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Nuclear Power or Renewable Energy?: Available Options in Today's Energy Market

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The blackout of 2003 and the skyrocketing prices of gasoline have put the topic of energy into the forefront of national debate in the United States. National resources are becoming scarce and foreign countries hold the power in fuel production and distribution. Lingering questions regarding the future of energy have spurred research into the best renewable resources and possible alternatives to fossil fuels. The energy market has a colossal impact on the economy and a profound effect on the environment. The future remains uncertain, but it is imperative that the United States and each individual state thoroughly examine alternative energy sources in order to alleviate the growing demand for energy as the population increases and the climate of the earth changes.

This Article will introduce the intricacies of nuclear power as well as some renewable energy resources: hydroelectric, wind, and solar power. Part I of the Article gives an in-depth analysis of the role of the federal government concerning nuclear power plants and the intricacies associated with the plants. Part II deals with the four nuclear power plants in New Jersey and evaluates their effectiveness as an energy source. Finally, Part III provides a breakdown of hydroelectric, wind, and solar power. It further discusses legislation created by the federal government and the state government of New Jersey in regards to renewable energy resources. Although New Jersey is the target of this analysis, it could be beneficial to many states that face an uncertain future in the energy market.

I. An Introduction to Nuclear Power and Nuclear Power Plants

Nuclear power is a growing source of energy production, not just in the United States, but throughout the world. In the year 2000, the United States generated almost 31% of the net nuclear electricity produced by the world while France was second with 16%.[1] Furthermore, "104 nuclear reactors licensed to operate in 31 States generated approximately one-fifth of [U.S.] electricity."[2] During the past decade, "nuclear electric generation has increased by 25 percent."[3] Nuclear power has become an exciting and beneficial alternative to the energy sources of the past, such as coal and other fossil fuels. Production expenses for nuclear reactors are more cost-effective than those of competing energy sources such as fossil fuels, thus making nuclear power a more attractive alternative.[4]

The Clean Air Act of 1970 provides for the continuing use of nuclear power as a source of energy for the United States.[5] As a result, 20% of the electricity produced in the United States will come from non-emitting nuclear energy to keep up with air quality standards that are needed to offset the pollutants that come from fossil fuel plants.[6] Each state is given a permit and cap as to the emissions it can produce for air pollution standards and nuclear energy allows a state to use the permitted levels of pollution to account for other energy resources.[7] Additionally, under the nuclear energy bill S. 472, nuclear power plants would be included in any "greenhouse gas" incentive program to improve capabilities to avoid or prevent emissions, encouraging construction of new nuclear power plants as an environmentally beneficial alternative to fossil fuels.[8] As an example of the benefit of nuclear energy, one can simply look at how states are dealing with the U.S. Environmental Protection Agency's (EPA's) cap on nitrogen oxide (NO_x) emissions. EPA placed an emissions limit for NO_x, a factor contributing to ground-level ozone, on 21 eastern states in order to reduce the production of the harmful gas.[9] Since EPA established this cap, almost 40% of New Jersey's limit

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1. U.S. Nuclear Regulatory Commission (NRC): Information Digest 30 (2002) (defining "net" as the total percentages of nuclear generation in the world) [hereinafter NRC Digest].
2. *Id.* at 20.
3. *Id.*
4. *Id.* at 21 (illustrating that in 2000, the cost per megawatt hour (mwh) for nuclear power plants was $18.29 whereas fossil steam and coal-fired plants cost $22.45 per mwh).
5. 42 U.S.C. §§7401-7671q, ELR Stat. CAA §§101-618 (Clean Air Act (CAA)). Nuclear Energy Institute, *Nuclear Energy Contributes to Clean Air Compliance*, *at* http://www.nei.org/doc.asp?catnum=2&catid=41 (last visited Jan. 5, 2005) (describing air pollution and the reduction of it by nuclear power plants) [hereinafter *Compliance*].
6. *Compliance*, *supra* note 5 (commenting on how the CAA assumes that nuclear energy will be included in future energy consumption).
7. *Id.*
8. S. 472, 107th Cong. (2001). *See also* Mark Holt & Carl E. Behrens, Congressional Research Service, Nuclear Energy Policy, Issue Brief for Congress CRS-3 (2002).
9. *Compliance, supra* note 5.

would have been used had there been no emission-free nuclear energy.[10]

One of the major advantages to nuclear power is its impact on the environment as compared to fossil fuels and coal. Nuclear energy is considered emission-free because the plants do not emit NO_x or sulfur dioxide (SO_2), which are known to affect the environment through smog and acid rain. Smog and acid rain damage forests, fish, and other living things and reduce "how far and clearly we can see through the air."[11] Nor do nuclear plants emit carbon dioxide (CO_2) or other greenhouse emissions, which have had a major impact on global warming.[12] The U.S. Department of Energy (DOE) noted that in 2001, nuclear power plants contributed almost one-third of the voluntary reductions in greenhouse gases, thereby allowing for a more safe alternative energy source.[13]

Additionally, the plants take up relatively small areas of land.[14] This provides several benefits. Since land development has boomed in recent years, many states, such as New Jersey, are creating legislation that opt for open space preservation.[15] This is not only to preserve the environment from the pollutants that come from such development, but it also protects the natural resources of the area. Nuclear power plants produce a large quantity of electricity on a few acres of land, while solar and wind farms, which occupy a large portion of land, have to be constructed in "geographically unpopulated areas far from energy demand."[16] For example, an average solar park may use 35,000 acres and a wind farm may use 150,000 acres[17] whereas the Salem and Hope Creek nuclear power plants in New Jersey are both situated on a 700-acre parcel of land.[18] Nuclear power plants can be great space savers.

Nevertheless, nuclear power has its disadvantages. Nuclear power plants are a possible source of radiation exposure as seen in the 1986 accident at Chernobyl, Russia, where the effects of radiation are still being uncovered today.[19] The United States had its own accident in Pennsylvania on Three Mile Island in 1979, and though the environmental damage was not as catastrophic as Chernobyl, the threat is always there.[20] During the last 40 years, several incidences of radiological contamination forced the Nuclear Regulatory Commission (NRC) to stabilize the area surrounding the plants in a short amount of time in order to protect the safety and health of the people in the surrounding area and the environment.[21]

Radiation leakage is a threat to the safety of the American people. The NRC has tried to alleviate some of the threat caused from human exposure by offering potassium iodide (KI) pills to states where nuclear power plants are present.[22] The U.S. Senate Committee on Environment and Public Works passed legislation in July 2002, S. 1746, which contained provisions on the federalization of KI pill distribution.[23] Along with that legislation, the Public Health Security and Bioterrorism Preparedness and Response Act of 2002, Pub. L. No. 107-188, "requires the federal government to give KI tablets to state and local governments to stockpile at schools, hospitals, and other public facilities within 20 miles of nuclear power plants."[24] The NRC has put forth almost $1 million to ensure that each person within a 10-mile radius of a nuclear power plant will have at least one or two pills.[25] Though 34 states currently have nuclear power plants, only 10 states, including New York and New Jersey, have requested the iodide pills.[26] The pills preclude the absorption of radioactive iodide in the thyroid gland in order to prevent certain types of thyroid cancers and other diseases that could result from accidental exposure.[27] Although this measure may be effective, it is imperative for states to also have an evacuation plan and shelters in the surrounding areas to protect the public from the other harmful effects of radiation.[28]

A second problem is that nuclear power plants produce low-level and high-level radioactive waste. Operators of the facilities must determine to handle the waste for thousands of years into the future.[29] The NRC and DOE are responsible for the operation, transportation, storage, and geologic disposal of nuclear waste.[30] In the congressional energy bill H.R. 4, enacted in 2002, DOE sought a budget increase of 40%, close to $527 million, for the nuclear

10. *Id*. (including several other states that would have a greater burden on the cap of NO_x such as Connecticut, Pennsylvania, South Carolina, and Virginia).
11. U.S. EPA, *Acid Rain, at* http://www.epa.gov/airmarkets/acidrain (last visited Jan. 11, 2005).
12. *Id*. *See also* Nuclear Energy Institute, *Environmental Preservation, at* http://www.nei.org/doc.asp?catnum=2&catid=38 (last visited Feb. 17, 2003) (describing the lowest environmental impact, emission-free energy sources, aquatic life conservation, wildlife conservation, land and habitat preservation, and endangered species with biodiversity protection) [hereinafter *Preservation*].
13. Nuclear Energy Institute, *Quantifying Nuclear Energy's Environmental Benefits, at* http://www.nei.org/doc.asp?catnum=2&catid=43 (last visited Jan. 11, 2005) (commenting on the annual emissions that can be avoided by having nuclear power plants and that one of the harms that arise from the gases is acid rain).
14. *Preservation, supra* note 12.
15. Press Release, Office of the Governor, Governor Showcases Her Commitment to Open Space Preservation in New Jersey: Unveils Sign as Public Reminder That State Is Serious About Land Preservation (Jan. 24, 2001), *available at* http://www.state.nj.us/transportation/press/2001releases/012401.htm.
16. *Preservation, supra* note 12 (characterizing the nature of land and habitat preservation that is an advantage of nuclear power plants).
17. *Id*.
18. Wackenhut, *Salem/Hope Creek Generating Station, at* http://www.wackenhut.com/object.php?obj=950029 (last visited Jan. 5, 2005) [hereinafter *Salem/Hope Creek*].
19. U.S. NRC, Regulator of Nuclear Safety 15 (2000) (providing information on the history of nuclear power plants as well as NRC inspections, how nuclear power plants operate, and the effects of radioactivity) [hereinafter NRC Regulator].
20. *Id*.
21. NRC Digest, *supra* note 1, at 94.
22. Jennifer Brown, *States Offer Free Pills No One Wants to Take* (June 7, 2002), *at* http://www.stateline.org/stateline/?pa=story&sa=showStoryInfo&id=242240 (detailing the distribution of KI pills to cities near nuclear power plants).
23. S. 1746, 107th Cong. (2002). *See* also Holt & Behrens, *supra* note 8, at CRS-7.
24. Public Health Security and Bioterrorism Preparedness and Response Act of 2002, Pub. L. No. 107-188, 116 Stat. 594 (2002). *See also* Holt & Behrens, *supra* note 8, at CRS-8.
25. Brown, *supra* note 22.
26. *Id*. (commenting that pharmaceutical companies will ship the pills directly to the states and New Jersey has requested 800,000 pills).
27. *Id*.
28. *Id*.
29. NRC Digest, *supra* note 1, at 82 (stating the "mission, goals, and statutory authority of the NRC as a regulatory agency").
30. *Id.* at 85.

waste disposal program.[31] This amount of money could drastically increase the possibility for research on waste management and disposal.

A lack of storage space for nuclear waste prompted the federal government to search for locations in which to hold the waste for a long time period. In 1982, the government enacted the Nuclear Waste Policy Act, which gave DOE the duty to research possible sites to build a repository.[32] In 1985, the choices were narrowed down to Hanford, Washington, Deaf Smith County, Texas, and Yucca Mountain, Nevada.[33] In 1987, Yucca Mountain was chosen as the only location to be researched.[34] The U.S. House of Representatives, in May 2002, passed H.J. Res. 87, which allowed Yucca Mountain to proceed as the location to store the waste.[35] By July 2002, President George W. Bush signed the resolution (Pub. L. No. 107-200) making Yucca Mountain a repository to store spent nuclear fuel and high-level radioactive waste.[36]

Located more than 100 miles from Las Vegas, Nevada, Yucca Mountain was chosen for its remote location, its dry climate, and its deep water table.[37] These characteristics are crucial because the life of nuclear waste could potentially last for thousands of years; therefore, the risk to the population as well as the environment must be limited.[38] The location must be remote in order to contain any exposure possible to the public, the climate must be dry because water could cause the radioactive waste to be displaced from the repository, and the water table must be deep, approximately 1,000 feet below the surface of the mountain, in order to prevent any possible rain or snow from penetrating the repository.[39] Although there are risks in transportation and storage for the repository, they are minimal.[40] A person who travels from Los Angeles to New York and then back receives a "5,000 to 12,500 times more radiation dose" than someone standing around 100 feet away from a moving truck carrying waste going at a slow speed.[41] Furthermore, in Amargosa Valley where radioactive particles flow to from water from Yucca Mountain, there would be "little or no increase in radiation exposure from the repository" for at least 10,000 years after the repository would be closed.[42] Therefore, Yucca Mountain would be a good choice for the repository.

Before nuclear power plants can be built, they go through an extensive process by the federal government to ensure safety by continued regulations. The NRC, created in 1974, along with the Atomic Energy Act of 1954, serve as the foundation for regulating the nuclear power industry.[43] The NRC has many duties, the most important of which are "licensing the design, construction, operation, and decommissioning of nuclear plants and other nuclear facilities, inspecting licensed and certified facilities and activities, and investigating nuclear incidents regulated by the NRC."[44] The NRC does not own or operate any of the nuclear power plants in the United States—a majority are privately owned; however, it regulates and monitors them.[45]

Regulation of nuclear power plants is intensive and strict. This is because of the inherent risks involved when dealing with radioactive material.[46] The effects of exposure to radiation are dependent on a number of factors. The time of exposure, the distance between the object emitting the radiation and the person, as well as the type of radiation play roles in determining the amount of potential harm to the people closest to the nuclear power plants.[47] The risks can be reduced by proper regulations and safety inspections. Inspections are extremely important because of the risks that power plants cause to the public and environment. An inspection is done to review "plant security, emergency planning, radiation protection, environmental monitoring, periodic testing of plant equipment and systems, fire protection, construction activities," and other specific concentrations.[48] Inspections are a necessary tool of the NRC to promote safety.

The NRC has created four regions of nuclear power reactors in order to easily track licenses, inspections, and other such activities.[49] For example, New Jersey is classified in Region 1 (containing most of the northeastern states) with its four nuclear power plants.[50] A license is approved by the NRC for a period of 40 years and can be renewed for subsequent 20-year periods.[51] Renewing the license is up to the owner of the nuclear power plant and dependent upon the economic situation of the plant and whether or not it can still conform to the regulations of the NRC.[52] This is an important process because some of the first nuclear power plants built in the United States are in line for the first round of renewals and it will be beneficial to assess the progress of nuclear energy since the inception of the first plant.

31. H.R. 4, 107th Cong. (2001). *See also* HOLT & BEHRENS, *supra* note 8, at CRS-1.
32. Office of Civilian Radioactive Waste Management Yucca Mountain Project, *History of Nuclear Waste Program, at* http://www.ocrwm.doe.gov/ymp/about/history.shtml (last visited Jan. 5, 2005) (commenting on the process taken to determine where nuclear waste should be stored).
33. *Id.*
34. *Id.*
35. H.R.J. Res. 87, 107th Cong. (2002). *See also* HOLT & BEHRENS, *supra* note 8.
36. Yucca Mountain Repository Site Approval Act, Pub. L. No. 107-200, 116 Stat. 735 (2002). *See also* Press Release, White House, President Signs Yucca Mountain Bill (July 23, 2002), *available at* http://www.whitehouse.gov/news/releases/2002/07/20020723-2.html.
37. Office of Civilian Radioactive Waste Management Yucca Mountain Project, *Why Yucca Mountain?, at* http://www.ocrwm.doe.gov/ymp/about/why.shtml (last visited Jan. 5, 2005).
38. *Id.*
39. Office of Civilian Radioactive Waste Management Yucca Mountain Project, *Overview: Yucca Mountain Project, at* http://www.ocrwm.doe.gov/factsheets/doeymp0026.shtml (last visited Jan. 5, 2005) (explaining how the repository works).
40. Office of Civilian Radioactive Waste Management Yucca Mountain Project, *Americans' Average Radiation Exposure*, *at* http://www.ocrwm.doe.gov/factsheets/doeymp0337.shtml (last visited Jan. 11, 2005).
41. *Id.*
42. *Id.*
43. NRC DIGEST, *supra* note 1, at 3-4.
44. *Id.* at 6.
45. *Id.* at 47 (clarifying the process for oversight of U.S. Commercial Nuclear Power Reactors).
46. NRC REGULATOR, *supra* note 19, at 1.
47. *Id.* (explaining why nuclear power plants should be regulated).
48. *Id.* at 5.
49. NRC DIGEST, *supra* note 1, at 41-44.
50. *Id.* at 41.
51. *Id.* at 52 (commenting on the future of nuclear power reactor licensing and renewal process).
52. *Id.*

There are two different types of nuclear power plants in the United States.[53] The first type is called a pressurized water reactor (PWR).[54] This is a two-step system in which the heated water is carried in pipes where a second set of pipes creates steam to spin the turbine.[55] Cool water returns back to the reactor and the process keeps going.[56] The second style of reactors is called the boiling water reactor (BWR).[57] In this process, the water in the reactor is brought to a boil and creates its own steam, which goes directly into the turbine.[58] The steam is then converted into the electricity that is used within the states.[59] About 66% of the nuclear power plants are PWRs[60] because the water is only under pressure and it does not boil allowing most of the radioactivity to remain in the reactor.[61]

Understanding how a nuclear power plant operates is essential in determining how to best use the energy resources of the United States. Obtaining nuclear power is a complex process that can yield harmful results and, therefore, alternatives must be researched and implemented. In order to determine the best choice, there will be an exploration into the nuclear power plants within New Jersey and a further examination of alternative energy sources that could be more or less beneficial to the state. Even with the amount of information available, every choice can be disputed, but one thing remains vital—whichever energy source predominates in the United States, and specifically New Jersey, the energy choice must have long-term capabilities to ensure a healthy environment and independence from other nations.

II. Effects of the Four Nuclear Power Plants in New Jersey

New Jersey has four nuclear power plants located on three sites: Oyster Creek, Hope Creek, and Salem Creek (which has two nuclear units).[62] The plants, located in southern New Jersey, produce nearly 49.3% of the electricity produced in the state.[63] Utilizing the benefits of nuclear power, New Jersey has been able to reduce the harmful emissions that pollute the air, alleviating some of the adverse effects from emissions on the environment felt from traffic and industry.[64] Even with the advantages of nuclear power, New Jersey has faced some issues ranging from dead fish to possible cancers from nuclear waste and radiation. New Jersey must evaluate the best possible energy resources available to meet the growing demand for energy.

A. Oyster Creek

The Oyster Creek nuclear power plant, near the Jersey Shore, is located in Lacey Township.[65] Built in 1969, Oyster Creek is the oldest commercial nuclear power plant in the United States still in operation.[66] This plant is a BWR that generates almost 650 net megawatts.[67] In 2002, the new owners (AmerGen) of the Oyster Creek nuclear power plant looked into the possibility of extending the life of the plant, a decision that has to be made by April 9, 2004, although the license expires on April 9, 2009.[68] Even though there was a withdrawal of the request, there is still time to submit the application to the NRC, which would renew the license for another 20 years, or the owners could decide to shut the plant down all together.[69] The shutdown could lead to job loss but there would be fewer risks to the community in terms of cancer scares and water pollution.

In 1972, one issue that concerned the residents of Lacey Township was the increased number of dead fish in the nearby waterways. In *State v. Jersey Central Power & Light Co.*,[70] a suit was brought claiming that hazardous substances were introduced into the waters, a violation of New Jersey statute §23:5-28.[71] The case would also help to determine if the cause of the dead fish was the Oyster Creek nuclear power plant. After many hearings, on December 4, 1964, Lacey Township issued a permit to Jersey Central Power & Light Company (J.C.P. & L.) to "build a boiling water nuclear fueled reactor at Oyster Creek" in order to help abate some of the energy burdens in the state.[72] One of the concerns with the plant was that it would need to cool its condensers and the plan was to use water, a close source.[73] The plant was to be situated between Oyster Creek and the South Branch of Forked River, all which would flow into Barnegat Bay.[74] The proposition was to have water from Forked River "run through the plant where it would be heated," then it would be returned to Oyster Creek leading to the bay.[75] The fear was that because of the heated water, a change in the bay's environment could endanger the fish population.[76]

In accordance with the plan, the water was pumped from the river into the condensers, which was then discharged into the creek, leading to a increase of approximately 20 de-

53. NRC Regulator, *supra* note 19, at 10.
54. *Id.* (noting that water slows down the chain reaction in order for the process to continue).
55. *Id.* (reporting on the process of pressurized water reactors and then comparing that to the process of boiling water reactors).
56. *Id.*
57. *Id.* (providing that only one-third of nuclear reactors are BWR).
58. *Id.*
59. *Id.* at 11.
60. *U.S. Nuclear Reactors*, *at* http://www.eia.doe.gov/cneaf/nuclear/page/nuc_reactors/reactsum.html (last visited Jan. 11, 2005).
61. Nuclear Science & Technology, *Electricity: Types of Plants: Pressurized Water Reactor*, *at* http://www.aboutnuclear.org/print.cgi?fC=Electricity,Types_of_Plants,Pressurized_Water_Reactor (last visited Jan. 11, 2005).
62. Nuclear Energy Institute, *Nuclear Power in New Jersey*, *at* http://www.nei.org/documents/maps/statebystate/newjersey.html (last visited Jan. 5, 2005).
63. *Id.*
64. *Id.* (describing the clean air benefits to New Jersey).
65. *Id.*
66. Exelon, *Oyster Creek Generating Station*, *at* http://www.exeloncorp.com/generation/nuclear/gn_oyster.shtml (last visited Jan. 5, 2005).
67. *Id.*
68. Newsday.com, *Nuclear Plant Owner Withdraws Bid for Filing Extension* (Sept. 26, 2002), *available at* http://www.ohiocitizen.org/campaigns/electric/pre2003/oyster_creek.htm.
69. *Id.*
70. 351 A.2d 337, 6 ELR 20352 (N.J. 1976).
71. *Id.* at 342.
72. *Id.* at 339.
73. *Id.* (referencing that a study would be conducted to examine the affects of the discharge of the plant into the water).
74. *Id.*
75. *Id.*
76. *Id.* (explaining that the town board "disclosed no significant radiation hazard associated with the proposal").

grees Fahrenheit (˚F).[77] The primary fish that live in the water and that were killed were menhaden, which are "caught in New Jersey, Delaware, Maryland, and parts of Long Island" and migrate to these warmer waters because they cannot survive temperatures under 39˚F.[78] Between January 27 and January 31, 1972, the plant became inoperative; therefore, there was unheated water being pumped into Oyster Creek.[79] In the next hours, the temperature of the creek fell from 60˚F to 34˚F, and although this change killed the fish because of the drop in temperature, the evidence showed that the change would have occurred anyway once the creek's water combined with the river.[80] Since the drop in temperatures would have occurred naturally at some period, the plant could not be held responsible for the death of the fish since the plant's warm water was actually keeping the menhaden there for a longer period of time than normal.[81] Therefore, the state could not prove its case that the Oyster Creek nuclear power plant was the cause in fact of the fish dying.

In that case, New Jersey tried to use statute §23:5-28,[82] Pollution and Obstruction of Waters, to make the Oyster Creek nuclear power plant responsible for some of the aftereffects of the plant. The argument did not survive because the natural course of the fish was to migrate to warmer waters and the plant was under no obligation to continue pumping in the warm water just so the fish could thrive in those waters. The statute explains that no person shall place any hazardous, poisonous, or other such materials in a manner where it could harm fresh or tidal waters in the state.[83] Since the power plant was found to have not violated the statute, the company did not face any of the penalties associated with the statute.

Even though the Oyster Creek plant was not responsible for the dead fish in the 1972 incident, in September 2002, hundreds of fish were found dead near the power plant when the "pump used to cool water was taken off line."[84] The water temperature rose nearly 20˚F to make it 106˚F after the shutdown.[85] The matter was to be taken under investigation by the New Jersey Department of Environmental Protection (NJDEP).[86] In December 2002, the NJDEP issued a fine of $190,000 to AmerGen for "violating the Water Pollution Control Act" and additionally the state seeks "$182,912 in natural resource damages for the subsequent killing of more than 5,800 fish caused by the illegal plant operations."[87] The problems for the Oyster Creek nuclear power plant still exist after all these years.

77. *Id.* at 340.
78. *Id.*
79. *Id.* (noting that the plant had to shut down on January 27, 1972, as the generator became inoperative the next day, and the generator was not able to come back on until January 31, 1972).
80. *Id.*
81. *Id.* at 341.
82. N.J. STAT. ANN. §23:5-28 (1997).
83. *Id*. §23:5-28
84. KYW-TV, *Fish Kill at Oyster Creek N.J. Power Plant*, CBS 3, Sept. 25, 2002, *available at* http://kyw.com/Local%20News/StoryFolder/story_1159868924_html/?pp=1.
85. *Id.*
86. *Id.*
87. Jersey Coast Anglers Ass'n, *Oyster Creek Generating Station Fined for Water Violations and Fish Kill: DEP Seeks Compensation for Natural Resource Damages*, JCAA NEWS, Dec. 12, 2002, *available at* http://www.jcaa.org/JCNL0301/FishKill.htm.

Another major concern among residents living in close proximity to the nuclear power plants is that of possible links to cancer from the radiation. A study commenced in 1958 in St. Louis was conducted using the teeth of young children to determine levels of the radionuclide strontium-90 (Sr-90), which can damage stem cells of bone marrow and affect important tissues in the body.[88] The study was conducted over a span of time, and in its first few years it concluded that the Sr-90 levels increased when there was nuclear weapon testing, but it declined when the testing ceased.[89] The Otto Hug Radiation Institute in Germany also had conducted tests showing that radioactivity in the teeth increased almost 10 times in the aftermath of the Chernobyl accident.[90] As of 2000, the Radiation and Public Health Project, which began studying Sr-90 concentrations in baby teeth in 1998, analyzed teeth from Suffolk County in Long Island, which is located in an area surrounded by the Indian Point nuclear power plant in New York and the Oyster Creek nuclear power plant in New Jersey, as well as plants in Connecticut.[91] During the winter winds, radioactive particles fly southeast from Indian Point to Suffolk County whereas the summer winds carry particles from Oyster Creek north-northeast to the county.[92] The study labeled Oyster Creek and Millstone (a power plant in Connecticut) to "have emitted the second- and third-highest levels of airborne iodine-131 and other particulates since 1970" amid the plants located in the United States.[93]

The Radiation and Public Health Project study made conclusions showing that an increase in the levels of Sr-90 is correlated to increased radioactivity.[94] The tests revealed that since Sr-90 "does not exist in nature . . . , the source of these elevated levels is likely nuclear power plant emissions."[95] With the levels on an increase, there was a 47% rise in the cancer rates among young children in the Suffolk region over a three-year period and when the levels of Sr-90 decreased, so did the incidence of cancer.[96] The end result showed that increased radioactivity from accidents, such as Chernobyl and Three Mile Island, and standard emissions from nuclear power plants are linked to rising rates of cancer.[97]

A petition from concerned citizens in the southern New Jersey region supports the closing of the Oyster Creek nuclear power plant. The petition states that the study con-

88. Joseph J. Mangano, *Strontium-90 in Newborns and Childhood Disease*, ARCHIVES ENVTL. HEALTH, July/Aug. 2000, at 240, *available at* http://www.findarticles.com/p/articles/mi_m0907/is_4_55/ai_65948995 (providing a report detailing the effects of Sr-90).
89. *Id.*
90. *Id.*
91. *Id.* (indicating that since radioactivity increased in the teeth while there was no nuclear testing, the contributing factor for the high levels came from nuclear power plants).
92. *Id.*
93. *Id.*
94. *Id.* (linking the highest concentrations of radioactivity in teeth when nuclear accidents, such as Three Mile Island, occurred, and showing increased levels of cancer at those time periods).
95. *Id.* (explaining that the embryo, fetus, and infants are more susceptible than adults to radioactivity, causing increased rates of cancer among children).
96. *Id.*
97. *Id.* (providing that the study will not only assess how the radioactivity is correlated to increased cancer rates, but how radioactivity produces a decline in the overall health in children).

ducted on baby teeth demonstrates that nearly two out of three children around the Jersey Shore area and the rest of the state where nuclear power plants are located have high levels of Sr-90 in their teeth and that the plant is located only nine miles from Toms River where a large group of children were diagnosed with cancer.[98] Additionally, the petition stated that emissions can travel up to 50 miles by air and water and Oyster Creek has the dirtiest nuclear plant fallout in the United States, which is nearly five times higher than Three Mile Island.[99] Besides Sr-90, Cesium 137, a product resulting from nuclear fission, has also been found in older homes around Toms River, and other contaminants have made some soil radioactive in surrounding areas of the Oyster Creek nuclear power plant.[100] Research up to this point shows that the repercussions from nuclear power plants could be felt long into the future.

The community of Lacey Township was also aware of the risks surrounding nuclear waste when they attempted to create an ordinance that prohibited importation of spent nuclear fuel and other waste for storage purposes. The Oyster Creek plant is authorized to store spent nuclear material on-site.[101] Formerly, J.C.P. & L. was able to send the plant's waste to a site in New York. In 1976, however, New York refused to take additional waste. In 1983, New York decided to ship the waste back to the plant. In response, the town tried to create an ordinance in order to stop the waste from reentering the township.[102] But in *Jersey Central Power & Light Co. v. Township of Lacey*,[103] the U.S. Court of Appeals for the Third Circuit held that the Atomic Energy Act of 1954, along with the Hazardous Materials and Transportation Act, preempted the local ordinance.[104]

Lacey Township not only wanted to stop the importation and storage of the waste at the Oyster Creek nuclear power plant, but they also sought to impose monetary penalties for a violation of the ordinance.[105] However, the penalties were declared unconstitutional and the ordinance was said to violate the Supremacy Clause since there had already been federal jurisdiction over this area.[106] Because the ordinance concerned an area of safety, the Atomic Energy Act was the prevailing law.[107] The township was unable to regulate the movement of the waste not only because of safety concerns, but also because to do so would impede the free movement of the hazardous material across the highways.[108] The future of the Oyster Creek nuclear power plant is unclear, but it has certainly had its problems since the inception of the plant in 1969.

B. Hope Creek

The Hope Creek nuclear power plant is located in Lower Alloways Creek Township, New Jersey. This plant has been owned by Public Service Electric and Gas Company (PSE&G) since the initial proposal to build the plant.[109] Hope Creek was originally "envisioned" to have two units, but the accident at Three Mile Island made it too expensive so the plant only has one.[110] Since nearly one-half of all the electricity in New Jersey comes from nuclear power, the Hope Creek plant plays a major role in providing the state's energy needs.[111] Several problems with Hope Creek have existed and still do exist, such as the fact that a residential area is located only 3.5 miles from the plant,[112] but the plant has not had any recent troubles.

PSE&G recently went to the NRC to seek permission to increase the power production of the Hope Creek nuclear power plant.[113] The NRC approved the increase in the plant's generating capacity by 1.4%, giving the plant the capability to produce approximately 1,133 megawatts of electricity.[114] The NRC did a careful evaluation before deciding that Hope Creek was ready for more power.[115]

The NRC, in periodic reviews, assesses the Hope Creek nuclear power plant for its performance. Hope Creek was evaluated in 1996 and was given an overall rating of "good."[116] The NRC bases its ratings on four major areas of the plant: operations; maintenance; engineering; and plant support.[117] Although the NRC found improvements in three of the four major areas from the previous evaluation, Hope Creek was only "good" because the NRC noticed a decline in plant support due to "problems with security, radiation exposure controls and emergency preparedness implementation."[118] The problems of nuclear power plants often exist because every minute detail of the plant

98. Garden State EnviroNet, *Oyster Creek Nuclear Power Plant Petitions*, EnviroNews, Sept. 20, 2000, *available at* http://www.gsenet.org/library/11gsn/2000/gs01002b.htm (questioning the health impacts of nuclear power plants and promoting a suspension of operations of the New Jersey nuclear power plants).

99. *Id*.

100. T.E.A.C.H, *Slightly Elevated Levels of a Nuclear Fission Byproduct Found in Toms River, N.J., Dust Study*, *at* http://www.tr-teach.org/resources/covers/2001december.html.

101. Jersey Cent. Power & Light Co. v. Township of Lacey, 772 F.2d 1103, 1105, 15 ELR 20940 (3d Cir. 1985) (defining spent fuel and noting that spent fuel is highly radioactive and long-lived, is stored in a water-filled pool at the site, which is only a short-term solution, and that it constitutes "hazardous materials" as defined in the Hazardous Materials Transportation Act (49 U.S.C. §1802(2))).

102. *Id.* at 1106.

103. 772 F.2d 1103, 15 ELR 20940 (3d Cir. 1985).

104. *Id*. at 1104.

105. *Id.* at 1108.

106. *Id.* at 1108-09.

107. *Id.* at 1112.

108. *Id.* at 1113. *See also* N.J. Stat. Ann. §27:5H-1 (1998).

109. PSE&G, *Hope Creek Generating Station, at* http://www.pseg.com/companies/power/pdf/factsheets/hope_creek.pdf (last visited Mar. 10, 2003) (providing a fact sheet about Hope Creek).

110. *Id.* (stating that the plant received its permit to begin construction in 1974 and was completed in 1986).

111. *Id.*

112. *Salem/Hope Creek, supra* note 18.

113. U.S. NRC, NRC Approves Power Uprate for Hope Creek Nuclear Power Plant in New Jersey (2001), *available at* http://www.nrc.gov/reading-rm/doc-collections/news/2001/01-095.html.

114. *Id.*

115. *Id*. (describing that the NRC performed a safety evaluation before making a determination to allow increased power including such things as instrumentation and control systems, accident evaluations, and electrical systems where they determined that with a few modifications to the equipment and other minor changes, the plant could safely generate more power).

116. U.S. NRC, Hope Creek Nuclear Power Plant Receives "Good" Ratings in NRC's Latest Systematic Assessment of Licensee Performance Report (1996), *available at* http://www.gsenet.org/library/16nuc/hopcrkgd.htm.

117. *Id*. (rating the plant by three categories, the best being "superior," the next being "good," and the lowest is "acceptable").

118. *Id*. (commenting that the reports based on performance are issued approximately every 18 months by the NRC).

must comply with numerous regulations and standards, making it difficult for plants to keep up with all necessary daily performances.

In the case of *In re PSE&G Shareholder Litigation*,[119] a number of problems concerning the Hope Creek nuclear power plant came to light when the shareholders of PSE&G accused the company of recklessly mismanaging the nuclear power plants it owned.[120] Even though the court ruled against the shareholders for many reasons, the case brought to light many failures of the nuclear power plant and it shed light on some incidents that may not have been common knowledge to the population surrounding the plant. In 1995, there was a release of radioactive material during maintenance operations at Hope Creek; a few months later, a shutdown went amiss "when the plant's operators left a discharge valve open, causing an increase in the reactor coolant temperature."[121] During the NRC's assessment of the plant's performance, Hope Creek was given an "acceptable" rating—the lowest one available—because of the incidences to which it was prone, and another evaluation by an oversight organization gave Hope Creek a "poor" rating.[122] Because of the many problems the NRC encountered with the plant, PSE&G received several penalties, including fines and oversight by the NRC.[123]

C. Salem

The Salem nuclear power plant harbors two units, both located in Lower Alloways Creek Township, New Jersey, adjoining the Hope Creek nuclear power plant, where both are situated on the same parcel of land.[124] PSE&G is the owner and operator of the Salem nuclear power plant as well as the Hope Creek plant.[125] The Salem nuclear power plant is the center of production of electricity for New Jersey since its capabilities of generating power are greater than Oyster Creek and Hope Creek.

The Salem units have encountered many of the same problems as Oyster Creek and Hope Creek, though the Salem plant has taken extra steps to make amends for any possible concerns associated with nuclear power plants, such as preserving wetlands and the surrounding habitats. The Salem plant has also had a problem with fish being killed in the local waterway, the Delaware River and Delaware Bay, because of changes in water temperature since the plant uses almost 3.024 billion gallons of water per day on a monthly average.[126] Annually, almost three billion fish of different varieties are killed in the Delaware River and Delaware Bay combined, creating outrage among many environmentalists.[127] Despite the fish killing, the Salem plant applied for a renewal of its permit to use the Delaware waterways and its application was approved on June 29, 2001.[128]

When the Salem nuclear power plant received its initial permit in 1994, the NJDEP created a restoration program, the PSE&G Estuary Enhancement Program (EEP), to offset, to a certain extent, the negative effects of the plant on the environment.[129] With the permit, PSE&G agreed to restore 32 square miles of coastal waterways in New Jersey and Delaware by implementing such things as creating fish ladders to help the fish travel and stay away from the plant and preserving 14,500 acres of wetlands in order to restore and improve animal habitat.[130] With the renewal of the permit 2001, the NJDEP allotted $7.8 million toward the EEP project and PSE&G will be required to conduct research and monitor the impact on the fish and the success of its previous devices to help the fish.[131] The EEP is the "largest privately funded wetlands restoration and improvement program in the country" and is regarded as necessary for the protection of the environment from the effects of nuclear power plants.[132]

The Salem nuclear power plant has been plagued with many problems as presented in the case of *In re PSE&G Shareholder Litigation*, discussed above.[133] During the time period in question in that case, the Salem plant was severely fined for several malfunctions and safety violations.[134] The most notable events that occurred are as follows: (1) in February 1983, the plant's reactor protection systems failed to run automatically, forcing the shutdown to be done manually; (2) in November 1991, one of the turbines exceeded its safe maximum speed, causing parts of the blades to fly off the shaft; (3) in December 1992, some managers were accused of harassing a group of employees who wanted to file an incident report in regard to the plant's safety; (4) the same month, an employee turned off the annunciator, which alerts employees in case of emergencies, without anyone knowing about it for nearly 90 minutes; (5) in June 1993, the second unit had to be shut down because of a failure in the rod control system; (6) in 1994, unit one was shut down because some marsh grass had clogged the water coolant system; and (7) in 1995, both units had to be shut down at the same time for failures in pieces of equipment.[135]

The NRC was forced to take several steps after nearly every incident to ensure the safety of the plant, the surrounding area, and the people. After the 1983 incident, the plant's license was revised, "requiring remedial actions to assure the safe operation of the plant."[136] The 1991, 1992, and 1993 incidents were followed by safety inspections performed by the NRC, and because of the enormity of the problem in 1995, the NRC prohibited the plant from restarting the units

119. 801 A.2d 295 (N.J. 2002).

120. *Id.* at 301.

121. *Id.*

122. *Id.* at 302.

123. *Id.*

124. PSE&G, *Salem Generating Station, at* http://www.pseg.com/companies/power/pdf/factsheets/salem.pdf (last visited Mar. 10, 2003) (providing a list of facts about the Salem nuclear power plant).

125. *Id*. (stating the first unit began its production of electricity in December 1976 and the second unit started in May 1981).

126. Garden State EnviroNet, *New Jersey Renews Nuclear Plant's Water Permit Despite Fish Kills*, EnviroNews, July 19, 2001, *available at* http://www.gsenet.org/library/11gsn/2001/gs010720.php (describing what the owner's of the nuclear power plant are to provide in order to receive the permit to use the Delaware River).

127. *Id*. (noting the temperature change in the water and the fact that the fish are drawn through water intakes at the plant contribute to the death toll).

128. *Id.*

129. *Id.*

130. *Id.* (requiring PSE&G to purchase a minimum of 8,000 acres of degraded wetlands plus additional land in order to receive the permit).

131. *Id.*

132. PSE&G, *Salem Generating Station*, note 124.

133. 801 A.2d at 295.

134. *Id.* at 301.

135. *Id.*

136. *Id.* at 302.

without approval from the NRC.[137] For the years of 1993 and 1994, the plant received a rating of "acceptable," and it placed the plant in the "bottom quartile nationally."[138] In 1997, the NRC put the Salem plant on its "watch list."[139] The fines assessed to PSE&G incorporated both the Salem nuclear power plant and the Hope Creek nuclear power plant, totaling over $2 million.[140] The company had tried to resolve many of the possible problems by upgrading equipment in 1989; nevertheless, the following years proved disastrous in terms of the mistakes by the plant.[141]

The nuclear power plants in New Jersey have obviously affected many communities surrounding them in terms of the environment and personal health. The benefits of nuclear power plants have not outweighed or even been balanced with the disadvantages. The short- and long-term consequences still exist and would be unknown for several years. Radiation leakage, problems with storage, and many other environmental factors will have to be monitored and researched in order to determine the best long-term energy source for New Jersey with the least amount of consequences to the public and environment. Although nuclear power may aid in the present energy crisis, nuclear power will not be an effective long-term solution as long as the side effects are producing such horrible consequences.

III. Alternative Energy Sources: Hydroelectric Power, Wind Power, and Solar Energy

Renewable energy is on the cusp of federal and state legislation. The United States has prided itself on discovery and it is time to discover alternative sources of energy. In the Renewable Energy Investment Act of 2003, the federal government sought to "enhance national security, environmental quality, and economic stability by increasing production of clean, domestically produced renewable energy as a fuel source for the national electric system."[142]

A. Hydroelectric Power

Hydroelectric power, or hydropower, is one of many renewable energy sources used by states. Hydroelectric power is an energy cycle whereby water evaporates from the many bodies of water, precipitation then falls in the form of rain or snow, where the water eventually finds itself back in the oceans and lakes.[143] This type of power generates about 7% of the total electricity produced in the United States.[144] Additionally, hydroelectric power provides approximately 99% of electricity stemming from renewable energy sources.[145] According to a House bill, H.R. 1337, the U.S. Congress wishes to "encourage the development of hydroelectric projects" by providing many incentives, including payments to operators of qualified hydroelectric facilities and authorizing appropriations of $50,000,000 for "each of the fiscal years 2004 through 2013" to carry out the incentive payments.[146]

Hydropower, like any other source of energy, has its advantages and disadvantages. One advantage is that hydroelectric power is a renewable energy source that does not rely on foreign countries to supply the resource.[147] This type of energy source is also environmentally friendly because it does not emit pollutants into the atmosphere, as do many fossil fuels.[148] CO_2, one of the harmful emissions, is lowered by the use of hydroelectric power because the very nature of this energy comes from natural resources.[149] Hydropower also has the ability to meet increased power demands in a quick period of time all while operating with very low costs.[150] These types of projects also can provide benefits beyond that of generating power, such as creating a water supply, aiding in flood control, navigating, and recreating.[151] Hydroelectric power has the potential for many benefits to the environment.

There are, however, several problems encountered with hydropower. First of all, although operating costs may be low, initial building costs are quite high.[152] Secondly, there are environmental impacts associated with the hydroelectric power plants. This type of power could alter the flow of rivers or streams, decrease the quality of the water, kill fish

137. *Id.*

138. *Id.*

139. *Id.* (explaining the "watch list" to mean that a plant that had encountered many problems would be carefully watched by the NRC in case of future problems where the plant might need approval from the NRC for operation).

140. *Id.*

141. *Id.*

142. S. 944, 108th Cong. (2003) (discussing renewable sources including wind, solar sources, and incremental hydropower).

143. Idaho National Engineering & Environmental Laboratory, *More About Hydropower, at* http://hydropower.id.doe.gov/hydrofacts/pdfs/01-ga50627-01-brochure.pdf (last visited Jan. 12, 2005) (giving a description of how turbines and generators are built in or around dams or pipelines to carry pressurized water into the powerhouse stations that generates electricity, that the power comes from the flow rate of the water combined with the elevation at which the water falls from its location through the plant, and that there are also two categories of hydroelectric power, conventional and pumped storage).

144. Idaho National Engineering & Environmental Laboratory, *Hydropower Research and Development, at* http://hydropower.id.doe.gov/research/default.shtml (last visited Jan. 12, 2005) (providing some of the reasons for research and development of hydropower).

145. M.J. Sale et al., U.S. Department of Energy Idaho Operations Office, OE Hydropower Program Annual Report for FY 2001, at 1 (2002).

146. H.R. 1337, 108th Cong. (2003). The bill states that

> hydropower is a domestic energy source which currently produces 92,000 megawatts of electricity per year, a figure representing 10 percent of the generation capacity in the United States, that the Energy Information Agency estimates that, of the 75,000 dams in the United States, only 2,400 or three percent of these dams currently produce electricity, and that 92,000 megawatts of electricity currently generated by hydropower avoid the annual emission of 4.75 million tons of sulfur dioxide and 2 million tons of nitrous oxide by eliminating the need to burn 345 million tons of coal.

147. Idaho National Engineering & Environmental Laboratory, *supra* note 143 (commenting on the "large renewable domestic resource base" creating an important advantage).

148. *Id.*

149. James E. Francfort, Hydropower's Contribution to Carbon Dioxide Emission Reduction 1 (Idaho National Engineering & Environmental Laboratory 1997), *available at* http://hydropower.inel.gov/environmental/pdfs/ornlecon.pdf (last visited Jan. 12, 2005).

150. Idaho National Engineering & Environmental Laboratory, *supra* note 143.

151. Sale et al., *supra* note 145.

152. Idaho National Engineering & Environmental Laboratory, *supra* note 143 (describing the numerous disadvantages associated with hydropower although commenting that "proper design and operation" could "mitigate these impacts").

when they inadvertently get caught in the turbines, prevent the migration of fish, and possibly flood nearby ecosystems.[153] DOE has developed a program, the Advanced Hydropower Turbine System, in order to research, study, and find solutions to the adverse impacts on the environment.[154] The goals of the program are to reduce the rate of fish mortality by using new turbine technology, to improve the quality of water by having more oxygen dissolved during the flow, and to reduce the amount of CO_2 that could pollute the air.[155]

Though many states incorporate the use of hydroelectric power to generate electricity, New Jersey does not have any hydroelectric plants that generate hydropower for the state supply of energy.[156] Though the state borders the Atlantic Ocean, many of the areas surrounding the ocean are used for recreation. Building a hydroelectric power plant in any of the outlying areas could be detrimental to the tourism industry in New Jersey since the beaches attract many people throughout the year. The Jersey Shore, as it is often referred, is well known and the entire coast is filled with boardwalks from the northern tip of the state down to Atlantic City and Wildwood. A hydropower plant could devastate the economy if there was less access to the beaches.

New Jersey is not blessed with inner waterways, rivers, or lakes that have the capability to hold large hydroelectric power plants. Many of the states that are able to incorporate hydroelectric power into their energy production have access to water sources that would not adversely effect the economy or availability of space as it would in New Jersey. New Jersey houses some developed sites where the potential to use hydropower could be harnessed; however, none produce any power because the resources needed to create and run such facilities are not available.[157] According to Hydropower Evaluation Software (HES), created by DOE's Hydropower Program to assess potential hydropower sites along with other suitability factors, New Jersey has an undeveloped hydropower capacity of 81.82%, meaning that the potential does exist for possible use of hydropower in the state.[158]

Though the Federal Energy Regulatory Commission (FERC) regulates hydroelectric power plants, the generation of hydropower is not only expected to decline through 2020 by 6% because of changes in the federal budget, environmental factors, and complex regulations set forth by the government, but "no new hydropower capacity is predicted through 2020."[159] The 108th Congress created the omnibus energy bill, H.R. 6, to determine energy policy for renewable energy.[160] Although the omnibus bill has yet to pass, legislation has been passed as a result in regards to tax credits and certain budgets for fiscal year (FY) 2004 and FY 2005.[161] In terms of hydropower, the 2004 budget was $4.9 million and DOE sought $6 million for FY 2005 but received only $5 million.[162] In addition to the budget, the president signed the American Jobs Creation Act on October 22, 2004, which provides for a renewable energy production tax credit, including a half-credit over five years for small hydropower used for irrigation.[163] Even though a large percentage of renewable energy production comes from hydropower, the federal government has provided little funding and in fact looks to the states to use "green power," which is electricity supplied by renewable energy, on their own.[164] With a lack of funding and incentives to use hydropower, New Jersey will probably remain among the bottom of the 50 states in using hydroelectric power as an alternative renewable energy resource.

B. Wind Energy

Wind energy is another alternative energy source that can be used to replace some of the more environmentally harmful power sources. Wind energy uses turbines to convert wind into electricity that can be used in homes, businesses, schools, and elsewhere.[165] Wind occurs naturally in the environment since it is a form of solar energy.[166] Collectively, the U.S. wind industry produces enough electricity to serve about one million people.[167] Since wind energy is an import

153. *Id.*

154. Idaho National Engineering & Environmental Laboratory, *Hydropower Technology Transfer, at* http://hydropower.id.doe.gov/hydrofacts/pdfs/01-ga50627-01-brochure.pdf (last visited Jan. 12, 2005) (explaining the Advanced Hydropower Turbine Systems Program and its benefits).

155. *Id.*

156. Idaho National Engineering & Environmental Laboratory, *Undeveloped Hydropower Potential, at* http://hydropower.id.doe.gov/hydrofacts/pdfs/01-ga50627-01-brochure.pdf (last visited Jan. 12, 2005) (graphing the megawatts of undeveloped hydropower potential for the United States).

157. Alison M. Conner et al., U.S. Hydropower Resource Assessment Final Report 21 (Idaho National Engineering & Environmental Laboratory 1998), *available at* http://hydropower.inel.gov/resourceassessment/pdfs/doeid-10430.pdf (last visited Jan. 12, 2005).

158. *Id.* at iii, 30.

159. Sale et al., *supra* note 145.

160. H.R. 6, 108th Cong. (2003) (noting that the bill is still in the Senate even though the House passed a similar version). *See also* Fred Sissine, Congressional Research Service, Renewable Energy: Tax Credit, Budget, and Electricity Production Issues, Issue Brief for Congress (2004) [hereinafter Sissine 2004].

161. Sissine 2004, *supra* note 160, at CRS-1.

162. *Id.* at CRS-2, CRS-16 (stating that there has been a decline in the use of hydropower to due the effects of drought in many locations which led to a "major drop in nation renewable energy use").

163. American Jobs Creation Act, Pub. L. No. 108-357 (2004). *See* also H.R. 4520, 108th Cong. (2004). *See also* Sissine 2004, *supra* note 160, at CRS-1.

164. Sissine 2004, *supra* note 160, at CRS-2, CRS-8. *See also* Fred Sissine, Congressional Research Service, Renewable Energy: Tax Credit, Budget, and Electricity Production Issues, Issue Brief for Congress CRS-5 (2002) [hereinafter Sissine 2002] (showing that in previous years Congress made more of an effort as in the Senate version of H.R. 4 (S. 517), which proposed that utility companies obtain a minimum percentage of energy production from renewable energy sources, including some incremental hydropower. Although New Jersey does participate in this program, referred to as "green power," the market for alternative energy sources by the utility companies remains in the hands of the residents of the state and is limited because of the high cost of renewable energy).

165. Clean Power Now, *Quick Facts About Wind Energy, at* http://www.Cleanpowernow.org/modules.php?op=modload&name=Sections&file=index&req=viewarticle&artid=19 (last visited Jan. 12, 2005) (answering many of the basic questions about wind power such as its history, how it works, its advantages, and its disadvantages).

166. *Id.* (illustrating the history of windmills, including the fact that they were erected as early as the 19th century, and stating that when there is an uneven heating of the atmosphere, the inconsistency of the earth's surface coupled with the rotation of the earth causes a generation of the wind, which can then be harnessed by wind turbines to produce electricity).

167. State & Local Climate Change Program, U.S. EPA, Wind Energy 1 (2000), *available at* http://yosemite.epa.gov/oar/global

form of renewable energy, DOE received nearly $41.3 million in their FY 2004 budget and will receive about $41.6 million for FY 2005 for the use of wind power.[168]

Wind turbines are similar in look to propellers and turn the moving air to generate power by producing an electric current.[169] These turbines are grouped together, usually on a large piece of open space, called wind farms, where the electricity is generated in large amounts.[170] The electricity is then received by a local utility grid that then disperses the power to customers in the surrounding areas.[171] Classes of wind, ranging from one to seven, determine if wind power is a good source of energy generation in certain parts of the country.[172] Good wind, which averages 13 miles per hour, is found along the East Coast as well as other portions of the country.[173] The faster the wind speed, the more electricity that can be generated.

Wind energy proves to be a good source of renewable energy because of its many advantages. First of all, wind is free and can potentially last forever, meaning there will always be an abundance of it.[174] Another benefit is that there are no pollutants or greenhouse gases emitted from wind turbines.[175] For example, California, which eliminated 2.5 billion pounds of CO_2, and Texas, which reduced emissions by 1.83 million tons per year, are the leading states to utilize wind farms to reduce the amount of carbon emissions.[176]

Disadvantages exist with wind farms as well. The technology required to have wind turbines and other machinery associated with them present high initial costs.[177] However, rates remain competitive in comparison to energy from fossil fuels and other sources.[178] Advances in technology look to mitigate some adverse factors such as the use of large parcels of land, concerns over noise, as well as the death of some birds.[179] Furthermore, wind is not always available when it is needed to produce electricity and it cannot be stored, unless batteries are used.[180] Additionally, the best wind speeds occur in remote locations away from the places of demand.[181]

The federal government has stepped in to provide incentives and growth opportunities for wind energy as a renewable energy source. The Public Utilities and Regulatory Policy Act of 1978 allows individuals to use wind generators with the utility companies paying for any excess power that is produced from the generators, known as net metering.[182] This not only saves the individuals money, but it promotes the use of a clean energy. The goal of the federal government and DOE is to have the wind industry increasing its generating capacity in order to stay competitive in the markets.[183] Congress, in §1914 of the Energy Policy Act of 1992, created an income tax credit for those producing electricity created by wind and other sources.[184] This is an "income tax 'production' credit of 1.5 [cents per kilowatt hour (cents/kwh)] for electricity produced by wind."[185] Additionally, under Senate bills S. 1637 and S. 2095 and under H.R. 6, there would be a "15% residential tax credit worth up to $2,000 for homeowners" that purchase wind energy and that would be in effect until December 2006.[186] The Working Family Tax Relief Act of 2004 also provides a production tax credit of "1.8 cents/kwh over 10 years" for any wind projects that are "installed by December 31, 2005."[187] These initiatives prove vital as an incentive.

New Jersey, with the help of former Gov. Jim McGreevey, pushed the state to use energy sources that are environmentally beneficial. New Jersey has contracted with the Green Mountain Energy Company, which provides nearly 12% of the states' renewable energy sources.[188] In 1999, New Jersey passed a law enabling utility customers to use a net metering program, which would require utility companies to offer the service to those using wind or solar power[189] but placed a cap on the "net metering capacity at 0.1% of the utility's peak demand or at an annual financial impact to the utility of $2,000,000."[190] In 2004, the state ex-

warming.nsf/uniqueKeyLookup/SHSU5BWK54/$file/windenergy.pdf?OpenElement (explaining wind programs on the state and local level).

168. Sissine 2004, *supra* note 160, at CRS-16.

169. Clean Power Now, *supra* note 165.

170. *Id*. (describing how turbines come in various sizes; for example, one machine can be as large as a football field and 20 stories high whereas a majority are between 8 and 25 feet and stand 30 feet tall).

171. *Id*.

172. *Id*.

173. *Id*. (noting that the other locations that have good wind are the Appalachian Mountain chain, the Great Plains, the Pacific Northwest, and particularly North Dakota where enough energy could be produced to "supply 36% of the electricity of the lower 48 states").

174. *Id*.

175. *Id*. (explaining that wind energy produces clean and nonpolluting energy).

176. *Id*. *See also* Barry G. Rabe, Greenhouse and Statehouse: The Evolving State Government Role in Climate Change 13 (2002) (summarizing case studies on the leading states that look to provide energy alternatives).

177. Clean Power Now, *supra* note 165 (detailing that the cost of initial investment for wind power is higher than that of fossil fuel generators and that 80% of the cost for wind power is simply the machinery).

178. *Id*.

179. *Id.*

180. *Id.* (explaining that "not all winds can be harnessed to meet the timing of electricity demands" as one of the drawbacks of utilizing wind power).

181. *Id.*

182. Public Utilities and Regulatory Policy Act of 1978, Pub. L. No. 95-617, 92 Stat. 3117 (1978). *See also* Clean Power Now, *supra* note 165.

183. Jack Klein, The DOE Today, Major Programs and Components (2004), *available at* http://www.faircount.com/web04/energy/pdfs/doetoday.pdf (last visited Jan. 12, 2005).

184. Energy Policy Act of 1992, Pub. L. No. 102-486, §1914, 106 Stat. 2776 (1992). *See also* Sissine 2002, *supra* note 164, at CRS-3.

185. Energy Policy Act of 1992, Pub. L. No. 102-486, §1914, 106 Stat. 2776 (1992). *See also* Sissine 2004, *supra* note 160, at CRS-4.

186. S. 1637, §823, 108th Cong. (2004). *See also* S. 2095, §1323, 108th Cong. (2004). *See also* H.R. 6, 108th Cong. (2003). *See also* Sissine 2004, *supra* note 160, at CRS-6.

187. Working Families Tax Relief Act of 2004, Pub. L. No. 108-311 (2004).

188. Green Mountain Energy, *New Jersey State Government Begins Buying Cleaner Power From Green Mountain Energy Company*, *at* http://www.prnewswire.com/cgi-bin/micro_stories.pl?ACCT=142794&TICK=GREENM&STORY=/www/story/05-03-2002/0001720502&EDATE=May+3,+2002 (last visited Jan. 10, 2005) (stating that a wind turbine as big as the Statue of Liberty was dedicated to New Jersey for its commitment in using alternative energy sources).

189. American Wind Energy Ass'n, *Small Wind in New Jersey, Net Metering, at* http://www.awea.org/smallwind/newjersey.html (last visited Jan. 10, 2005) (describing the net metering laws in general and in New Jersey).

190. Database of State Incentives for Renewable Energy (DSIRE), *New Jersey Incentives for Renewable Energy, Net Metering, at* http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=

panded the net metering program to increase the maximum capacity of the systems and remove the cap.[191] The state also created a law making wind equipment fully exempt from the 6% New Jersey sales tax.[192] There are currently several locations in New Jersey, such as Atlantic City, Belmar, and Newark, from which wind energy is available and data is compiled to measure its effectiveness.[193]

New Jersey is ahead of many other states in providing alternative energy sources for electricity to its residents. In 2003, New Jersey created legislation that would "allow counties, municipalities and school districts to join with the State under certain circumstances for acquisition of alternative electrical energy systems," including wind power and solar energy.[194] Clearly wind energy could be an important asset in providing a cleaner energy choice.

One issue that could present some trouble for New Jersey is the need for large amounts of space on which to place the wind turbines. With the commitment to preserve open space in the state, finding available parcels of land for wind farms may pose a problem. However, the benefits of wind energy may surpass the disadvantages of installing the numerous wind turbines. Space that would be dedicated to construction of housing or other such uses may be held instead for the creation of wind farms. Though the initial costs may be high, the long-term benefits may induce the state government to spend the money. Since a good class of wind exists on the East Coast, New Jersey could reap the benefits of the wind in the area. For example, Atlantic City seeks to erect an offshore wind farm that would be one of three proposed wind projects in New Jersey looking to provide "coastal wind power development."[195] With the tax incentives and an increase in the budget for wind as a renewable energy source, New Jersey could take advantage of both and increase its generation of electricity by using wind energy. Wind energy is among the most effective energy alternatives for the future in New Jersey.

C. Solar Energy

Solar energy is one of the most popular forms of renewable energy. As long as the sun burns, which will be for about 4.5 billion years, solar energy will be available to use as an alternative energy resource.[196] The two main groups of solar power are solar thermal technologies, which use the sun to generate heat, and photovoltaic (PV) cells, which directly convert solar radiation into electricity by use of those cells placed on panels.[197] Although most people are aware of solar energy, it only encompasses about 0.1% of the energy resources used by the United States.[198] There are several reasons, such as cost and efficiency, for the low number, but as the need for power increases, the market for solar energy is on the rise.

PV cells are the main source of solar power because they are highly reliable and need virtually no maintenance. PV cells can provide various amounts of energy from a small watch to an entire electric grid or even satellites.[199] PV cells can be a cheaper alternative to fossil fuels when providing electricity for lighting the home, pumping water, and providing other such necessities.[200]

The use of solar energy has many benefits. PV cells do not produce any harmful emissions, preventing CO_2, SO_2, and NO_x from entering the atmosphere, and there is no fuel required, meaning no dependence on foreign nations.[201] Solar energy is also free since solar panels need only sunlight.[202] Furthermore, solar panels can be built to any size to accommodate a business or a homeowner, allowing for more flexibility not available with other energy sources such as nuclear power plants.[203] The benefits of using solar energy provide a valid renewable energy resource for the future.

There are disadvantages of solar energy, yet work is being done to resolve these problems, thereby making the advantages of solar energy outweigh its disadvantages. When solar power needs to be stored, it is placed into batteries, which contain acid. This poses a problem of disposal.[204] However, more facilities are able to recycle batteries, which would negate this problem. Also, being able to store electricity in batteries creates reliability since this allows power to be available any time of the day and in any type of weather.[205] Another concern is that PV cells use metals such as cadmium, which are also difficult to recycle.[206]

Solar panels and solar plants are not as prevalent in the United States as they are in other parts of the world, primarily due to the high initial cost of solar panels and the costs of using this power.[207] Additionally, the efficiency level of so-

NJ03R&state=NJ&CurrentPageID=1 (last visited Jan. 13, 2005) [hereinafter *Net Metering*].

191. N.J. Admin. Code §14:4-9 (2004). *See also Net Metering, supra* note 190 (expanding the systems from 100 kilowatts to 2 megawatts).

192. N.J. Stat. Ann. §54:32B-8.33 (1980).

193. Pacific Northwest Laboratory, Wind Energy Resource Atlas of the United States tbl. C1 (1986), *available at* http://rredc.nrel.gov/wind/pubs/atlas/tables/tablec1/nj.html (last visited Jan. 10, 2005) (providing a table of wind data).

194. A3188, 210th Leg. (N.J. 2003).

195. Monmouth County Audubon Society, *Windmills to Blow Power Into Atlantic City, at* http://www.monmouthaudubon.org/PDF_files/aug_sep_02_.pdf (last visited Jan. 12, 2005) (displaying a newsletter dedicated to wildlife conservation and providing an article about wind energy).

196. Peter Hemberger, Renewable Energy Policy Project, *Solar Power: FAQs, at* http://www.crest.org/articles/static/1/995469913_2.html (last visited Jan. 10, 2005) (answering many questions dealing with solar power such as the cost and different types of solar technology).

197. *Id.* (using the PV method, beams of ultraviolet light from the sun strike metal plates where electrons start to flow and create a direct current, which is then converted to an alternate current, the type of electrical power that is used in homes and buildings).

198. *Id.*

199. Energy Efficiency & Renewable Energy, U.S. DOE, *Solar Energy Technology Program, at* http://www.eere.energy.gov/solar/ (last visited Jan. 10, 2005) (explaining the development of solar technology).

200. Energy Efficiency & Renewable Energy, U.S. DOE, *PV in Use: Getting the Job Done With Solar Energy, at* http://www.eere.energy.gov/solar/pv_use.html (last visited Jan. 12, 2005) (describing the origin of PVs).

201. Hemberger, *supra* note 196.

202. Energy Efficiency & Renewable Energy, U.S. DOE, *Why PV Is Important to You, at* http://www.eere.energy.gov/solar/to_you.html (last visited Jan. 12, 2005) (commenting on the advantages of PV).

203. *Id.*

204. Hemberger, *supra* note 196.

205. Energy Efficiency & Renewable Energy, U.S. Department of Energy, *PV Systems With Battery Storage, at* http://www.eere.energy.gov/solar/pv_batteries.html (last visited Mar. 10, 2003) (providing an explanation of PV with battery storage).

206. Hemberger, *supra* note 196 (producing this metal is on the rise because PV cells are starting to include cadmium instead of silicon to reduce the costs of production of solar power; although cadmium is a concern, the impact to the environment remains relatively small).

207. *Id.*

lar power is not as high as those of other energy sources.[208] Even though the problems of cost and efficiency exist, researchers and people in the field have been able to improve solar technology by reducing the costs and increasing efficiency by experimenting with different types of cells and materials to use in solar panels.[209] Between 1998 and 1999, there was an increase of nearly 50% in the production of solar panels, and DOE has projected that the solar power industry could grow by 25% per year until the year 2020.[210]

Solar power is one of the more expensive energy sources. However, the cost can depend on the size of the solar panels. To get a full system installed, including the module, batteries, inverter, wiring, and other support, it could cost between $7 to $20 per watt, where an average home uses between 1 and 2 kilowatts.[211] If a plant were created for several homes in an area, the cost could be offset because there is relatively no maintenance needed for the solar panels and the less power used, the lower the cost to the homeowners.[212]

The cost of solar power can also be offset by the federal and state governments creating certain incentives to promote the use of solar energy as an efficient alternative energy source. DOE has one of its largest budgets in renewable energy for solar energy in FY 2005. The budget in 2005 for solar energy is $86.5 million, up from $83.4 million in 2004.[213] Additionally, in §1914 of the Energy Policy Act of 1992, the federal government provides a 10% tax credit for businesses that choose to use solar equipment.[214] Furthermore, congressional bills S. 1637, S. 2095, and H.R. 6 provide incentives for homeowners by creating a "15% residential tax credit worth up to $2,000" if they purchase PVs and solar water heating equipment.[215] DOE also created a program called the Million Solar Roofs Initiative to bring solar energy to the rooftops of over a million homeowners and businesses by the year 2010.[216] The federal government is doing its part by placing panels on federal buildings to encourage the use of solar energy for state governments as well.[217]

Congress appropriated money for many different forms of renewable energy. Although many forms of renewable energy will get increased funding, the FY 2005 budget increases funding by 4% for solar energy from the previous year.[218] This could boost industry production of solar cells and other solar equipment in the market and show that solar energy is a viable renewable energy resource. Moreover, the American Jobs Creation Act provides for a "renewable energy production tax credit to include 1.8 cents/kwh over five years" for solar energy projects that are installed by December 31, 2005.[219] The American Jobs Creation Act also "creates a $2 billion tax-exempt bond program for green building demonstrations at brownfields, which includes goals for solar photovoltaics."[220] The budget increases as well as tax incentives and bonds could promote the use of solar power.

D. States' Roles in Renewable Energy Sources

New Jersey's participation with the Green Mountain Energy Company has led to the opening of South Jersey's largest operating solar facility.[221] The entrance features a display of the amount of CO_2 emission the panels will help avoid, one of the many benefits that come from solar power.[222] The amount of CO_2 that will not pollute the air as a result of using the solar panels is equivalent to 2,000 trips by car the length of the Atlantic City Expressway.[223] New Jersey is becoming one of the more energy-efficient states in the country due to the use of solar power.

New Jersey has proved itself in becoming an environmentally friendly state by encouraging the use of alternative energy sources such as solar energy. New Jersey created the Clean Energy Program to provide financial incentives for individuals and companies to convert to cleaner, more efficient, and renewable energy sources.[224] Some of these incentives are given directly to utility companies in order to entice them to participate in the program.[225] The program encourages the installation of different systems; among those that qualify are PVs, fuel cells, small wind, and sustainable biomass equipment.[226] The government provides a

208. *Id*. (noting, however, that since 1954 when efficiency rates were at 6%, "recent single-crystal silicon cells" have the ability to produce between 15 to 24% efficiency).

209. *Id*.

210. *Id*.

211. *Id*. (explaining that the prices can fluctuate depending on the quality and size of the system). *See also* CNN.com, *Discovery May Spur Cheap Solar Power*, CNN.COM/TECHNOLOGY, Oct. 2, 2003, *available at* http://www.cnn.com/2003/TECH/biztech/10/02/solar.cells.reut/index.html (stating that "a major European chip maker said this week it had discovered new ways to produce solar cells which will generate electricity twenty times cheaper than today's solar panels").

212. Hemberger, *supra* note 196.

213. SISSINE 2004, *supra* note 160, at CRS-16.

214. Energy Policy Act of 1992, Pub. L. No. 102-486, §1914, 106 Stat. 2776 (1992). *See also* Hemberger, *supra* note 196.

215. S. 1637, §823, 108th Cong. (2004). *See also* S. 2095, §1323, 108th Cong. (2004); H.R. 6, 108th Cong. (2003). *See also* SISSINE 2004, *supra* note 160, at CRS-6 (reiterating the same policy exists for wind energy and this credit also remains in effect until December 31, 2006, for PVs and solar water heating equipment).

216. U.S. EPA, STATE AND LOCAL CLIMATE CHANGE PROGRAM, SOLAR ENERGY 1 (2000), *available at* http://yosemite.epa.gov/oar/globalwarming.nsf/UniqueKeyLookup/SHSU5BVR3A/$File/solarenergy.pdf (commenting on the advantages of solar energy and programs encouraging solar power use).

217. *Id.*

218. SISSINE 2004, *supra* note 160, at CRS-16.

219. American Jobs Creation Act, Pub. L. No. 108-357 (2004). *See also* SISSINE 2004, *supra* note 160, at CRS-11.

220. American Jobs Creation Act, Pub. L. No. 108-357 (2004). *See also* SISSINE 2004, *supra* note 160, at CRS-11.

221. Green Mountain Energy, *South Jersey's Largest Operating Solar Facility Unveiled*, *at* http://www.prnewswire.com/cgi-bin/micro_stories.pl?ACCT=142794&TICK=GREENM&STORY=/www/story/05-16-2002/0001729657&EDATE=May+16,+2002 (last visited Jan. 10, 2005) (stating that BJ's Wholesale Club unveiled 1,330 solar panels on the roof of their building in Deptford, New Jersey, in order to promote the use of solar energy in New Jersey because of the growing demands in the state by its residents to use Green Mountain Energy).

222. *Id*. (financing for the facility coming from the New Jersey Clean Energy Fund and noting that there are enough solar panels, 12,000 square feet, on the roof of BJ's to fill the Phillies' infield at Veterans Stadium).

223. *Id*.

224. New Jersey's Clean Energy Program, *Financial Incentives to "Get With the Program," at* http://www.njcep.com/html/2_incent.html (last visited Jan. 10, 2005) (providing incentive levels for New Jersey).

225. *Id*.

226. New Jersey's Clean Energy Program, *What Is the New Jersey Clean Energy Program?, at* http://www.njcep.com/html/1_overview.html (last visited Jan. 10, 2005) (explaining what the clean energy program is and reasons to buy clean energy systems).

reduction in costs depending on the size of the system installed; however, the size must fit the needs of the individual or company and cannot be exceeded.[227]

New Jersey has put in place many incentives for the residents and companies of the state to use solar energy. In early 1999, Gov. Christine Todd Whitman (R-N.J.) signed legislation that would provide a 10% discount to customers when utility companies used a portion of its power output from solar and wind power, along with other renewable sources.[228] The legislation also provides for no less than 50% of funding, close to $140 million, for energy efficiency programs to be geared toward renewable energy sources.[229] Additionally, under the New Jersey Permanent Statute, the state also provides a "full exemption from the state 6% sales tax for all solar equipment."[230] Furthermore, the New Jersey net metering program, which also encompasses wind power, is also applicable to solar power.[231] This program "credits a customer-generator at the full retail rate for each kilowatt-hour produced" by a solar energy system "installed on the customer-generator's side of the electric revenue meter. . . ."[232] With the help of the federal government, New Jersey could take the lead in supporting the solar power industry to create a more energy-efficient state.

State governments have taken a large role in producing legislation to provide renewable energy sources to its residents. New Jersey is among the leaders in creating initiatives to reduce greenhouse gas emissions in addition to Georgia, Massachusetts, Minnesota, Nebraska, North Carolina, Oregon, Texas, and Wisconsin.[233] These states have incorporated many energy alternatives depending on the need and primary concerns within each area. For example, Texas has increased the usage of wind power; Minnesota has decided to plant more trees; and New Jersey has turned to Green Mountain Energy.[234] As of 2001, about 1% of the residents of New Jersey took advantage of the choice for alternative energy even though the cost is a little higher.[235] The number of participants in the program should increase as people become aware of the benefits of clean energy. At least the residents of New Jersey have the choice in which type of energy they choose to consume in their homes.

IV. Conclusion

After exploring the many energy sources available, nuclear power plants, hydroelectric power, wind power, and solar energy, it would seem that a combination of both solar and wind power could help eliminate the need for fossil fuels and could possibly make nuclear power plants obsolete. Nuclear power plants have built-in disadvantages that cannot be easily overcome. They are not 100% safe and are vulnerable to accidents. Further, nuclear waste has a long shelf life and long-term adverse side effects are possible. With solar and wind power, there are many environmental benefits with few consequences.

The best option for states is to incorporate several of the renewable energy sources together to provide the growing energy needs of the state. In New Jersey, the combination of solar and wind energy would work best and has several advantages. First of all, the state already utilizes both forms of energy, just in smaller portions. With federal incentives and state laws promoting clean energy, the costs associated with solar and wind power could be offset. Secondly, sunlight and wind are free and abundant. They also minimize the amount of pollution that produces adverse effects on the environment. Additionally, solar and wind power allow for a state to be independent of foreign countries and the power requires minimal efforts by the federal government. New Jersey, therefore, should continue to offer its residents the choice for clean energy and should increase its use of solar and wind power in order to become a model for other states to use renewable energy sources. Other states should follow New Jersey's lead by looking into alternative energy sources such as hydroelectric, wind, and solar energy as alternatives to nuclear power.

227. DSIRE, *New Jersey Homeowner Incentives for Renewable Energy, at* http://www.dsireusa.org/library/includes/maphomeowner.cfm?State=NJ&CurrentPageID=1 (last visited Jan. 10, 2005) (summarizing the financial aspects of the New Jersey Clean Energy Program, as well as tax exemptions and the net metering policy).

228. Press Release, Office of the New Jersey Governor, Governor Whitman Signs Energy Deregulation Bill, Consumers to Receive a 10% Discount 1 (Feb. 9, 1999) (on file with author).

229. *Id.*

230. N.J. STAT. ANN. §54:32B-8.33 (1980). *See also* DSIRE, *New Jersey Incentives for Renewable Energy*, *Solar and Wind Energy Systems Exemption, at* http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=NJ01F&state=NJ&CurrentPageID=1 (last visited Jan. 13, 2005) (stating that even though the regulations that define eligible systems expired in 2000, the exemption is still in existence).

231. N.J.A.C. §14:4-9 (2004). *See also Net Metering*, *supra* note 190.

232. N.J.A.C. §14:4-9 (2004). *See also Net Metering*, *supra* note 190.

233. RABE, *supra* note 176, at ii.

234. *Id.* at 13, 22, 38.

235. Northeast Sustainable Energy Ass'n, *New Jersey, at* http://www.nesea.org/energy/info/situationnj.html (last visited Jan. 10, 2005) (illustrating some of the effects of New Jersey's energy choice program).