

REDUCING INSURANCE CLAIMS  
WITH NEW ELECTRICITY OPTIONS

By Joel N. Gordes

**Northeast Sustainable Energy Association**

**SEPTEMBER 2000**

© Copyright 2000 Northeast Sustainable Energy Association

**All rights reserved.**

**About the Author**

Joel Gordes of Environmental Energy Solutions is an independent energy consultant who has been involved in energy conservation and renewable energy fields for 25 years. He has designed active solar hot water and space heating systems, as well as designed or aided in design of 250 passive solar homes. He is currently involved in energy conservation program and renewable energy program design and implementation. He resides in Colebrook, CT.

**About the Northeast Sustainable Energy Association**

NESEA aims to strengthen the economy and improve the environment by bringing clean electricity, green transportation, and healthy, efficient buildings into everyday use. We are a regional membership organization comprised of engineers, educators, builders, students, energy experts, environmental activists, transportation planners, architects, and other citizens interested in responsible energy use. Our programs and activities focus on the northeastern United States (from Washington, DC to Maine). For more information, please visit our website, [www.nesea.org](http://www.nesea.org).

Copies of this report are available from the Northeast Sustainable Energy Association. You can also download it from our website.

## Acknowledgements

We would like to thank the United States Department of Energy for providing the grant support that made this report possible. In addition, the author would like to thank the following individuals:

Ann Deering for her foresight in recognizing the synergies which could be realized between the insurance industry and renewable energy resources, as well as for pioneering an approach acceptable to the insurance industry from which she came.

Jeremy Leggett for his early actions to bring European insurers in contact with the renewable energy community and his continuing efforts to commercialize photovoltaic technologies, as well as for the continuing inspiration and good cheer that he offers to all in this field.

Eugene Lecomte, former President of the Institute for Business and Home Safety, for generously giving of his time, talent, and experience in reviewing a paper for the insurance industry and offering his valuable insight into how the industry thinks and operates.

Tom Thompson, former Executive Director of NESEA, who took the risk of bringing insurance industry considerations into the clean energy dialogue and later gained firm support among those who earlier doubted him.

Warren Leon, current Executive Director of NESEA, who enthusiastically supported this project and spent countless hours editing drafts of this report. Alexandra Floratos, NESEA's MEMbership Coordinator, handled the graphic design and production.

John Thornton of the National Renewable Energy Laboratory and Bill Young of the Florida Solar Energy Center for their extensive work in applying renewable energy technologies to emergency situations and providing feedback and workshops to emergency management officials.

Evan Mills and his team at Lawrence Berkeley Laboratory for the effort and originality in identifying the many interfaces between energy efficiency and property loss reduction.

Joseph Galdo, Kathy Ghandehari, and Gregory Kats from the US Department of Energy for their untiring support for and advice on this and other initiatives which will link new energy technologies with disaster mitigation and recovery efforts. Without their past and present support, this project would not have been possible.



# The Power to Insure

## Reducing Insurance Losses with New Energy Options

### I. Power Unreliability: A Growing Problem for Insurers

In recent years, the insurance industry has seen property-casualty losses increase significantly, in great part because of the proliferation of high-value property in coastal areas and other locations prone to disasters. Hurricane Andrew wiped out 20 years of premiums in a few hours and led to overall losses of \$25 billion and insured losses of \$16 billion. Andrew fortunately did not hit the Miami area where damage could have exceeded \$65 billion in insured losses.<sup>1</sup> Other notable recent weather-related losses have included the Midwest floods of the mid-1990's, a string of multi-billion-dollar-loss hurricanes, and the ice storm of January 1998 in Eastern Canada and the Northeastern United States.

Significant portions of these financial losses were caused by business interruption tied to loss of electricity.<sup>2</sup> And when businesses are unable to operate, the entire community can suffer. Residents cannot go to their usual local outlets for necessary supplies, such as food, gasoline, and lumber. Moreover, the income these businesses generate for local people may be lost, sometimes forcing people to relocate permanently. This can even erode the local tax base. In addition, loss of power to the residential sector can result in costly dislocation expenses while recovery proceeds.<sup>3</sup>

The spurt of weather-related disasters from the late 1980's onward has been so unusual that there has been speculation that climate change may have played a hand and could exacerbate future losses. National Public Radio recently reported that "Florida insurers have used a scientific model they commissioned to argue that global warming means that hurricane strength will continue to increase in the coming years, thus the need for rate increases."<sup>4</sup>

Even if global warming turns out not to be a significant factor in the immediate future, shifts

in decadal hurricane patterns could lead to significantly higher losses. Professor William Gray of Colorado State University, the "dean" of hurricane forecasters has warned that the upcoming decade will show a return to the storminess which marked the period from the mid-1940's to the late 1960's.<sup>5</sup>

Yet, having forgotten the lessons of recent hurricanes, many vulnerable areas have not only been rebuilt but extended in size and density of wealth. A single storm could inflict over \$50 billion in damages.

So insurers, as well as Americans generally, are faced with increased risks of weather-related losses. But, luckily, newly emerging electric power choices can mitigate many of these property-casualty losses.

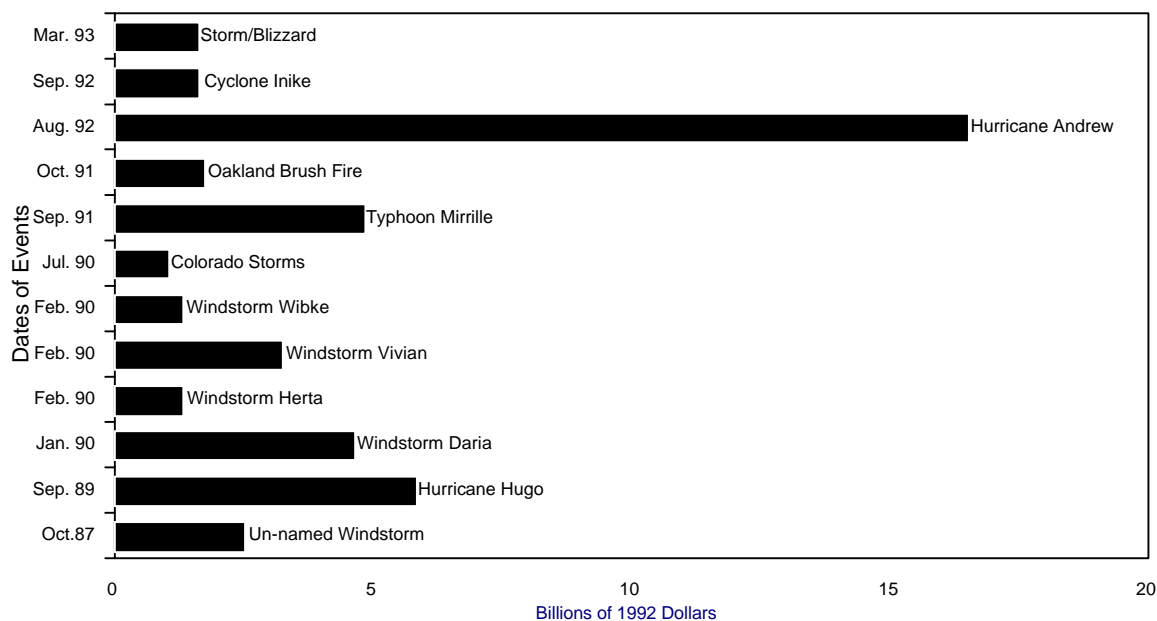
#### ***The Potential Costs of Electric Unreliability***

Insurers may wish to consider the growing threat of weather-related electrical outages in the context of an increasingly unreliable electric grid. Some energy analysts have concluded that the current restructuring of electric markets aids in diminishing electric service reliability,<sup>6</sup> much of this through downward pressures on price which trivialize other factors including reliability.<sup>7</sup>

New York City, for example, suffered a major loss of power in July 1999. Sections of Manhattan were plunged into darkness for 19 hours. In addition to a suit by the city for \$3 million,<sup>8</sup> there were additional losses from business interruption.<sup>9</sup> In one instance, Columbia University's College of Physicians and Surgeons lost "untold" research materials accumulated over years which were kept in freezers when the power failed.<sup>10</sup> Critics of the utility company charged that the outage stemmed from the company's failure to upgrade older feeder cables.<sup>11</sup>

Some energy industry analysts foresee more frequent outages in the future<sup>12</sup> and major ones have already occurred in Chicago, New Jer-

## Catastrophic Weather-related Losses 1987-Early 1993



sey, and Detroit with stresses on systems from California to New England. As severe as the New York outage was, it did not cause any loss of life. But had it been more widespread and been combined with intense, prolonged heat as in Chicago in 1995 where 700 deaths occurred, there would surely have been many fatalities from heat-related effects.<sup>13</sup>

As America becomes ever more dependent upon computers, the risks to insurers from electric power interruptions may increase. A federal judge in Arizona recently ruled that property insurance covering “physical damage” also covers damage from loss of computer data, access, use, and functionality. The decision stated:

At a time when computer technology dominates our professional as well as personal lives, the Court must side with Ingram’s broader definition of “physical damage.” The court finds that “physical damage” is not restricted to the physical destruction or harm of computer circuitry but includes loss of access, loss of use and functionality. ...Lawmakers around the country have determined that when a computer’s data is unavailable, there is

damage; when a computer’s services are interrupted, there is damage; and when a computer’s software or network is altered, there is damage. Restricting the Policy’s language to that proposed by American would be archaic.

In this case, even though electric service was restored within a half hour, because programming for three mainframe computers was lost, those computers remained unusable for considerably longer and connections between the company’s data center and six other locations were not restored for eight hours.<sup>14</sup>

Should that decision be upheld on appeal, business interruption claims based on lost data could skyrocket. Aside from traditional steps such as raising premiums, setting higher deductibles, and encouraging contingency planning for such outages, insurers might advise their clients on how to protect against electricity interruption using new energy technologies.

### ***Not by Accident Alone: Intentional Electric Disruptions***

Severe weather and electric system degradation from deregulation are not the only threats to electric reliability. Terrorist nations, groups, or individuals

could disrupt America's infrastructure, including the electric grid.<sup>15</sup> This has been dubbed "cyberwar" or "cyberterrorism" to connote that it would be induced through disruption of computer networks controlling vital functions. Among the foremost of vital functions is the electric power grid and the hierarchy of services it enables.

Modern societies are composed of four critical, highly interrelated, and symbiotic infrastructures upon which their national and personal survival depends: The power grid is the foundation of it all. We run it all on electricity, no matter how it is generated, and distribute it over a huge web of overhead wires and underground cables...<sup>16</sup>

While information warfare has been a concern for a number of years, that concern has mostly been confined to the military and some large corporations whose vulnerability has already been exposed by computer hackers. Lest there be doubt about the seriousness of the threat, the United States Air Force's Space Command in Cheyenne Mountain Colorado has been given the task of the government's response to cyberwar/cyberterrorism. Admiral Herbert Brown, Deputy Commander of Space Command in charge of cyberwarfare, has stated:

Virtually any country that has a computer has an opportunity to enter into cyberspace and be disruptive... [The ability to bring down a power grid] is absolutely real. Let me give you a quick example, I drive a 1961 Corvette. I've never had a computer problem in that car. It always runs. My wife drives a new automobile that's got a computer system in it that's a big pain....That's because the computer chip...brings that wonderful automobile to a complete standstill. So why would you think that a grid that is dependent upon computers would not be like that automobile? Certainly, this is not theory, this is very real.<sup>17</sup>

Unfortunately, this concern has not yet penetrated into the mainstream of most corporations that this form of "damage" could be as real and destructive as if inflicted by an explosive device. Responding to the assertion that cyberwar is a threat that the government cannot defend against all by itself, Richard Clarke, the White House Advisor on Cyberwar, commented:

The owners and operators of electric power grids, banks and railroads; they're the ones who

have to defend our infrastructure. The government doesn't own it, the government doesn't operate it, the government can't defend it. This is the first time where we have a potential foreign threat to the United States where the military can't save us.<sup>18</sup>

Although no known successful or unsuccessful attacks against an electric grid have been made known as yet, there has been at least one unconfirmed attack against a computer network of a major corporation:

The computer network of a Fortune 100 company was obliterated last week by a new virus that one official called "the first legitimate incident of cyber-terrorism" he had ever seen. Although Hodges declined to name the attacked company, he said 10 sites and several thousand servers and workstations had been infected... "These guys were very smart," Hodges said. "They had a good enough idea of where to put it in order to make it spread very quickly."<sup>19</sup>

It will only be a matter of time until a well-documented and publicized attack does take place. Whether losses due to a cyberattack could meet "standards of insurability" or whether a premium could even be developed or be approved by regulators are questions open to speculation, and ones that need to be addressed.<sup>20</sup>

## II. The Distributed Generation Solution to Power Unreliability

To defend against power outages and the future threat of cyberwar/cyberterrorism against the electric grid, our society should take steps to provide a counterbalance to the current centralized electricity generation system. Under this system, very large power plants produce electricity for transmission over long distances. This approach, which has gone hand-in-hand with utility monopolies, has been the norm for the past 80 years.

We can instead move towards decentralized, small, and diverse generation, which is generally referred to as "distributed generation." As energy expert Michael Totten has put it:

Since large, centralized energy systems are repeatedly singled out in these reports as one of the most vulnerable parts of society's critical infrastructures, the implication is clear: transition to more resilient distributed power

systems which, if they fail, do so gracefully, not catastrophically.<sup>21</sup>

With distributed generation, the power source is located at or close to the point of use. It therefore has the advantage of not requiring use of the transmission and distribution system of wires and substations which are the portion of the system most prone to interruption by natural or man-made disasters. Distributed generators close to the point of use would also enhance power quality for sensitive information and manufacturing operations. Although a power glitch may last only a fraction of a second, the harm can take hours to recover from and cause high costs for certain businesses.

In addition to increasing power reliability at the specific businesses that install small generating systems, greater use of distributed generation would enhance the overall reliability of the entire US electric system. Because distributed generation would use a wide range of generators and fuel sources, the electric system as a whole would become more diversified, and therefore less vulnerable to supply shortages or other problems associated with over-reliance on a single type of fuel.

In the past, generators have been available, but most of them have been either too large for all but the largest businesses or they used technologies which were either inefficient, costly to maintain, or were highly polluting. But now a number of new

options have begun to emerge which overcome all of these barriers and can offer reliable power.

### ***Differentiating Price From Value***

Although distributed generating systems generally entail a significant first-cost expenditure, a business which suffers an interruption or whose power quality deteriorates to the point that computer-related operations are compromised, will likely see that cost as justified. Since many businesses are covered by business interruption insurance, the insurance industry might also be attracted to the reliability aspects of the distributed generating technology. The table below shows the value of lost operations from electricity interruptions for various businesses.

When viewed in relationship to the risk, a system that will provide power reliability can seem eminently cost-effective. This adheres to the “precautionary principle” well known in the insurance realm wherein it is deemed prudent to invest a small amount in preventative measures if it has the potential to mitigate large losses. The insurance industry might consider reducing the premium or otherwise encouraging a business equipped with such back-up systems, thereby recognizing the value of such systems through actual cost-sharing with the customer. This may take a number of field installations before their value is verified to the satisfaction of the insurance industry.

### **Cost of Power Interruptions to Business Activities<sup>22</sup>**

<b>Industry</b>	<b>Average Cost of Down Time</b>	<b>Source</b>
Cellular Communications	\$41,000 per hour	Teleconnect Magazine
Telephone Ticket Sales	\$72,000 per hour	Contingency Planning Research-1996
Airline Reservations	\$90,000 per hour	Contingency Planning Research-1996
Credit Card Operations	\$2,580,000 per hour	Contingency Planning Operations-1996
Brokerage Operations	\$6,480,000 per hour	Contingency Planning Operations-1996
Grocery Store	\$50-80,000 per day	<a href="http://www.eren.doe.gov/distributedpow">http://www.eren.doe.gov/distributedpow</a>
Electronic Chip Fabrication Plant	\$62 million per episode	Electronic Buyers News
Average Small Business	\$7,500 per day	Impulse Research of Los Angeles-1998

### III. Types of Distributed Generation

#### **Microturbines**

Advances in gas turbine technology are responsible for much of the interest in distributed generation. Gas turbines, which evolved from the jet engine used for aircraft propulsion, were once so inefficient they were only considered for short-term use as peaking generators run only on the hottest days. But now, even relatively small units can match the efficiency of the largest coal-fired steam plant.

A whole new generation of modular gas turbine and fuel cell power plants which are small enough to power retail stores, restaurants, apartment houses and even individual homes are beginning to hit the market. An example of one is the Capstone microturbine, which is only 30 kilowatts, or small enough to entirely run a fast food restaurant.

Much of the microturbine's economic advantage comes from not having to pay a \$.02 kilowatt-hour (kWh) to \$.04/kWh transmission and distribution charge as well as other charges embedded in bills under deregulation. However, in some states they may have to pay an exit fee which would reduce some of this advantage. In locations where small gas turbines are able to provide combined heat and power (cogeneration), their advantage is even greater.

Microturbines do not need to rely on natural gas. They are also capable of using diverse renewable fuel feed stocks. Tests have already been conducted in combination with digester gas, which is methane supplied from the waste treatment process. Other efforts are under way to use them with gasified biomass which could include everything from sawdust waste from wood industry operations to food waste and biodiesel.

#### **Fuel Cells**

A fuel cell is a device that converts hydrogen and oxygen into electricity. Fuel cells are similar to batteries in their design, yet they do not run down or need recharging. They instead rely on an external supply of hydrogen. They have no mov-

ing parts and produce little noise.

Because fuel cells convert the fuel to electricity through an electrochemical process rather than a combustion process typical of most power plants, the emissions are much cleaner. The first generation of commercially available fuel cells will get their hydrogen from fossil fuels, such as natural gas and propane, or from methane generated from sewage digesters or landfills. Fuel cells will offer even greater environmental benefits when it becomes economical to extract pure hydrogen from water.

Fuel cells are already commercially available in 200 kilowatt models from UTC's ONSI Corporation and may soon be proliferating in units as small as one kilowatt which will open up enormous markets for them. Many observers expect that work being done by the Ballard Company in association with several large automobile companies may provide the production economies of scale to make them not only competitive in the transportation sector but also in the stationary power sector as well. Companies such as Plug Power which have significant financial backing (General Electric) may be able to introduce commercially available models in the seven kilowatt range within several years.

SurePower Corporation recently installed a system at the First National Bank of Omaha. With fuel cells at its core, it provides the credit card operation with "six-nines" (99.9999%) reliability. Earlier this year, it received the Frost & Sullivan Year 2000 Market Engineering Entrepreneurial Company Award to recognize that "the rapid growth of high-tech, financial and healthcare sectors is proportionally driving the demand for stand-by, high-quality, uninterrupted power supplies."<sup>23</sup> (For more information: [www.hiavailability.com/welcome.html](http://www.hiavailability.com/welcome.html).)

#### **Photovoltaics (PV)**

Photovoltaics directly convert sunlight into electricity and are, perhaps, the most modular of all the renewable energy distributed resources. This allows them to be tailored to many uses in remote areas or in areas where it would be inappropriate to operate other forms of generators. Potential cost-

effective niche markets include PV-powered outdoor lighting, residential rooftop PV systems with integrated uninterruptible power supply (UPS) systems, PV augmented UPS for computer networks, and PV power supplies for wireless communications systems and emergency management systems<sup>24</sup>. Bill Young of the Florida Solar Energy Center notes that photovoltaics are especially well suited to applications used for critical loads when all else fails, since they are indefinitely sustainable as a source.<sup>25</sup>

The primary barrier to photovoltaics is their currently high purchase cost due to lack of economies of scale in production. In addition to cost barriers, solar PV struggles with the intermittent nature of the sun's availability, as well as unfamiliarity by most utility personnel and lack of a solid commercialization infrastructure. Nevertheless, photovoltaics possess certain traits which deserve recognition. Their modularity, reliability,

zero fuel needs, and power quality will have greater value as the restructured electric market develops further. Moreover, they generate their maximum output just at those times when power is most required. This "load following" characteristic allows them to provide grid relief during hot summer days when air conditioning loads are extremely high which account for many of the outages or voltage reductions which are so harmful to computer operations.<sup>26</sup> (See chart on next page.)

At the other extreme, after the ice storm in January of 1998 in Maine, Canada, portions of New York, Vermont, and New Hampshire, solar energy levels were sufficient to power photovoltaic systems.<sup>27</sup>

Another particularly attractive application which has been investigated by the Rhode Island Renewable Energy Collaborative made up of that State's utilities, state agencies, and others is to use PV with wireless digital telecommunications systems. This marriage of technologies would provide a super reliable system capable of operating during disasters even with loss of grid power. A telecommunication system dubbed "fixed wireless" is already in use as a highly reliable means to send voice, data, and other broadband services without having to use "copper" for the last mile. It has been cited in a number of business continuity case studies for its survivability. This could be further enhanced were it to be powered by PV arrays on rooftops where the fixed wireless antennas are also located. Together, they would have almost unlimited ability to function during lengthy loss of power episodes.

### **Wind**

Wind energy conversion systems, while for the most part sited in more remote areas than other distributed resources, may still become a preferred source due to its relatively low capital cost (\$1100-\$1300 per kilowatt) compared to many other renewables. It requires minimum annual winds speeds in the 14 mph range to be viable.

### **Using PV For Disaster Recovery**

One example using photovoltaics directly for disaster recovery involves Direct Global Power's Reconstructive Solar Technology and Relief Taskforce (RESTART) which deploys solar-powered sources for use in disaster-stricken areas.



One specialized use even includes a PV-powered mobile office system which is being leased for demonstration purposes by American Modern Insurance Group to process claims in disaster areas without power. Discussions are also underway for a larger PV-powered office in a bus.

## IV. Advantages of Distributed Generation

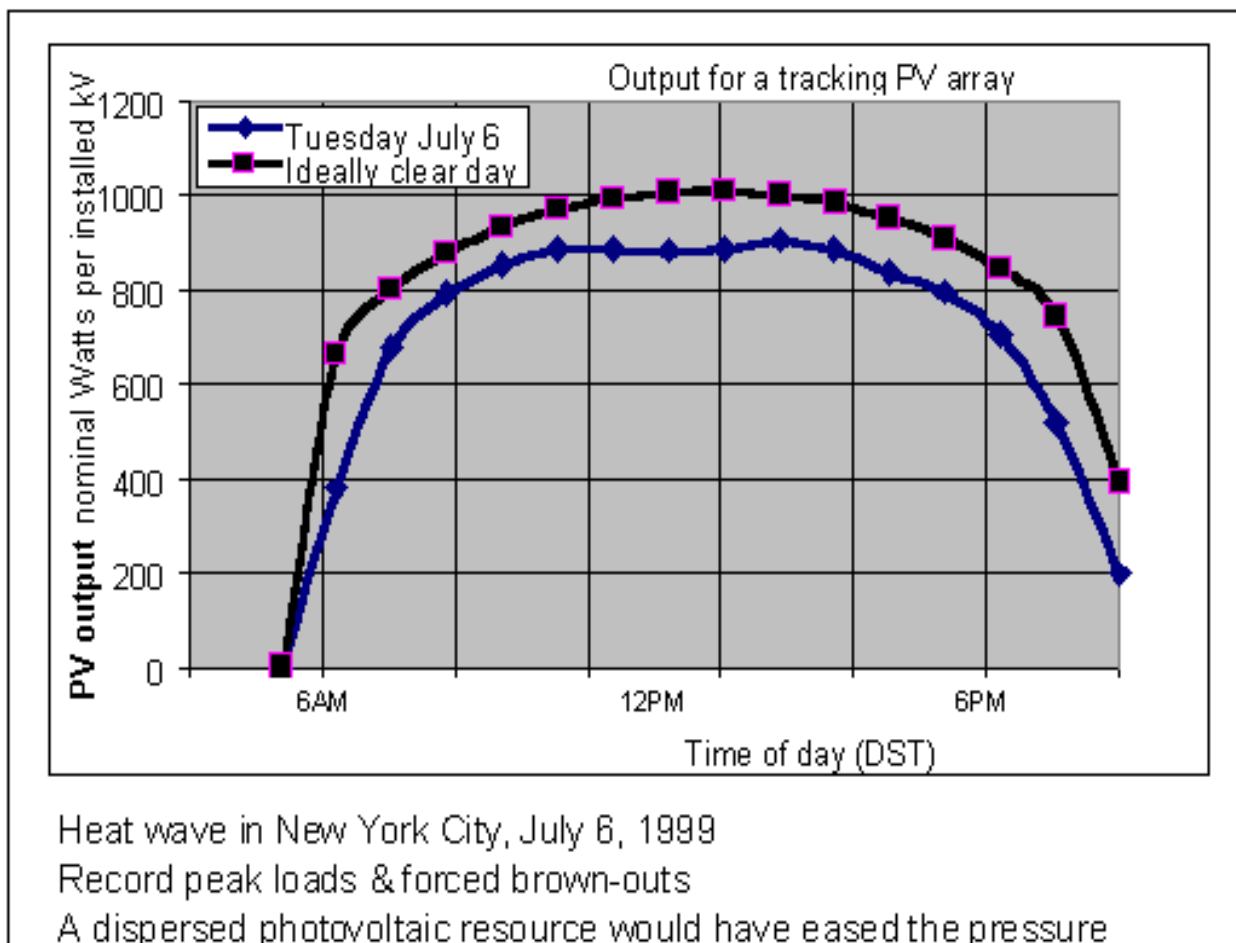
Distributed generation offers many advantages. Because insurers focus on risk management, power reliability and quality gains that reduce risks will be of the greatest interest to them. But there are other less obvious financial and regulatory risks that also deserve consideration. They can indirectly affect reliability through delays in large plant construction or the inability to site critical transmission and distribution (T&D) facilities. Distributed generation can overcome these problems because of the following factors:<sup>28</sup>

- **Ease of Siting.** It has become increasingly difficult to locate large power plants and the siting process can take years if

opposition arises. Community groups will often oppose such projects if they perceive them to be hazards to health, the environment, or property values. It is generally easier to win public acceptance for small-scale distributed and renewable energy facilities.

- **Short Lead Times.** Shorter lead times mean fewer financial uncertainties. Since distributed technologies are built in the factory rather than on-site, there are fewer risks associated with lead times which, in the case of larger nuclear plants, sometimes stretched out to 13 years from inception to completion. This reduces financial uncertainty and the time gap between when a unit is financed vs. when it begins

### PV Output Can Match Peak Electricity Demand<sup>29</sup>



producing income.

- **Project Scale vs. Technology Risk.** With smaller, distributed technologies there is less investment risk compared to placing large amounts of capital in larger, soon-to-be obsolete technologies. For instance, some large new gas plants have been built in areas where there is electric transmission congestion reducing their ability to sell power and endangering their economic viability. Small distributed sources do not share this risk.
- **Low Financial Risk.** By definition, there is less financial risk with small-scale projects than with large ones. Lenders take a much lower risk when investing in numerous but small distributive projects.
- **Less Regulatory Risk.** There is less risk of regulatory changes for the short planning and installation cycle of a distributive technology than for larger, centralized longer term projects where air emission or siting requirements might change during the process.
- **Lower Fuel Diversity Risk.** Since many of these new technologies can use renewable energy sources, there is risk reduction by diversifying the fuel mix away from sources which are either in short supply at any given time or under control of nations which may not share democratic values. Even where large reserves are domestically available, such as with natural gas, there is still the threat of disruption and escalating price pressures.
- **Modularity.** In the past, in order to realize economies of scale, it was necessary to build steam turbines of 1000 MW or more which often entailed billion-dollar expenditures and produced overcapacity situations with large rate increases until loads caught up. The modular nature of

distributive technologies allows for perfect load matching which avoids this situation of overbuilding and overspending. Investors need not risk tying up capital in such costly projects which may end up being underutilized.

- **Fuel Cost Insensitivity.** Because distributed generation can make use of renewable energy, it will not be as subject to fluctuating fuel price risk as are many less efficient competing options. Natural gas prices have gone up in tandem with rising oil prices in the past year as well as due to an increasing number of new centralized power plants using it as their primary fuel.
- **Mobility.** Distributive systems have the flexibility to be moved to a new location if loads do not develop or decrease over time or a total operation needs to be moved.

#### ***Non Risk-Related Advantages of Distributive System***

Distributed generation systems have additional attributes which influence either their cost or value in non-risk, but still relevant, ways. These considerations will often make the difference between a project which is cost-effective and one which is not. Incentives from utilities, public benefits funds, or even insurers can provide the margin that tips the decision-making process in favor of distributed technologies.

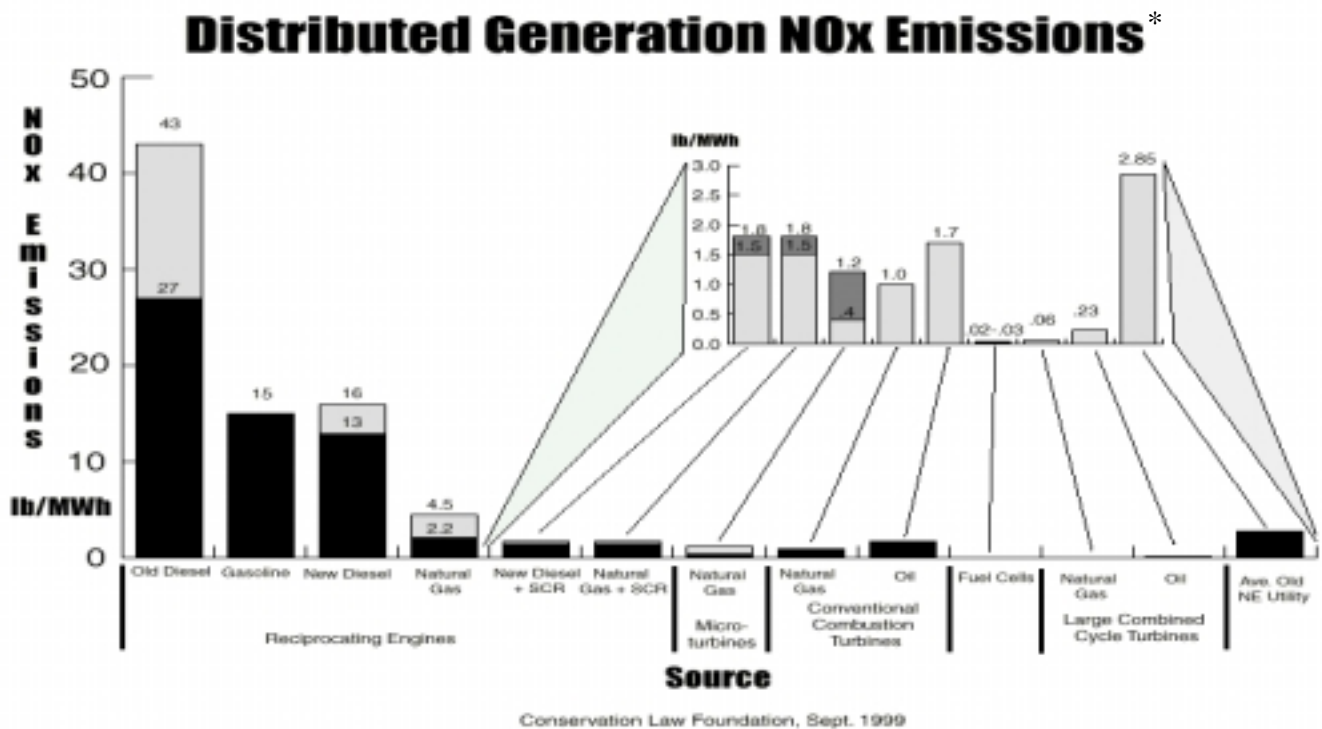
- **Incentives from Deregulation.** Deregulation (or restructuring as it may be more correctly termed) legislation has, in many states, mandated a system benefits charge that creates funds which are designated for use in furthering renewable energy and demand-side management technologies and practices. It may be possible to access some of these funds for installation of systems used for power reliability, quality, or disaster preparedness purposes.

Many states have also instituted “renewable portfolio standards,” which require providers of electricity to supply a certain percentage of their power from renewable sources, some of which could be distributed resources.

- **Environmental Improvement.** Most distributive technologies result in ultra low emissions of air pollutants. They also generally produce lower greenhouse gas emissions than traditional electricity generation. (see chart below, which compares various distributive technologies with conventional conversion technologies for NO<sub>x</sub> emissions.)
- **Deferral of Transmission and Distribution Costs.** Americans’ demand for electricity is growing at almost two percent per year, but the power grid is expanding at only half that rate.<sup>30</sup> In many situations, distributive technologies

offer a lower cost option than traditional transmission and distribution upgrades such as substations or new high voltage lines.

- **Reduced System Losses.** There are fewer line losses with generation closer to points of use. When electricity is transported over long distances and in areas where there may not be sufficient line capacity to accommodate increased loads, line losses can account for 6-8% . Distributed technologies can all but eliminate these losses.
- **Low Operations and Maintenance (O&M) Costs.** Photovoltaics have no moving parts and therefore require little maintenance. Fuel cells have few moving parts. And even microturbines, with some moving parts, may have lower operating and maintenance costs than large traditional generating systems.



\* The two numbers on each bar indicate the range of emissions for different plants of the particular type.

## Distributed Generation Opportunities

**1. Fuel cells on farms.** One interesting testing ground for distributed technologies involves rural electric cooperatives in the Midwest. Electric reliability on farms is important to ensure uninterrupted operation of such equipment as milking machines and to provide hot water for maintaining required sanitary conditions associated with food handling. Some electric cooperatives are exploring installing fuel cells onto the premises of rural customers to replace reliance on long-distance transmission and the electric grid.<sup>31</sup> Photovoltaic systems are also being considered.<sup>32</sup>

This distributed generation approach could save the electricity coops money since rural lines can cost many thousands of dollars per year to maintain while they may only reap a few thousand dollars in revenues because of low customer density. This results in a net loss to the utility which, by mandate, must still maintain them.

**2. PV in Cities.** In some cases, distributed generating facilities could enable a utility to avoid having to upgrade expensive electricity distribution facilities. Such was the case in the Southern California Edison distribution area when they placed photovoltaic panels on a school to alleviate power constraints caused by increased usage of air conditioning.<sup>33</sup> In this case, they avoided the expensive and disruptive option of ripping up pavement to upgrade an old underground trunk line. In such a situation, if the utility and the customer contract for a cost-sharing arrangement, they may realize a win-win situation where each pays less (or loses less) and reduces overall technological and financial risk.

## V. The Role of Conservation and Load Management.

For distributed generation to be successful, it needs to be combined with energy conservation and load management. Together, they are termed distributive resources or “DR.” Conservation is usually the most cost-effective energy step a business can take and it is absolutely essential in

order to reduce the cost of the generation options which can be employed later. Conservation and load management also have disaster mitigation value in and of themselves. See the sidebar on the next page for two of over 80 examples of such mitigation researched by Lawrence Berkeley Labs and others.

## VI. Avoiding Overreliance on Natural Gas

As environmentally friendly and economical as distributed technologies are to operate, some of them depend upon a plentiful and reliable source of relatively cheap natural gas to gain their economic and environmental advantages. While this advantage is currently available, this may not always be the case. Over-investment in gas-fueled technologies should be avoided.

We should keep in mind that additional gas supply will be required in some areas where its use for electrical generation has traditionally been low. Several pipelines in the Northeast have either been completed or planned to attempt to meet this need. Nevertheless, in spite of new pipelines, there will still be supply and price pressures which must be calculated into the cash flows of projected new plants. As natural gas becomes the fuel of choice for electricity generation, increased demand has already led to higher prices.

While supply may, for the most part, prove reliable, and the number of pipelines has increased in areas of the Northeast, periodic constrictions can have enormous human and political consequences. An example of the latter is the two-week sub zero weather which engulfed the northern tier of the nation during December 1989 and led to full-page ads asking gas customers to curtail natural gas usage. At that time only a tiny percentage of gas was used to produce electricity. Any similar situation which might arise now that gas could potentially generate 40% or more of the Northeast region’s electrical requirements within a decade could force government officials to decide who receives gas for heating versus who receives gas for electricity production.

## VII. Roles for Insurers and Risk Managers: A Call to Action

The insurance industry can play an important role in preventing losses from power interruptions. Although the insurance industry does not actively crusade as a social engineering group, they have been responsible for the introduction of numerous technologies and programs which have bettered people's lives while reducing their own liabilities. For example, the industry has promoted seat belts, air bags, anti-lock brakes, sprinkler systems, fire alarms, home alert systems, building code upgrades, and anti-drunk-driving and anti-smoking efforts.

In addition to Arkwright Mutual Insurance's involvement with getting dangerous fire-prone lighting out of college dormitories (see sidebar), there is precedent for insurance involvement in energy efficiency. In the early 1980's, Hanover Insurance of Worcester, MA provided policyholders in six states with a 10% reduction in premiums for solar, underground, and energy-efficient homes. Their rationale was that statistics indicated that 20% of all fires in one or two family homes were traced to conventional home heating systems but in an energy-efficient home those systems fire much less often and largely reduce the hazard associated with combustion.

Another precedent was set in the course of the Northeastern ice storm of 1998 when Prudential Property and Casualty announced that they would allow residential policyholders who were without heat and electrical power to be reimbursed under their homeowners policy for the purchase of a conventional generator up to \$600. They permitted this in order "to enable all their policyholders whose homes are still without power to return to their homes and normal activities as quickly as possible." The company recognized the value of such systems for reducing further losses from home freeze ups or having to pay for people to travel and stay in shelters or other accommodations away from home.

Conventional portable generators entail risks, however. Reports after Hurricane Andrew indicated that that a number of burn injuries were

### Disaster Mitigation Benefits of Energy Efficiency Measures

**Ice Dam Mitigation.** In colder climates, so-called "ice dams" often form after a heavy snowfall. These are accumulations of ice along the edge of rooflines which can not only damage gutters and shingles but also lead to a pooling of water which works its way up the roof and under the shingles. The water can then enter the building and causes internal damage to ceilings, walls, and personal property. This leads to claims payable by insurers. The underlying cause of ice dams is the loss of heat from the structure through the roof which melts the snow from below. The melted snow then runs down the roof only to re-freeze on the unheated eave to form the dam. Addition of insulation and venting of the space above the insulation not only corrects this situation but saves energy.<sup>34</sup>

**Halogen Torchier Lamp Replacements.** Halogen torchiere lamps have been cited as the cause of over 350 fires and 30 fire-related deaths. High profile incidents include the fire of jazz-great Lionel Hampton's apartment in New York and the massive fire which destroyed much of Windsor Castle in UK in 1992. These 200 to 500 watt bulbs can burn in excess of 1000° F and cause rapid ignition of nearby combustibles. In addition, they use tremendous amounts of electricity for the amount of light they provide. Pioneering work by Lawrence Berkeley Labs has prompted several utilities to offer torchiere turn-in programs where they provide a substitute low wattage (32 W) compact fluorescent bulb which uses a fraction of the energy, is cooler, and provides comparable lighting effects. At least two have emphasized risk mitigation as a primary selling feature of their programs. Arkwright Insurance has sponsored efforts to remove halogen torchiere lamps from college dormitories.<sup>35</sup> For further information see: <http://eetd.lbl.gov/cbs/insurance/ci.html>.

reported from the use of conventional generators, usually from the refueling operation.<sup>36</sup> Insurers might therefore consider providing at least partial coverage or a premium reduction to policyholders for distributed generation systems which do not entail such hazards. Such incentives could be

provided prior to emergency situations and would place the policyholders in a more resilient situation at the time of the disaster. Many policyholders may be considering such systems anyhow and a small financial incentive might become the make or break point on such a decision. One survey found that:

“25% of US homeowners are actively considering purchase of back-up generating systems.” The report also went on to say that affluent consumers, concerned about their computer systems, security, hobby and home entertainment equipment, would be willing to pay a premium of 10% to their energy supplier to provide back-up for their home generators. Those with home businesses had a high level of interest in on site technologies which would also ensure power quality and protect them during emergencies.<sup>37</sup>

Incentivization by insurers to motivate consumer action can be pivotal and is advocated by some of the leading theorists in risk management. Paul Kleindorfer and Howard Kunreuther argue that:

Premium reductions for undertaking loss prevention methods can be an important first step in encouraging property owners to adopt these measures. The basic rule in this case is a simple one: if the premium reduction is less than the savings in expected claim payments due to mitigation, it is a desirable action for the insurer to promote....An alternative way to encourage consumers to adopt mitigation measures is to change the nature of their insurance coverage rather than reducing the premium. More specifically, the insurer could offer a lower deductible to those who adopt mitigation at the same or lower price than if they had decided not to invest in RMM [risk mitigation measures] Such a program is likely to be very attractive given the empirical and experimental evidence which suggests that consumers appear to dislike deductibles even though they offer considerable savings in premiums.<sup>38</sup>

Frank Nutter, President of the Reinsurance Association of America, has long championed greater involvement in energy matters by the insurance industry as a way to mitigate risks and in a 1996 speech set out a number of ways in which insurers could take a more active role. In that speech, he said, “Our industry also has an opportunity and a responsibility to encourage

energy efficiency, as one significant action to improve our climate.” He went on to endorse the work of the Center for Building Science at Lawrence Berkeley National Laboratory which recommended that the insurance industry and their customers (encouraged with use of premium differentials):

1. Adopt technologies that increase energy efficiency and have the potential to reduce health and property losses;
2. Participate in research for the commercialization of energy-efficient technology;
3. Operate their own buildings in an energy-efficient manner;
4. Foster energy-efficiency in financing or purchasing buildings;
5. Create new insurance products for energy service companies;
6. Work with research and development programs and energy regulators in the identification of safety enhancing aspects of energy-efficient technologies;
7. Encourage energy-efficient improvements in the rebuilding or retrofitting of existing structures;
8. Review existing new construction applying standards for energy efficiency and safety opportunities to reduce risk of insured loss and improve energy efficiency.<sup>39</sup>

Going beyond Mr. Nutter’s general advice, insurers might take on a leadership role in promoting distributed generation in order to reduce the risks inherent in changes in the electric power sector. In particular, they could:

1. Track the trends in electric power unreliability to determine if it is increasing,

the causes for the increases, and their effect upon insurance losses.

2. If there is an increased trend in unreliability with accompanying losses, work with the market and regulators to correct it.
3. Test distributive generation with selective clients to determine their ability to reduce losses.
4. Investigate the liability aspects of the distributive generation units themselves and provide reasonably priced products for their insurability.
5. Provide incentives on insurance policies for businesses and individuals who choose to employ distributive resources that testing can show increase reliability and power quality.
6. Request regulators make policy changes that would allow setting business interruption loss insurance rates based partly upon local electric reliability.
7. Lobby for tax incentives which provide the insurance industry with tax credits for the amount of money spent in mitigation activities including incentivization of distributed resources.<sup>40</sup>
8. Participate in the refinement of certifications and standards such as IEEE 929 and 1262, UL 1741 and 1703, and NEC 690 which govern solar panel and system requirements for proper and safe installation.
9. Attend conferences, forums, and workshops on distributive technologies to learn first hand about advances in the systems, codes, standards, and certifications and the factors which may impact the insurance industry both as

benefits and liabilities.

10. Undertake active participation in the distributive technologies field (including formation of a “captive” if so required) in order to remove barriers that prevent these options from entering the market. In so doing, build a lucrative, new component of the insurance business in advance of competitors. As part of building this business, sponsor conferences, forums, and workshops pertaining to distributive systems from an insurer’s perspective.
11. Review the historical aspects of the insurability of energy-related activities such as oil depots, gasoline stations, electric utility sub-stations, and other hazardous but more passe technologies. Determining how they might have been treated by the insurance community in their formative stages could add valuable perspective.
12. Because of electric restructuring legislation, many states now have funds for energy efficiency and renewable energy which can partially pay for distributive resource research, development, demonstrations, and ongoing programs. It may benefit insurers to become active participants in these activities in order to enlist partners to undertake the suggestions made above. The opportunities for cost sharing among as many players as possible lowers the cost to any single participant. Insurers can play a valuable role in such partnerships while gaining benefits.

## **Conclusion**

In summary, there are new risks and opportunities for the insurance industry. On the one hand, there are ever-greater threats to power reliability, while, on the other, the emergence of new distributive energy sources provide a host of options for mitigating many power-connected losses.

In the past, the insurance industry has been on the cutting edge in adopting new and innovative technologies, standards, and financial products. From incentives for fire sprinklers and alarm systems to working for stronger building codes and offering catastrophe bonds, they have taken an activist approach and have risen to the challenge when new tools have become available. It would seem to be a logical next step for the industry to investigate and apply new distributive energy technologies as a loss mitigation strategy. With its understanding of markets and risk management, the industry is in an ideal position to develop specific new financial products to advance these technologies. Ideally, a collaborative approach can be developed which brings together those from the insurance sector with those from other disciplines to fashion win-win outcomes for all.

# Notes

- <sup>1</sup> Ann Deering and John Thornton, “Applications of Solar Technology for Catastrophe Response, Claims Management, and Loss Prevention,” NREL/TP-520-26490. April 1999. p. 2.
- <sup>2</sup> Ongoing communications with Ann Deering.
- <sup>3</sup> Personnel communication with Bill Young on 9/11/00.
- <sup>4</sup> Philip Davis, “Florida Hurricane Insurance, National Public Radio, *All Things Considered*, 8/31/00.
- <sup>5</sup> William M. Gray, “Perspectives on Multi-Decadal Variability of Atlantic Hurricane Activity, Climate Prediction and Global Change,” Prepared for Employers Reinsurance Corporation, Global Climactic Change Conference, April 26, 1996.
- <sup>6</sup> “Competition May Affect Electricity,” NewsEdge Corporation, January 6, 2000.
- <sup>7</sup> Personal communications from Gregory Kats, US DOE, 8/29/00.
- <sup>8</sup> “NYC Will Sue Con Ed for Heat Wave Blackout,” *The PointCast Network*, July 21, 1999.
- <sup>9</sup> “100 N.Y. Businesses Sue Over Blackout,” NewsEdge, April 12, 2000.
- <sup>10</sup> Susan Rabinowitz, “College Takes Heat on Blown Research,” *New York Post Online*,
- <sup>11</sup> “Lessons From the Blackout,” *New York Times*, July 13, 1999.
- <sup>12</sup> “Expect Deadly Energy Shortages—They are Here to Stay, ABI Says,” *PointCast Network*, July 12, 1999.
- <sup>13</sup> “’95 Heat Wave That Killed Hundreds Haunts Chicago,” *The Hartford Courant*, Associated Press, July 14, 1996.
- <sup>14</sup> “Insurance Coverage Ordered for Lost Computer Data, Mealey’s Reports,” *PRNewswire*, June 1, 2000.
- <sup>15</sup> M.J. Zuckerman, “Targeting Cyberterrorism: Government Declares War to protect USA’s Infrastructure,” *USA Today* October 20, 1997. p. 17A.
- <sup>16</sup> Winn Schwartau, “Electronic Civil Defense,” *Information Warfare*, Thunder’s Mouth Press, New York, 1996. p. 43
- <sup>17</sup> Steve Croft with Admiral Herbert Brown on *60 Minutes*, segment on “Cyber War.” 4/9/00.
- <sup>18</sup>op. cit. *60 Minutes*.
- <sup>19</sup> Personal correspondence via Nancy Pitblado on 12/23/98 from Network Associates.
- <sup>20</sup> Personnel communication with Eugene Lecomte on 8/16/00
- <sup>21</sup> Correspondence from Michael Totten of 1/26/99.
- <sup>22</sup> Kim Barnes, “Deregulation: Differentiate Your Energy Services Business by Providing Customers with Computer Grade Power and Reliability,” *Energy.com*, April 7, 1999; Sandy Chen, “Huge Blackout in Taiwan Affects Chip Industry,” *Electronic Buyer’s News*, July 30, 1999; “AlliedSignal: Power Outages Cost Small Business Big Bucks,” *PMA OnLine Breaking News*, February 1, 1999. The last of these articles specifically stated, “The importance of reliable electric power can not be over emphasized for the nearly 90% of small businesses in the United States who report experiencing at least one power outage during 1998. According to a survey of 500 small business owners sponsored by AlliedSignal Power Systems Inc., these small businesses reported an average of three power outages last year, costing each business an approximate average of \$7,500 per day.”
- <sup>23</sup> “Sure Power Honored With Frost & Sullivan’s ‘Market Engineering Entrepreneurial Company’ Award,” *Businesswire*, January 10, 2000.
- <sup>24</sup> Lucid, Inc. *Commercialization Strategies for Photovoltaics in Southeastern New England*, Apr. 1998 for the Rhode Island Renewable Energy Collaborative.
- <sup>25</sup> Personnel communication with Bill Young on 9/11/00,
- <sup>26</sup> Richard Perez, “1999 Heat Wave, Peak Demand Records & Outages in New York City...PV Would Have Worked!” <http://lunch.asrc.cestm.albany.edu/~perez/>.
- <sup>27</sup> Richard Perez, “Photovoltaic Availability In The Wake Of The January 1998 Ice Storm,” State University of New York, Albany. 1998.
- <sup>28</sup> These points are partially derived from: Howard Brown (ed.) w/Tom Strumolo, *Decentralizing Energy Production*, (Yale University Press, New Haven, 1978). Fred Gordon, Joe Chaisson and Dave Andrus, *Helping Distributed Resources Happen*, The Energy Foundation, Dec. 1998.

Amory Lovins and Andre' Lehman, *Small is Profitable*, pending publication in 1999.

<sup>29</sup> Richard Perez, "1999 Heat Wave, Peak Demand Records & Outages in New York City...PV Would Have Worked!" <http://lunch.asrc.cestm.albany.edu/~perez/>.

<sup>30</sup> Charlotte Legates, "Will WAM-ing Solve the BANANA Problem?" Energy.com. March 2, 1999.

<sup>31</sup> Discussions with Rhett Rose of the US Fuel Cell Council on 5/18/00 and 5/25/00.

<sup>32</sup> "Can PV Replace Power Lines?" PV for You Connections, *The Utility Photovoltaic Report*, Issue 12, Spring '00. P. 17.

<sup>33</sup> Edan Prabhu, "SCE's Innovative Solar Neighborhood Program," *Solar Today*, July/August 1995, pp. 22-26.

<sup>34</sup> Rick Schwolsky and James I. Williams, *The Builder's Guide to Solar Construction*, McGraw-Hill Book Com., 1982. pp. 169-170.

<sup>35</sup> Evan Mills, "Energy Efficiency: No Regrets Climate Change Insurance for the Insurance Industry," Research Review, *Journal of the Society of Insurance Research*. Fall 1996. pp. 21-58.

<sup>36</sup> op. cit. Deering and Thornton, p. 5.

<sup>37</sup> "America Unplugged? Landmark Customer Survey Points to Promising New Markets for Distributed Power Generation," *Business Wire*, 30 September 1998

<sup>38</sup> Paul Kleindorfer and Howard Kunreuther, "The Complimentary Roles of Mitigation and Insurance in Managing Catastrophic Risk," Wharton Financial Institutions Center and Risk Management and Decision Processes Center Project, December 11, 1999. pp. 11-12.

<sup>39</sup> Franklin W. Nutter, "Insurance And The Natural Sciences: Partners In The Public Interest," Speech delivered at The Climate Institute Conference, September 4, 1996.

<sup>40</sup> Anecdotally, it has been said that for every dollar spent on mitigation, two dollars are saved in damage claims at the time of a disaster. In addition, electric utilities in some states are permitted bonus rates of return for the moneys they invest or oversee in conservation and load management programs and this would offer an analogous incentive to insurers.