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ALLOCATING RISKS: AN ANALYSIS OF INSURANCE REQUIREMENTS FOR SMALL-SCALE PV SYSTEMS

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ABSTRACT

This paper explores the policy implications of utility-imposed liability insurance requirements on the installation and operation of small-scale, grid-connected solar photovoltaic (PV) systems. We review the potential liability risks to the utility system of PV system operation, describe the difficulties for PV systems owners of complying with utility insurance requirements, and assess the historical and present-day evidence of safety or power quality problems from small-scale renewable energy facilities. We find that the risk to utilities or to third parties of property damage or personal injury caused by the operation of customer-owned, grid-connected PV systems installed in compliance with applicable national standards appears to be extremely small. Accordingly, we conclude that utility-imposed insurance requirements beyond typical homeowner's liability policies create unnecessary costs that discourage customers from investing in grid-connected PV systems.

1. INTRODUCTION

The Public Utility Regulatory Policies Act (PURPA) of 1978 established the legal right of non-utility generators to produce their own electricity using cogeneration or renewable energy generation. Many states have further encouraged small-scale renewable applications by enacting net metering laws and simplified interconnection standards. Interest in renewable applications has grown rapidly in recent years with falling system costs, improved reliability and performance, and the enactment of electricity industry restructuring laws that included financial and regulatory incentives to encourage renewable energy development.

Despite recent progress in overcoming some of the barriers to interconnection of small-scale generating facilities, some problems remain that make it unnecessarily difficult and expensive for customers to generate their own electricity using renewable energy. One of the most intractable problems is the issue of protecting utilities against the risk of property damage or personal injury potentially associated with the malfunction of the customer's generating facility.

The risk of property damage arises from the potential delivery into the utility network of power that does not match the utility's strict requirements for voltage and frequency, is not properly synchronized with the utility's waveform, or otherwise does not meet the utility's power quality standards (harmonics, voltage flicker, and power factor, among others). The failure to comply with these requirements can result in damage to utility equipment or to the electrical equipment of nearby customers.

The more serious concern is the risk of personal injury or death associated with the potential failure of a customer-owned generating facility to stop feeding power to the utility grid in the event of a power failure. Because utility workers and the public are generally unaccustomed to non-utility owned generation, they tend to assume that a utility line that has been disconnected or otherwise isolated from the utility's own generation will be isolated from all generation. In theory, however, an improper connection or malfunction in a customer-owned generating facility could feed power into an otherwise de-energized utility line, creating a so-called 'islanding' condition. If utility workers or others fail to take adequate precautions, contact with this power island can result in serious injury or even death from electrocution.

Utilities argue that as long as there is a risk – no matter how small – of being held financially accountable for safety or power quality problems caused by a customer-owned generating facility, then customers should be required to protect the utilities against such financial risks. Any other outcome, they argue, results in utility ratepayers or shareholders unfairly bearing risks from the operation of facilities over which the utilities have no control.

Renewable energy advocates argue in response that innovations in power electronics have made any risks inconsequential, and that existing legal mechanisms such as mutual indemnification and contractual limitations on liability are the appropriate way to address utility concerns. Accordingly, renewables advocates argue that the only practical effect of insurance requirements is to discourage customers from generating their own electricity and to stifle the market for small-scale renewable generation.

2. SCOPE OF THE PROBLEM

Insurance requirements cause two types of problems for self-generating customers. First, the cost of complying with utility requirements for liability insurance can offset much or all of the energy benefits the customers expected to capture from their renewable generating facilities. This problem is particularly severe for micro-scale facilities under 1 kW. Second, the utility requirements often create administrative burdens for customers, with accompanying costs (in both time and expense) customers must bear. The rest of this section discusses these issues in more detail.

2.1 Insurance Costs In Context

Interviews with self-generators revealed various situations in which insurance requirements have created substantial economic and administrative burdens. For instance:

- ✧A customer in the Northeast U.S. wished to install a 3 kW PV system and was told the utility required $250,000 of commercial-class coverage, referred to as "comprehensive general liability" (CGL) insurance. The customer's insurance company informed her that it would not write such a policy for a homeowner because CGL insurance is only available for businesses. The insurer also informed the homeowner that CGL coverage was "very expensive," although no specific quote was obtained.

- ✧A customer in the Southeast U.S. installed a 9.3 kW PV system and was required by the utility to carry a $1 million liability insurance policy. Because the customer was affiliated with state government and was otherwise self-insured, it had to obtain a policy solely for the PV system. The premium for this policy was $6,252 per year, more than four times the value of the energy produced annually by the system. The large negative cash flow produced by the high premium forced the customer to shut down the system, which remains out of operation.

- ✧When a Pacific Northwest state implemented its net metering law, one of the utilities proposed that net metering customers maintain $2 million in liability insurance. One insurer told a customer exploring the possibility of installing a small PV system that obtaining coverage at or beyond $1 million placed the homeowner in a different policy category, requiring an 'umbrella' policy with general liability coverage. The additional premium for this policy was over $200 per year.

While an annual premium increase of $200 may seem modest, it is important to recognize that some renewable generating technologies, including solar and wind electric systems, are available in sizes as small as 100 Watts and produce as little as 180 kilowatt-hours per year, worth approximately $15 at retail rates.[1] This means that even the most modest insurance requirements can offset much or all of the energy savings from self-generation.

Insurance costs can be a substantial economic burden even for larger residential-scale facilities. For example, a 4 kW PV system may produce 7,200 kWh/year, with a value of approximately $580 per year. A $200 increase in the homeowner's insurance premium is equivalent to 34% of the annual energy savings from the PV system and increases the simple payback period for the system by nearly 40 years.

In addition, insurance costs that are high enough to cut into energy savings may encourage customers to interconnect without informing the utility. As a utility executive in the Southeastern U.S. put it: "*If we insist on a one million dollar liability policy, we will force the homeowner to install his system without telling us. We will create a safety problem in the name of safety.*"

2.2 Difficulties In Meeting Other Utility Requirements

Requirements for high levels of liability coverage are not the only insurance-related institutional difficulties customers wishing to interconnect their small-scale PV systems have encountered. Other issues include:

[1] The calculations in this section assume the availability of net metering and an average retail rate of $0.08 per kWh.

2.2.1 'Additional Insured' Requirements

Some utilities have sought to impose a requirement that they be listed as an 'additional insured' on the homeowner's insurance policy. The utilities' intent is to require the customer's insurer to defend the utility, as well as the homeowner, against claims associated with the operation of the customer's generating facility.

Utilities argue that additional insured requirements are necessary to ensure that they do not incur expenses associated with defending claims, even when those claims are ultimately found to be the customer's responsibility. On the other hand, renewable energy advocates argue that there is no evidence of utilities defending claims associated with small-scale, customer-owned generating facilities.

A more fundamental problem with additional insured requirements is that while such requirements are not unusual in commercial insurance, they are largely unheard of for homeowner's insurance. In fact, most net metering customers who have explored this issue have reported that their insurers refused to list the utility as an additional insured. The Natural Resources Defense Council, in written comments filed in opposition to a New York utility's proposed additional insured requirement, noted that "it is virtually impossible that any insurance company would ever agree to add [the utility] as an additional insured under a homeowner's liability policy."(1)

2.2.2 Commercial-Class Insurance Requirements

Some utilities have sought to require that customers obtain specific types of insurance, as well as specific amounts of coverage. Most homeowner's policies provide coverage for personal liabilities, but utilities have proposed that residential customers obtain comprehensive general liability coverage. As part of the implementation of New York's net metering law, for example, several of the utilities proposed that residential customers purchase CGL insurance in amounts of $500,000 to $1 million, and one utility further proposed that the customer's insurance be written by an insurance company with a Best's rating of not less than "A" and a net surplus of not less than $50 million. During the implementation of New York's net metering law, renewables advocates noted that "in rural areas, residents may have policies with small, local insurance companies that would not meet [the utility's] rating and asset requirements."(1)

2.2.3 Administrative Burdens

In addition to the economic costs of increased policy premiums, self-generating customers must expend the time and expense necessary to contact their existing insurance company, discuss policy options, determine if they can meet 'additional insured' requirements and other utility-imposed requirements, and contact additional insurers regarding these same issues if their existing insurer is unable to comply at a reasonable cost. Although these administrative burdens are hard to quantify, anything that makes it more difficult for customers to interconnect and operate their PV systems represents the potential loss of a customer.

2.2.4 Self-Insured Entities

Insurance requirements pose a particular problem for self-insured entities, such as government agencies and large businesses. In Washington State, one utility told a federal government agency installing a 2 kW PV that a $200,000 liability policy was required. Because the federal government is self-insured, the agency was unable to provide such a policy. At the time of this writing, the system has not yet been connected to the utility grid.

3. PERCEIVED RISKS: STAKEHOLDER VIEWS

This section describes the viewpoints of the various stakeholders involved in addressing liability issues associated with the operation of small-scale PV systems.

3.1 Equipment Manufacturers

The position of the PV equipment manufacturers is that compliance with national standards, including those developed by the Institute of Electrical and Electronics Engineers (IEEE) and Underwriters Laboratories (UL), ensure that PV systems are incapable of causing the safety or power quality problems of concern to the utilities. The manufacturers believe that for PV systems manufactured and installed in compliance with applicable standards, no additional consumer insurance should be required.

The manufacturers also make the point that they either carry their own product liability insurance or, in some cases, are self-insured. In either case, the manufacturers are in a position to indemnify customers or utilities compelled to pay for property damage or personal injury attributable to the malfunction of the manufacturers' equipment.

3.2 System Vendors and Installers

PV system installers believe that the systems they install in accordance with national electrical and safety standards are safe. They also note that most jurisdictions require that PV systems be permitted and inspected to ensure compliance

with local building codes and the National Electrical Code. It is important to note, however, that some jurisdictions have no permitting or inspection requirements for residences.

3.3 System Owners

Homeowners generally do not wish to take on any additional liability for a PV system, and if faced with increased insurance premiums are less likely to purchase one. A homeowner we interviewed noted: "If it isn't safe, it shouldn't be on my house. If it is safe, I shouldn't have to pay for additional insurance."

3.4 Utility Distribution Companies

Utilities are responsible for maintaining the safety and integrity of their electrical networks. This is a tremendous obligation and one the utilities take very seriously. Accordingly, they are entitled to be concerned about the interconnection of non-utility owned generating equipment.

While most utilities agree that the risk associated with PV systems is minimal, they note that the risk is not zero. Many believe that they should not have to bear any additional risk created by the interconnection of these systems.

Moreover, utilities recognize that anyone filing a claim for personal injury or property damage that relates in any way to operation of the utility grid may see them as 'deep pockets.'

4. DOCUMENTED RISKS

This section discusses the historical and present-day liability risks associated with the operation of small-scale PV systems. The examples are drawn from both small-scale PV and wind energy applications, which tend to encounter many of the same liability-related issues.

4.1 Historical Risks

As noted in the Introduction, the risks from the operation of customer-owned generating facilities, from which utilities seek to protect themselves, fall into two categories. The first is the potential for property damage caused by the delivery of poor quality power from these facilities. The second is the potential for personal injury caused by islanding.

As part of this study, we spoke with several long-time industry professionals to determine whether there was any record of power quality or islanding problems resulting in property damage or personal injury. We received the following responses:

- ✧According to John Bzura of the New England Electric System companies: *"In our 16 years of grid-connected PV experience (which includes my 13 years as PV Project Manager) I have never heard of islanding occurring."*

- ✧Rob Wills of inverter manufacturer Advanced Energy Systems, said: "*I am unaware of any property damage or personal injury caused by the malfunctioning of inverters used for residential applications.*" Mr. Wills went on to note that he was aware of three cases worldwide involving property damage from fires caused by malfunctioning inverters, but that all three cases involved wiring or switchgear in high-power inverter applications at utility-scale facilities. He emphasized that in all three cases, the damage was limited to the equipment at the facilities, with no effects on the utility grid or on other customers.

- ✧Mick Sagrillo of Lake Michigan Wind and Sun has been directly involved with the installation of over 700 grid intertied renewable energy systems since 1982. Mr. Sagrillo stated that he has "*never heard of a single lawsuit or insurance claim resulting from a PV or small wind energy system feeding energy back into a utility grid when the grid was down.*"

- ✧A 1988 Wisconsin Power & Light Company titled "A Performance Analysis of Four Wind Energy Systems" analyzed the performance of four small wind turbines that were interconnected to the utility's grid. The utility studied the machines over a period of 8 years. Energy Engineer and author Scott K. Pigg concluded: "*No safety problems were encountered at any of the sites during the operating history of the machines. There were also no power quality problems at the site, except for a tendency for clocks to run slightly fast at the Fond du Lac site.*"

- ✧Mike Bergey, President of Bergey WindPower Company, the largest producer of small wind energy systems in the United States concurred: "*The industry has 6,000 - 7,000 machines interconnected in the U.S. all the way back to 1977. We have more than half a billion run hours on grid-intertied small-scale renewable energy systems, without any reported injuries or liability claims from the interconnected operation of these systems. This is in spite of the fact that most of these operational hours are with inverters that do not meet the emerging inverter safety standards such as IEEE 929-2000 and UL 1741. It has always been necessary for manufacturers to insure the safety of their equipment. This industry is no exception. Wind turbine and PV manufacturers make safety a top priority, with or without regulatory or utility requirements.*"

We also asked representatives of four investor-owned utilities with experience interconnecting small-scale, customer-owned PV or small wind systems if they had ever had to defend themselves against a claim for property damage or personal injury associated with the operation of these facilities. None had.

In short, to our knowledge there have been no instances of small-scale, utility-intertied PV or wind energy systems causing power quality or islanding problems, much less creating potential property damage or personal injury liabilities to the connecting utility.

4.2 Present-Day Risks

The small-scale renewable energy industry has been working with a variety of stakeholders to develop nationally-recognized technical standards for utility interconnection of inverter-based small-scale renewable energy facilities. These standards include IEEE 929-2000 and UL 1741. The principal purpose of these standards is to ensure that inverters meeting these standards reliably address utility power quality and anti-islanding requirements.

John Stevens, Senior member of Technical Staff at Sandia National Laboratories and Chair of the IEEE 929 working group states: "*In IEEE 929 we define a non-islanding inverter. We also include as part of the standard, a test that will determine if an inverter meets the non-islanding performance requirements. This test has been incorporated into the new UL 1741 standard. If a utility is concerned about potential islanding, we recommend that they require an inverter that meets the UL 1741 standard effective May 1999. If an inverter meets this UL standard, it is incapable of islanding.*"

It is impossible, of course, to prove that an event will never occur. Moreover, with increasing market penetration of small-scale solar and wind energy systems, it is possible that eventually an equipment malfunction or an operator error will result in property damage or personal injury. In such an event, it is also possible that a liability claim will be brought against the interconnecting utility. Nevertheless, both historical experience and the development and adoption of new IEEE and UL standards clearly suggest that small-scale inverter-based PV and wind systems are extremely unlikely to create actual liabilities for the interconnecting utilities.

In short, there is no technical or historical evidence to justify imposing additional insurance requirements on the owners of small-scale inverter-based PV and wind systems. The primary effect of such requirements is to discourage customers from investing in these renewable technologies.

5. RECENT REGULATORY ACTIVITY

In the past few years, several states have addressed the issue of liability insurance for small-scale renewable energy systems and, to a lesser extent, other distributed generating facilities. In most of these cases the issue has been raised in the context of adoption or implementation of net metering requirements.

California, Delaware, Maryland, Nevada, and Oregon have explicitly prohibited additional insurance requirements in their net metering statutes or regulations. In other states, regulators have rejected utility proposals imposing high liability insurance requirements (ranging from $500,000 to $2,000,000) for net metering facilities. In each of these states, regulators allowed a more modest insurance requirement that was well within the normal coverage limits for residential and commercial customers – usually $100,000 for residential customers. See Table 1 for details. Moreover, regulators in these states have rejected requirements that the utility be named as an additional insured on the customer's policy.

TABLE 1: LIABILITY INSURANCE REQUIREMENTS FOR NET METERING CUSTOMERS, BY STATE

State	*Utility Proposal*	*Commission Ruling*
ID	$1,000,000	$100,000
NY	$500,000-$1,000,000	$100,000
VT	$500,000	$100,000 Residential; $300,000 Commercial
WA	$2,000,000	$200,000

In Washington, one of the states' utilities, Puget Sound Energy, chose to purchase a rider on its corporate liability policy that would cover the utility for liability pertaining to the operation of net metered systems. The annual cost to the utility is $10,000. Regulators allowed the utility to recover those costs from ratepayers by including the costs in the utility's administrative expenses associated with the net metering program because "the development of new renewable resources within PSE's system could be considered a benefit to all ratepayers, and because the language of HB 2773 [the net metering law] suggests that benefits and costs should be considered as they apply to all ratepayers."(2)

In Texas, the PUC concluded that mutual indemnification and limitations of liability between the homeowner and the utility are appropriate in order to protect the utility, its ratepayers, and the customer. The PUC stated, "Mutual indemnification is the most reasonable approach because it required each party to bear the consequences of its negligence." The PUC found it unnecessary to allow the imposition of additional insurance requirements, explaining

that it is "willing to consider an appropriate insurance requirement with specific liability limits" but noting that insurance requirements "subject to the utility's sole discretion could easily be used as an unreasonable barrier to DG [Distributed Generation] installation."(3)

6. ANALYSIS AND CONCLUSIONS

Small-scale grid intertied renewable energy systems have been installed in the United States since the enactment of the federal PURPA law in 1978. These systems cumulatively have over half a billion operating hours, apparently without any reported personal injury or property damage claims attributed to their interconnection and operation.

New standards have been developed by IEEE and UL that meet or exceed utility power quality standards and prevent small-scale inverter-based systems from feeding power to the utility grid in the event of a utility power failure.

Numerous utility regulators have declined requests by the utility industry to require liability coverage in excess of amounts normally carried by a homeowner. Utility efforts to apply to small-scale facilities rules that were developed for large or mid-sized generators have been rejected as inappropriate by regulators across much of the country. Similarly, utility efforts to be listed as 'additional insureds' on their customers' policies have been uniformly rejected.

Utilities that remain concerned about their exposure to liability claims have the option of adding a rider to their insurance policies to cover them for liabilities related to the operation of these systems. If utilities are self-insured, they have the option of applying to the appropriate regulatory body for indemnification from liability unassociated with utility actions.

As a practical matter, excessive liability insurance requirements will discourage the installation of net metering facilities because the incremental cost of higher insurance premiums can easily offset the customer's energy savings, particularly for smaller systems.

7. RECOMMENDATIONS

We recommend the following steps:

✧Policymakers should adopt both IEEE 929 and UL 1741 as mandatory standards. Comparable standards should be approved and adopted for other inverter-based technologies. Greater uniformity in manufacturing and installation will improve safety and reliability. All stakeholders should insist that only equipment meeting applicable technical standards be used and that it be installed in accordance with local electrical codes and the National Electrical Code.

✧Manufacturers of these systems should continue to maintain product liability insurance to protect against potential property damage or personal injury claims.

✧No additional insurance requirements should be placed on the owners of small-scale systems. Existing legal remedies, including mutual indemnification, are adequate to protect the interests of all parties.

✧Utilities that continue to be concerned about potential liability from systems meeting the new national standards have the ability to obtain an insurance rider which covers utility liability for these systems. Regulators should allow the utilities to recover the cost of these riders in their rates.

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9. REFERENCES

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(2) Washington Utilities and Transportation Commission, Staff Recommendation on Dockets UE-990015 and UE-990016 (February 10, 1999), p. 1.

(3) Texas Public Utility Commission, Substantive Rules § 25.211 "Interconnection of Distributed Generation" and § 25.212 "Technical Requirements for Interconnection and Parallel Operation of On-Site Distributed Generation" (November 23, 1999), pp. 29-31.