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Solar and Wind Energy Development in Maine: 1973-1997

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SOLAR AND WIND ENERGY DEVELOPMENT

IN MAINE: 1973-1997

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Focusing on how Maine reflected, as well as stood out from national trends in the development of wind and solar energy, this study concentrates particularly on how Maine state government and environmental groups contributed to this development, as well as on the technological progress of these energy sources. It draws primarily on state government documents, newspapers, and periodicals for evidence. The 1973-74 energy crisis, combined with the rise of the environmental movement, led to an increased exploration of alternative energy sources, in particular those that were relatively friendly to the environment like solar and wind energy. Attempts to utilize these energy sources during the 1973 to 1976 period were filled with hopeful idealism, but also limited by the relatively primitive nature of the available technology. During the late 1970s, Maine state government provided several financial incentives for renewable energy sources, particularly solar energy. It also played an important educational role, publishing many brochures and papers geared towards the general public. Maine's environmental

advocates also played an educational role, and encouraged some of the state's actions in favor of renewable energy.

The high point in government and public interest in solar and wind energy came during the late 1970s and early 1980s in Maine and across the country. It began to decline after this due to the comparative lack of support from the Reagan Administration, and a concurrent decrease in oil prices. Federal tax incentives, a strong encouragement to adopt wind and solar energy, expired at the end of 1985. Technologically speaking, wind energy was rather unreliable generally until the late 1980s in the U.S. Solar energy, on the other hand, proved more reliable for the general public, as early as the late 1970s. Neither was competitive economically with fossil fuels in locations on the utility power grid. Off the grid, however, this became less and less true over time, particularly for solar energy. Despite their differences, both energy sources improved technologically over time.

The second half of the 1980s was a quiet period for solar and wind energy development in Maine, but during the early 1990s a large wind farm proposal by a California wind power company, Kenetech, created quite a bit of attention since it was easily the largest proposed wind or solar energy project in Maine's history. This project faced several hurdles, including environmental advocates' concerns over its location in an undeveloped part of the western Maine mountains, and the necessity of land-use rezoning. By 1995 it had received approval from the state government and Maine's major environmental groups, only to fail two years later due to Kenetech's financial problems and a lack of utility contracts. This episode illustrated Maine's dependence on out of state forces to develop wind and solar energy. Generally, these included the

technological development and cost of solar and wind energy, fluctuating oil prices, and the national political climate. But it also showed that its own support for them was substantial (despite the project's failure). Maine's support for solar and wind energy arose in part from the strength of its environmental movement and its general independence.

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INTRODUCTION

Renewable energy, in particular wind and solar, began to draw much greater attention in the United States after the 1973-1974 energy crisis. This grew out of the dramatically higher oil prices that resulted from the crisis, a heightened recognition of U.S. dependence on foreign oil, and the emerging environmental movement in the U.S. within which wind and solar were preferred energy sources. The development of wind and solar energy in the state of Maine during this period makes an interesting case study because Maine was particularly dependent on foreign oil for its energy needs, while generally speaking its residents were known for their independence. It was also a state ("vacationland") with vast natural beauty in its coast, mountains, and forests, and where the environmental movement was quite strong.

Wind and solar energy were certainly not the only renewable energy sources that Maine residents looked to. In fact, they were insignificant compared to hydroelectric power and biomass (wood burning generally) in 1973, and remain so today. So, why focus on wind and solar energy in particular? There are several reasons why a focus on these two energy sources is particularly instructive. First, fossil fuels, the dominant energy sources in the country for at least the last one hundred years, are inevitably polluting, as well as finite, resources. Thus, as they grow scarcer and environmental concerns mount in the world, solar and wind energy may become the energy sources of the future.

Second, solar and wind energy provide a fascinating opportunity to examine the juxtaposition of environmental concerns with technology. These two energy sources have

relied on technological breakthroughs to make them reliable and affordable. Yes, generally speaking they were environmentalists' preferred energy sources, and yet they still represented a technological solution to an environmental, as well as an energy, problem. A significant part of the environmental movement, however, has been quite skeptical of technological solutions to society's problems. In fact, technology has often been pointed to as a problem in itself to some extent, as a source of pollution, waste, resource depletion, and environmental degradation. So, as environmentalists learned more about wind and solar power, they realized that these technologies did have some environmental drawbacks. This became particularly evident during the 1990s in Maine, in the case of a large-scale wind power proposal. Still, while environmentalists in Maine have opposed basically every new sizable energy project since 1970, they gave qualified support to this one.

Third, the government and the general public have played pivotal roles in the development of new energy sources, and of particular (utility-scale) energy projects. This is particularly interesting in the cases of wind and solar energy during the 1973-1997 period because the whole process was basically in its infancy, as opposed to fossil fuels. And while Maine has been influenced greatly by events outside its borders, such as the energy crises and the technological progression of wind and solar as energy sources, on some level their development has taken place locally, in Maine. Still, national trends have probably had a greater influence. Beyond technological progress, political and economic trends have been crucial, particularly the energy crises of the 1970s (and oil prices generally), and the attitude of successive presidential administrations towards

renewable energy

So, one focal point in this paper is the technological progress of wind and solar energy, nationally, and how this affected Maine. For instance, how did it affect government and public willingness to support and/or adopt these energy sources? Another focal point is the involvement of the Maine state government in the development of these energy sources. It served an educational role, through its many renewable energy publications, as well as a financial role, in providing tax incentives for adopters of these technologies. Maine's environmental advocates, particularly the Audubon Society, the Natural Resources Council of Maine, and the *Maine Times*, combined educational efforts with advocacy. Perhaps the most basic questions in this study are the following: why the interest in solar and wind energy in Maine, and what forces caused their development to progress as they did?

CHAPTER 1: 1973-1980

Introduction

Wind and solar energy development in Maine from 1973 to 1980 was influenced strongly by national trends, particularly the energy crises and the rise of the environmental movement. Additionally, it was seriously limited by the relatively modest technological advancement of these energy sources. Nevertheless, Maine's state government, and its environmental advocates, also made significant contributions, through a mixture of educational efforts, legislation, and advocacy.

National Background

The 1973-74 energy crisis in the U.S. resulted mainly from the growing power of the Organization of Petroleum Exporting Countries (OPEC) to increase oil prices, and the approximately six-month long oil embargo during late 1973 and early 1974. The embargo itself resulted from the Yom Kippur War between Israel and Arab nations such as Egypt and Syria. Generally, it represented an Arab protest against U.S. aid to Israel, an issue that acquired a heightened importance during this war.[1] The American public blamed the energy crisis on profiteering oil companies first and foremost, along with the federal government and the Arabs. Historian Martin Melosi related that its effects may have been "as much psychological and emotional as practical." In fact, oil prices

[1] Martin V. Melosi, *Coping with Abundance: Energy and Environment in Industrial America* (Philadelphia: Temple University Press, 1985), 281.

stabilized between 1974 and 1978.[2] However, the Islamic Revolution in Iran in 1979, during which the U.S.- backed Shah was forced to flee from power, along with the uncertainty created by the Soviet invasion of Afghanistan, led to a second energy crisis in the U.S.[3] Market instability resulted in another dramatic increase in oil prices, reinforcing public anxiety about energy issues.

As long as energy prices and dependence on foreign oil were important issues, public and government interest in alternative energy sources remained comparatively strong, though still minimal compared to that in fossil fuels and nuclear power. However, federal energy policy did not change significantly until Jimmy Carter became president in 1977, in particular with the 1978 passage of the National Energy Act, and the creation of a new cabinet-level Department of Energy. This new level of federal involvement in energy also included the encouragement of renewable energy development, especially through tax incentives, as well as conservation and energy efficiency incentives.

Maine: 1973-1975

Maine, at the time of the 1973-74 energy crisis, was heavily dependent on oil, more so than most other states. According to a 1974 study at the Public Affairs Research Center at Bowdoin College, oil constituted 76.7 percent of Maine's energy use, 56.3 percent of which was imported.[4] This, combined with the cold Maine winters, made the

[2] Ibid., 281, 285.

[3] Ibid., 281, 282.

[4] Maine, Office of Energy Resources, *Discussion Paper on the Direct Use of Solar Energy in Residential & Commercial Buildings in the State of Maine* (Augusta, Me.: Office of Energy Resources, 1977), 8.

energy crisis particularly relevant here. Since Maine has generally been a rather independent, as well as isolated, state, the search for its own means of producing energy was important. The homegrown alternatives to oil – nuclear, hydroelectric, wood and biomass, solar, and wind energy – generally saw increased use in Maine as the 1970s progressed. Nuclear and hydroelectric power had already been established (very recently in the case of nuclear energy) in Maine by 1974. Wood burning had, of course, been extant in Maine on some level since before colonial times, although as of 1974 it was not a very significant part of the state's total energy budget (only 2.1 percent).[5]

Solar and wind energy, on the other hand, were almost nonexistent components of Maine's total energy use in 1973. They also played small roles nationally, due to the lack of government effort and financial resources to develop them, their relatively modest technological advancement, and a resultant economic uncompetitiveness. Still, at the outset of the energy crisis Maine had the wherewithal to expand its efforts to produce solar and wind energy.

In 1973 and 1974, wind power in Maine drew its first noticeable press attention. This centered in particular on two figures, Henry M. Clewes and Bill Gillette. Clewes became well known as a windmill expert throughout the U.S., after setting up an Australian-made windmill on his homestead near East Holden, Maine, in 1972. *Mother Earth News* referred to him as "the country's foremost expert on windmills," forming the basis of his notoriety. He subsequently drew correspondence from people all over the country. In 1973, Clewes was in the process of setting up the Solar Wind Company to

[5] Ibid., 9.

sell Australian and Swiss windmills and, perhaps, design his own. The U.S. had no real equivalents to these foreign manufacturers.[6] An article in the *Maine Times* stated that Clewes, although he did have a degree in aeronautical engineering, "knew relatively little about the subject" of windmills before purchasing his own.[7] That he became a noted expert in nine months showed the almost total lack of expertise on wind power in the U.S. in 1973. The article also illustrated the naive optimism that wind power attracted during this period. The statement that "Wind is a carefree system. Windmills have been known to run more than forty years without repairs, and maintenance requirements are minimal: a can of oil in the gearbox every five years," would prove wildly optimistic for anything but very modest systems, such as agricultural water pumping windmills.

In Brunswick, Bill Gillette set up the Zephyr Wind Dynamo Company with the intention of producing an innovative wind-powered generator he designed and patented. Local interest in this corporation was high, and Gillette and treasurer Alan Lishness were able to quickly raise $25,000 in capital, mostly from selling stock to Brunswick-area residents. One notable potential customer at this time was Robert A.G. Monks, head of the Maine Office of Energy Resources. Gillette, like Clewes, had some technical background. He was a former high school physics teacher and ran an aerial photography company, but he too was essentially a newcomer to the wind power business.[8]

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[6] Sandra L. Gregor, "How One Family Came to Wind Power," *Maine Times*, 4 May 1973, 3.

[7] Sandra L. Gregor, "How One Family Came to Wind Power," *Maine Times*, 4 May 1973, 2.

[8] Frank Sleeper, "A Windmill May Revolve in Brunswick," *Portland Press Herald*, 10 December 1974, 1, 15.

Tellingly, only two years later the original enthusiasm for wind power had died down, as had the initial shock of the energy crisis. Clewes's Solar Wind Company received far fewer inquiries in 1976 than it had in 1973-1974, and had scaled back the size of the windmills it sold due to the greater financial and mechanical risks inherent in the larger ones. Clewes had shifted the running of the business to Majo Kelleshian. Solar Wind Company was selling fewer windmills, as knowledge of their mechanical problems had become more evident, along with the passing of the first energy crisis.[9] Similarly, Gillette and Lishness were more cognizant of the technological limitations of, and the relatively modest rate at which progress was being made in, wind power technology. Lishness was realistic but still hopeful at this point: "People are going to have to reassess the alternative energy thing," he said, "every home is not going to have a windmill in their backyard and a solar collector on their roof by December. It's not discouraging. It's going to happen. But it's going to happen slowly."[10] Zephyr Wind Dynamo Co., in contrast to Solar Wind Co., still had solid plans for the future at this point.

The experiences of these two wind energy companies illustrated the interest in this renewable energy source in Maine at the beginning of the first energy crisis, and served as an introduction to the realities of wind energy. They also showed the independence and

[9] Peter A. Dammann, "There Won't Be a Windmill in Every Yard Quite Yet," *Maine Times*, 13 August 1976, 10.

[10] Peter A. Dammann, "There Won't Be a Windmill in Every yard Quite Yet," *Maine Times*, 13 August 1976, 11.

ingenuity that Maine was known for, characteristics that suited the development of these energy sources, and make Maine an interesting case study for this development.[11]

Wind and Solar Energy - Technological Progress over Time

Wind Energy

Wind power, while it did have some success during the first few decades of the twentieth century in the U.S., almost totally fell out of favor between the end of World War II and the early 1970s. It had not experienced the scale of use, technological development, or government and industry support of fossil fuels like coal, and then oil, through World War II. During the postwar period fossil fuel energy was cheap and abundant. Utilities encouraged electricity consumption.[12] Fossil fuel scarcity and environmental issues were not as pressing to the general public as in the 1970s. Additionally, the federal government poured money into nuclear energy research and development (R+D) rather than wind or solar power, arising out of Cold War concerns, and a related desire to use nuclear technology for more than just bombs.[13] Due to the general lack of utilization of wind power during the post war period, much of the old

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[11] For a discussion of Maine's distinct identity and reputation for individualism see Kenneth T. Palmer, G. Thomas Taylor, and Marcus A. Librizzi, *Maine Politics and Government* (Lincoln NE: University of Nebraska Press,1992), xxii, 7.

[12] Robert W. Righter, *Wind Energy in America: A History* (Norman, Ok..: University of Oklahoma Press, 1996), 149.

[13] Righter, 143.

technical expertise had been lost by the 1970s. This contributed to the reliability problems that wind turbines experienced after the resurgence in public interest.[14]

In 1974 Congress passed the Solar Energy Research Act, which established the Solar Energy Research Institute (SERI). This included funds for federal research on wind power, which totaled approximately $380 million from 1973 to 1988.[15] At SERI, which worked in connection with the National Aeronautics and Space Administration's (NASA) Lewis Research Center in Cleveland, researchers spent most of their time and money developing large wind turbines (generally between one and three megawatts capacity) in order to take advantage of economies of scale. These efforts centered on the MOD (Modification) prototypes, which were generally built by commercial aerospace companies like General Electric and Boeing Corporation, using government funding and designs. These large turbines experienced constant reliability problems. While researchers did learn from their failures, none of the MOD prototypes became commercially viable products. The high cost of repairs, combined with the relative inexperience of the builders and designers with wind turbines, contributed to the overall lack of success.

The federal government did also fund R+D for smaller wind turbines (1.5 to 40 kilowatts), particularly at Rocky Flats, Colorado under the Department Of Energy's (DOE) Federal Wind Energy Program. Here it tested commercial turbines, several of which were installed at various utilities across the U.S. The majority of these did not

[14] Righter, 173.

[15] Righter, 158.

perform successfully. After a questionnaire was sent to thirty-two of the participants, two-thirds of them gave the turbines a poor performance rating.[16] These turbine failures were not as dramatic or as costly as those of the MOD prototypes, but in both cases, reliability remained a critical issue. However, the amount of government funding devoted to wind energy research still paled in comparison to that invested in nuclear energy ($27 billion between 1955 and 1964).[17]

Solar Energy

Solar energy, in particular photovoltaics (PVs), did not achieve significant usage in the U.S., compared to energy use as a whole, prior to the energy crises of the 1970s. Two central issues in the development of PVs over time have been the cost and efficiency of the photovoltaic cells. Their development relied on continued chemical and engineering breakthroughs, the progress of which has not always been rapid. PVs utilize the photoelectric effect to convert light into electricity. British scientists William Grylls Adams (and his student Richard Evans Day) discovered the photoelectric effect in a solid material in the late 1870s (it had already been observed in a conducting solution earlier in the century).[18] Engineers did not begin to develop practical applications of this, however, until the early 1950s. The main use for PVs in the U.S. between this time and the 1970s, was for the space program. Satellites and probes powered by solar panels did not need

[16] Righter, 172-73.

[17] Righter, 150.

[18] John Perlin, *From Space to Earth: The Story of Solar Electricity* (Ann Arbor, Michigan: Aatec Publications, 1999), 16-17.

refueling or new batteries, ultimately making solar the most appropriate energy source for them. However, until the 1970s, photovoltaic cell prices remained extremely high, influenced considerably by the dominance of NASA and its need for perfection in materials (since, at this point, no one could repair faulty satellites or probes once in space).[19]

By the early 1970s, Dr. Elliot Berman and his Solar Power Corporation had discovered that NASA's perfectionism was not necessary for earth-based PV cell applications. In the process, prices came down to the level where they were affordable for remote applications, where access to the utility grid was prohibitively expensive.[20] Notable commercial applications of PVs in the 1970s included offshore and remote land-based oil platforms and wells, along with U.S. Coast Guard-operated lighthouses and buoys. Other uses included railroad warning signals, and microwave repeater systems used for communications.

Another form of solar energy, solar hot water heaters, experienced a usage history more akin to that of wind power than that of PVs. Solar hot water heaters, unlike PVs, were available for public use, particularly for domestic purposes, during the first half of the twentieth century. They did not rely on cutting edge science to the same extent as PVs, and thus the first models available in the U.S. were the work of entrepreneurs / inventors rather than scientific / engineering teams. Warm weather dominated heater sales. Between 1900 and 1920, they experienced a boom of sorts in southern California,

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[19] Perlin, 50-51.

[20] Perlin, 54-55.

but natural gas discoveries brought this to an end after about 1920.[21] Florida experienced booms in solar hot water heater sales in the early 1920s and late1930s, linked to housing trends. A real estate boom in the early 1920s, and Federal Housing Administration mortgage programs during the late 1930s, played a crucial role in solar heater fortunes. The lack of fossil fuel options, combined with the sunny climate in Florida, created the market for these heaters. But new home construction became the vehicle through which the solar heater boom arrived. For instance, "80 percent of homes built in Miami between 1937 and 1941 had solar hot water heaters."[22] Again, though, the fortunes of solar heaters in Florida proved highly dependent on outside forces (beyond technology), dropping off after 1941 due to WWII, and remaining minimal after the war due to cheaper electricity and fossil fuel options. They did not experience a resurgence in the U.S. until the late 1970s.

Before 1970, the link between wind and solar energy technologies and the environment, as perceived by its advocates or the general public, was not that strong. The main issues were cost and practicality. But with the rise of the environmental movement, and then the coming of the 1973-74 energy crisis, these environmentally friendly, renewable energy sources found a new rationale for adoption.

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[21] Daniel M. Berman and John T. O' Connor, *Who Owns the Sun?: People, Politics, and the Struggle for a Solar Economy* (White River Junction, Vt.: Chelsea Green Pub. Co., 1996), 13.

[22] Berman and O'Connor, 15.

Environmentalists' Support for Wind and Solar Energy

Background (U.S.)

Broadly speaking, the "environmental movement" in the U.S. arose during the 1960s and early 1970s, in large part due to concerns about air and water pollution. The booming economy during the 1950s and 1960s featured a greatly expanding industry, and a similarly expanding use of industrial chemicals and burning of fossil fuels. Environmentalists wanted to bring attention to these issues, and search for ways to address them. This resulted in, at the federal government level, the Clean Air and Clean Water acts, and the creation of the Environmental Protection Agency. Environmentalists have been, since 1973, among the strongest supporters of solar and wind power. This stemmed from several factors. Firstly, these are probably the "greenest" energy sources, creating lower levels of pollution and toxic waste than the rest. Secondly, environmentalists often mistrusted industrial society and large energy corporations. Ideologically, they were sympathetic to smaller, more democratized power sources like solar and wind energy, which also promised greater self-sufficiency. Additionally they shared, along with the general U.S. population, a concern about skyrocketing energy prices and U.S. reliance on foreign oil that resulted from the energy crises of the 1970s.

Solar and wind energy systems are "green" because, during energy production, they create no pollution or toxic waste; nor do they consume finite resources. Oil, coal, natural gas, and nuclear power cause ecological disruption and/or pollution during and after the processes of extraction, refinement, and energy production. Hydroelectric power, another significant energy source, does not create obvious pollution or waste, but

is still quite disruptive ecologically, and not only near the actual dams themselves. Solar and wind energy are certainly not perfect energy sources. The manufacturing of solar panels and wind turbines is not pollution free, particularly that of solar panels, which require many toxic chemicals to produce. Additionally, they both need to be disposed of after their useful lives have ended. Both take up a lot of space if used for large-scale energy projects (but not if used by individual homeowners). Wind turbines have also been known to kill birds. Still, these drawbacks are modest compared to those of oil, coal, nuclear energy, and natural gas.

During the 1970s environmentalists downplayed the drawbacks of wind and solar power. This stemmed partly from a basic lack of information about them, due to the absence of large-scale wind and solar power production. Technologically speaking, they were rather primitive and untested. Many environmental activists felt or hoped they could enact sweeping changes in industrial society's processes, including energy production. Thus, the potential of these relatively "green" energy sources led environmentalists to view them quite idealistically. Generally, this applied to Maine as well as the country as a whole.

Support from Maine's Environmental Advocates

Three environmental advocates of particular prominence in Maine have been the Maine Audubon Society (MAS), the National Resources Council of Maine (NRCM), and the *Maine Times*. They supported wind and solar energy for more or less the same

reasons as other environmental advocates did, and played educational as well as advocational roles.

MAS was Maine's chapter of the National Audubon Society (formed in 1905). A relatively significant event for renewable energy prospects in Maine was MAS's decision to use renewables such as solar energy and wood fuel to heat its proposed new headquarters building in Falmouth in 1975. Apparently, this building embodied the first large-scale utilization of renewable energy (not including hydroelectric) in Maine.[23] The heating system was purposely designed to be inexpensive and relatively easily built, in order to demonstrate to homeowners and contractors the value and feasibility of these renewable energy sources. Although it encountered some mechanical difficulties and other delays, by the fall of 1977 the solar heating system had been deemed successful.[24] The planning and success of this building had obvious symbolic value, and the relative prominence of the Audubon Society added to this. Additionally, MAS gave public educational tours of the building and its heating systems for years after its opening. This project, undertaken by a non-profit organization, paralleled federal government actions such as President Carter's placing of solar panels on the White House to promote conservation and renewable energy development. It was MAS's most notable effort to promote wind and solar energy during the 1970s. The other manifestations of MAS's support were mostly, like this, geared towards educating the public.

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[23] Barbara A. Riegel, "Putting Your $200,000 Where Your Philosophy Is," *Maine Times*, 11 July 1975, 8.

[24] "Audubon Society's Solar Heating at New Headquarters Is Successful," *Maine Sunday Telegram*, 16 October 1977, 3E.

In 1978 MAS (along with the Natural Resources Council of Maine) wrote an open letter to Governor James Longley, which the *Bangor Daily News* printed. The letter presented an energy plan that promoted the use of renewables such as solar and wind energy, along with diverse energy sources in general (that is, not relying on just one or two), and also stressed energy efficiency. A response to Longley's challenge to propose "a realistic energy plan for Maine," the letter pointed to the number of jobs that these diverse efforts could create, as a means of promoting its potential value to Maine.[25] It helped to spur public debate, and made environmental group involvement in energy issues evident to citizens. Additionally, MAS, in connection with Casco Bank & Trust Co., sponsored a lecture series on energy in 1979, in various locations around Maine. Topics included conservation and solar and wood heat.[26] Overall, MAS played more of a practical, hands-on role in its support for renewable energy than did NRCM or the *Maine Times*. This was embodied in the construction of its new headquarters building, of course, but also in its educational tours and demonstrations. The other two advocates' roles were more advocational, although advocacy itself can also serve an educational function.

The Natural Resources Council of Maine (NRCM), an umbrella organization for many of Maine's environmental groups based in Augusta, formed in 1959. It had been publishing the newsletter *Maine Environment* since before the beginning of the first energy crisis, and this was a helpful, though not ideal, source from which to judge its

[25] "Environmentalists Release Letter to Gov. Longley," *Bangor Daily News*, 7 October 1978, 28.

[26] "Maine Audubon-Casco Bank Lecture Series on Energy," *Maine Sunday Telegram*, 14 October 1979, 14E.

support for wind and solar power. From the start, its monthly and sometimes bimonthly publication schedule, and eight to ten page length, placed a considerable limit on the amount of material it could cover. What it presented as the most important environmental issues tended to drown out the rest. As a result, wind and solar power received relatively modest coverage over the last thirty years. Part of this was attributable to the limitations of *Maine Environment* itself, but it also may have reflected the overall priorities of the NRCM.

In order to lend some context to the amount of discussion of wind and solar power in *Maine Environment*, one can compare it to the coverage of energy issues in general. This, in fact, was quite substantial. For instance, in 1977, between the energy crises of the 1970s, *Maine Environment* presented a piece on its 1978 budget. A pie chart of NRCM staff allocation indicated that about 50% was devoted to various energy-related issues, including 33% to the Dickey-Lincoln dam alone.[27] This project drew a considerable amount of coverage throughout the energy crisis years, until its death in 1981. Whether in small updates or full articles, *Maine Environment* and NRCM spent a great deal of effort questioning and criticizing it.

The NRCM supported "soft-path" renewables such as solar and wind power, but in a tempered fashion, aware of their economic and technological limitations. It was more interested in stopping large, environmentally destructive dams, coal-fired plants, and the Maine Yankee nuclear power plant in Wiscasset, as well as promoting energy efficiency and conservation, than in specifically promoting renewables.

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[27] "NRCM's '78 Budget," *Maine Environment*, August 1977, 5.

The *Maine Times*, unlike the NRCM or MAS, was not nominally an environmental advocacy group, but rather a weekly alternative newspaper. Compared to the NRCM's *Maine Environment,* it was a weekly as opposed to monthly publication, and generally contained thirty to fifty pages per issue rather than ten or so. It began in 1968 (published by Peter W. Cox), and though not intended as solely an environmental newspaper, the *Maine Times* did have a strong commitment to environmental issues from the beginning, and it was still a much richer source on renewable energy issues than *Maine Environment* during the 1970s and 1980s. First and foremost, this stemmed from its editorial staff's priorities, especially editor John N. Cole's commitment and advocacy.

Cole's editorials (entitled "John's Column") showed him to be a hopeful and enthusiastic proponent of renewable energy, going back to at least 1973-74. At the beginning of the first energy crisis Cole criticized President Nixon's policies for dealing with the energy crisis, calling them too dependent on fossil fuels. He suggested that Maine develop its own energy policy, and take better advantage of renewable energy sources and energy efficiency efforts than federal policy would.[28] The *Maine Times* published many articles on solar and wind energy when, in a modern sense, they were in their technological infancy. It featured articles on individuals who had attempted to incorporate solar heating into their homes, and on businesses such as Zephyr Wind Dynamo Co. One engaging manner in which the *Maine Times* covered renewable energy developments was to revisit particular individuals or businesses, following their progress and, consequently, that of the energy sources themselves. For example, it covered Bill

[28] John N. Cole, "The Maine Times Version: An Energy Policy for Maine's Future," *Maine Times*, 16 November 1973, 8-9.

Gillette and Zephyr Wind Dynamo Co. from 1974 to 1980, from the optimistic founding of the corporation to the more sober, technical problem-plagued reality of 1980. The *Maine Times* also contained how-to pieces for those interested in using these new technologies and Cole's hopeful interpretation of the potential for renewable energy development, along with state policy recommendations.

As a whole, these three environmental advocates were probably ahead of the general public in their interest in wind and solar energy. MAS, NRCM, and the *Maine Times* educated the public about these energy sources (to differing degrees) and encouraged the state government to support them.

Maine State Government's Support for Wind and Solar Energy

By early 1977, Maine state government began to take a stronger role in the promotion and support of renewable energy, which became quite substantial by 1980. The Office of Energy Resources (OER) had just produced a new State Comprehensive Energy Plan. Probably the most comprehensive energy plan in Maine's history, it forecasted potential energy resources to 1985, discussing prospects for virtually all known energy sources, from oil to tidal power. While renewables like solar and wind energy did not play a big role in these projections, due particularly to their lack of development and economic uncompetitiveness, the Energy Plan highlighted the potential for the future, especially considering their relatively environmentally friendly natures. It encouraged legislative action, recommending that new solar and wind energy equipment be exempted

from sales and property taxes.[29] In addition to the energy plan, the OER also put out a discussion paper that focused specifically on solar energy, *Discussion Paper on the Direct Use of Solar Energy in Residential & Commercial Buildings in the State of Maine.* This paper examined the feasibility of solar energy development in Maine and recommended numerous actions in order to encourage solar development, including public educational efforts, tax incentives, loan guarantees for solar equipment purchases, government use of solar energy systems, and certification of solar equipment.

The OER's recommendations on behalf of wind and solar energy influenced future legislation. In April 1977, the Maine State Legislature, after considering the OER's "State of Maine Energy Policy Statement" (basically the State Comprehensive Energy Plan), voted to send it to the Joint Standing Committee on Energy, which would make recommendations for action. In the meantime, the legislature passed "An Act to Encourage the Use of Solar Energy in Maine Through Tax Exemptions," which modified current statutes to allow for sales tax refunds and property tax exemptions for solar equipment purchased until January 1, 1983.[30] Several other acts followed in the next couple of years. In 1978 the legislature passed "An Act to Establish a Solar Water Heater Demonstration Program for Maine." This act provided $400 grants, to be given in addition to other incentives, for homeowners or institutions that installed solar water

[29] Phyllis Austin, "Maine's Energy Plan: This Time Around It's Much More Comprehensive," *Maine Times*, 21 January 1977, 13.

[30] Maine, "An Act to Encourage the Use of Solar Energy in Maine Through Tax Exemptions," *Public Laws* (1979), 1105-06.

heating systems.[31] It set aside $16,000 - enough for forty recipients - for this purpose, with the possibility for more if enough people applied. Relatively modest acts such as this one, although it was more lucrative per recipient than most, benefitted individuals primarily and did not do much for the introduction of large-scale solar systems. The term "demonstration program" illustrated the main intent, which was to simultaneously encourage people to adopt new solar technologies, while educating the public about their existence.

After its passage, the state received 120 applications for the forty $400 grants, forcing it to choose winners based on a lottery system, as well as geographically. The *Portland Press Herald* printed the names of all forty recipients, thus lending some publicity to these Maine residents who had decided to adopt solar technology.[32] Following this, the OER selected seven geographically dispersed water heater set-ups in order to study performance. It paid particular attention to operation and economic viability, intending to provide information to the public on these matters (its essential purpose).[33] Generally, the response this demonstration program generated indicated the value the public placed on these government incentives, along with a willingness to explore tentative renewable energy sources.

The state government continued its impressive efforts to encourage wind and solar energy in 1979, by passing acts that addressed the need for standards for solar energy

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[31] Maine, "An Act to Establish a Solar Water Heater Demonstration Program for Maine," *Public Laws* (1978), 3660-61.

[32] "State Solar Lottery Warms 40 Winners," *Portland Press Herald*, 22 July 1978, 14.

[33] Lloyd Ferriss, "Maine Eyes Benefits of Sun-Heated Water," *Maine Sunday Telegram*, 11 February 1979, 1A, 3A.

equipment installation, and set minimum warranties as well. For instance, "An Act to Establish Minimum Warranties for the Sale and Installation of Solar Energy Equipment in Maine" addressed legislative concerns that "a major detriment to the commercialization of solar energy in Maine is lack of consumer confidence in the performance and reliability of solar energy equipment."[34] This act provided, at a minimum, "a 5-year manufacturer's express warranty against defects in materials or manufacture of solar collectors," and "a one-year warranty against failure of the solar system when such failure is the result of improper installation." It was enforced with civil fines, ranging from $200 to $1000, for dealers or installers who failed to adhere to it.

The *Legislative Record* of the Senate debate on this act highlighted the dissent, although it passed rather easily (17 to 5).[35] Oxford County Senator Donald O'Leary (D) found numerous problems with the bill, arguing against its assumption that consumer confidence in the performance of solar equipment was the real issue, pointing instead to Maine's northern climate and related unsuitability for solar energy use. O'Leary also believed that the proposed minimum warranties inequitably singled out solar equipment for warranty protection and did not allow for marketplace solutions to the problem. Thus the main concern appeared to be an excess of government authority to interfere with the free market. Senator Howard Trotzky (R) of Penobscot County concurred, suggesting that requiring five-year warranties on this questionable new solar technology would discourage dealers from selling it, unless at noticeably higher prices, thus diminishing

[34] Maine, "An Act to Establish Minimum Warranties for the Sale and Installation of Solar Energy Equipment in Maine," *Public Laws* (1979), 366-367.

[35] Maine, *Legislative Record – Senate* (1979), 1075-76.

overall purchases of solar equipment. A Home Builders Association lobbyist argued against the bill for basically the same reason, worrying that it might discourage builders from constructing solar homes.[36] From this debate, the dissent appeared to be conservative in origin (if not all from the same political party). It expressed distrust in government intrusion into the free market, and used the questioned effectiveness of solar energy as rationale for inaction. Again, though, the bill passed easily, and the dissent did not reflect any clearly evident public sentiment against government actions to advance solar and wind energy.

The legislature also passed "An Act to Establish a Voluntary Training and Certification Program for Installers of Solar Energy Equipment in Maine" in 1979. The main purpose of this act, according to the legislative finding and intent, was "to assure the quality workmanship necessary to bring about increased utilization of solar energy and the public health and safety thereof."[37] Addressing consumer confidence concerns, it gave consumers the opportunity to specifically seek out certified installers, but did not insure this, as often does occur in cases where public safety is in serious danger or where an industry or profession has become more comfortably established. It remained a voluntary program.

Another tax credit bill passed in 1979, this time applying to state income tax, "An Act to Provide a State Income Tax Credit for Installation of Renewable Energy Systems." This credit, a maximum of $100, applied to solar and wind systems, along with wood

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[36] "Solar Warranties: Benefit or Barrier," *Maine Times*, 6 April 1979, 6.

[37] Maine, "An Act to Establish a Voluntary Training and Certification Program for Installers of Solar Energy Equipment in Maine," *Public Laws* (1979), 344-45.

furnaces.[38] Although apparently the first Maine state income tax credit for renewable energy use, it was rather modest. But, adding this to all of the other renewable energy-related acts the legislature had passed from 1977 to 1979, the clear interest on the part of the state government and the public at large to explore renewable energy development became evident.

Beyond bills passed by the legislature, the state government, in particular the Office of Energy Resources, showed its desire to promote renewable energy to the public with several publications in the late 1970s and early 1980s. One example was *The Economics of Solar Water Heaters: A Guide for Evaluating the Cost-Effectiveness of Active Solar Water Heating Systems in Maine* (1979). This helpful guide explored the many considerations to take into account before purchasing a solar water heater, such as state and federal solar legislation, prices and quality of solar equipment, and a comparison of solar to other energy sources. Similar in aim to this (but not as in-depth) was *Bank on the Sun: The Dollars and Sense of Solar Energy Investments: An Economic Comparison Between Solar & Non-renewable Energy Sources* (1982). Another publication, the *Maine Professional Solar Services Directory* (1979), listed companies and individuals involved with solar energy in Maine, along with information on the kind of work and services they did. Some of these publications presented a fairly detailed analysis such as *The Economics of Solar Water Heaters*, or included specific practical how-to advice like *Solar Site Evaluator: How to Determine the Solar Potential of Your Building Site* (1982). Others were more brochure-like, simple five-page introductions to solar photovoltaic

[38] Maine, "An Act to Provide a State Income Tax Credit for Installation of Renewable Energy Systems," *Public Laws* (1979), 1335-36.

energy or solar hot water systems. While publications like these did mention some of its limitations, they were geared towards potential users and generally presented an optimistic outlook on the present and future of solar energy. They complemented the laws passed by the state legislature, and indicated a generally healthy state support for renewable energy.

One publication included an OER-conducted survey of people who had requested tax credits for solar water heaters.[39] This served as a means to encourage potential solar energy users. The OER sent questionnaires to 200 people, 122 of which returned them, which was actually an impressive percentage. According to the survey, the average user saved $313 per year on fuel or electricity costs. Over 80 percent of the respondents were satisfied with their system and its installation, and would recommend it to others. Seventy-four percent of the systems had been installed by certified installers, which provided feedback on the success of the voluntary certification program the state legislature had enacted. While this one survey should not be taken as comprehensive evidence of Mainers' attitudes towards solar energy, it represented a significant percentage of water heater owners at the time, and gives some indication of the perceptions of early solar adopters.

Going beyond putting out publications, the OER took part in a project designed to help low income families with home heating costs. It helped to train workers with the

[39] Maine, Office of Energy Resources, *Hot Water from the Sun: A Guide to Solar Hot Water Systems* (Augusta, Me.: The Office, 1983), 4.

Community Action Program (CAP) to install basic solar air collectors in low-income housing. The CAP also funded winterization and energy efficiency projects.[40]

Maine state government also engaged in mostly symbolic acts in order to demonstrate the viability of solar energy, similar to the Audubon Society's promotion of its new energy system or to President Carter's placing of solar panels on the White House. In 1979, the Maine OER installed a solar hot water heater in the annex of the Governor's Blaine Mansion. The OER selected this building for its public visibility, and calculated that the system would save money in the long run. This grew out of a study on the "solar conversion potential of state owned buildings," funded by the Northeast Solar Energy Center in Cambridge, Massachusetts.[41]

Overall, state government support for solar and wind energy during the late 1970s was a broad-based effort, consisting of an educational component, financial incentives, and regulations on equipment sales and installation. It reflected public interest, and addressed many of Maine's environmental advocates' concerns.

Public Interest in Renewable Energy in Maine

In May of 1978, Mainers took part in a national "Sun Day" sponsored by Solar Action, Inc., a Washington, D.C.-based nonprofit group. President Carter participated in this event by giving a speech on solar energy in Golden, Colorado.[42] In Maine, about one

[40] Rick McGinley, "Community Action Programs Build Solar Air Collectors for Low-Income Families," *Maine Sunday Telegram*, 14 October 1979, 24E.

[41] "Blaine Mansion Annex $2,700 Solar Hot Water System Is Good Long-Term State Energy Saving," *Maine Sunday Telegram*, 14 October 1979, 6E.

[42] "Thousands Pay Sun Tribute," *Bangor Daily News*, 4 May 1978, 2.

thousand people celebrated the sun at an event on top of Cadillac Mountain in Bar Harbor. The participants either hiked or drove to the top of the mountain to witness the sunrise, the first in the United States to see it. Events included folk-based cultural celebrations, along with speeches on solar energy. U.S. Senator James Jeffords (R-Vermont), who took part in the Maine festivities, remarked, "When you see thousands of people willing to walk up a mountain at 4 in the morning, it will strike fear in the hearts of all politicians, but most importantly in President Carter."[43] Comments like this, from a Republican, suggested a good future for solar energy and forecasted the federal measures to promote renewables use of the next two years. It also gave an indication that Carter was not as strong a supporter of renewable energy as his rhetoric and symbolic actions may have suggested.

The League of Women Voters of Maine took part in the promotion of solar energy with a "Solar Networking" project in 1979. A Maine version of a national effort by the League, this project aimed to "publicize the growth of solar conservation lifestyles," and to create a network of solar energy users in order to facilitate communication. It also published a newsletter, which discussed various solar projects and programs from around the state.[44]

The major newspapers of Maine reflected the local and national interest in energy issues. The *Maine Sunday Telegram*, for instance, published a special energy section, in cooperation with the OER, at least three years in a row (1977-1979). The *Bangor Daily*

[43] Ruth Moss and Christopher Spruce, "Sun Hides Out at His Festivities," *Bangor Daily News*, 4 May 1978, 1-2.

[44] "League of Women Voters Coordinate 'Solar Networking,'" *Maine Sunday Telegram*, 14 October 1979, 31E.

News contributed by printing the environmentalists' letter to Gov. Longley and, like the *Portland Press Herald / Maine Sunday Telegram*, ran various news items on renewable energy developments.

One notable example of renewable energy utilization in Maine in the 1970s was a solar powered waste treatment plant in Wilton. Funded 75 percent by the U.S. Environmental Protection Agency (EPA), and 15 percent by Maine's Department of Environmental Protection (DEP), this plant was the first in the country, and probably the world, of its kind, combining essentially nonpolluting renewable energy with pollution control. Its innovative design included passive and active solar components for heating the building and its water. In addition, solar energy heated anaerobic digesters, which simultaneously broke down sewage and produced methane gas, an energy source in itself. Designed to produce 20 percent of its own energy, the Wilton plant served as a model for others of this nature as, nationally, two more solar waste treatment plants were in the planning stage at the time of its dedication.[45]

In Portland, a federal grant of $12,750 from the Department of Energy (DOE) funded a solar demonstration project in the Munjoy Hill area in 1980. This project, co-sponsored by the Munjoy Hill Association and the Maine Audubon Society, featured the setting up of solar panels and other solar energy devices for seventeen homeowners. It served as a means to familiarize the public with solar energy, including its physical characteristics, and its potential to cut down on energy bills once installed. Apparently,

[45] Bruce Hertz, "Solar Treatment Plant is Dedicated at Wilton,"*Bangor Daily News*, 29-30 September 1979, 1, 14.

this project was one of sixteen like it around the country at the time, and Washington officials found the Munjoy Hill application "'exemplary.'"[46]

Conclusion

During the 1973-1980 period wind and solar energy development in Maine saw two somewhat distinct parts. The first three years, epitomized by the wind energy enterprises of Henry Clewes and Bill Gillette, was a hopeful, preliminary period in the modern development of these renewable energy sources. The environmental movement and the 1973-1974 energy crisis largely inspired the newfound interest in them. But without the technology, knowledge, or institutional support behind them, these enterprises would not be successful at the time. What distinguished the 1977-1980 years was, in particular, Maine state government's strong role in encouraging the development of wind and solar energy, through educational efforts, financial incentives, and renewable energy equipment regulations. This, in turn, was influenced by Maine's environmental advocates, as well as by federal government actions. By 1980 the body of knowledge on wind and solar energy was vastly larger than that in 1973. Technologically speaking, though, they were far from ideal. Reliability was still a considerable issue, particularly with wind turbines, as was cost-competitiveness. And this level of government support would not last.

[46] Mark McCain, "Hill Gets Taste of the Sun," *Evening Express*, 9 October 1980, 1; McCain, "Warm Response: Hill Solar Project Praised," *Evening Express*, 2 December 1980, 1.

CHAPTER 2: 1981-1988

Introduction

The momentum that wind and solar energy had attained during the 1970s began to dissipate after 1980. Much of this was due to one of the same factors that created this momentum in the first place - oil prices. During the 1980s, they began to decline, however, discouraging public interest in alternative energy sources. A change in the political climate also played a big part, with the coming of the conservative Ronald Reagan Administration, which was generally unconcerned with environmental issues. These two factors would dominate wind and solar energy development in Maine during the 1980s, evident in state government support, and environmentalists' and public attention. This did not occur instantly however, but over a period of about five years.

The second half of the 1970s saw an increased government focus on, and public interest in, renewable energy. One simple way of seeing this trend is to look at newspaper articles, books and government publications on solar energy and wind power. Most of them were written in the 1970s and early 1980s, in Maine as well as in the rest of the country. However, a rather dramatic change in federal energy policies occurred after President Reagan took office. A major goal of the Reagan administration was to cut federal funding, not just for renewable energy, but also for federal energy programs generally, especially the Department of Energy (DOE). Reagan, in fact, had a desire to do

away with the department entirely.[1] He was not able to accomplish this, but still basically believed in a free market solution to the energy crisis.

One illustrative example of Reagan era policy was the DOE budget for Research and Development (R&D). Federal budgets for renewable energy R&D had fluctuated between $500 million and $800 million per year from 1978 to 1981, but dropped to $314 million in 1982 and to $82 million in 1983. Fossil fuel R&D was not spared from these cuts. In fact, it declined proportionally to the renewable energy funding, illustrating that Reagan administration energy policy included dramatic cuts in almost every R+D program.[2] Nuclear power was the one energy source that did not experience dramatic R&D budget cuts. Its reliance on federal support to survive contributed to this decision, coupled with political considerations in the pro-nuclear administration.[3]

While nuclear was the only energy source that survived the R+D cuts relatively unscathed, this did not indicate a general lack of support for all other energy sources. The Reagan administration did support fossil fuel production in other ways, consistent with supply-side economics. It opened up previously off-limits federal lands to oil exploration in an attempt to increase domestic production and decrease dependence on foreign oil. At the same time, it gave tax relief to oil producers.[4]

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[1] James Everett Katz, *Congress and National Energy Policy* (New Brunswick, N.J.: Transaction Books, 1984), 154.

[2] Ibid., 163.

[3] Ibid., 159, 160.

[4] Ibid., 157-58.

By 1983 oil prices had dropped to their lowest level in several years, due to an international oil glut.[5] At the end of 1985 the federal tax incentive for solar and wind energy systems expired. Proposals to extend it drew no support from the Reagan administration.[6] The combination of these factors led to a sharp decline in public interest in renewable energy. Despite the loss of government and public interest, though, the developers of wind and solar energy continued their efforts to perfect these technologies.

Maine - Solar and Wind Energy Development during the 1980s

National political and economic trends affected the prospects for solar and wind energy in Maine significantly in the 1980s, as they had in the 1970s. Using attention in the press as a barometer, for instance, a noticeable decline in interest in solar and wind energy did occur between 1984 and 1990. The end of federal incentives discouraged Mainers from purchasing renewable energy systems. Nationally, the expiration of the federal incentives caused solar hot water heater sales to fall by 80 percent.[7] Although a couple of Maine state renewable energy incentives and programs remained as of 1985, the bulk had expired without renewal. This, combined with the federal government tax credit expirations and lower oil prices, significantly diminished the economic attractiveness of solar and wind energy.

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[5] Melosi, 328.

[6] Robert W. Righter, *Wind Energy in America: A History* (Norman, Ok.: University of Oklahoma Press, 1996), 215-16.

[7] Pat Nyhan, "Competing with Other Sources Is Difficult Because the Playing Field Isn't Level," *Maine Times*, 2 October 1987, 1B.

The Maine OER continued its regular publication of renewable energy pamphlets through the early 1980s, but curtailed them significantly after 1983. In 1981, near the height of government and public interest in wind and solar power in Maine, the OER held about forty solar energy themed workshops and conferences, attended by a total of about 2500 people.[8] According to its 1983-84 annual report public education was its "best means to advocate" solar energy, most prominently through its publications, and its technical training program. The Solar Installers Certification Program it designed was "successfully transferred" to the Regional Vocational Institutes (two-year colleges featuring technical and vocational training) during the early 1980s. This resulted from the 1979 legislative act, "An Act to Establish A Voluntary Training and Certification Program for Installers of Solar Energy Equipment in Maine." It awarded certificates to those who undertook a minimum fifteen hour training course, had at least one year of experience installing solar energy equipment, and demonstrated competence in this work. An OER paper entitled "Helping Maine People: The Role of the OER" stated that this was the first program of its kind in the country, an indication of the innovative nature of Maine state government's efforts on behalf of renewable energy, and which showed that they did more than just copy national efforts. However, the 1983-84 annual report contained an acknowledgment that a sharp decline in federal funds had negatively affected its solar program, illustrating the direct role these funds played in Maine's state government.[9] At this point the OER's wind energy program was even more modest, due

[8] From "Helping Maine People: The Role of the OER,"2/2/82, in OER Archive Box #7, Maine State Archives.

[9] Office of Energy Resources Annual Report, 1983-84, pp.7-8, contained in OER Archive Box #7, Maine State Archives.

in part to this decrease in funding. It did still include an anemometer loan program, intended for wind speed data gathering across the state, which could help determine appropriate sites to set up wind turbines. Augusta's support for wind energy had not been as strong as solar to begin with, evidenced by the greater number of government incentives and programs devoted specifically to solar energy. This probably arose due to the fact that solar energy, particularly hot water heaters, was clearly more reliable, and more ready for consumer use, than wind turbines.

Public interest in, and adoption of, these energy sources, following the aforementioned trends, continued at a relatively high level until the mid 1980s. For instance, in late June of 1982 Maine residents took part in National Solar Day, similar to Sun Day of 1978, though it did not receive the same level of public attention. The Maine events celebrating Solar Day included an OER-sponsored tour of the homes in Wayne that utilized solar energy, along with solar exhibits, workshops at the Hill house in Augusta, and music.[10] As of 1984, Maine solar and wind energy usage included over 2000 solar hot water heaters, about 140 photovoltaic systems, and 65 wind generators.[11]

Prominent public installations of solar systems continued into the early 1980s. At the University of Southern Maine in Portland, "one of the state's largest solar panel installations" was placed on the gym to heat water. It was purchased with a $55,000 federal grant, but soon after its installment the U.S.M. facilities manager said that the

[10] Paul Betit, "Solar Day: Tours and Exhibits," *Kennebec Journal*, 23 June 1982, 3.

[11] "A Selection of Renewable Energy Projects Located in the New England States and the Eastern Canadian Provinces," p.14, OER Archive Box #8, Maine State Archives.

diminishment of federal funds was likely to prevent future purchases of this nature.[12]

By 1983 Monhegan Island residents had installed thirteen solar photovoltaic systems, while the entire mainland of the state had installed only about 140.[13] The driving force behind this endeavor was the lack of utility power service on the island, which necessitated alternative power sources, such as diesel generators. As had been typical with solar and wind systems, they only became truly cost effective for customers off the power grid. However, this did not take into account the environmental costs of energy sources such as oil, coal, and nuclear, nor did it factor in the healthy government subsidies they received. The residents praised these systems for their lack of noise or exhaust (unlike the diesel generators), and they fit in well with the quiet and remote island atmosphere.[14]

Photovoltaic cells also saw use for communications in remote areas in Maine, particularly by state government-supported entities. For instance, six ranger stations in Baxter State Park began using photovoltaics for their two-way radios in 1984. The park's maintenance supervisor at the time doubted that their use would be expanded to heating or electricity in the near future, since it would require too much extra equipment. Prior to this time, photovoltaics had already been used for up to ten years by the Maine Forest Service to power microwave repeaters.[15] These modest communications utilizations of

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[12] "Mother Nature Set to Heat USM Water," *Portland Press Herald*, 10 June 1983, 11.

[13] Stephen Schultze-Jena, "Photovoltaics on Monhegan: A Pie in the Sky Idea Becomes Practical," *Maine Times*, 23 September 1983, 74.

[14] Schultze-Jena, 74-75.

[15] Pat Nyhan, "Photovoltaics Are Ideal on a Mountainside," *Maine Times*, 28 September 1984, 31B.

solar energy did not represent a significant percentage of overall energy use in the state, but were illustrative of where solar was becoming a cost effective energy choice. Into the 1990s solar energy found more and more applications of this nature on a national scale, relatively unheralded but quietly gaining acceptance.

One encouraging event amidst the 1980s drop-off in federal government support for renewable energy was that Maine state government renewed its state income tax credit in April 1984. Originally passed in 1979, this tax credit expired at the end of 1983. The renewal effort did encounter some difficulties, however. The Taxation Committee supported the bill for renewal, but then the Appropriations Committee decided not to fund it. John Kerry, director of the Office of Energy Resources, managed to convince them to reconsider this action, which gave the bill a second life. This illustrated that the OER was, to some extent, still committed to renewable energy. Originally, the Taxation Committee had actually increased the maximum credit amount, from $100 to $500, but then lowered it to the original $100 fearing the failure of the bill. Part of the difficulty it encountered resulted from the differing priorities of the two committees. Additionally, a perception that these tax credits went mostly to "an educated upper income elite" caused some opposition.[16] The bill did pass, however, effective until January 1, 1989. Still, this did not signal that Maine was generally ignoring national trends. The state legislature, after passing several renewable energy related acts in the late 1970s, did not pass any significant new ones during the 1980s. But, while the conservative Reagan administration negatively impacted federal funding for renewable energy, in Maine the

[16] "Solar Energy: Tax Credits? Maybe," *Maine Times*, 27 April 1984, 10.

Democrats held both houses of the legislature and the governorship from 1983 to 1987 (the Republicans held only the Senate from 1981 to 1983 and that by one vote). Lower oil prices and the national political climate, to a greater extent than a change in Maine's political climate, led to the decline in interest in solar and wind energy in Maine after the early 1980s.

Wind and Solar Energy - Technological Progress

During the early 1980s wind turbine production experienced rapid growth, particularly in California, which contained most of the wind power generating capacity in the United States. However, the reasons for this expansion were not technological improvements as much as abundant federal and state tax credits. Commercial enterprises built thousands of new turbines, but most of them were still not very reliable. Thus, the positive side of the tax credit expirations of the mid 1980s was that most of the exploitative companies that were there primarily to capitalize on the credits lost their incentive to stay in business.

Despite the end of the tax incentives, and the numerous disreputable companies and investments in California, engineers and manufacturers gained a sizeable amount of experience and knowledge during this period. By the mid 1980s the U.S. wind power companies had also learned that Danish-made wind turbines were much more reliable than those manufactured in the U.S., and had begun importing them in large numbers. The Danish turbines were characterized by their extremely sturdy and relatively simple designs, along with their modest size.

The difference in reliability between the Danish and U.S. turbines during the 1980s was instructive. Paul Gipe, in *Wind Energy Comes of Age*, saw two models of wind power development in the U.S. at this time. The first model, funded by federal R+D and manufactured by big aerospace companies, emphasized economies of scale and cutting edge, original technology. The second model, carried out by independent activists and entrepreneurs, emphasized small-scale turbines - a "bottom-up strategy."[17] Gipe felt that the first model basically failed, but that the second, essentially the Danish model, was relatively successful. He based this assessment mainly on the number of reliably performing wind turbines in each case, and the overall amount of wind energy produced. Interestingly, while one could blame the relative failure of U.S. turbine manufacturers on insufficient R+D (compared with that given to nuclear power for instance), Gipe showed that the success of the Danish turbines was achieved with proportionally much lower R+D expenditures than in the U.S. In fact, per R+D dollar, Denmark produced about three times the power generation.[18] He thus advocated increased government incentives for U.S. companies to develop turbines, based on what actually worked and proved reliable, and looking to increase size incrementally from successful models, rather than in substantial leaps.[19]

The relative lack of success of the U.S. federal government / aerospace industry wind turbine efforts of the late 1970s and early 1980s may have stemmed partly from their emphasis on creating innovative cutting-edge turbine designs. They did not adopt

[17] Paul Gipe, *Wind Energy Comes of Age* (New York: John Wiley & Sons, Inc., 1995), 77.

[18] Gipe, 73.

[19] Gipe, 91-92.

successful Danish designs since these were not "ours," nor were they particularly sophisticated. Gipe called this the "not invented here" syndrome, which was evident in much of the U.S. R+D community, not only in wind turbine research.[20] Additionally, the aerospace companies had a tendency to apply their knowledge of aircraft wings and helicopter blades to wind turbine manufacture, despite crucial differences in the purposes of each. In particular, long-term dependability is much more important for wind turbines than for aircraft. That is, the latter are serviced constantly to ensure safety, the primary concern, while wind turbines need to operate for extended intervals as much as possible, in order to maximize productivity.[21]

Until the expiration of the sizable federal tax credits for solar installations at the end of 1985, solar hot water heater sales boomed in the U.S., especially in sunny states like California and Hawaii.[22] Their success was dependent on this government support however. It fell off dramatically afterwards, seemingly regardless of technological innovation in solar heater design. For photovoltaics, technological progress was linked to overall utilization to a greater degree. The efficiency, and therefore cost, of solar cells improved constantly during the 1980s and onwards. This paralleled improvements in computer technology over the same period. Both, in fact, are silicon-based technologies.

By the early to mid 1980s wind and solar technology had begun to differentiate themselves concerning reliability, in Maine, as well as in the rest of the country. Solar hot water heaters and photovoltaics had achieved some level of success. Photovoltaics in

[20] Gipe, 81.

[21] Gipe, 84.

[22] Berman and O'Connor, 23, 29.

particular made steady progress as a technology during these years, in cost and efficiency. Wind power, on the other hand, experienced constant reliability problems in Maine, and as well on a national level. Compared with solar energy, wind systems had more moving parts, and were more susceptible to ice and mechanical failure. Additionally, siting errors, that is, the placing of windmills in insufficiently windy areas, plagued uninformed homeowners. As a result, noted Maine wind power entrepreneurs such as Bill Gillette (of Zephyr Wind Dynamo Co.) and Peter Talmage (of Talmage Engineering), became somewhat discouraged with the viability of the business. Talmage exited it in around 1982 (and shifted his attention to solar energy), while Gillette got out of the business in 1987.[23] The differentiation in reliability between these two energy sources was backed up by the 1984 Maine usage statistics quoted earlier. The number of solar energy systems in use dwarfed that of wind turbines. Reliability was an important issue, but additionally, installing a wind turbine required more space and, often, money. It also required an appropriate site, as mentioned, whereas solar systems could be placed on almost any building.

Generally, both technologies (wind and solar) made progress during the 1980s, but their utilizations took different paths. Solar energy applications tended to be small, modest, and practical mostly for specific remote area uses, taking on more of these as the technology improved. Wind energy, on the other hand, took on larger-scale and more visible challenges, particularly in California, but also experienced greater failures, as its practitioners attempted to, perhaps, push it beyond its technological limits.

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[23] Clark T. Irwin, Jr., "Wind Power: Developer Proposes Windfarm Despite Early Disappointments," *Maine Sunday Telegram*, 30 August 1987, 1C.

Maine's Environmental Advocates' Support for Wind and Solar Energy

Gauging Maine's environmental advocates' level of support for wind and solar energy provides insight into how much of an environmental issue energy was, and more specifically, how important a cause renewable energy was to them. An analysis of their level of support after the subsiding of the energy crisis shows the extent to which they were riding a crest in public interest on overall energy availability and cost, as compared to simply voicing their own environmental priorities.

During the 1980s large-scale energy projects drew constant attention in the Natural Resource Council of Maine's (NRCM) *Maine Environment*. One example was the proposed "Big A" dam on the west branch of the Penobscot River, which was a prominent issue in the 1980s until cancelled in 1986. The NRCM also questioned Central Maine Power's (CMP) proposal to import energy from Hydro Quebec over a twenty-nine year period. It was an intervenor in CMP's application to Maine's Public Utilities Commission (PUC) for this project. The NRCM's concerns included the following: the necessity of the project, that energy efficiency could negate the need for this imported energy, and the impact of the required new power lines on the environment.[24] The PUC rejected CMP's proposal in 1989.

After the Big A dam defeat in 1986 the NRCM decided that, more than just helping to defeat large energy projects, it needed to propose its own concrete energy program and offer "viable alternatives." A big part of their program was to stress energy

[24] Mark Ishkanian, "Council Intervenes in Hydro-Quebec Case," *Maine Environment*, October 1987, 8.

conservation and energy efficiency.[25] This was evident in their questioning of the Hydro Quebec proposal. Another example of NRCM's efforts along these lines was its drafting of state legislative bill L.D. 306 in 1989, "An Act to Promote Conservation Purchases by Electric Utilities," which "require[d] utilities to pay 20 percent more for electricity made available through [energy] efficiency improvements than from all other sources."[26] This bill did not pass, however. Judging from the modest coverage in *Maine Environment*, the NRCM did not place a high priority on solar and wind power promotion.

The Maine Audubon Society's (MAS) activities during the 1980s included the production of a directory which listed solar builders and suppliers in 1983, and a book entitled *Guide to Energy Efficient Space and Water Heating* (which included some coverage of solar energy).[27] In 1984, MAS took part in the Energy Education Conference, which was attended by over fifty educators (pre-collegiate level), and included a classroom workshop on low-cost solar collectors. It also conducted tours of the energy systems at its headquarters over a period of several years.[28] In 1988 MAS offered a spring field trip called "Powering Your Home Efficiently: Photovoltaics and Alternative Energy Sources," and co-sponsored a workshop on solar power with Central Maine Power.[29]

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[25] "Energy #1: Why Energy Is a Priority," *Maine Environment*, March 1989, 7.

[26] "Legislative Report: Energy," *Maine Environment*, May 1989, 5.

[27] "New Directory Lists Solar Builders and Suppliers,"*Habitat*, December 1983 / January 1984, 6; "Space and Water Heating Are Subjects of MAS Book," *Habitat*, December 1983 / January 1984, 6.

[28] "MAS Participates in Energy Education Conference," *Habitat*, August 1984, 8.

[29] See *Habitat*, March 1988, p.13 and April 1988, p.5.

Based on the evidence from newspapers, periodicals, and other publications, the public education roles dominated MAS's renewable energy efforts. However, it did also take part in public advocacy. This included the 1978 open letter to Gov. Longley (see Chapter 1). According to its annual report published in 1984, "During 1983, Maine Audubon strengthened its efforts to help Maine achieve environmentally sound energy independence. Recognizing that there has been little movement toward alternative energy resources by those who manage small industries, commercial buildings, and urban dwellings, our energy staff initiated several studies to identify energy constraints in these areas and to develop initiatives to overcome them." Along with this, they "worked with the legislature to renew Maine's solar tax credits."[30] In 1984 MAS developed a Portland Energy Action Plan, one aspect of which included an "assessment of indigenous renewable resources which could be used to decrease reliance on petroleum."[31] While perhaps not exactly public advocacy, the creation of this plan showed MAS's direct involvement in energy issues at the local government level, and how it was able to encourage renewable energy use in this context.

From 1983 onward MAS published *Habitat*, a (mostly) monthly periodical, and a good source for documenting its activities. Similar to overall government and media interest in solar and wind energy, its coverage declined noticeably after 1984. It remained, like *Maine Environment*, relatively more concerned with energy efficiency and conservation, and with questioning large energy projects like the Big A dam. Generally,

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[30] "The Maine Audubon Society Annual Report," *Habitat*, November 1984, 32.

[31] "Portland City Council Accepts MAS Energy Plan," *Habitat*, February 1984, 6.

with the exception of the U.S. Windpower / Kenetech wind farm proposals of the early to mid-1990s, MAS's concerns with energy issues declined after the mid-1980s.

The *Maine Times'* coverage of wind and solar power began to drop off noticeably after about 1981. While it still featured two or three articles per year on wind and solar energy during the mid to late 1980s, this drop-off mirrored the public decline in interest in energy issues after the subsiding of the energy crisis.

Conclusion

During the early 1980s national interest in renewable energy still remained high after the explosion of public attention in the 1970s. But a combination of factors, including a more conservative national political climate and lower oil prices, caused a steady erosion of government and public interest in renewable energy, particularly noticeable during the second half of the decade. Nevertheless, solar and wind energy progressed technologically during the course of the 1980s. While sizable public funding certainly could aid this progress, it happened on a modest but steady level without it. The situation in Maine did reflect national trends generally but, considering the obstacles to wind and solar power development in the state, it appeared to have a comparatively high level of support. Maine did not have the same climatological advantages that national leader California had. The windiest sites in Maine - the western mountains and the coast - are plagued by snow, ice and erosive salt air (coast only). Concerning solar energy, the sun's rays are not as powerful in Maine as in the South. Most parts of the country had climatological advantages for the use of either one or both energy sources.

Despite these disadvantages, Maine still managed to keep its state income tax credit for renewable energy until the end of the decade, and to sustain state government utilizations of solar energy until 1985, at least. Similarly, MAS kept up its public education efforts through about the mid 1980s, while the *Maine Times* still covered developments in wind and solar power utilization throughout the decade, if modest by its end. No institution in Maine appeared to be immune to national trends, including the environmental advocates, yet Maine still sustained some level of involvement.

CHAPTER 3: 1989-1997

Introduction

Around 1990 a convergence of events and trends created a more favorable climate for renewable energy in the U.S. once again. In 1990, the twentieth anniversary of Earth Day, and a concurrent rise in public concern about global warming, signaled a resurgence of the environmental movement in the U.S. Then, the 1991 Gulf War illuminated the link between oil and national security and, along with a temporary increase in energy prices, created a stronger public and government desire to curtail U.S. reliance on foreign oil. Unlike the experience during the energy crises in the 1970s, this time the resurgence in interest in renewable energy was at least met with decent wind and solar technologies. By this time each had progressed technologically for a good fifteen years, taking advantage of the peak in public interest of the late 1970s and early 1980s. And while not apparently competitive economically with fossil fuels, the cost of wind and solar energy systems had decreased dramatically. They had also become much more reliable and efficient. Solar energy found use particularly in remote off-the-utility-grid areas, while wind power was utilized especially in sizable wind farms that fed into the utility grid. Each energy source continued its technological progress, yet still, this and the resurgence in public interest did not lead to a dramatic increase in renewable energy production in the U.S.

Rather than only small tentative companies doing most of the innovation in wind and solar energy, now larger and much more heavily financed companies existed in the

U.S. More and more, the latest in wind and solar technology was likely to come out of California and, to a lesser extent, other western states. During this time, a proposed wind energy project in the western Maine mountains represented potentially the largest solar or wind energy project of any kind in Maine's history. Proposed by a company from California, the national leader in wind and solar power, it illustrated Maine's direct connection to national situation.

Wind and Solar Energy - Technological Progress and Overall Development

Wind Energy

Despite the mid 1980s "bust" in the wind power industry in California, U.S. manufacturers, and wind farm developers, learned from their failures and from the Danish successes. This led to decent progress in the reliability of the wind turbines used in the U.S. between the mid 1980s and mid 1990s, most of which were the solid but relatively simple Danish models. Despite the success of these models, U.S. engineers continually tried to improve on them with more innovative designs. As of the mid 1990s many felt that engineering breakthroughs would displace the Danish models fairly soon.[1] Most of the developing models at this time were medium sized, in the approximately 200 to 400 kW range. Thus, while U.S. engineers attempted to design cutting edge turbine technology, the influence of the Danish turbines was still evident in the preference for a medium size, rather than the 1 MW and larger turbines produced by federal R+D during the late 1970s and early 1980s.

[1] Robert W. Righter, *Wind Energy in America: A History* (Norman, Ok.: University of Oklahoma Press, 1996), 269-270.

However, the reliability improvements during this period were, to some extent, lost on much of the U.S. public and the utility companies (according to a 1991 study referred to by Robert Righter), who still associated wind power with the failures of the 1970s and early 1980s.[2] This lag-time between the state of current wind power technology and the public perception of it served to hold back the development of the wind power industry. Thus, as Righter pointed out, technology / reliability was hardly the only issue concerning the future of the industry. In fact, he felt that as of the mid 1990s, "the great riddle of reliability" was "close to resolution," but that public utilities' reluctance to give contracts to wind farms was a problem. Many functioning wind turbines had to be shut down due to their perceived economic uncompetitiveness.[3] The utilities often based their assessment on price per kilowatt-hour in their attempt to keep prices low for the general public. Utility contracts could swing one way or the other on two cents per kilowatt-hour, raising questions about how these costs were determined, especially considering factors such as government subsidies, and the external costs of one energy source compared with another.[4] The wind farms generally lost this battle. One constant problem for green energy sources, compared with fossil fuels and nuclear energy, has been that their environmental and social benefits have not been adequately calculated into their overall cost, thus making them appear less competitive than they really were.

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[2] Righter, 268-69.

[3] Righter, 286.

[4] Righter, 289-90.

Solar Energy

As costs came down and manufacturing processes became more sophisticated, applications for photovoltaics (PVs) expanded. By the late 1980s this allowed for small scale PVs to compete with batteries in consumer products such as calculators. They also appeared in radios and walk lights.[5] That solar power could be used on this modest level distinguished it from wind power, and gave it more opportunities for utilization. Photovoltaic systems of a somewhat larger size became cost effective for remote homeowners off the power grid, and for agricultural / rural water pumps. By the late 1990s, PVs had expanded into the National Park Service, portable highway signaling signs, vacation cabins, and RVs (campers). Diesel generators had been the most prominent energy source for these applications previously, but they were plagued by unreliability, noise, and pollution. PVs gained acceptance and moved towards becoming the preferred energy source in these and other cases in the 1990s.[6]

As with wind energy, technological innovations and cost reductions in PVs were not the only issues affecting their adoption as energy sources. From the mid 1970s to the present day, adopting PV technologies has necessitated moving away from conventional energy systems. This was somewhat easier for remote applications with few good options, or for say, consumers deciding to purchase an inexpensive calculator. But for government and industry to change their basic energy sources from predominantly fossil

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[5] Gary Cook, "Photovoltaics," in *The Energy Sourcebook: A Guide to Technology, Resources, and Policy*, ed. Ruth Howes and Anthony Fainberg (New York: American Institute of Physics, 1991), 176.

[6] John Perlin, *From Space to Earth: The Story of Solar Electricity* (Ann Arbor, Michigan: Aatec Publications, 1999), 192.

fuels, and thus overcome the sizable bureaucratic inertia, would be a daunting task, as John Perlin suggested in *From Space to Earth.*[7] Likewise, the federal government was not prepared to plan for or encourage a time when most homeowners would get their heat and electricity from renewable energy sources. This did not change a great deal between 1973 and 1997.

While the costs per kilowatt-hour for PVs in urbanized (on-grid) areas had not become competitive with utility power (disregarding government subsidies, social and environmental costs), it grew much closer during the 1980s and 1990s. On-grid homeowners had begun installing PV systems on their roofs, particularly in places like Sacramento, California where local government and utilities encouraged it in the 1990s.[8] These homeowners were willing and able to pay a little extra for environmental reasons and / or independence. Another incentive to adopt PV systems was the decision by large lenders Fannie Mae and GMAC Inc. to include them in home mortgages.[9] This helped to alleviate the relatively large up-front payments required for one of these systems, a significant impediment to their adoption. Net metering, under which homeowners sell the electricity they produce with PV (or wind) systems back to the utilities at equal rates, also encouraged their adoption. This existed in twenty-three states as of the late 1990s.[10]

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[7] Perlin, 187-88.

[8] Perlin, 152.

[9] Perlin, 156.

[10] Perlin, 155.

Maine - Solar and Wind Energy Development

National trends in the solar and wind industries continued to affect Maine significantly. The biggest news concerning renewable energy in Maine during the 1990s was the U.S. Windpower / Kenetech proposal for a sizable wind farm in the western Maine mountains. The first serious proposal for a wind farm in this area, however, came from Harley Lee. In 1989, Lee, who ran the Endless Energy Company in New Gloucester, proposed a relatively modest project for the construction of twenty wind turbines on Sugarloaf Mountain (the location of a large ski resort).[11]

Lee signed a research and development demonstration contract with Central Maine Power (CMP), in which he would generate up to a capacity of fifteen megawatts of electricity. By then, he had a plan to build forty-five wind turbines, enough for five megawatts. But, two years later, Lee had not firmly established a site, nor had he acquired the sufficient financial backing or the turbines themselves.[12] Thus, as of 1991, the project was still very much a work in progress. That year, California-based U.S. Windpower, a noted national wind power company, proposed another, significantly larger, project in the same region.

U.S. Windpower (originally a subsidiary of Kenetech Co., it became Kenetech Windpower on January 1, 1994) modified its proposal over the next few years, but settled on a project with a capacity of 210 megawatts, featuring 639 turbines. It was to have run along the Kibby and Caribou mountains in the vicinity of Eustis and Stratton.

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[11] "Sugarloaf: Harnessing Wind," *Maine Times*, 3 March 1989, 3.

[12] Randy Wilson, "Harley Lee Puts His Energy into Wind: Maine Has Enough Wind, but No Turbines—Yet," *Maine Times*, 18 January 1991, 12.

Several obstacles got in the way of the enactment of this plan. One was the objection of environmental groups and hikers. While there was certainly not uniform opposition from these groups since wind power was one of the cleanest energy sources, they still had numerous concerns. These included the potential for wind turbines to harm raptors (such as eagles and hawks) and migrating songbirds. Another was the potential disruption that the project could cause to what was essentially a wilderness area. Although paper companies like Boise Cascade and S.D. Warren had cut nearby forests for decades, it was still one of the most remote areas of Maine, not only lacking development, but seeing few seasonal residents, hikers, or other recreationists. And while this area was not home to unique wildlife species or particularly critical habitats, getting to the proposed sites and erecting the turbines were bound to cause erosion and disruption to local mountain ecosystems, which are more sensitive than sea-level forested areas. Some worried that this project might be a foot in the door for continued development in the area. Another concern, voiced by the Appalachian Mountain Club in particular, was about the impact the turbines and power lines would have on scenic views in the area.[13]

These concerns never went away but, significantly, in 1994 four environmental groups endorsed the Kenetech plan, albeit with certain conditions. The Natural Resources Council of Maine, Maine Audubon Society, Appalachian Mountain Club, and the Conservation Law Foundation required that other mountain areas be permanently protected from development, on the order of 10,000 acres, in order to gain their support. Kenetech also signed an agreement with the state Department of Inland Fisheries and

[13] Phyllis Austin, "Out of Sight, Out of Mind? Backers of Wind Power in Maine Have Picked the State's Most Remote Area," *Maine Times*, 8 July 1994, 2.

Wildlife to undertake a study of the effects of the turbines on birds, and to subsequently make sure that the wind farm did not adversely affect them.[14]

The fact that a relatively green energy source like wind power could draw all this concern from environmental groups was significant considering that they had been among the largest supporters of wind and solar energy for most of the 1970s and much of the 1980s. This raises the question, if not energy sources like these, then which would suffice? Of course once wind projects like those in Maine are proposed, consideration of potential social and environmental impacts must be undertaken, and these do bring up legitimate concerns. This would happen with utility scale projects using any energy source, all of which cause disruption. Examples in Maine have included the Maine Yankee nuclear power plant, and hydroelectric projects like the Big A dam and Dickey-Lincoln, all of which were opposed by environmentalists. An important long-term question appears to be, what energy sources does society ideally, as well as realistically, want to use. But this tends to be dealt with one proposed project at time, rather than all at once, and is generally decided according to current economic concerns primarily.

A crucial factor has always been the difficulty of displacing the currently dominant energy sources (fossil fuels in particular), those which government and corporate bureaucracies, and society in general, count on. This becomes easier if the new proposed energy source is clearly cheaper than those currently in use, or receives massive government subsidies (as with nuclear power). In Maine in particular, most proposed energy projects have drawn fierce opposition, at least since 1970. So, the

[14] Phyllis Austin, "Quid Pro Quo: Windpower Intervenors Want 'Equivalent Protection," *Maine Times*, 24 June 1994, 8.

environmentalists' concerns with wind power were, like those of any other interested group, based their own cost-benefit analyses. They placed a high value on wilderness preservation and, of course, the environment, and thus any development of this scale in a wilderness area would have raised a lot of concern. Still, in the end, the major environmental groups lent qualified support to the Kenetech proposal. This illustrated the complexity of the issue, as well as the case-by-case approach to power projects. In addition, timing was critical. The only real constants from one project to the next appeared to have been a concern with cost, and that there would be opposition from various groups.

Another obstacle in the path of the Kenetech proposal, which would have created a New England Wind Energy Station (NEWES), was land use regulations. It brought up zoning issues that the Maine Land Use Regulation Commission (LURC) had never dealt with before. These related to the remote mountain ridge zone in question, environmental issues, and wind development itself.[15] This required negotiation and public hearings on the project. The process also included the input of the four mentioned environmental groups as "intervenors" in the hearings and the zoning and development decision process.[16] In August 1995 the LURC gave its preliminary approval to the project,

[15] Phyllis Austin, "Windpower and Mountain Ridges: The First Serious Environmental Questions Are Being Raised," *Maine Times*, 15 October 1993, 6.

[16] Phyllis Austin, "Quid Pro Quo: Windpower Intervenors Want 'Equivalent' Protection," *Maine Times*, 24 June 1994, 8.

rezoning the proposed site to accommodate the wind farm, while addressing its various potential impacts.[17]

This, however, did not lead to smooth sailing for the project. Kenetech had a difficult time finding utilities to purchase their potential power, in particular due to the looming deregulation of the industry, which caused much apprehension about the future. And then, in 1996, Kenetech filed for chapter 11 bankruptcy in Oakland, Ca.[18] At this point it tried to sell many of its wind projects to other companies, including the proposed NEWES. It searched for a buyer for the Maine project for several months, but in March 1997, the Maine LURC effectively ended it by refusing to extend the deadline for action on the project, encouraged by an environmental group, Friends of the Boundary Mountains.[19] In the end, then, a combination of factors led to the demise of the NEWES, but Kenetech's financial difficulties, affected by technological problems with its own turbines, and the lack of buyers for the power, were the two crucial issues. This was, in fact, quite representative of the difficulties the wind power industry was experiencing nationally during the mid 1990s.

This still left the proposed wind farm site, or perhaps another one in the western Maine mountains, as a potentially viable one for future wind projects. Harley Lee expressed interest in a much more modest project on the site. Throughout the 1990s,

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[17] Dieter Bradbury, "Bankruptcy Could Sink Maine Wind Power Plan: Kenetech Hopes Another Developer Will Buy the Rights to the Project, but Analysts Are Doubtful," *Portland Press Herald*, 30 May 1996, 1.A.

[18] Bradbury, 1.A.

[19] Phyllis Austin, "Harley Lee Wants to Pick Up Where Kenetech Left Off," *Maine Times*, 20 March 1997, 8.

Lee's efforts to set up smaller wind projects had paralleled the proposed NEWES project. By 1993, Lee had a CMP demonstration contract, and all the necessary permits needed to begin the project on Sugarloaf Mountain, but only lacked financial backing (a familiar story by now). Soon, he formed a business partnership with a California wind energy company, Zond Systems. Zond, one of the major wind energy companies operating in the U.S., had flirted with bankruptcy circa 1986, and had also been forced to shut down operable turbines during the early 1990s for economic reasons and lack of utility contracts.[20]

In late 1994 Zond postponed the deal, citing the unsuitability of the site's soil and rocks for supporting the wind turbines. It would have necessitated a prohibitively expensive effort to fly concrete up to the site with helicopters. The harsh weather conditions of approaching winter prompted the initial postponement. Lee felt Zond had been too cautious with the project, and filed a $3 million lawsuit against them.[21] This was later settled out of court. After the postponement, CMP cancelled its contract with Endless Energy.[22] Lee also explored a larger wind project for the Reddington Pond Range and Black Nubble Mountain. This project had not gone as far into the development stage as the Sugarloaf plan, and it too was unsuccessful.

The failure of these wind farm proposals, then, had more to do with the national companies who intended to run them, than with Maine's unsuitability or the

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[20] Righter, 236, 286.

[21] Tom Molloy, "Wind Turbine Project Blown Away," *Kennebec Journal*, 29 November 1994, 11.

[22] Phyllis Austin, "Harley Lee Wants to Pick Up Where Kenetech Left Off," *Maine Times*, 20 March 1997, 8.

unwillingness of the public to accept them. Maine state government (LURC in particular) had given its approval to the NEWES and Lee's Sugarloaf project, as had Maine's major environmental groups. Still, the latter had done so with reservations, especially in the NEWES case. One minor environmental group, Friends of the Boundary Mountains, encouraged the NEWES' demise. The utilities were probably the largest obstacle, from within Maine itself, to the success of these projects. While CMP did give a contract to Lee, it later backed out when Lee and Zond Systems encountered difficulties. CMP had also engaged in talks with Kenetech about purchasing their power, but had not signed a long term deal, mainly due to looming deregulation of the power industry. Power utility deregulation is certainly an important issue in relation to the subject matter of this paper, but it occurred too recently to determine its effect on wind and solar power development. At any rate, once the difficulties with Kenetech and Zond became known, the utilities were even less likely to sign power purchasing contracts.

The proposed mountain locations for these projects did not make things easier certainly. The NEWES project had been intended for a wilderness area, as had Lee's Reddington area project. His Sugarloaf project was to be set up on the already developed Sugarloaf Mountain, however, and did not appear to draw as much opposition from hiking and environmental groups as the other two. In any case, the mountain locations would have made construction difficult. The same could be said for the mountain winter weather, which also would have made operation of the wind farms challenging. This raises this question, where would the ideal location be? The flatter and more developed regions generally do not have as much available space for development or are not as

windy. And the more developed an area, the more complaints from property owners and residents for any proposed construction project would occur. Actually, the NEWES proposal had been carefully selected for its combination of high wind speeds, its lack of interference with the logging industry, and its avoidance of noted Maine scenic and recreational areas.[23] California, and other states interested in wind power development, also struggled with location issues.

Maine's experience with wind farm proposals was somewhat similar to that in other parts of the country, yet its efforts to make the projects work (particularly one as large as the NEWES proposal), and this in a state rather adverse to development generally and to new power projects specifically, suggested that its interest in wind energy was beyond that of the average state.

Solar energy, on the other hand, saw no large proposed projects in Maine. Even though solar photovoltaic systems have tended to be more reliable than wind turbines on a national level, the wind companies have set up more large electricity producing enterprises. This appears to have been heavily influenced by California, which produced about 90 percent of the country's wind power by 1994. In the late seventies and early eighties California had an excellent tax credit situation for wind energy, highlighted by a 25 percent state credit, which could be added to the 25 percent federal credit until 1986. Additionally, California utilities made contracts with many wind energy companies to buy electricity at a fixed rate for ten years. Also, due to the tax credits, financial investors put a good deal of money into wind systems, regardless of the huge reliability problems in

[23] Phyllis Austin, "Out of Sight, Out of Mind? Backers of Wind Power in Maine Have Picked the State's Most Remote Area," *Maine Times*, 8 July 1994, 2.

the early 1980s, often using it as a tax shelter.[24] All of this helped to create a big wind power infrastructure in California, building up technical and business expertise, and leading to its dominance in the field. Solar energy did not benefit to this extent.

By 1994, solar power had enjoyed modest success in individual cases in Maine. Interestingly, two articles, one in the *Maine Times* and the other in the *Kennebec Journal*, appeared to have rather different assessments of it. The *Maine Times*, in a profile of two homeowners who had adopted active solar systems, discussed the significant improvements in technology and cost over the previous fifteen or so years. It also stated, reassuringly, that "all alternative energy system components and appliances are now tested and certified with performance ratings."[25] The article conveyed that there was a great deal of information about setting up solar systems, and listed twelve Maine companies that dealt with them, but related that the average homeowner was not aware of how to get this information, nor with the general state of affairs in solar energy in the first place. Thus, the average homeowner still had a tendency to view it as "prohibitively expensive and inconvenient."[26] Public education was a key need, then, particularly to update Maine residents about the progress of solar (as well as wind) energy over the past ten years. While the state government, MAS, the *Maine Times*, among others, had filled this role during the late 1970s and 1980s, their efforts had dropped off after this.

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[24] Daniel M. Berman and John T. O' Connor, *Who Owns the Sun?: People, Politics, and the Struggle for a Solar Economy* (White River Junction, Vt.: Chelsea Green Pub. Co., 1996), 230.

[25] Tory Haiss, "Off the Grid: Electrical Independence Is Easier and More Affordable than Ever," *Maine Times*, 23 September 1994, sec 1, p.5.

[26] Tory Haiss, "Off the Grid: Electrical Independence Is Easier and More Affordable than Ever," *Maine Times*, 23 September 1994, sec 1, p.6.

The *Kennebec Journal*, on the other hand, in an article entitled "Solar Water Panels out of Vogue but Still Working," addressed solar hot water heaters in particular. It discussed several cases, including those in government buildings, of solar hot water systems that still worked (generally they were about fifteen years old). It portrayed them as "out of vogue" and stated that hardly anyone manufactured them any more. While one of the main sources used in the article expressed remorse that the government did not do more to fund solar energy, the overall tone was that the solar heaters, and by association, solar energy itself, was a relic of the past.[27] This discrepancy in the portrayal of solar power prospects in Maine at the time may have partially reflected the editorial stances of these papers, the *Maine Times* being a strong proponent of renewable energy in the past. But it also appeared to be a general indication of the public's lack of pertinent information on the subject, and that without an energy crisis and a related renewable energy "vogue," the public was not interested, especially when it could afford standard utility power without a great deal of trouble.

Conclusion

During the period from 1989 to 1997, the situation surrounding wind energy in Maine differed noticeably from that of solar energy. Wind energy saw the notable effort to establish a major wind farm by Kenetech, along with Harley Lee's more modest proposals. None of these were successful, but the effort expended on their behalf, particularly in the Kenetech case, illustrated the commitment in Maine to renewable

[27] Dan McGillvray, "Solar Water Panels Out of Vogue but Still Working," *Kennebec Journal*, 19 April 1994, 9.

energy. The experience with solar energy was much more modest, essentially the efforts of individual homeowners or small businesses to install photovoltaic systems. Yet it was no less successful, in the end, than the much more prominent and larger scaled wind farm proposals. Inadvertently this may have shed light onto the future prospects of renewable energy, perhaps in favor of small-scale individual ownership of power production rather than large utility-controlled enterprises. In fact, this idea was promoted extensively, on a national scale, in Berman and O'Connor's *Who Owns the Sun?: People, Politics, and the Struggle for a Solar Economy*. Still, most of the effort concerning these renewable energy sources in Maine during this period was expended towards the wind projects.

One thing that these rather disparate experiences had in common, however, was the influence of the out-of-state development of the solar and wind energy industries. Technologically speaking, Maine was essentially dependent on innovations made elsewhere, as solar and wind systems improved in efficiency and cost, although this was nothing new. Moreover, the wind farm proposals, Kenetech's in particular, were also dependent on outside companies for the development of the entire project in Maine. The Kenetech project did not, however, fail because of the lack of a "made in Maine" status, but due to Kenetech's own financial problems, and difficulty finding utility contracts in Maine. This, in the wind power case, along with the more decentralized steady forward progress of solar energy, was quite representative of the national situation. What made Maine stand out in particular, however, was its participation and effort to move along this sizable wind energy proposal, as most states did not attempt projects of this scale. The project gained support from the major environmental groups, unlike most large energy

projects in Maine over the last thirty years, which had generally failed. Considering that it failed due to an outside company's difficulties and the uncertainty caused by the looming deregulation of the power industry (a national trend), rather than due to opposition from the public and state government, suggests that the energy source of this project made it preferable.

CONCLUSION

On the whole, the development of wind and solar energy in Maine had a lot in common, particularly the modest stage of technological development at which they found themselves in 1973, and their status as perhaps the most environmentally friendly energy sources in an era when the environmental movement in the U.S. flourished. But still, the development of each was distinct in a number of ways in Maine. During the 1973-1974 energy crisis, wind power became the more prominent renewable energy source of the two, specifically in the enterprises of Henry M. Clewes and Bill Gillette. Clewes, in particular, became nationally known for his wind power expertise (however tenuous and short-lived that may have been). However, the lack of reliable technology to back up these enterprises eventually resulted in their failure, and diminished public interest at the same time.

Maine state government did not begin to actively support wind and solar energy until after 1975. During the height of this government activity during the late 1970s and early 1980s, solar energy, despite wind energy's greater public notoriety during the early 1970s, received the most attention, particularly evident in the amount of bills passed to encourage solar water heater purchases. This did not indicate an attempt to discourage wind energy, which did receive some support, rather it appeared to be an acknowledgment of the better technological (and economic) readiness of solar energy, solar water heaters in particular. Following from this, actual adoption of solar energy technologies in Maine during the 1980s far exceeded that of wind turbines.

During the 1990s, public attention shifted decisively back to wind power, because of the scale of the Kenetech wind farm proposal. Unlike the previous solar (and wind) applications in Maine, this proposal was for a utility power station, and required the development of mountain-top wilderness areas. It necessitated a complex approval process, involving state agencies such as the Land Use Regulation Commission and many of Maine's major environmental groups, and also required a sizable utility contract. Clearly it was a more prominent project than any other wind or solar enterprise before it in Maine's history. In the end, however, it failed, marking the second failure of a prominent wind power project (although those in the 1970s were much more modest) in Maine since the early 1970s. In the meantime, solar energy continued its modest forward progress, generally one person or small business at a time. Wind power, like solar power, did make impressive progress technologically between 1973 and 1997, but it did not reach the point of reliability as soon, and its failures (whether technological or otherwise) were more prominent. It may well be, as suggested in Berman and O'Connor's *Who Owns the Sun?*, that this is a portent of the future, that small democratic applications of wind, and especially solar, power will be the most relevant. In this scenario, individual homeowners, businesses, and institutions would produce the power, rather than the utilities.

A crucial factor throughout was economics, particularly how competitive wind and solar energy systems were with fossil fuels, nuclear, and hydroelectric power. The state incentives of the late 1970s acknowledged this. But once most of the state and federal incentives had expired, sales of solar and wind systems, particularly solar hot

water heaters, dropped significantly. This showed that competing directly with the dominant energy sources, especially in areas on the utility grid, was generally a losing battle. In remote areas without easy access to utility poles, however, wind and solar power did become much more competitive. Solar energy, in particular, found increasingly more remote applications over time, most notably perhaps, on Monhegan Island. It was particularly effective in displacing diesel generators, which were noisy, polluting, and less reliable.

In all of this, Maine's experience with wind and solar power did parallel, and was significantly influenced by, the national experience. The energy crisis especially, and the environmental movement, were responsible for the surge in interest in these energy sources after 1973. Maine took part in national events such as "Sun Day" in 1978. Some of its state tax incentives for renewable energy appeared to be influenced by similar federal incentives, but at the same time, Maine residents could benefit from these federal incentives. Technology was an important factor, since Maine was dependent on national and international innovations in wind and solar devices. This ranged from the primitive and unreliable technologies of the 1970s to the much improved state of affairs during the 1990s, and included the differentiation in development between wind and solar energy. Reliability and cost were key concerns throughout. Solar and wind energy in Maine experienced significant downturns after the early 1980s due a drop in oil prices and the Reagan Administration's lack of support for these renewable energy sources. The experience with the Kenetech proposal during the 1990s was not only reminiscent of wind power projects in other states, but it (and Harley Lee's proposals) included

partnerships with California wind power companies. The wind farm proposals drew public skepticism, particularly from environmental groups, due to location issues, and antidevelopment pressures, as had projects in California, Minnesota, and other states. The looming deregulation of the power industry during the mid 1990s, which influenced Central Maine Power's reluctance to sign a power contract, was also a national trend. In many ways the Kenetech proposal in Maine was a microcosm of the wind farm experience in California; although in California many successful wind farms were actually in operation by 1997.

Thus, while Maine's experience with solar and wind power from 1973 to 1997 can be portrayed as a microcosm of the nation's, it also stood out in several ways. First, it featured many noted or innovative projects or individuals, particularly from 1973 to 1984. These included Henry Clewes's national notoriety during the early 1970s, the Wilton solar powered waste treatment plant, Portland's Munjoy Hill solar energy project, and the Solar Installers Certification Program. Maine state government's support for solar energy during the late 1970s and early 1980s was quite impressive, featuring many tax incentives, certification programs, educational programs, and publications. This occurred in a cold northern state without nearly as much strong sunlight as in prominent solar energy states such as California, Florida, and Hawaii. Similarly, the fact that the Kenetech proposal got as far as it did, and failed more due to this California company's problems rather than lack of government and public support, said quite a bit about Maine's willingness to support this kind of renewable energy. On top of this, these wind farm proposals were planned in a state that was generally adverse to development, and

has seen one unsuccessful power generation proposal after another since 1970. Of course it did, in the end, fail but it got government support, and was the only significant one over this time period that was not opposed by the major environmental groups.

Numerous factors have influenced the rise in interest in, and development of, wind and solar power in Maine, but perhaps two motivating forces stood out among the people who played a part in this - environmental concerns and a desire for independence from mainstream society or utility companies. This could be seen particularly in John N. Cole's strong advocacy for these energy sources in the *Maine Times*, in prominent engineer Peter Talmage's work over the years, and in his many clients (and other adopters of these technologies), who often lived in remote areas.

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