LESSONS FROM THE PRICE-ANDERSON NUCLEAR INDUSTRY INDEMNITY ACT FOR FUTURE CLEAN ENERGY COMPENSATORY MODELS

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The following note discusses the Price-Anderson Nuclear Industry Indemnity Act as a model liability insurance system for future clean energy technologies and sources such as carbon sequestration and geothermal energy. The Price-Anderson Act implements a tiered insurance system that requires individual commercial nuclear power plants to secure private insurance policies for site-specific incidents up to a certain threshold. This first layer of indemnity is then supplemented by an industry-wide pooling system that provides indemnification in the event of an incident that accrues greater financial losses than the initial, primary insurance layer obtained by the responsible nuclear plant. In the event the industry-wide insurance pool funds are exhausted, the federal government is the final indemnifier, providing additional compensation to affected individuals when deemed appropriate. This note considers the history of the Price-Anderson Act, its development and subsequent amendments since its enactment in 1957, and highlights the specific aspects of the system that should be adopted in the future. In particular, the note argues that carbon sequestration technology and geothermal energy are presently situated in a similar situation as the nuclear industry was in the early 1950s. The parallels between the industries – most notably the low risk of an industrial accident, yet extensive consequences in the event of an incident – invite comparison and analysis into whether the nuclear industry indemnity system is a transferable model to future clean energy technologies. Ultimately, the note argues that a number of the key components of the Price-Anderson Act – particularly its liability cap, federal involvement, no-fault liability, federal jurisdiction, and continually written policies – not only are suitable for future systems, but in fact should be implemented by the insurance industry when underwriting the carbon sequestration and geothermal energy insurance system. The note concludes that the United States is in dire need of restructuring its national energy policy and an essential aspect to this national policy is creating an underlying system of liability that can be applicable, with specific adaptations in lieu of inherent

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differences in these technologies, to new clean energy sources. The current system of the Price-Anderson Nuclear Industry Indemnity Act is America's best solution.

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I. INTRODUCTION

With the increasing energy demand in the United States and the diminishing supply of traditional domestic fossil fuels,[1] the nation is confronted with serious energy concerns that necessitate a review of our national energy policy. Not only is the United States the largest energy producer, consumer and net importer per capita in the world,[2] but the

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[1] Energy production from fossil fuels (*e.g.*, coal, oil and natural gas) is expected to continue to dominate U.S. energy production for years to come. Naturally, the continual production of fossil fuel reserves and the increased energy demand within the United States has led to significant concerns of a diminishing domestic supply of such resources. While the energy industry is alarmed at the potential diminution in domestic fossil fuel resources, the United States has witnessed a boom in the exploration, development and early production of natural gas reserves located in deep, shale rock formations around the country. These shale formations contain natural gas reserves that were previously considered inaccessible and uneconomical for energy production. However, with the increasing development and use of a technological drilling process called hydraulic fracturing (fracking) these shale fields are opening up a vast amount of potential for natural gas production within the United States. The practice, however, is highly controversial. The energy industry currently heralds fracking as the answer to U.S. energy needs while environmental groups and legislators are concerned with potential groundwater contamination and increased seismic activity within surrounding drilling areas. The national debate on the practice is presently unfolding. *See* J. DANIEL ARTHUR, P.E., BRIAN BOHM, P.G. & MARK LAYNE, PH.D., P.E., HYDRAULIC FRACTURING CONSIDERATIONS FOR NATURAL GAS WELLS OF THE MARECELLUS SHALE, Ground Water Protection Council 2008 Annual Forum 7-9 (Sept. 21-24, 2008).

[2] *See International Energy Statistics*, UNITED STATES ENERGY INFORMATION ADMINISTRATION, INDEPENDENT STATISTICS AND ANALYSIS, http://www.eia.gov /cfapps/ipdbproject/IEDIndex3.cfm?tid=44&pid=44&aid=2 (last visited Aug. 21, 2011). *But see China Overtakes the United States to Become World's Largest Energy Consumer*, INTERNATIONAL ENERGY AGENCY (July 20, 2010), http://www.iea.org/index_info.asp?id=1479 (finding China has recently surpassed the United States in total energy consumption, however the United States remains the largest energy consumer per capita).

country also boasts the world's largest coal reserves – making the United States extremely dependent on fossil fuel energy for short-term and long-term economic growth.[3] Concerns over energy security and foreign dependence are exacerbated by scientific and social apprehension surrounding the leakage of greenhouse gas from these fossil fuel energy sources into the environment.[4]

Accordingly, the United States must continue to focus on its development of clean energy sources that can help mitigate many of the risks and problems associated with fossil fuel energy. Headlining these developments are clean energy sources and technologies such as nuclear energy, carbon sequestration and geothermal energy. In order to properly support the clean energy movement, the United States must attract significant financial investment from the private sector as well as provide a system of adequate insurance coverage in order to mitigate any associated risks.

The following commentary examines the benefits and deficiencies of the current financial protection program of the nuclear energy industry, which was established by the Price-Anderson Nuclear Industry Indemnity Act. It continues, arguing in support of the development of a similar, yet varied version of the underlying nuclear industry indemnity system to insure future clean energy sources and technologies.

Analysis of the Price-Anderson Act reveals a variety of important issues and concerns for insurers attempting to provide coverage for clean energy technologies and sources such as carbon sequestration and geothermal energy. While these technologies are each distinct and consist of specific, technical issues that are unique to their own field, the Price-Anderson Act offers a general model of a public-private partnership that has successfully insured the nuclear industry for over fifty years.

The following commentary will begin by discussing the history and development of the Price-Anderson system, as it has been amended and renewed four times since its original enactment. The note will then provide analysis of the long-term liability issues associated with the nuclear

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[3] *See* Guri Bang, *Energy Security and Climate Change Concerns: Triggers for Energy Policy Change in the United States?,* 38 ENERGY POL'Y 1645, 1645 (2010).

[4] KEVIN A. BAUMERT, TIMOTHY HERZOG & JONATHAN PERSHING, NAVIGATING THE NUMBERS: GREENHOUSE GAS DATA AND INTERNATIONAL CLIMATE POLICY 12 (World Resources Institute 2005) (The United States is among the leading emitters of greenhouse gases in the world, most notably carbon dioxide. In 2000, the United States amounted for 20.6% of the world's greenhouse gas emissions.).

industry, carbon sequestration and geothermal energy. In particular, the note will argue in support of the establishment of a similar, private-public tiered insurance pool system for future clean energy industries.

II. BACKGROUND TO THE PRICE-ANDERSON ACT

The United States is in a similar position today as it was in the 1950s. In the 1950s, the nation was confronted with the harsh realities of the aftermath of World War II and the increasing industrial growth of the nation. The need for a rise and diversification in its energy production to meet the demand was essential. Therefore, the federal government encouraged energy diversification, invested in research and development of alternative energy sources, and provided regulatory incentives to advance oil, coal and nuclear development within the private sector.[5]

In 1954, Congress passed the Atomic Energy Act, which provided for the development and regulation of civilian and military uses of nuclear materials in the United States.[6] The Act marked the first time the private sector was encouraged to become a player in the development of commercial nuclear power plants. The initial version of the statute, however, did not establish a system of indemnification for, or limits on, private licensee liability in case of offsite injury to individuals or damage to property.[7]

Thus, the private sector approached the invitation with both caution and uncertainty. The private sector was concerned with the lack of nuclear experience – not only from a technological standpoint but also from an insurance perspective. The lack of certainty prompted a resistance from insurance companies to provide commercial liability coverage for private

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[5] *See* Roger H. Bezdek & Robert M. Wendling, *A Half Century of US Federal Government Energy Incentives: Value, Distribution, and Policy Implications*, 27 INT'L J. GLOBAL ENERGY ISSUES 42, 43 (2007).

[6] Atomic Energy Act of 1954, 42 U.S.C. § 2011 (2006) (The Act is the fundamental U.S. law on both the civilian and the military uses of nuclear materials. It provides for the development and regulation of nuclear materials and facilities in the United States. The Act declares that "the development, use, and control of atomic energy shall be directed so as to promote world peace, improve the general welfare, increase the standard of living, and strengthen free competition in private enterprise.").

[7] Atomic Energy Act of 1954, Pub. L. No. 83-703, 68 Stat. 919 (1954), *amended by* the Price-Anderson Act, Pub. L. No. 85-256, 71 Stat. 576 (1957) (current version at 42 U.S.C. § 2012(i) (2006)).

sector nuclear development.[8] Accordingly, representatives from the private sector stressed to Congress that they would be forced to withdraw from the field if their liability was not limited by legislation.[9]

III. THE PRICE-ANDERSON NUCLEAR INDUSTRY INDEMNITY ACT

In response to such concerns, Congress passed the Price-Anderson Act in 1957 as an amendment to the Atomic Energy Act. The Price-Anderson Act established a nuclear liability indemnity system and encouraged further development of the nuclear industry within America.[10] This system included a liability cap in the event of a nuclear incident – a provision that was necessary for initiating private investment and development of nuclear energy within the United States.[11]

The nuclear industry is an area in which large amounts of energy production is accompanied with low, yet devastating, potentials of risk, especially during early developments. Thus, the Price-Anderson Act sought

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[8] *See* Barry Brownstein, *The Price-Anderson Act: Is It Consistent with a Sound Energy Policy?*, CATO INSTITUTE (Apr. 17, 1984), http://www.cato.org/pub_display.php?pub_id=902 ("Consider the following statements from the 1956 and 1957 hearings on the then-proposed Price-Anderson amendment. A vice president of Westinghouse, Charles Weaver, stated: 'Obviously we cannot risk the financial stability of our company for a relatively small project no matter how important it is to the country's reactor development effort, if it could result in a major liability in relation to our assets.'") (quoting Joint Committee on Atomic Energy, Governmental Indemnity for Private Licensees and AEC Contractors Against Reactor Hazards-Hearings Before the Joint Committee on Atomic Energy, 84th Cong., 2d sess., 1956, p. 110); *see also id.* ("General Electric also indicated during the hearings that it was prepared to halt its work in the nuclear industry should a limitation on liability not be passed.") (citing Joint Committee on Atomic Energy, Hearings Before the Joint Committee on Atomic Energy on Governmental Indemnity and Reactor Safety, 85th Cong., 1st sess., 1957, p. 148); and *id.* ("Suppliers of reactor shields also indicated their unwillingness 'to undertake contracts in this field without being relieved of uninsurable liability in some way.'") (quoting Joint Committee on Atomic Energy, Hearings Before the Joint Committee on Atomic Energy on Governmental Indemnity and Reactor Safety, 85th Cong., 1st sess., 1957, p. 148).

[9] *See* Duke Power Co. v. Carolina Environmental Study Group, Inc., 438 U.S. 59, 64 (1978).

[10] Act of September 2, 1957, Pub. L. No. 85-256, 71 Stat. 576 (codified as amended in scattered sections of 42 U.S.C.).

[11] 42 U.S.C. §§ 2210(b)(4)(A)(i)-(ii) (2006).

to implement a sufficient liability and compensation framework to both protect the American public in the event of a nuclear incident as well as advance financial investment and development of the industry.[12] The Act is essentially an insurance program that encourages private development of nuclear power, establishes a legal framework for handling potential liability claims, and provides a ready source of funds to compensate injured victims of nuclear accidents.[13]

In drafting the indemnity plan, Congress initially established a two-tiered insurance system. The primary layer of the system required each commercial nuclear power plant to secure its own insurance coverage up to a certain threshold. In the event that the primary layer was exhausted, the federal government would provide an additional layer of financial protection.[14]

The initial two-tiered model has since been bolstered to include an additional industry-wide pool that requires nuclear reactors to collectively contribute to a separate insurance pool.[15] Accordingly, the current system consists of a three-tiered system. To date, the primary layer requires each nuclear plant to secure $375 million in financial protection.[16] In the event of an incident exceeding the primary layer's coverage, the industry-wide pool kicks in and each reactor is assessed a prorated share of the excess up to $111.9 million.[17] The $111.9 million is adjusted every five years for

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[12] The original act implemented a system that would last for ten years. This was an attempt by legislators and nuclear industry actors to readdress the Amendment once significant development within the nuclear field and commercial liability industry could occur. 42 U.S.C. § 2210 (2006).

[13] *National Energy Issues: Hearings Before the S. Comm. on Energy and Nat. Resources*, 107th Cong. 53, 54 (2001) (statement of John L. Quattrocchi, Senior Vice President, Underwriting, American Nuclear Insurers, West Hartford, CT) [hereinafter Quattrocchi].

[14] *The Price-Anderson Act: Background Information*, AM. NUCLEAR SOC'Y (Nov. 2005), http://www.new.ans.org/pi/ps/docs/ps54-bi.pdf.

[15] The Insurance Institute defines an insurance pool as "a group of insurance companies that pool assets, enabling them to provide an amount of insurance substantially more than can be provided by individual companies to insure large risks such as nuclear power stations." *See Insurance Pools Definition*, INSURANCE INFORMATION INSTITUTE, http://www2.iii.org/glossary/i/ (last visited Aug. 22, 2011).

[16] *Fact Sheet on Nuclear Insurance and Disaster Relief Funds−Nuclear Insurance: Price-Anderson Act*, UNITED STATES NUCLEAR REGULATORY COMMISSION (Jun. 2011), http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/funds-fs.html.

[17] *Id*.

inflation and represents the maximum retrospective assessment that each insured licensee can be assigned per incident.[18]

The additional pool, also known as the Secondary Financial Protection program, is currently comprised of 104 power reactors and amounts to nearly $12.6 billion dollars.[19] This industry-wide retrospective rating program will be used in the event that a loss exceeds the primary insurance limit.[20] In turn, if the second tier is fully exhausted, Congress is committed to determine whether additional relief is needed.[21] If Congress determines additional relief is necessary, the federal government is the final indemnifier.[22]

Since its enactment, the Price-Anderson Act has been amended in 1966, 1975, and 1988. Recently, the Act was renewed with the passage of the Energy Policy Act of 2005, which extended the program until December 31, 2025.[23] The following sections discuss the development and amendments to the Price-Anderson Act and their significance to the legal and insurance framework of the nuclear industry.

A. 1957 PRICE-ANDERSON ACT

In 1957, Dwight Eisenhower signed into law the Price-Anderson Act, establishing the first nuclear indemnification plan for commercial nuclear power plants within the United States.[24] The Act initially required a commercial nuclear power plant licensee with energy capacities of 100,000 electrical kilowatts or more to obtain $60 million of financial protection –

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[18] *See* Quattrocchi, *supra* note 13, at 56.

[19] *Need for Nuclear Liability Insurance*, AMERICAN NUCLEAR INSURERS 2 (Jul. 2011), http://www.amnucins.com/library/Nuclear%20Liability%20in%20the%20US.pdf [hereinafter ANI Liability Insurance].

[20] *See* Quattrocchi, *supra* note 13, at 59; *see also* 42 U.S.C. § 2014(k) (2006).

[21] 42 U.S.C. § 2210(e)(2) (2006).

[22] 42 U.S.C. § 2210(c) (2006). (The federal indemnity agreement covers liability for any bodily injury, sickness, disease or death, or loss of or damage to property by a nuclear incident occurring within the United States. *See* 42 U.S.C. § 2214(q) (2006)).

[23] Cole Mahone Adams, *Damages and Injury:* Smith v. Carbide and Chemicals Corporation *and the Application of Kentucky Law under the Price-Anderson Act*, 22 J. NAT. RESOURCES & ENVTL. L. 175, 177 (2008-2009).

[24] *See* S. REP. NO. 85-296, at 8 (1957) (The Act provides the United States with "a practical approach to the necessity of providing adequate protection against liability arising from atomic hazards, as well as a sound basis for compensating the public for any possible injury or damage arising from such hazards.").

the maximum amount of private insurance potentially available at the time – in order to remain in operation.[25] In the event of a nuclear incident, the Atomic Energy Commission agreed to indemnify the nuclear operators or manufacturers for all liability up to, but not in excess of, $500 million.[26]

The initial act established the precedent for a liability cap for the federal government and also included "omnibus coverage," which extended coverage not only to a person with whom an agreement of indemnification was executed but also to any person or persons deemed liable under state tort law.[27] While the original $500 million proved to be a rough estimation of liability, each successive amendment Congress has addressed, and raised, the liability cap to reflect an appropriate balance between industry capacity and potential harm.[28]

B. PRICE-ANDERSON ACT: 1966 AND 1975 AMENDMENTS

In accordance to the 1957 version of the Price-Anderson Act, the statute was to expire following a ten-year trial period.[29] Congress, however, extended the bill in 1966[30] and again in 1975.[31] The 1966 amendment addressed three major concerns of legal impediments claimants faced when seeking relief under the Act – proving legal causation, state statutes of limitations and jurisdictional variances.

The Joint Committee tasked to remedy the deficiencies of the Act was concerned that the burden of establishing causation was too stringent, as many state tort laws required findings of fault or negligence.[32] The argument followed that proving the fault or negligence standard was too difficult of a burden on the individual victim. Thus, in order to address the uncertainty in state tort law regarding the applicability of causation, the

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[25] Price-Anderson Act, Pub. L. No. 85-256, 71 Stat. 577 (1957) (codified as 42 U.S.C. § 2210(b) (2006)).

[26] Dan M. Berkovitz., *Price-Anderson Act: Model Compensation Legislation?–The Sixty-Three Million Dollar Question*, 13 HARV. ENVTL. L. REV. 1, 7 (1989).

[27] *Id*. at 8.

[28] *See* Quattrocchi, *supra* note 13, at 58.

[29] *See* Price-Anderson Act, Pub. L. No. 85-256, 71 Stat. 576 (1957) (current version at 42 U.S.C. § 2011 (2006)).

[30] *See* Act of September 29, 1965, Pub. L. No. 89-210, 79 Stat. 855.

[31] *See* Act of December 31, 1975, Pub. L. No. 94-197, 89 Stat. 1111.

[32] David M. Rocchio, *The Price-Anderson Act: Allocation of the Extraordinary Risk of Nuclear Generated Electricity: A Model Punitive Damage Provision,* 14 B.C. ENVTL. AFF. L. REV. 521, 538 (1987).

1966 amendments included a provision for the waiver of various defenses under state tort law in the event of a major accident termed an "extraordinary nuclear occurrence."[33] This provision was enacted in order to assure that the victim's entitlement to compensation would be determined under a strict liability standard, instead of the negligence standard that most state courts require.[34]

In addition, the Committee addressed the fact that due to the latent nature of injury, harm and damage caused by exposure to radioactive material, state statutes of limitation would most likely invalidate any claims as untimely.[35] As a result, the 1966 Amendment provided a provision that waived the application of state statutes of limitations that were more restrictive than the three-year limit specified by the Act.[36] Finally, the 1966 amendment invoked a removal provision, which brought claims arising out of an extraordinary nuclear occurrence within the jurisdiction of federal district courts.[37]All claims resulting from the same "extraordinary nuclear occurrence" were to be consolidated into one federal court. The court would then be responsible for adjudicating all claims, distributing any compensatory damages if necessary and prioritizing any payouts in the event of fiduciary exhaustion.[38]

In 1975, Congress reauthorized the Act through 1987. The 1975 amendments drastically changed the system by beginning to phase out the $500 million layer of federal indemnity. The amendment shifted the secondary layer of protection instead to the nuclear industry and private

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[33] 42 U.S.C. § 2014(j) (1982) (An extraordinary nuclear occurrence is defined "any event causing a discharge or dispersal of source, special nuclear, or byproduct material from its intended place of confinement in amounts offsite, or causing radiation levels offsite, which the Nuclear Regulatory Commission or the Secretary of Energy, as appropriate, determines to be substantial, and which the Nuclear Regulatory Commission or the Secretary of Energy, as appropriate, determines has resulted or will probably result in substantial damages to persons offsite or property offsite." When determining whether an incident is to be considered an extraordinary nuclear occurrence, the Nuclear Regulatory Commission established a set of criteria that can be found in 10 C.F.R. §§ 140.81-140.85 (1988)).

[34] *See* S. REP. NO. 89-1605, at 3-4 (1966).

[35] *See* Rocchio, *supra* note 32, at 525.

[36] *See* 42 U.S.C.A. § 2210(n)(1)(F)(iii) (2006) (The Act allows "any issue or defense based on any statute of limitations if suit is instituted within three years from the date on which the claimant first knew, or reasonably could have known, of his injury or damage and the cause thereof.").

[37] 42 U.S.C. § 2210(n)(2) (2006).

[38] 42 U.S.C. § 2210(n)(3)(A)-(C) (2006).

insurance companies.[39] The Act required each nuclear plant to contribute up to $5 million of retrospective premiums in the event of a nuclear accident at any commercial nuclear plant within the United States for which damages exceeded the required $60 million amount of private insurance for each site.[40] The total amount of financial protection in this secondary layer depended on the number of operating power plants, however the government retained the assurance that it would provide compensation in the event that the total protection was less than the previous amount of $560 million.[41]

C. 1988 AMENDMENTS

In the aftermath of the 1979 accident at the Three Mile Island nuclear power plant,[42] Congress opted to further increase the liability cap and financial protections of the Act.[43] In the 1988 amendment, Congress increased the liability of the nuclear industry to $9.87 billion dollars, nearly ten times greater than the original liability cap.[44]

Following the Three Mile Island incident, lawsuits were filed in state and federal courts due to the language of the Act – that is, only "extraordinary nuclear occurrences" could be consolidated in federal court.[45] Thus, Congress amended the Act in 1988 by granting United States district courts with original removal jurisdiction over all "public liability

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[39] Berkovitz, *supra* note 26, at 14.

[40] *Id.* at 14-15.

[41] *Id*. at 15.

[42] *See* Nuclear Regulatory Commission. *Three Mile Island Accident: Backgrounder*, NUCLEAR REGULATORY COMMISSION, *available at* http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/3mile-isle.html (last visited Aug. 22, 2011) (On March 28, 1979, the Three Mile Island nuclear power plant near Middletown, Pa., suffered a severe core meltdown, leading to the most serious nuclear incident in U.S. commercial nuclear power plant operating history. No deaths or injuries to plant workers or members of the nearby community occurred, but it brought widespread change to the security, operation, emergency response and regulations of the nuclear industry).

[43] *Id.*

[44] Berkovitz, *supra* note 26, at 41.

[45] *See* El Paso Natural Gas Co. v. Neztsosie, 526 U.S. 473, 486 (1999) (The Supreme Court held, among other issues, that the Price-Anderson Act's terms "are underscored by its legislative history, which expressly refers to the multitude of separate cases brought 'in various state and Federal courts' in the aftermath of the Three Mile Island accident.").

actions" arising under the Price-Anderson Act.[46] This amendment, combined with the waiver of defense provisions, the omnibus coverage and the predetermined sources of funding, provided individuals seeking legal recourse significant advantages in federal court that might not otherwise be offered under state tort law.[47] The substantive rules for decision, however, remain derived from state law in which the nuclear incident occurs, unless such law is inconsistent with the provisions of the Price-Anderson Act.[48]

D. PRICE-ANDERSON ACT SINCE 2005

With strong bipartisan support, Congress passed the Energy Policy Act (EPAct) of 2005, which, among other provisions, provided for the extension of the Price-Anderson Act from 2005 until December 31, 2025.[49] This is the longest extension of the program since its enactment. The most significant amendment from EPAct is the increase in the amount of annual financial contributions from commercial reactors.[50] The Act now requires individual site operators to provide $375 million of primary financial protection and to contribute $111.9 million to the Secondary Financial Protection Program, plus 5% for legal costs per reactor.[51]

IV. THE REGULATING AGENCY: THE NUCLEAR REGULATORY COMMITTEE

Congress established the Nuclear Regulatory Commission (NRC) as an independent regulating agency designed to license and regulate the nation's civilian use of nuclear materials to ensure adequate protection of public health and safety, to promote the common defense and security, and to protect the environment.[52] An essential component of the NRC's role as

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[46] 42 U. S. C. § 2210(n)(2) (2006).

[47] O'Conner v. Commonwealth Edison Co., 13 F.3d 1090, 1100 (7th Cir. 1994) (citing S. REP. NO. 100-218, at 4 (1987)).

[48] 42 U.S.C. § 2014(hh) (2006).

[49] Price-Anderson Amendments Act of 2005, Pub. L. No. 109-58, §§ 602-608, 119 Stat. 779, 779-781 (2005).

[50] 70 FR 61885-01, Rules and Regulations, Nuclear Regulatory Commission (2005) (codified in scattered sections of 10 C.F.R.).

[51] Nuclear Regulatory Commission, *supra* note 16, at 1.

[52] William C. Ostendorff, Commissioner, Nuclear Regulatory Comm'n, Keynote Address at the Emerging Issues Policy Forum, Powering the Future 2010: Nuclear Regulation and the Nuclear Renaissance 1-2 (Oct. 4, 2010), *available at* http://pbadupws.nrc.gov/docs/ML1027/ML102790151.pdf.

a federal agency is that it is not an entity that promotes the use of nuclear and radiation technologies,[53] but instead is one that regulates the use of such technologies to ensure the safety and security of the nuclear industry.[54]

As stated by Commissioner William C. Ostendorff during a keynote address on the nuclear renaissance in Amelia, FL,[55] the agency strives to adhere to its principles of good regulation through independence, transparency, efficiency, clarity, and reliability.[56] If the nation is to proceed with clean, alternative energies as an integral part of our national energy policy, then the clean energy technologies will also need an independent regulatory agency similar to the NRC. Such an agency would ensure best practice techniques, regulation of licenses and operations, and uniformity across the industry as well as provide direction as an oversight committee in promoting safety and the public interest.

V. THE INSURERS: THE AMERICAN NUCLEAR INSURERS

Since the establishment of the Price-Anderson system, a group of member insurance companies – the American Nuclear Insurers (ANI) – has been responsible for all of the nuclear liability policies.[57] American Nuclear Insurers is an unincorporated voluntary joint underwriting association that directly writes nuclear liability insurance for nuclear facilities.[58] In order to be a member company of ANI, insurers are required to contain an A.M.

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[53] *Id.* at 2. The role of promoting nuclear technologies was assigned to the Department of Energy and its predecessor, the Energy Research and Development Administration (ERDA), in the 1970s.

[54] *Id.*

[55] Commissioner Ostendorff is one of the five head members (commissioners) of the Nuclear Regulatory Commission. NUCLEAR REGULATORY COMMISSION, The Commission, http://www.nrc.gov/about-nrc/organization/commfuncdesc.html (last visited Sept. 5, 2011).

[56] *See* Ostendorff, *supra* note 52, at 2.

[57] As of January 1, 1998, the insurance pools had underwritten the following policies: Operating power reactors: 69 sites; Non-power reactors: 27; Fuel fabrication facilities: 6; Waste disposal and storage facilities: 12; Miscellaneous facilities including nuclear laundries and research laboratories: 55; Discontinued nuclear facilities: 20; Suppliers and transporters: 225. *See* Paul Bailey, THE PRICE-ANDERSON ACT - CROSSING THE BRIDGE TO THE NEXT CENTURY: A REPORT TO CONGRESS, ICF INCORPORATED FOR THE NRC 75 (Oct. 1998).

[58] American Nuclear Insurers, *Overview*, http://www.amnucins.com/About Ani.html (last visited Aug. 21, 2011) [hereinafter ANI].

Best Rating of "A-" or better, possess a policyholder surplus (PHS) of at least $100 million, and release unqualified, audited financial statements for the latest financial reporting period.[59] Currently, there are 21 insurance companies that are member companies of ANI.[60]

American Nuclear Insurers manages both domestic and foreign underwriting syndicates.[61] The domestic syndicate provides third party nuclear liability insurance to every commercial nuclear power plant in the United States as well as other entities that support the operation of power plants such as fabricators of nuclear fuel, nuclear research facilities, waste management and disposal facilities, and companies that supply any goods and services to the nuclear industry.[62]

Under the foreign underwriting syndicate, ANI participates in reinsurance programs in 18 foreign countries.[63] ANI retains around a third of the liability exposure under each policy while ceding the remaining amount to insurers around the world.[64] This approach allows ANI to organize the resources of the worldwide insurance community and spread the uncertainties of the risk over a large financial base.

American Nuclear Insurers provide four specific liability policies in order to satisfy nuclear plant's requirements under the Price-Anderson Act. These policies include a Facility Form Policy, Secondary Financial Protection Program, Facility Worker Form Policy, and Supplier's and Transporter's Policy.[65] The Facility Form Policy is the site-specific insurance coverage that owners or operators of commercial nuclear power plant are required to have under the Price-Anderson Act.[66] This coverage is strictly limited to liability for bodily injury or offsite property damage

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[59] Richard Jones, *Nuclear Insurance: Where Does it Fit in the Green Generation?*, 16 J. REINSURANCE 71, 74 (Spring 2009).

[60] *Id.* at 75. These insurance companies include Ace American Insurance Company, Employers Mutual Casualty Company, AXIS Reinsurance Company, Federal Insurance Company (Chubb), Swiss Re America, and State Farm Mutual Auto Insurance Co., among others.

[61] *Id.* at 76.

[62] *Id*.

[63] *Id.*

[64] Ian Hore-Lacey, World Nuclear Association, The Encyclopedia of Earth, *Price-Anderson Act of 1957, United States (*Dec. 7, 2009, 10:35 PM), http://www.eoeart h.org/article/Price-Anderson_Act_of_1957_United_States (last accessed Aug. 22, 2011).

[65] *See* ANI Liability Insurance, *supra* note 19, at 1-4.

[66] *Id.* at 1-2.

caused by nuclear material.[67]

Underwriters for the Facility Form Policies included two distinct provisions in order to tailor it to the nuclear industry. First, the policies are written on a continuous basis with no explicit end date. The insurance coverage ends only when the owner or operator of the commercial nuclear power plant or ANI cancels the terms.[68] Any claims resulting from the policy term remains under the coverage. This takes into account the latent nature of any damage or harm stemming from nuclear exposure.[69] Second, the policies cover not only the owner or operator of the plant but also any entity connected with the nuclear plant, thus assuring all third party nuclear liability claims will be covered while also preventing potential stacking of limits.[70]

The Secondary Financial Protection Program, discussed previously, provides for the industry-wide indemnification in the event of a nuclear incident that exceeds the site-specific insurance policy. The structure of the insurance coverage under the Price-Anderson Act has enabled insurers to provide stable, high quality coverage for nuclear risks.

VI. PRICE-ANDERSON ACT AS MODEL COMPENSATION

The Price-Anderson Act represents the balancing of the interests and needs of the public not only as private citizens but also as consumers in and beneficiaries of the private business enterprise of nuclear energy.[71] The following sections highlight the components of the Act that make it a model compensation system for clean energy technologies that have not yet enjoyed the long history and maturity of the nuclear industry.

A. NECESSITY OF A LIABILITY CAP

In order to encourage development of the nuclear industry as well as provide adequate protection for the American public, Congress implemented the liability cap for the nuclear industry in order to strike the appropriate balance of accountability and development. This limitation, however, does not directly limit the ability of individual claimants affected by any nuclear incident from recovering. As discussed in *Duke Power v.*

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[67] *See* Jones, *supra* note 59, at 77.
[68] *Id*.
[69] *Id*.
[70] *Id*. at 78.
[71] *See* Quattrocchi, *supra* note 13, at 55.

Carolina Environmental Study Group, Inc., the legislative history of the Act clearly indicates that the primary – and secondary insurance pools – are not figures that were arrived at on the supposition that it alone would be sufficient to guarantee full compensation in the event of a nuclear accident.[72] The initial primary insurance was conceived of as a "starting point" or "a working hypothesis" derived from expert appraisals of the exceedingly small risk of a nuclear incident involving claims in excess of that figure.[73] This figure has risen from $560 million to $12.6 billion over the past four decades in order to ensure public protection. In addition, legislative history indicates that Congress would likely enact extraordinary relief provisions in order to provide for additional relief.

> [T]his limitation does not, as a practical matter, detract from the public protection afforded by this legislation. In the first place, the likelihood of an accident occurring, which would result in claims exceeding the sum of the financial protection, required and the governmental indemnity is exceedingly remote, albeit theoretically possible. Perhaps more important, in the event of a national disaster of this magnitude, it is obvious that Congress would have to review the problem and take appropriate action. The history of other natural or man-made disasters, such as the Texas City incident,[74] bear this out. The limitation of liability serves primarily as a device for facilitating further congressional review of such a situation, rather than as an ultimate bar to further relief of

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[72] Duke Power Co. v. Carolina Envtl. Study Grp., Inc., 438 U.S. 59, 85 (1978).

[73] *Id.*

[74] *See* Hugh W. Stephens, *The Texas City Disaster, 1947* (1997). The Texas City incident was the worst industrial accident in United States history, killing at least 581 people, injuring over 5,000 individuals and causing extraordinary amounts of property damage from ammonium nitrate blasts in the Port of Texas City. Following the incident, a class action was filed against the federal government under the Torts Claim Act, however the Courts refused to provide compensation for the victims because the Act may be invoked only on a "negligent or wrongful act or omission" of an employee, which created no absolute liability of the Government by virtue of its ownership of an "inherently dangerous commodity" or property, or of its engaging in an "extrahazardous" activity. After the court decision, Congress acted to provide compensation through Public Law 378, 69 Stat. 707 (1955). The last claim was processed in 1957, resulting in federal compensation of nearly $17 million.

the public.[75]

While upholding the constitutionality of the Act, the Supreme Court duly noted the legitimacy of and need for the cap on liability by stating "the limit on liability [is] 'a classic example of an economic regulation—a legislative effort to structure and accommodate 'the burdens and benefits of economic life.'"[76]

The limit on liability remains the most controversial component of the Act, as critics argue that it constitutes a subsidy for the nuclear industry by not requiring unlimited liability. First of all, there is no record of the federal government ever paying a direct subsidy to any private licensees under Price-Anderson. The nuclear industry not only has paid the costs of the private, and secondary financial protection, insurance fees but it has also "paid millions of dollars in indemnity fees and has assumed more than $9 billion in potential retrospective assessments to compensate injured accident victims – all of this at no cost to the government."[77]

In exchange for the limit on liability, the Price-Anderson Act provides a large, readily available source of compensation for any individuals affected from a nuclear incident that would otherwise not exist.[78] To the contrary, the Bhopal Disaster in India in 1984 demonstrates the problems with a system that fails to assure an available pool of funds in the event of an industrial accident, despite having no liability cap. The Bhopal Disaster is considered the world's worst industrial catastrophe, as a leak of methyl isocyanate gas and other chemicals from a pesticide plant in Bhopal, Madhya Pradesh, India resulted in the exposure of hundreds of thousands of people to hazardous toxins.[79] The Indian government panel charged with tabulating the deaths and injuries determined that over 3,800 individuals died as a result of the leakage, 11,000 were disabled and an additional 150,000 to 600,000[80] were affected.[81]

Following years of litigation, the operating company, Union Carbide Corporation, settled with the Indian Government for $470 million,

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[75] *Duke Power* at 85-86 (quoting H.R. REP. NO. 89-883, at 6-7 (1965)).

[76] *Id.* at 83.

[77] *See* Quattrocchi, *supra* note 13, at 59.

[78] *Id.*

[79] Jackson B. Browning, *Union Carbide: Disaster at Bhopal*, *in* CRISIS RESPONSE: INSIDE STORIES ON MANAGING IMAGE UNDER SIEGE 365 (Jack A. Gottschalk ed., 1993).

[80] *See* AMNESTY INT'L, CLOUDS OF INJUSTICE: BHOPAL DISASTER 20 YEARS ON 61 (2004).

[81] Browning, *supra* note 79, at 365.

approximately $1,000 in compensation for each individual killed, disabled or injured from the disaster.[82] The Price-Anderson Act represents not only a balancing of the risks of the nuclear industry but also of the protection of the American public. The truth of the matter is "that there is always a limit on liability – that limit equal to the assets of the company at fault."[83] Those who drafted the Price-Anderson Act understood this and the legislative branch appropriately determined the private-public partnership, which established a liability threshold for the industry, was the most reliable system to ensure financial protection to the American people.

Throughout the five decades of the Price-Anderson Act, the public has never had to bear the economic brunt of any nuclear incident within the United States. Thus far, the insurance pools of the nuclear industry have paid more than $200 million in claims and litigation costs since Congress passed the Act.[84] Out of this assessment, $71 million in costs were disbursed following the Three Mile Island Accident in 1979.[85] The cost of nuclear commercial power plant insurance is borne by the industry, which is unlike various other energy sources within the United States. For example, the hydropower electricity industry is not responsible for incidents such as dam failure or resultant flooding; instead the public is the one to bear the burden of such costs.[86] This example is illuminated by the 1977 failure of the Teton Dam in Idaho, which caused approximately $500 million in property damage, however the individuals affected from the failure were only compensated $200 million of low-cost government loans.[87]

In contrast, under the Price-Anderson Act, the insurance pools have absorbed $200 million of the costs and the nuclear industry has paid $21 million in indemnity fees to the federal government.[88] The success of this program has led Congress to extend the model to protect the public from other hazards or harm, such as medical malpractice, faulty vaccinations, toxic waste and terrorist attacks.[89] Congress should again adopt such a

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[82] *See* Quattrocchi, *supra* note 13, at 59.

[83] *Id.*

[84] Nuclear Energy Inst., *Price-Anderson Act Provides Effective Liability Insurance at No Cost to the Public*, (Jun. 2010), http://www.nei.org/resourcesandstats/documentlibrary/safetyandsecurity/factsheet/priceandersonact/.

[85] *Id.*

[86] GWYNETH CRAVENS, POWER TO SAVE THE WORLD: THE TRUTH ABOUT NUCLEAR ENERGY 214 (Alfred A. Knopf 2007).

[87] *Id.*

[88] *See* Nuclear Energy Inst., *supra* note 84.

[89] *Id.*

model to extend towards clean energy technologies and production in order to properly encourage investment, development and innovation while also maintaining a high level of protection to the public.

B. NO-FAULT LIABILITY

In 1966, the legislative branch addressed concerns that many state tort laws required findings of fault or negligence in order to establish liability. This created a major obstacle for individual's seeking relief from the nuclear industry, as the technicalities and even knowledge of radioactive leakage, the nuclear industry and the proximate cause of an injury proved evasive. To appropriately resolve this issue, the Act implemented a waiver of defenses under state tort law in the event of a nuclear incident that shifted the standard essentially to one of strict liability.

Under this regime, claimants are legally required to only demonstrate that the injury or property damage sustained was caused by the release of nuclear material from the insured facility, however fault on a particular defendant does not have to be established.[90] The result of this provision is to effectively ensure a strict liability standard that provides the public with necessary protections from the judicial system. Such protections are essential in areas in which legal causation is difficult to prove.

C. FEDERAL JURISDICTION

State tort laws have historically governed nuclear liability determinations,[91] however amendments to the Price-Anderson Act following the events at Three Miles Island revised the system in order to provide a federal overlay. Currently, the Act contains a pre-emption provision,[92] which gives federal district courts jurisdiction over tort actions arising out of nuclear accidents and "expressly provides for removal of such actions brought in state court even when they assert only state-law claims."[93] The removal of such claims eliminates confusion and

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[90] *See* Quattrocchi, *supra* note 13, at 57.

[91] John L. Quattrocchi, *Nuclear Liability Insurance in the United States: An Insurer's Perspective*, *in* REFORM OF CIVIL NUCLEAR LIABILITY: INTERNATIONAL BUDAPEST SYMPOSIUM 1999 (OECD 2000).

[92] 42 U.S.C. § 2014(hh) (2006).

[93] *See* El Paso Natural Gas Co. v. Neztsosie, 526 U.S. 473, 484-85 (1999).

uncertainties surrounding the applicability of the Price-Anderson Act and establishes a level of assurance in how the judicial system will approach such claims.

Furthermore, as discussed in *El Paso Natural Gas Co. v. Neztsosie*, the Price-Anderson Act "provides clear indications of the congressional aims of speed and efficiency."[94] The chief judge of a district court is given the authority to appoint a special caseload management panel to oversee all filings and court hearings associated with a nuclear incident case.[95] These panels are designed to consolidate cases, set priorities, expedite cases or allow more equitable considerations of claims, and implement any measures as "as will encourage the equitable, prompt, and efficient resolution of cases arising out of the nuclear incident."[96] Each of these provisions is in place to reduce the legal costs as well as promote efficiency and efficacy of the compensation process.

D. LIABILITY IS CHANNELED TO THE PARTICULAR LICENSEE RESPONSIBLE

The Price-Anderson Act channels financial responsibility and liability insurance obligations to the particular nuclear power plant responsible for the incident.[97] This mechanism helps assure that claimants will be provided financial compensation in the event of sustaining injury or property damage.[98] Under the Act, contractors, subcontractors, and suppliers to DOE contractors and NRC licensees, as well as the DOE contractors themselves, are fully indemnified for all liability.[99] These operators, however, are all connected with, or "channeled" to, a particular nuclear power plant. Accordingly, each power plant is responsible for indemnifying any accidents or incidents arising from its contractors, subcontractors, or suppliers activities. This is crucial in order to ensure full protection as well as development of the nuclear industry from all sectors. Without such assurance – both the economic assurance of indemnification for the public and legal insulation from individual liability for participating entities in the nuclear industry – the development of nuclear energy would certainly have faltered.

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[94] *Id.* at 486.
[95] 42 U.S.C. § 2210(n)(3)(A) (2006).
[96] 42 U.S.C. § 2210(n)(3)(C)(vi) (2006).
[97] 42 U.S.C. §§ 2014(t), 2210(c) (2006).
[98] *See* Quattrocchi, *supra* note 13, at 56.
[99] Berkovitz, *supra* note 26, at 8.

E. GUARANTEED POOL OF FUNDS; CONTINUOUSLY WRITTEN

While criticism surrounds the liability cap of the Price-Anderson Act, the alternative of the Act is that the nuclear power plants would need to secure their own source of coverage. Not only, as mentioned already, would this detract most, if not all insurance companies, but in fact it would place the public in an extraordinarily unsettling situation. Establishing liability without the Price-Anderson Act would, in theory, place no legal limit on liability, however each claim would depend on state tort law and procedures, which may or may not provide for no-fault liability.[100] Even in the event that defenses are waived, a defendant with theoretically no liability limit might not be able to pay a judgment if obtained.[101] Thus, the Price-Anderson Act establishes "assurance of prompt and equitable compensation under a pre-structured and nationally applicable protective system [which gives] way to uncertainties, variations and potentially lengthy delays in recovery."[102]

Under the Price-Anderson Act, compensation is evenly distributed over the entirety of those affected, however in an alternative system, such as a claim-based system, when the defendant's assets are exhausted by earlier judgments, future claimants will be left without any compensatory relief or redress through judicial system.[103] Such a system would create an onslaught of lawsuits in order for claimants to be the first to express their grievances, rather than appropriately assuring the public a system that will orderly and equitably compensate those affected by any nuclear incident.[104]

This sentiment was expressed in *Duke Power*, as the Supreme Court noted that

> . . . the congressional *assurance* of a $560 million[[105]] fund for recovery, accompanied by an express statutory commitment, to "take whatever action is deemed

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[100] *See H.R. 8631: To Amend and Extend the Price-Anderson Act Before Joint Comm. on Atomic Energy*, 94th Cong. 69 (1975) (statement of William A. Anders, Chairman, U.S. Nuclear Regulatory Commission).

[101] *See* Quattrocchi, *supra* note 13, at 59 ("The simple fact is that there is always a limit on liability—that limit equal to the assets of the company at fault.").

[102] Duke Power Co. v. Carolina Envtl. Study Grp, 438 U.S. 59, 89 (1978).

[103] *Id.* at 90.

[104] *H.R. 8631: To Amend and Extend the Price-Anderson Act*, *supra* note 101.

[105] This was the figure at the time of *Duke Power*, however, the current assurance from both the primary insurance and secondary insurance pool is $12.6 billion.

> necessary and appropriate to protect the public from the consequences of" a nuclear accident, [is] a fair and reasonable substitute for the uncertain recovery of damages of this magnitude from a utility or component manufacturer, whose resources might well be exhausted at an early stage.[106]

Furthermore, the American Nuclear Insurer policies are written on a continual basis and contain no expiration date.[107] Claims based during the time of the policy are accounted for and the licensee is still held responsible if the claim is found valid, even if they are no longer in operation.

F. LITIGATION AND INVESTIGATION COSTS INCLUDED

Under the Price-Anderson Act, the expenses of investigating and defending claims or suits against the nuclear industry are included in the limit of liability.[108] The legal costs for defending many of these actions can be quite expensive. By including the legal and investigation costs in the Act, Congress established definite confines for liability costs that insurance companies providing the financial protection plans to the nuclear industry could rely upon. In essence, the inclusion of these costs enables insurers to offer their maximum capacity commitments without fear of exceeding such commitments.[109] This provision is crucial in enabling insurers to maintain and, most likely, increase the assets they place at risk.[110]

G. THE PRICE-ANDERSON ACT PROVIDES STABILITY IN THE MARKET

Finally, the requirement of the Price-Anderson Act that each nuclear commercial power plant must obtain a specified amount of private insurance as well as participate in the secondary financial protection program provides stability in the market that might otherwise not be there. Not only was the private insurance industry precarious in providing financial protection for the nuclear industry at the dawn of its development, but the liability insurance market is also a volatile entity by nature.

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[106] *Duke Power Co.,* 438 U.S. at 90-91 (citation omitted).

[107] Richard Jones, *Nuclear Insurance: Where Does it Fit in the Green Generation?*, 16 J. REINSURANCE 71, 77 (Spring 2009).

[108] *See* 42 U.S.C. § 2210(e) (2006).

[109] *See* Quattrocchi, *supra* note 13, at 56.

[110] *Id.*

This very instability was demonstrated by the liability insurance crisis from late 1984 through 1986, when major economic disruptions in the commercial liability insurance market created concerns over the availability and affordability of a number of commercial insurance policies – notably for chemical and pharmaceutical companies, the medical system and municipalities.[111] However, when the liability insurance crisis hit the nation in the mid-1980s, the nuclear liability insurers continued to provide a stable market for their limited customer base as a result of the system provided by the Price-Anderson Act.[112] The nuclear industry was shielded from any increase in liability premiums, cancellation of policy coverage or diminishment in scope of coverage[113] – not only was this critical for the nuclear industry but it also protected the public from any exposure to an uninsured, or volatile, nuclear industry.

VII. CARBON SEQUESTRATION: AN OVERVIEW

With the growing demand and development of carbon sequestration technology, insurers are beginning to determine the best approach in providing liability frameworks for private, state and federal projects using this new technology. Briefly, carbon sequestration is the process that involves capturing carbon dioxide at the point of combustion – most notably from coal power plants – and injecting it into geological formations beneath the surface of the earth.[114] Essentially, the technology is the reverse of pumping oil or natural gas from a confined geological aquifer.[115] The life-cycle of a carbon sequestration project can last over a couple of centuries as the process involves several phases from site selection, characterization, and regulatory review;[116] to CO2 injection and well closure;[117] to post-closure monitoring;[118] and finally to long-term

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[111] G.C. Lai et al., *"On Liability Insurance Crisis"*, Risk Theory Seminar Conference, Univ. of Ala. 1 (Apr. 1997).

[112] *See* Quattrocchi, *supra* note 13, at 58.

[113] *See* Lai, *supra* note 111.

[114] INT'L ENERGY AGENCY, TECHNOLOGY ROADMAP: CARBON CAPTURE AND STORAGE 8-9 (2009).

[115] Alexandra B. Klass & Elizabeth J. Wilson, *Climate Change and Carbon Sequestration: Assessing a Liability Regime for Long-Term Storage of Carbon Dioxide*, 58 EMORY L.J. 103, 115 (2008).

[116] *Id.* This phase is expected to last anywhere from one to ten years.

[117] *Id*. (twenty to thirty year life-span).

[118] *Id*. (estimating that this phase of the life-cycle lasts for a period of fifteen to thirty years).

stewardship.[119]

To date, carbon dioxide is the most abundant anthropogenic greenhouse gas in the atmosphere largely due to human activities.[120] The release of these gases into the atmosphere has contributed to global warming and increasing concerns of altering climatic, biological, and natural environments. The demand, and necessity, for solutions to mitigate greenhouse gas emissions are the propellant behind carbon sequestration projects.

While the technology is only increasing, carbon capture and storage projects are technically ready – but the associated costs, including insurance, need to be lowered and investment needs to increase in order for large-scale implementation of this technology.[121] In essence, the industry today parallels the circumstances of the nuclear industry in the 1950s, when the Atomic Energy Act was originally enacted. The manner in which the insurance industry approaches the long-term liability with carbon sequestration could significantly affect the development and investment in the technology.

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[119] *Id*. (estimating that CO_2 remains sequestered underground for hundreds of years).

[120] Carbon dioxide is the most important anthropogenic greenhouse gas (*see* Figure SPM.2). The global atmospheric concentration of carbon dioxide has increased from a pre-industrial value of about 280 ppm to 379 ppm in 2005. The atmospheric concentration of carbon dioxide in 2005 exceeds by far the natural range over the last 650,000 years (180 to 300 ppm) as determined from ice cores. The annual carbon dioxide concentration growth rate was larger during the last 10 years (1995–2005 average: 1.9 ppm per year), than it has been since the beginning of continuous direct atmospheric measurements (1960–2005 average: 1.4 ppm per year) although there is year-to-year variability in growth rates. The primary source of the increased atmospheric concentration of carbon dioxide since the pre-industrial period results from fossil fuel use, with land-use change providing another significant but smaller contribution. Eleven of the last twelve years (1995–2006) rank among the 12 warmest years in the instrumental record of global surface temperature (since 1850). *See* INTERGOVERMENTAL PANEL ON CLIMATE CHANGE 2007, *Climate Change 2007: The Physical Science Basis, Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (S. Solomon et al. eds., Cambridge University Press 2007).

[121] *Id.*

VIII. CARBON SEQUESTRATION RISK ASSESSMENT & COMPARISON TO THE NUCLEAR INDUSTRY

In regards to insurance necessities, policy writers must first understand the risks in which the technology presents. The inquiry first begins with what is to be protected and what threshold of risk mitigation required or desired by the client.[122] In general, insurance policies are structured, priced and conditioned based on the frequency and the severity of potential loss.[123] In developing such policies, insurers look towards past events and historical trends within the insured's field and practice area.

The difficult part of carbon sequestration is that the infancy of the technology does not lend itself to any insight in its past history. As a result, the insurance industry has reluctantly provided coverage for the risks and trends of the technology. However, this should not detract insurers, as the underlying liabilities and risks of carbon sequestration technology are analogous to the same uncertainties that faced the nuclear industry in the 1950s.

First, the main concern with carbon sequestration is the release of carbon dioxide from the project site. In its natural state carbon dioxide is non-toxic, however concentrations of 5-10% by volume is harmful to the life and health of plants, humans and animals.[124] Thus, there is a direct and measurable potential for damage resulting from the release of large quantities of carbon dioxide in the event of a site failure or storage site leakage due to a number of reasons such as equipment or construction failure, unexpected tectonic movements or unforeseen large-scale migration.[125] The inherent risks associated with the storage of carbon dioxide are similar, although much smaller, to radioactive exposure resulting from a nuclear power plant failure.

Secondly, there is general consensus that potential leakage of hazardous pollutants from storage reservoirs is very low – the Intergovernmental Panel on Climate Change estimates that for well-selected sites, there is a 90-99% probability that over 99% of liquefied CO2

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[122] PA. DEP'T OF CONSERVATION AND NATURAL RES., ASSESSMENT OF RISK, LEGAL ISSUES, AND INSURANCE FOR GEOLOGIC CARBON SEQUESTRATION IN PENNSYLVANIA 5-1 (2009).

[123] *Id.*

[124] Christina Ulardic, *Environmental Impairment Liability Insurance for Geological Carbon Sequestration Projects*, *in* INTERNATIONAL RISK GOVERNANCE COUNCIL WORKSHOP ON REGULATION FOR CCS 1, 3 (Mar. 2007), *available at* http://www.irgc.org/IMG/pdf/IRGC_CCS_SwissRe07.pdf.

[125] *Id.*

injected into underground wells will remain underground for over 100 years.[126] Again, this is analogous to the nuclear industry's low-frequency yet high-risk nature.

Also, while immediate injuries and harm can arise from industrial incidents with carbon sequestration at the time of the failure, the associated liability is often a result of storage leakage. In turn, this leads to injuries and harm that are latent in nature, as leakages tend to arise over long-term, chronic exposure to low-levels of hazardous materials. Likewise, a radiological incident can result in acute, short-term exposure as well as chronic, long-term exposure to surrounding communities and environments.[127] In both cases, victims are hindered with the difficulty of proving causation arising from both nuclear incidents and carbon sequestration failures. Finally, carbon sequestration is beginning to solidify itself as a crucial part in our national energy policy similar, albeit on a smaller scale, to the nuclear industry's rapid accent to the forefront of the energy sector in the middle of the twentieth century.[128] This commitment from the federal government intensifies the need to create an indemnity scheme that can serve the dual purpose of promoting the technology while also protecting the public.

Admittedly the release of radioactive materials is far more damaging to the public than concentrated volumes of carbon dioxide,

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[126] INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CARBON DIOXIDE CAPTURE AND STORAGE 14 (Bert Metz et al. eds., 2005).

[127] NAT'L CTR. FOR ENVTL. HEALTH CTRS. FOR DISEASE CONTROL & PREVENTION, THE PUBLIC HEALTH CONSEQUENCES OF DISASTERS 405 (Eric K. Noji ed., Oxford Univ. Press 1997) (Acute effects from radiological exposure vary in dosage from individual showing no outward symptoms, but instead having increased chromosomal aberrations in blood lymphocytes and lower blood count to high doses, which may affect the central nervous system causing seizures, gait disturbances and coma, almost always resulting in death. However, this high-dosage acute exposure is extremely rare in nuclear incidents; instead it is seen in intentional nuclear warfare.).

[128] *See* American Recovery and Reinvestment Act of 2009, 26 U.S.C. § 46 (2009) (The Advanced Energy Manufacturing Tax Credit, also known as Internal Revenue Code Section 48C, provides a 30% tax credit for future expenditures to support new, expanded, or re-equipped domestic manufacturing facilities for advanced energy projects. The tax credit was promulgated pursuant to the American Reinvestment and Recovery Act (ARRA) section 1302, which authorized the Department of Treasury to extend $2.3 billion for qualified investments in domestic manufacturing facilities that can be completed within a four year period. Credits are available for a two year period, or until the maximum dollar amount of credits has been reached.).

however the risk that is being covered by both industries mirror each other in associated problems – leakage of material causing exposure to individuals; groundwater contamination; wind-blown migration of the elements; and property damage due to an industrial meltdown or explosion. The Price-Anderson Act has already accounted for the similarities in the problems associated with each industry through, among other provisions, its liability channeling, no-fault causation standard, and removal to federal jurisdictions.

In addition, the private-public partnership of the Price-Anderson Act provides suitable incentives such as a liability cap, industry-wide pooling, and policies written on a continual basis that would attract greater financial investment, insurance coverage and ultimately employment of carbon sequestration technology.

A. NECESSITY OF A LIABILITY CAP

First of all, the liability cap is essential in attracting private insurance interest in new, clean energy sources that have yet to reach maturity within the market. This was an essential component for the nuclear industry, as the potential liability costs associated with a nuclear incident detracted private insurance companies from providing coverage for nuclear power plants. Likewise, the long-term risks associated with carbon sequestration concern insurance underwriters today. Thus, there needs to be incentives for private investment to generate the necessary development of the field – the liability cap is the first step in doing so. As was the case with the Price-Anderson Act, the federal government should implement a preliminary system that caps site-specific liability at a certain threshold while also ensuring federal indemnification in the event of an incident exceeding the primary, site-specific insurance. Then, once the industry begins to mature, the federal government can slowly turn the second-tier of the indemnification system over to private insurers that begin to adapt to and draw interest in the technology.

The tiered-system that blends site-specific insurance and an industry-wide pool of funds "both provide[s] site-tailored risk management and ensures[s] that adequate funds are available to cover damage in the post-closure period."[129] In addition, an industry-wide pool would allow for risk sharing on a national scale and financial protection for a variety of different projects. If indemnification was instead based on a state-level then proper financial protection might quickly be exhausted without the same

[129] *See* Klass & Wilson, *supra* note 115, at 167.

amount of diversity, contribution and risk sharing that occurs in a tiered, mutual insurance pool.[130]

Federal involvement is even more crucial with carbon sequestration because the technology does not tend to yield intensive amounts of revenues. In fact, the main concern of the technology is in diminishing the amount of carbon emissions in the atmosphere, not in turning a profit. Therefore, if there is to be individual and private investment in such projects, monetary or regulatory incentives must be in place for further development.[131]

B. REMOVAL OF CLAIMS TO FEDERAL COURT

The American Recovery and Reinvestment Act of 2009 was signed into law by President Obama on February 17, 2009 and provided the Office of Fossil Energy with $3.4 billion in the attempt to fund initiatives focused on research, development and deployment of technologies to use coal more cleanly and efficiently.[132] In order to accomplish these goals, federal agencies have invested significantly in carbon capture and storage projects across the nation. When dealing with issues such as our national energy policy, federal courts should be the forum for settling disputes, rather than in a plethora of state courts, especially if the technologies are targeted to decrease *national* carbon emission standards. Such an approach maintains cohesiveness as well as ensures an unbiased, equitable forum. The Price-Anderson Act contains a preemption provision[133] that not only gives federal courts jurisdiction over tort action arising out of nuclear accidents, but it also provides for removal of such actions brought in state court even when they assert only state-law claims.[134] This provision is essential for carbon sequestration claims.

First, the provision will limit the consequences of arriving at different conclusions on the applicable law as a result of a inherent differences throughout jurisdictions and variances in state tort law. Second, the tension between state law and federal preemption is a constant theme for CCS, especially due to the potential damages occurring in

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[130] *Id.* at 167-68.

[131] *See* ULARDIC, *supra* note 125, at 2.

[132] The Nat'l Energy Tech. Lab., *Carbon Sequestration: American Recovery and Reinvestment Act Funding (AARA)*, http://www.netl.doe.gov/technologies/carbon_seq/arra/index.html (last visited Sept. 6, 2011).

[133] *See* 42 U.S.C. § 2210(n)(2) (2006).

[134] *See* El Paso Natural Gas Co. v. Neztsosie, 526 U.S. 473, 484 (1999).

domains with strong state laws governing groundwater protection, mineral rights, or surface rights.[135] Carbon sequestration claims, however, should be heard under a federal overlay due to the fact that a lot of the water and mineral resources that will be in question involve several states as well as multiple state interests such as agriculture, urban development, tax revenues and wildlife preservation.[136] Thus, an indemnity system must include a provision that removes any claims from state court in order to preserve all interests in the matter, provide for efficiency and efficacy, and establish cohesive law regarding carbon sequestration facilities and events.[137]

Federal jurisdiction eliminates many of the uncertainties individual victims might encounter in state courts, such as more stringent causation standards or heightened burdens of proof. Additionally, the carbon sequestration liability scheme should adopt similar provisions to the Price-Anderson Act that give the chief judge of the federal district court the authority to consolidate cases, set priorities, expedite cases or allow more equitable considerations of claims, and implement any measures as that will encourage the equitable, prompt, and efficient resolution of cases arising out of the nuclear incident.[138] Such provisions will expedite compensation for affected individuals, which is in essence, the entire objective of the system.

C. CAUSATION: NO-FAULT IS GOOD

In order to provide proper protection to the public in the case of a storage leakage, the insurance policy should be written in such a manner that establishes a strict liability standard. Due to the long duration of carbon storage facilities, it will be much more difficult to detect and assign responsibility for any harm that might occur.[139] Furthermore, the latent nature of injury or property damage associated with carbon storage leakage hinders individual claimants from providing any other standard of legal causation.

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[135] *See* Klass & Wilson*, supra* note 115, at 168.

[136] *Id.*

[137] *Id.*

[138] 42 U.S.C. §§ 2210(n)(3)(C)(i), (ii), (v), (vi) (2006).

[139] SEAN MCCOY, CARNEGIE MELLON UNIV. DEP'T OF ENG'G & PUB. POLICY, POLICY BRIEF: COMPENSATION, LIABILITY AND LONG-TERM STEWARDSHIP FOR CCS 4 (July 13, 2009), http://www.ccsreg.org/pdf/LongTermLiability_07132009.pdf.

In addition, the judicial system has already established a long history of strict liability standard for torts similar to carbon sequestration leakages. This principal stems from *Rylands v. Fletcher*, the English decision which held that an individual "who for his own purposes brings on his lands and collects and keeps there anything likely to do mischief if it escapes, must keep it in at his peril, and, if he does not do so, is prima facie answerable for all the damage which is the natural consequences of its escape."[140]

This body of tort law has been extended in United States laws regarding cases of abnormally dangerous activities, and also, hazardous materials. Thus, in order to maintain consistency with legal precedent as well as ensure that affected individuals are duly compensated, a no-fault liability system is essential in carbon leakage claims.

D. ADDITIONAL ARGUMENTS FOR PRICE-ANDERSON ACT

The Price-Anderson system contains several other provisions that would be highly beneficial for the carbon sequestration system to incorporate. First, the Act channels liability to the particular facility that is responsible for any industrial incident. Carbon sequestration technology has the potential of including a large network of individuals due to its operating, post-injection and long-term stewardship phase. Thus, a large number of individuals are exposed throughout the phases of the technology, creating issues of widespread liability. Thus, an "omnibus" liability system, which allows for all suppliers, transporters, and participants of the carbon sequestration industry to be covered under the insurance system would not only be instrumental for the industry, but also for the public as an "omnibus" feature "permits a more unified and efficient approach to processing and settlement of claims."[141] Additionally, this establishes a centralized defendant in the event that affected individuals are unsure as to the negligent, or directly responsible party.

Second, the Price-Anderson Act provides a mutual insurance program that guarantees a certain amount of available funds in the event of an incident. This system provides for compensation to be evenly distributed

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[140] Fletcher v. Rylands, [1866] 1 L.R. Exch. 265 at 279 (Eng.).

[141] OMER F. BROWN, II, ENERGY CONTRACTORS PRICE-ANDERSON GRP., REPLY COMMENTS ON U.S. DEPARTMENT OF ENERGY NOTICE OF INQUIRY CONCERNING PREPARATION OF REPORT TO CONGRESS ON THE PRICE-ANDERSON ACT 4 (Dec. 31, 1997), http://energy.gov/sites/prod/files/gcprod/documents/REPLY_PAGroup.pdf.

to all affected individuals, while also assuring federal indemnification when necessary. This is more functional that having multiple state systems, which may not sufficiently spread risk and may not be adequately capitalized to cover actual damages incurred above insurance coverage limits.[142] Also, the Price-Anderson Act policies are written on a continual basis, ensuring the public that regardless of the timing of an incident the policy will cover any injuries, harm, or property damage so long as the claims are filed within a timely manner as provided for by the statute of limitations.

Finally, the Price-Anderson system includes litigation and investigating costs. This is crucial in order for the insurance industry to be fully aware of the risks that they are taking. Companies are able to properly assess the amount of financial protection they want to provide, while also allowing them to secure reinsurance to spread the risk over an even greater base.

IX. GEOTHERMAL ENERGY

In the past couple of years, investor interest in geothermal technology has increased significantly. This rapid increase in investment has been accelerated by growing demand for energy sources, increases in the price and scarcity of oil, and the developing awareness of the risks presented by carbon emissions.

With Enhanced Geothermal Systems (EGS), a well known as a production-injection well is drilled into hot basement rock that has limited permeability and fluid content.[143] Hot, dry rock that is closer to the earth's surface is ideal for this technology. The production-injection well consists of two drill points, the first being the injection well that serves to pump water under high pressure into the earth's core. Pumping the water under high pressure is to ensure fracturing or increase fracturing within the geological environment, thus creating an artificial geothermal reservoir.[144] Water is then circulated through the reservoir and the hot water is extracted

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[142] Charles H. Haake & Karyn B. Marsh, *Climate Change: Carbon Sequestration*, WORLD CLIMATE CHANGE REPORT, May 8, 2009, at 1, 6.

[143] U.S. Dep't of Energy, *The Basics of Enhanced Geothermal Systems*, GEOTHERMAL TECHNOLOGIES PROGRAM, http://www1.eere.energy.gov/geothermal/pdfs/egs_basics.pdf (last visited Sept. 6, 2011).

[144] Kai Sametinger, *How to Invest in Geothermal*, RENEWABLE ENERGY FOCUS, Jan.-Feb. 2009, at 84, *available at* http://www.renewableenergyfocus.com/view/886/investing-in-geothermal/.

from the production well, which is drilled with the intent to intersect the stimulated fracture system created by the injection well in a manner in which the most amount of the artificial reservoir is in contact with the well. In turn, the water extracted, known as brine, is pumped through an electrical power plant and the brine heats a working fluid that produces vapor to drive a turbine-generator.[145] The original water is then recycled through a cooling facility and is re-injected into the reservoir, thus completing the cycle.[146]

With the increase in investment in geothermal interest and the growing development of geothermal energy facilities, policy providers must be concerned and appropriately assess the inherent technical perils in the testing, construction and maintenance of these geothermal facilities. Most geothermal power projects take five to seven years to be operational, as each phase of the project has its own set of requirements and risks attached.[147] This concern is further exacerbated by installation, operation and development of projects in harsh unstable terrain, proximity to marine environments, and drilling necessities.

The current investment market for geothermal technologies is relatively weak. The length of the projects combined with the nascent history of the technology deters investors of these projects. The success of drilling – determined by the volume, temperature and pressure of the fluids discovered – is crucial to the financial stability of the project, as it consists of up to 30-40% of the entire project.[148] Therefore, in some cases government support and subsidies are necessary to help get the project off the ground.[149] Investors that then have to worry about insurance costs associated not only with the building but also with the maintenance and operation of the project are further deterred, as additional costs must be accounted for. Therefore, the Price-Anderson Act, which would provide incentive for financial investment by implementing liability caps in the event of an incident, failure in project development, and other instances, is crucial to incentivize financial investment.

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[145] U.S. Dep't of Energy, *supra* note 143.
[146] *Id.*
[147] Sametinger, *supra* note 144, at 85.
[148] *Id.*
[149] *Id.*

X. CONCLUSION

The rapidly rising demand for electricity, increasing costs of oil and gas, and concerns about energy security demonstrate the need not only for the "nuclear renaissance," but also for investment in alternative, clean energy technologies and sources.[150] The past few years have illuminated a heightened national interest and political commitment, from both sides of the aisle, regarding these objectives.

If the United States expects to continue to be atop the global pyramid, then it must reassess its current energy policy – especially its commitments to nuclear energy as well as alternative, clean energy technologies. Currently, the nuclear industry accounts for 19.4% of electrical production within the United States, while at the same time accounting for 73.6% of the emission-free electricity production.[151] In 2006 alone, the nuclear industry saved the United States and the world 681.2 million metric tons of CO2 emissions while providing the lowest-cost producer of base-load electricity at 1.72 cents per kilowatt-hour.[152] However, the United States' nuclear production is ninth in the world in percent of its total domestic electricity generation.[153]

Clean energy technologies, such as nuclear energy, are at the forefront of the national discourse on energy policy, while others, such as solar and wind power, geothermal developments, and carbon sequestration, are being pushed into the discussion. It is in these developments that the proper financial instruments and insurance policies must adequately support and protect this increasing development.

Accordingly, analysis of the Price-Anderson Act provides insight into an underlying insurance indemnification system that would provide a well-suited framework in addressing the growth of clean energy technologies, such as geothermal energy and carbon sequestration technology. These and similar technologies are currently struggling for the necessary financial backing and protection in order to become a key contributor to our national energy policy. As such, the liability cap

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[150] HOUSE SELECT COMM. FOR ENERGY INDEPENDENCE & GLOBAL WARMING, 110TH CONG., THE REALITIES OF NUCLEAR EXPANSION 2 (Sharon Squassoni 2008).

[151] Roger Bloom, *The Advantages of Nuclear Power in a Carbon Constrained World*. WESRCH.COM 1, 27-28 (Apr. 27, 2009), http://energy.wesrch.com/paper-details/pdf-TR17TE000CHAC-the-advantages-of-nuclear.

[152] *Id.* at 29-30.

[153] *About ANI*, AM. NUCLEAR INSURERS, http://www.amnucins.com/About%20ANI.html (last accessed Sept. 7, 2011).

instituted under the Price-Anderson Act is essential in encouraging growth within the clean energy sector.

Likewise, a no-fault system in which liability is channeled to the particular operator or owner of the facility is crucial in upholding accountability and protection to the American public. Finally, once a national market is established, creating a tiered system that requires site specific private insurance, a secondary, industry-wide pool, and finally federal indemnification in the event of exhaustion of the initial two layers will create a reliable network of compensation in the event of an industrial incident while also balancing the competitive needs of the clean energy sector. In addition to these components, future clean energy indemnification systems should include written insurance policies; inclusion of litigation and investigation costs in the liability limitations; and removal and consolidation of all claims to one federal district court.

Clean energy technologies are the future in American power production. Such technologies offer a number of similarities – most notably the inherent nature of high-impact, low frequency risk in their development, maintenance and production processes. Accordingly, these energy sources invite a more in-depth analysis into the best practices in promoting and developing the proper technological advancements, financial investments, and insurance policies to protect and promote the development of clean energy while safeguarding the American public. The Price-Anderson Act should be at the forefront of this analysis.