SOCIAL BARRIERS TO RENEWABLE ENERGY LANDSCAPES*

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ABSTRACT. After many years of slow progress, we find that worldwide environmental, political, and economic pressures are providing greater purchase for the accelerated development of renewable energy. Although many people would consider this quickening pace good news, the transition from conventional resources has encountered public resistance. In this article I examine the nature of challenges to the development of geothermal, wind, and solar energy projects in three places: the United States, Scotland, and Mexico. The common thread in the public reservations about renewable energy is landscape change and the consequent disruption such change produces to established ways of life for those who are nearby. It also suggests the importance of rebalancing the emphasis of renewable energy programs away from the traditional technical focus that dominates development planning. The more suitable and expedient approach would be to consider the challenges of development as predominantly social matters with technical components, rather than the other way around. To accept this view is to unlock the door to a renewable energy future. *Keywords: landscape, renewable energy, society.*

We are addicted to electricity. To most of us it is indispensable; it powers almost everything we need and like. Those of us with access see its continuous supply as essential to a lifestyle we would like to maintain. Those with little or no access see its greater availability as a way out of a lifestyle we would like to improve. But there is a problem. As demand increases, so too do the varied penalties the environment has to absorb in order to produce it. Flooded canyons, radioactive waste, lost mountaintops, and global warming are just a few of the better-known costs.

As these costs have expanded, our first instinct has been to try to shrink them using technical fixes. For example, a new and safer generation of nuclear reactors is on the drawing board, and we are spending great sums to develop cleaner ways to mine and burn coal. We are hoping, even betting, that such potential innovations can rescue the status quo and avoid cuts to the use of electricity that has become such an important component of modern well-being. The question is whether this is a wise wager; there is growing suspicion that it is not (Marx 1964; Mumford 1967; Winner 1986; Gould 1993; Thayer 1994).

We may be able to identify another approach. One option is for us to recast the long-running play of modern-day electricity supply. We could do this if we were to replace the tired actors we have relied on for so long and turn to some fresh understudies who can step in and take their place. These new actors are members of a troupe called "the renewables," and we judge that three of them have the greatest near-term promise: geothermal, wind, and solar. These substitute forms of energy

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have many advantages: They are all locally available, sustainable, have low to zero emissions, and—in the case of solar and wind—do not need to be cooled with water. With these advantages, one may wonder, Why have we been so slow to develop them more robustly? What has been holding us back?

One possible explanation for this sluggish pace is that these new players are still in training, that they need more work, that they are—to use less metaphorical terms—encumbered by technical issues. This premise, however, is open to question. For example, when we examine it more closely, we find that the conversion efficiency of photovoltaic cells has not changed significantly for more than a decade, that standardized wind turbines are now routinely mass-produced in several countries, such as Denmark and China, and that few if any important mysteries remain in the operation of most geothermal power plants.

The other possible reason for the holdup tugs us in a completely different direction: Social barriers are blocking our way. That is to say, people are creating the problems, not technology. This is not an entirely new observation; a rich literature exists on societal reactions to new technologies. The journal *Technology and Culture,* for example, is dedicated to exploring this idea, and David Nye and Joel Tarr, among other scholars, have examined various aspects of the social adoption of conventional energy sources such as coal, oil, and uranium (Nye 1999; Tarr 1999). What has been heard more recently, however, is a rising chorus of opposition to the very energy resources we have been hoping will help take their place.

The first thought might be that barriers erected to renewables are politically motivated, and no doubt that factor is important in the introduction of anything as fundamental as a change in the source of our electricity. However, politics are such an encompassing element in every decision that as an explanation for delay it evens out across all the resources. Another presumed barrier might be economics, specifically the purported higher economic cost for renewables. Although this argument might be valid in some cases and in some places, it is equally not valid in other circumstances, such as in Japan and many other places where the costs of conventional electricity are at least as high. Thus, if we discount economics and politics as causes, what else might be further inhibiting development of renewable energy resources?

Recent articles have addressed pieces of this question for individual resources, particular time periods, and separate countries (Wolsink 1988, 1989, 2007; Mallett 2007; Wüstenhagen, Wolsink, and Bürer 2007; Toke, Breukers, and Wolsink 2008; van der Horst and Toke 2010; Warren and McFadyen 2010). My approach is somewhat different. I examine three resources and move chronologically over a period of about two decades. I start with the early developments of geothermal energy in California; shift to burgeoning wind energy industry in the United States, Scotland, and Mexico; and end with the emerging controversies over solar energy development in the southwestern United States. Throughout, I consider the idea that opposition to landscape changes and the associated impacts on the way of life such changes might bring to local residents are generating the impediments to a renewable energy future.

Barriers to Geothermal Energy

The landscape burden of geothermal energy is stronger than that of any other energy resource for two reasons. First, geothermal energy is site specific: It must be developed quite close to where it is found, regardless of the topography or land use. Such spatial exclusivity concentrates virtually every phase of development—including exploration, access, well drilling, all construction, power-plant operation, and fluid reinjection—at the site of resource availability. In each phase, activity must accommodate to the existing landscape, be it flat or mountainous, desert or forest, empty wilderness or intense agriculture. Second, geothermal resources have lower energy densities than do other fuels. This means that wider areas are disturbed to produce equivalent amounts of electricity. Taken together, these characteristics result in a relatively large, unavoidable, and immovable landscape "footprint."

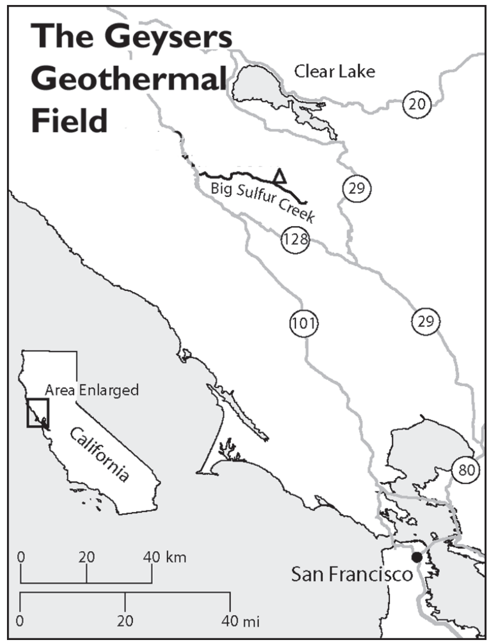

FIG. 1—The Geysers geothermal field in California's Mayacamas Mountains is the largest in the world. (Cartography by Mike Catsos, School of Geographical Sciences and Urban Planning, Arizona State University)

The spatial characteristics of geothermal energy are on full display in California. The Geysers, in the northern part of the state, is the world's largest commercial geothermal development. An uncommon, steam-dominated system, it covers about 30 square miles of the Mayacamas Mountains, 70 miles north of San Francisco (Figure 1). Because of its relative isolation and steep topography, developing The Geysers has required adjustments to steep and unstable slopes covered with a mix of grasses, chaparral, and oak species characteristic of the Mediterranean climate of California's coastal ranges.

The land at the precise location of The Geysers is used primarily for watershed protection, and no residential or commercial land uses exist within the boundaries of the field. This pattern of land use changes substantially with distance. To the west are occasional ranches and wineries; to the east, recreational activities around Clear Lake.

About 400 miles to the southeast, hard on the border with Mexico and not far from Arizona, the Imperial Valley geothermal resource underlies a completely different landscape. Instead of steep slopes, scattered oaks, and 30 inches of precipitation per year, the Imperial Valley is an agricultural oasis in the midst of a scorching,

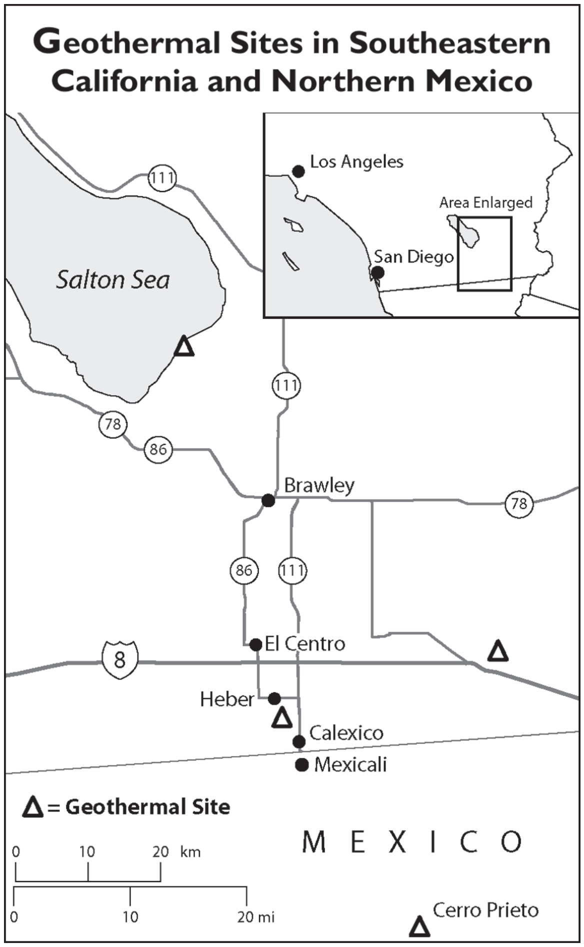

Fig. 2—The vastly productive Imperial Valley lies atop substantial geothermal resources, which have now been commercialized in three areas. (Cartography by Mike Catsos, School of Geographical Sciences and Urban Planning, Arizona State University)

desolate area that sometimes receives no rain at all (Figure 2). Meticulously fashioned into a leveled and finely calibrated system of irrigation and drainage canals, the approximately 460,000 acres of the Imperial Valley yield $1.3 billion in produce and livestock yearly, all sustained by 340 days of sunshine and 3.1 million acre-feet of water from the Colorado River (IID 2011).

Despite the common resource, the two places exhibit very different social barriers to development. At The Geysers, the initial view of developers was that the small population and low-intensity land use of the resource site would provoke little public resistance. Few obstacles, it seemed, existed that would deter plans to reshape the land, create new roads, level space for construction pads, drill production and reinjection wells, or lay pipe. With no obvious constraints, everything seemed well suited to turn the abundant hot steam found there into electricity for a growing population (Figure 3). For almost two decades The Geysers expanded impressively, reaching more than 2,000 megawatts (MW) of installed capacity by the mid-1980s. Then, suddenly, social obstacles began to appear (Pasqualetti and Dellinger 1989).

Conflicts at The Geysers pitted the industrial landscapes of geothermal energy against the recreational landscapes of Clear Lake. The reason for concern was apparent: Although The Geysers provided the county with some welcome tax revenue, recreational use of Clear Lake was, and is, its primary economic engine. Any action that menaced this mainstay was viewed with protective alarm. Though largely hidden by trees and topography, at some places The Geysers operations are as close as 15 miles from the lake, close enough for the malodorous hydrogen sulfide emissions to draw fire.

Fig. 3—Development of California's The Geysers geothermal site must adjust to the challenges of topography, unstable slopes, and nearby resorts. (Photograph by the author, June 1985)

Hydrogen sulfide, with its well-known rotten-egg aroma, is a common emission at geothermal operations; and the prevailing winds carried the powerful fragrance from The Geysers directly over the resorts that hug the lakeshore. Patrons of the resorts and restaurants objected to the proprietors, and the complaints reached local politicians. Talk about revoking power-plant licenses soon began (Pasqualetti and Dellinger 1989).

Although geothermal companies at The Geysers had foreseen several types of problems, they had not designed the facilities to avoid this one. The obnoxious odor emerged as an unexpected social barrier to the development of this renewable energy project. Wishing to protect their investment, geothermal developers scrambled to find solutions. The answer came in the form of hydrogen sulfide scrubbers, which are still in place. Complaints have subsided since they were installed.

Solving one problem, however, created another. The scrubbing by-product was classified as hazardous waste, requiring disposal at the nearest licensed disposal site, about 100 miles away. To transport the sludge, haul trucks had to maneuver along the area's narrow, winding roads. Fatal accidents occurred, and waste spilled into the environment; negative publicity followed. Geothermal operators, who thought that installing the scrubbers had erased a social problem with a technical solution, found themselves again on the defensive. Eventually, better equipment, refined handling procedures, and better driver training erased the problem from the public agenda (Pasqualetti and Dellinger 1989).

Fig. 4—After several decades of study, the existing agriculture and geothermal development now coexist in the Imperial Valley. (Photograph by the author, February 2008)

Development in the Imperial Valley faced a markedly different situation. There, the existing landscape was agricultural. For years, politicians, landowners, and field workers all worried that site-bound geothermal energy could not coexist with the lucrative field crops and feedlots. The concerns included whether withdrawal of geothermal fluids would disrupt the finely tuned irrigation and drainage systems, whether hydrogen sulfide emissions would reduce crop yields, and whether reinjecting the geofluids would stimulate seismic activity (Pasqualetti 1980).

These worries became effective barriers to renewable energy development, delaying meaningful commercialization of the geothermal resources for decades. Eventually, once convinced that the local economy would not suffer, Imperial County established guidelines and planning protocols that placed more than 147,000 acres of the county in a geothermal overlay zone (County of Imperial 2006). Today geothermal development and agriculture flourish side by side (Figure 4). However, ultimate development is still slow; at present, only about 350 MW of generating capacity is connected to the electric grid, a small fraction of the potential that exists beneath the fields. In contrast, 30 miles south of the international border, less intense agriculture use and less stringent environmental laws have facilitated development more than twice that size at Cerro Prieto (Gupta and Roy 2007).

Social Barriers to Wind Energy

Although geothermal plants are especially good for meeting baseload power, wind turbines have certain other advantages. For example, they need no cooling water, produce zero emissions, are simple to erect and dismantle, and can be installed quickly in a larger number of places. They also, however, produce the most blatant landscape changes of any renewable energy resource.

Being a form of solar power, wind energy is even more sustainable than is geothermal energy. Currently, it is also more successful: Compared with the 12,000 MW of global geothermal capacity at the end of June 2010, the generating capacity of wind turbines reached 36,300 MW in the United States and 175,000 MW globally by the same date (WWEA 2010).

Yet, despite its many advantages and quick rise in popularity, wind power continues to encounter social barriers. They fall into two principal categories. First are the generic barriers, such as the conspicuous and unavoidable presence of the wind turbines on the land. Second are the site-specific barriers. Although these barriers tend to vary from place to place in response to local natural and cultural sensitivities, the most fundamental of these is the interruption that wind turbines create on the landscape they transform (Pasqualetti, Gipe, and Righter 2002). Both sets of obstacles will influence what we can expect from wind power as a contributor to a renewable energy future. Several of the most significant examples of these barriers have emerged in the United States, Scotland, and Mexico.

In the United States, objections to the modern installation of wind turbines began in earnest in California in the 1980s, when the City of Palm Springs filed suit against Riverside County and the U.S. Bureau of Land Management for allegedly not following proper environmental procedures during the installations in San Gorgonio Pass (Pasqualetti 2001, 2002; Pasqualetti and Butler 1987) (Figure 5). The

FIG. 5—The eastern end of California's San Gorgonio Pass is one of the earliest large-scale wind developments in the world. (Cartography by Mike Catsos, School of Geographical Sciences and Urban Planning, Arizona State University)

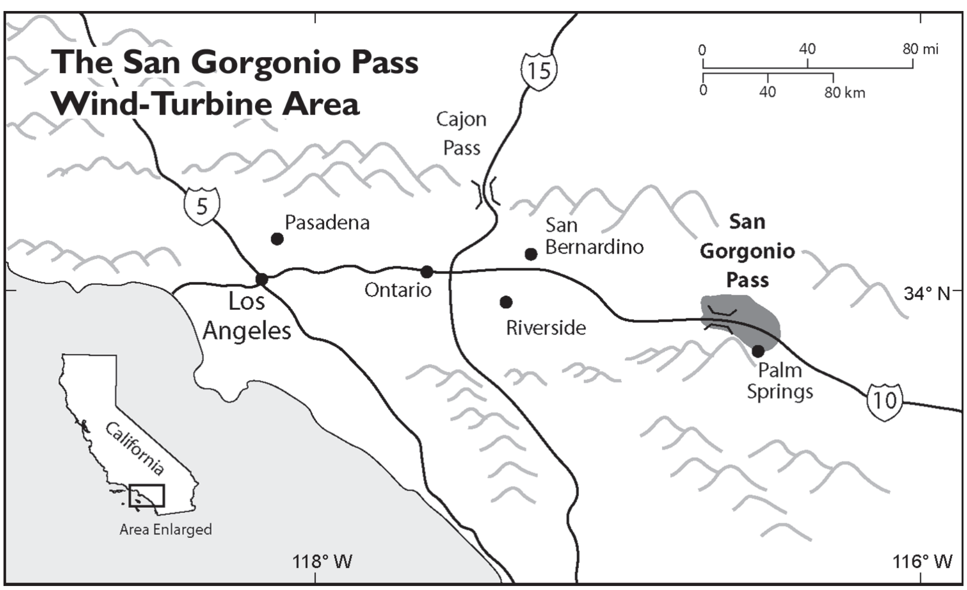

Fig. 6—One of the primary objections to the wind turbines in San Gorgonio Pass was that they interfere with the scenic vistas, such that of 11,000-foot Mount San Jacinto. (Photograph by the author, March 2006)

Fig. 7—After years of rancor between wind development and the existing communities, Palm Springs, California, now embraces the wind. (Photograph by the author, April 2002)

principal claim was that the wind turbines markedly degraded the beloved desert landscape right at the main entryway to the stylish resort community (Figure 6). Other objections included claims that the turbines were noisy, that they flickered as they rotated, that they leaked oil, and that their presence depressed land values.

In hindsight, the most surprising aspect of these objections was that they were raised at all. Although the eastern end of San Gorgonio Pass has a dramatic mountain landscape as a backdrop, it is windblown and subject to sandstorms, is full of transmission lines and discarded trash, and is bisected by noisy Interstate 10. In other words, it was not particularly attractive land for home sites. Given these circumstances, few people might have envisioned that wind developments there would arouse public opposition or give wind power a bad name. The reaction, when it came, was a surprise and an early lesson for all those who had anticipated a smooth path for the future of wind power. If people objected to wind development in San Gorgonio Pass, where would it be acceptable?

Eventually, the commotion settled down. Following the first flurry of construction, reactions, legal suits, and tax adjustments, wind developers and regulators worked together to craft pragmatic resolutions. For example, Palm Springs annexed several square miles of land occupied by the wind turbines and started receiving tax revenues. Opinions improved with the adoption of procedural adjustments developed by Palm Springs and Riverside County. Over the next ten years these adjustments, coupled with improvements in design, construction, and operation, produced a gradual shift in public opinion from opposition to mild indifference. By the turn of the millennium, the reversal was complete: The Chamber of Commerce, local hotels, and postcard publishers often promote wind farms that are literally in the backyard of Palm Springs. Tours of the wind farms are available, and even local property owners have come to terms with the installations as a part of the new landscape (Figure 7).

This change of heart did nothing to assure similar treatment elsewhere. Other issues began to appear. In many locations, especially Altamont Pass in Northern California, concern focused less on aesthetics and more on bird mortality (Bryce 2009; Curry 2009). In Minnesota, West Virginia, and elsewhere bat deaths were the focus of negative attention (Johnson and others 2004; Kunz and others 2007). In Wyoming, wind development encountered resistance from oil interests (Thompson 2009).

The number of objectionable locations continued to grow until soon the epicenter of U.S. opposition shifted to a project known as "Cape Wind" (Kempton and others 2005; Firestone and Kempton 2007; Williams and Whitcomb 2007). As originally proposed, the development would comprise 170 offshore turbines in a 25-square-mile area of Horseshoe Shoal, 5 miles south of Cape Cod, Massachusetts (Figure 8). From the start, it was considered a test case for offshore proposals all along the East Coast (Harrison 2010), and opposition was correspondingly strident. The public debate over the proposal has been vociferous and prolonged: By 9 June 2009, an article in the *Vineyard Gazette* stated: "It has been 2,755 days since the Cape

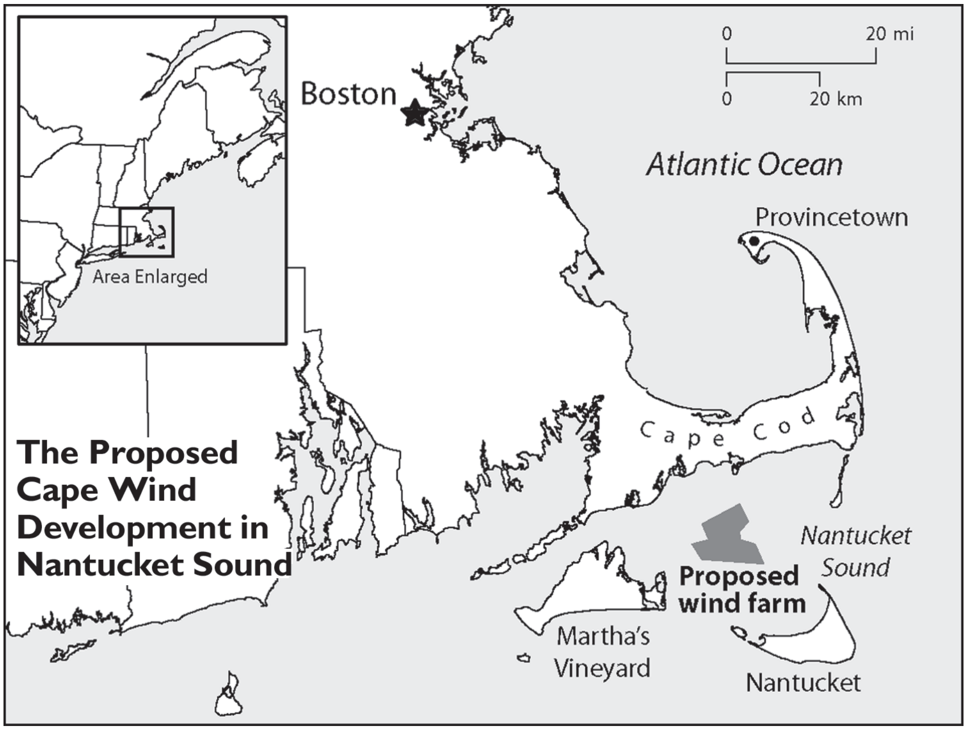

Fig. 8—The planned Cape Wind development in Nantucket Sound, Massachusetts. (Cartography by Mike Catsos, School of Geographical Sciences and Urban Planning, Arizona State University)

Wind project was first formally proposed. . . . Hostilities began only a few weeks after the war in Afghanistan" (Seccombe 2009). The controversy was finally resolved when, on 28 April 2010, Secretary of the Interior Ken Salazar made the final decision in favor of the Cape Wind project.[1]

During the long debate, both sides raised a wide variety of considerations. The principal objection was the envisioned changes to the high-valued recreational landscape. Ancillary objections included predicted threats to fishing resources and navigation, oil leaks, and, most recently, the Wampanoags' claim that the turbines will interfere with ancient burial grounds and traditional sunrise ceremonies. So heated did the debate become that segments of the environmental community even faced off against one another (Riley 2009). For example, in 2005 Robert F. Kennedy Jr., an ardent environmentalist, argued that developers are "trying to privatize the commons."

Wind energy controversy is also brewing in many places in Europe, among them Scotland (Figure 9). One such case has been on the Isle of Lewis, in the Outer Hebrides. In 2004 a partnership of private companies and British Energy applied to build a 234 turbine, 702-MW wind farm stretching across the three most northerly Lewis estates, Galson Estate, Barvas Estate, and Stornoway Trust Estate (Figure 10). The majority of the proposed wind-farm infrastructure fell within the boundaries of the Lewis Peatlands Special Protection Area, one of the largest and most intact

FIG. 9—Residents of Penicuik, Carlops, and Howgate, south of Edinburgh, Scotland, formed the Penicuik Environment Protection Association to oppose the proposal to build eighteen 2.5 MW wind turbines. The protest shown here took place at Auchencorth Moss, near Penicuik. (Reproduced courtesy of the Penicuik Environment Protection Association, [www.auchencorth.org.uk/])

known areas of peat land in the world (Scottish Government 2008). The project would be about twice the size of the entire wind capacity installed near Palm Springs and would involve hundreds of pylons, conductors, roads, and construction platforms. At full scale, the schemes proposed for the Isle of Lewis would generate enough electricity to meet the average needs of 1 million people indefinitely, assuming constant per capita demand. Opposition, however, was strident, with protests often accumulating under the banner of *Mǎnteach gun Mhuileann* (Moorlands without Turbines) (MWT 2010).

Sustained, determined, and effective resistance surfaced as soon as the project was announced, and it continued for several years (Ittmann 2005). By April 2008 the Scottish political body deciding on the application had received 10,924 letters of opposition and only 98 letters of support. This contributed to the decision by Energy Minister Jim Mather and the other ministers to turn down the request as a landscape change they could not approve (BBC 2008; Scottish Government 2008). The proposal, they said, "would have a serious impact on the Lewis Peatlands Special Protection Area. . . . Plans by Lewis Windpower for a wind farm . . . in Lewis have been refused consent on the grounds of incompatibility with European law" (Scottish Government 2008). The defeat at Lewis occurred in one of the most remote occupied places in Europe. In contrast to crowded and tony Cape Cod, the Lewis

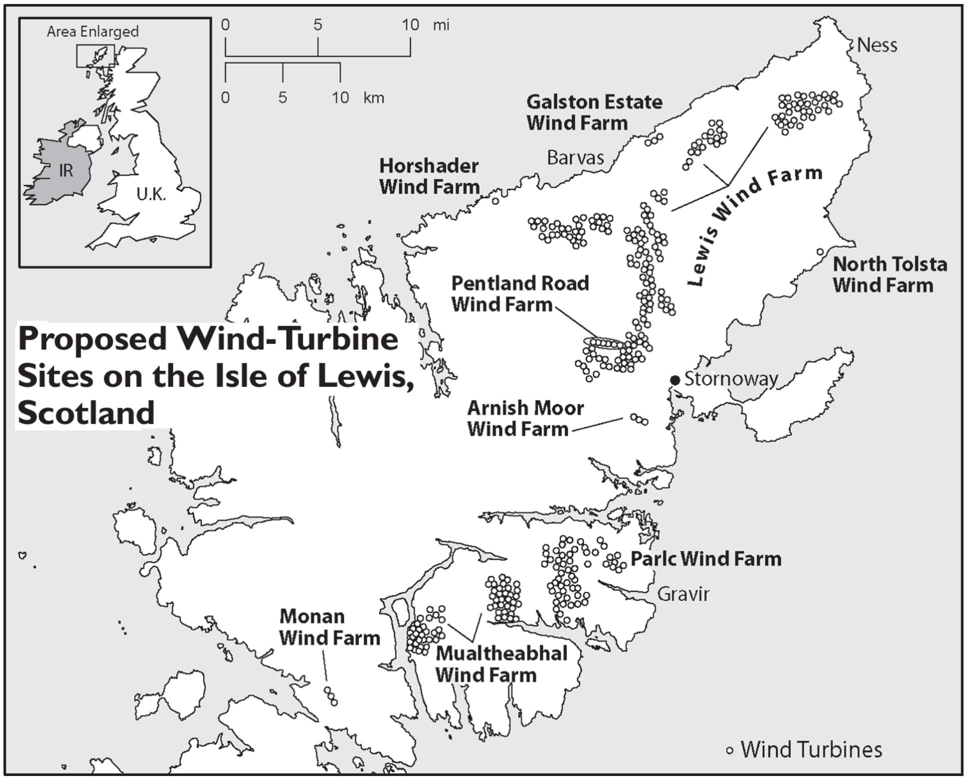

FIG. 10—The Isle of Lewis, Scotland, proposed site of the largest wind development in Europe. (Cartography by Mike Catsos, School of Geographical Sciences and Urban Planning, Arizona State University)

landscape is rural, open, and quiet. It is home to fewer than 20,000 people living a modest lifestyle, clinging to traditional ways, speaking Gaelic along with English. The locals fought to keep the area the way it is.

As in other locations, the list of barriers to the Lewis project started with unwanted changes to the landscape. It then grew to include threats to birds, damage to peat bogs, and risks that the whole project would pose to some of the finest megalithic cultural sites in Europe, the Callanish Standing Stones, erected around 2500 B.C. (Gray 2009). Everyone on the island, and thousands elsewhere, wanted to keep developers from transforming a bucolic landscape into an industrial landscape.

Lewis, and the sense of place that has developed on it, is as unique as its nature. Its primary residents are fundamentalist Presbyterians who do not brook intrusions or interference from outsiders—which a large wind project would surely produce. Whereas on Cape Cod, multiple merchants, well-off residents, and swarms of summer visitors keyed opposition, on Lewis isolation, modest living standards, and conservative local values kept working to prevent wind power from gaining purchase. It most ways the two places are very different; the one trait they had in common was a disdain for the anticipated changes to the existing landscape experience.

The decision against the Lewis wind farm can be considered as notable a defeat for renewable energy development as it was a stalwart example of the weight of public opinion. However, the final chapter for wind power on the Outer Hebrides is yet unwritten. Indeed, other projects on Lewis continue under review. By the beginning of 2010 the ministers had approved a project at Muaitheabhal, in the southerly Eishken Estate. Helen McDade of the John Muir Trust took note: "This is a test case for wild land. It is absolutely clear cut that this major development should not go here as the land is protected and the impact would be disastrous for the beauty of the area" (Gray 2009). In reaction to the news that the ministers might approve other proposals, another spokesperson for the trust said: "We are extremely concerned by this if it is true. I believe that Ministers would have severely misjudged the public mood and there would be enormous backlash" (Gray 2009).

Proving that objections to wind energy proposals are widespread not only geographically but also historically and culturally, we travel next to the Pacific lowlands of Oaxaca, Mexico (Figure 11). With 85 MW of generating capacity already in place in Oaxaca by mid-2009, expansion that is planned will dwarf any wind energy project in the world. Already, more than 12,000 acres of land are reserved for wind development in the municipalities of Juchitán de Zaragoza, Unión Hidalgo, El Espinal and San Dionisio del Mar; and more than 2,500 MW are to be installed by 2014 (AMDEE 2009). That is be roughly equivalent to the total installed wind-generating capacity of California as of spring 2009, a total that accumulated over a period of twenty-five years. Huge by any standard, full-scale development in Oaxaca is estimated at between 5,000 and 7,000 MW (Luengo and Oven 2009).

Topography and weather patterns make the Isthmus of Tehuantepec attractive for wind development. For a sense of the potential in this area, consider that a good wind-power density (wind class 4) is 400–500 watts per square meter. In large areas of Oaxaca, however, wind-power density commonly exceeds 700 watts per square

FIG. 11—The La Venta wind area of the Isthmus of Tehuantepec, Oaxaca, Mexico, one of the most promising areas for wind development in the world. (Cartography by Mike Catsos, School of Geographical Sciences and Urban Planning, Arizona State University)

meter (wind power class greater than 7) (Elliott and others 2003). This makes the Isthmus of Tehuantepec among the best wind energy sites anywhere—and most tempting for the Mexican government and various development partners.

The ultimate scale of development will rely on several factors other than raw wind strength and consistency. Much will depend on siting choices and cooperation between developers and local residents. Current plans are to concentrate the wind farms near the rural communities of La Venta and La Ventosa, northeast of Juchitán (Stevenson 2009). This could be a portentous choice. Founded in 1486, Juchitán is now home to about 75,000 citizens, mostly Zapotecs and Huaves. It is also the seat of the Coalición Obrera, Campesina, Estudiantil del Istmo, an influential popular movement that matured in the 1970s combining socialists, peasants, students, and indigenous groups (COCEI 2010). The relative ease of passage through the low-lying region of the isthmus has contributed to its strategic value and the long history of occupation in Juchitán. Such long occupation has helped create a close association between the people and their land (O'Connor and Kroefges 2008), as well as substantial autonomy from the central government in Mexico City.

The autonomy is reflected in the history of political unrest and activism common in this region. A revolt took place in 1834, and life was again interrupted by the Mexican-American War in 1847. Less than twenty years on, the people of Juchitán defeated the French. Porfirio Díaz, later a dictator of Mexico, populated his army mostly with citizens from Juchitán. In 1910 other natives of the town organized in support of the revolutionaries Pancho Villa and Emiliano Zapata. By 1980 Juchitán had attracted further attention by electing a left-wing, prosocialist municipal government, the first Mexican community to do so in the twentieth century. In February 2001 Juchitán received the military caravan of the Ejército Zapatista de Liberación Nacional. Many residents in the region clearly have an anarchist bent.

Given this historical and cultural background, it is not surprising that the changes which accompany the introduction of wind power have met with some resistance. In recent years the tendency for citizen activism has evolved into increasingly common clashes, ones that pit locals against the federal government over plans to alter their sense of landscape permanence by installing wind megaprojects in the area. Among the contentions is that local residents are receiving meager compensation for leasing land to the wind developers.[2] The reported amount has ranged from amounts equivalent to U.S.$51 per acre per year for a single turbine to U.S.$40–$48 per acre per year (Sanchez 2007; Hawley 2009). Others have reported the rate to be as low as U.S.$15 per year for 7.4 acres, as Karen Trejo reported in 2008:

> Faustina López Martínez, originally from the village of Juchitán, complained that the companies promised agriculture aid without ever following through. On the lands where she used to plant corn to sell, the Spanish company Union FENOSA plans to install windmills to generate wind energy for the next 30 years, and possibly extending to double the term. In exchange, López will receive 150 pesos (less than US$15) each year for the rent of each of her 3 hectares (7.4 acres) of land.

Such disproportion is one of the principal reasons behind the formation of organizations such as the Grupo Solidario de la Venta, which are opposed to wind development in the isthmus (Girón-Carrasco 2007). This and other groups claim that the "government has been violating the rights of indigenous peoples, causing both environmental and cultural destruction; that the intent of . . . wind park construction is to turn the isthmus into an industrial corridor" (Sanchez 2007).

These strong antiwind sentiments are being noticed in other wind-rich countries, including the Netherlands: "In Juchitán, in southern Mexico, the wind always blows. Very hard. Wind farms are springing up like mushrooms . . . to the great displeasure of the local Zapotec farmers. . . . Wind power projects on the Isthmus of Tehuantepec in southeastern Mexico harm land of Zapotecan farmers" (La Ruta 2009).

As in Massachusetts and Scotland, politics are playing an important and continuing role in Oaxaca. Developers, politicians, and officials of various government agencies in Mexico City have been peppered with questions of propriety, fairness, influence, and control. The public advocacy organization National Wind Watch offers this explanation: "The growing resistance to wind farm construction in southern Oaxaca . . . is based on local landowners' negative negotiating experiences with the CFE [the national electricity company], discomfort with the broad freedoms seemingly granted to multinational corporations and an increasing concern about the possible environmental consequences of the wind farms themselves" (Sanchez 2007, 1). "Are the ejidatarios being victimized?" asked a reporter from *USA Today,* at a public presentation at the Benjamin Franklin Library in Mexico City in June 2009 (Hawley 2009).[3]

A local leftist farm group known as the Asamblea en Defensa de la Tierra y el Territorio has complained about the treatment it has been receiving, saying: "They promise progress and jobs, and talk about millions in investment in clean energy from the winds that blow through our region, but the investments will only benefit businessmen, all the technology will be imported . . . and the power won't be for local inhabitants" (Stevenson 2009). The group is calling on supporters to defend the land "inherited from our ancestors." They have said "no to the wind energy megaproject in the isthmus that desecrates our lands and cultural heritage" (Sanchez 2007).

Protestors have taken to the streets, and incidents of rock throwing, accompanied by minor injuries, have occurred. In addition, some groups have barricaded roads leading to wind sites; others have marched, holding antiwind banners (Figure 12). Most of the protests are over the loss of land: "The Greedy Grabbers need land, and lots of it, to be able to put up sticks and blades and thus seize and put a meter between the people and heaven itself" (Giordano 2006).

Social Barriers to Solar Power

As geothermal and wind energy promoters have gained experience, they have attracted both praise and scorn. Objectors claim that projects interfere with sites of cultural heritage, that they threaten local ways of life, that they imperil the economic base, that they disrupt landscapes and land tenure, and that they bring inad-

FIG. 12—Protest banner against wind development in the Isthmus of Tehuantepec, Oaxaca, Mexico. The banner reads: "If they plant them today, what will we harvest tomorrow?"; "The isthmus is ours for the good of your children". "Inform yourself and spread the word." *Source:* ADLT 2008. (Reproduced courtesy of the Asamblea en Defensa de la Tierra y el Territorio)

equate compensation to those affected. In response, developers have felt compelled to refine their planning strategies, implement new regulatory requirements, undertake more complete impact assessments, include longer deliberation periods, broaden their programs of education and outreach, and, on rare occasions, abandon projects. Despite the breadth of such efforts by all participants, it would be unduly optimistic to count these steps as much more than just first efforts in a process that will be needed if renewable energy is to grasp a greater portion of the energy supply market. We should expect additional social barriers to appear as renewable energy resources of other types attract more attention and promise.

Take solar energy as the next case in point. Like recognition of the impacts of geothermal and wind power, sensitivity to impacts of the ultimate renewable energy resource has increased. For example, several well-known individuals have made statements that could derail some renewable energy plans. As the *New York Times* recently reported: "Senator Dianne Feinstein introduced legislation in Congress . . . to protect a million acres of the Mojave Desert in California by scuttling some 13 big solar plants and wind farms planned for the region" (Woody 2009). These and similar objections may have more consequence because much more is riding on the future of solar energy (Zweibel, Mason, and Fthenakis 2008; Riley 2009; Sullivan 2009).

A large part of southwestern United States and adjacent Mexican states receive insolation in excess of 7 kilowatt hours per square meter per day, values that equal or exceed those of most other sites on the planet. Solar energy is an obvious renewable energy resource of the region. Although no country generates more than a fraction of its electricity from solar energy, many people believe in its future and want to take better advantage of its many attributes. They appreciate, for example, that it is unlimited and clean, that its use produces neither greenhouse gases nor long-term wastes, that cooling water (for photovoltaics) is unnecessary, and that generation of solar energy produces little or no noise. Despite the advantages and abundance of solar energy, opposition to its development is on the rise, although the industry is not taking much notice yet (Pasqualetti and Schwartz 2011). Most of this opposition stems from how solar energy development will alter the landscape, whether natural or developed. For example, Home Owners' Associations (HOA) have attracted the attention of solar developers because their objections can deny the necessary approvals needed for installing these "eyesores" (Galbraith 2009).

Even in the absence of an active HOA, neighbors can sometimes clash about "solar access," usually when one homeowner is responsible for blocking the sun. One recent example of this problem comes from California where a resident asked his neighbor to remove his redwood trees because the shadows they cast fell across his solar modules. The neighbor refused, and the case went to court. A Superior Court judge ordered two of eight trees removed, citing the California Solar Shade Control Act of 1979 (Gorn 2008). Because such adjudication is not consistent across the nation, no settled law exists on this question (Leonard and Pasquale 2009). This means that, in addition to HOA resistance, access issues will continue to burden the expansion of solar power.

Although personal solar installations continue to attract public interest, the present direction for solar energy in the United States is for large, concentrated clusters. In 2002 Congress asked the U.S. Department of Energy to begin moving toward an initial goal of 1,000 MW of concentrating solar power (CSP) in the southwestern United States. This promotion was supplemented in June 2004, when the Western Governor's Association resolved to diversify its energy resources by developing 30,000 MW of "clean" energy in the West, including as much as 8,000 MW of distributed photovoltaic solar electricity systems and CSP plants and another 2,000 MW-thermal of solar hot water (WGA 2006).

Inevitably, plans of this magnitude are encountering social barriers. One of the most persistent of these barriers concerns the amount of land that would be required for such a large solar presence. For example, the 8,000,000 MW of solar potential identified in Arizona, Nevada, California, and New Mexico would require a land area of about 61,000 square miles—about 50 percent larger than Pennsylvania. If we take into consideration the seventy-one CSP project applications received by the Riverside office of the U.S. Bureau of Land Management by April 2009, 638,452 acres would be needed. This would produce a generating capacity of about 48,000 MW (CEC 2009), or about twice the current conventional generating capacity currently available to Arizona.

Commitments of so much land to solar energy are attracting the attention of several environmental groups. The California-based Alliance for Responsible Energy Policy argues that the push for "Big Solar" promotes the "permanent destruction of hundreds of thousands of acres of pristine public lands designated for multipurpose use that belong to the people" (Bailey 2008). Other groups argue that clearing and preparing large patches of desert for centralized power stations has no net environmental merit.

As with most social barriers, any discussion of land-use restrictions for solar energy involves nuances. For example, Byron Miller and I calculated that, when all steps in the fuel cycle are considered, the total land needs are comparable to those for conventional resources such as coal (Pasqualetti and Miller 1984). Similarly, Senator Feinstein's hesitation about the land commitment for solar energy stems not so much from solar energy itself as against the threats it produces to desert wildlife and earlier commitments made for the land (Freking 2009).

The emergence of public resistance to solar power is in its infancy, especially when compared with the existing issues that surround geothermal and wind energy. We should expect the emergence of more resistance to a variety of issues. For example, in addition to matters of solar access, HOAs, land requirements, and endangered species, other arguments are likely on topics such as need for water, competition for land, centralized versus decentralized deployment, stabilizing the spoils of the manufacturing processes, and price. We should expect that those objectors who are targeting solar energy are just getting started.

Adjusting to Renewable Energy Landscapes

We are knocking on the door of a renewable energy future, and we are making some progress. If we can consolidate our gains, we may be able to pass through the portal with some real chance of developing a genuine measure of sustainability. Some barriers, however, still block our way. Some of the remaining barriers are technical, but most of them are social, and they are accumulating. This is not surprising because each new step forward prompts more people to begin considering what a renewable energy future will mean to their lives. Their most common reaction is to try to slow things down until their questions and reservations are addressed.

The discomfort that some people feel about renewable energy may be explained as start-up pains that are common when any new technology is suggested, but such a diagnosis cannot reasonably explain all the symptoms of resistance we are seeing. Something more generic and basic is at work, something we must isolate and correct. If we do not, and a renewable energy revolution falters, any or all of the following scenarios could become reality:

- Stronger turn toward nuclear power
- Increased reliance on "clean coal"
- Speedier rise in greenhouse gas emissions
- Increased dependence on imported energy
- Greater pressure for mandatory restrictions on consumption
- A firmer turn toward environmentally burdened resources such as oil shale and oil sands (Pasqualetti 2011)

The social barriers to renewable energy have been underappreciated and underexamined. As the foregoing case studies illustrate, left unattended these barriers can inhibit, redirect, discourage, or even halt projects. We need to rebalance the attention we pay to these challenges.

Such rebalancing will require acknowledging that social issues can be as important as—and in many cases more important than—technical issues. We must realize that conditions for development differ from group to group, time to time, and especially landscape to landscape. This means that neither acceptance of nor opposition to a technology in one location will necessarily transfer to another location. Likewise, support or opposition to renewables will depend less on the type of resource than on how one location differs from another in terms of physical environment, cultural underpinnings, and social structures.

The problem that champions of renewable energy development face is that they have often assumed—and have expected to receive—unquestioning public support for their projects. What they have not anticipated is that love of existing landscapes can rout any benefits that renewable energy development may promise. We are finding that commercial development of renewable energy resources, now upon us, is repeatedly bumping up against this hard reality.

The mistake commonly made in the name of a renewable energy future is to consider the technical and economic challenges of commercialization as the only obstacles that must be overcome in order to make the leap from dream to reality. Government programs and industry attention allot little weight to the identification and remediation of social barriers. Consequently, attention tends to bounce around, alighting on one topic after another that happens to appeal to the media, or some interest group, or an individual set of researchers. With wind power, for example, attention has been directed to such topics as ice toss, fires, fluid leaks, turbine collapse, generator efficiency, blade design, interference with radar, aircraft navigation, and the potential of wind turbines to maim or kill wildlife. Although these are legitimate concerns, equal attention should be directed toward public attitudes, perceptions of risk, interference with established lifestyles, altered landscapes, and even the infringement of new projects on the local sense of propriety and justice, all topics that contribute much more directly to public attitudes.

Although cooperation between developers and the public is already evident in some places, no generic protocols yet exist to manage the inherent disagreements that sometimes arise between the two groups. As great a contribution as renewable energy sources may make to attain a more sustainable future, their collective advantages will not be enough to convince everyone in every place that they are a good idea.

For this reason, conflicts will continue to appear. In recognition of this reality, we may wish to consider adopting at least three new steps. First, it would seem appropriate to reweight project-evaluation processes by reducing overemphasis on technical solutions and then attend to social considerations more thoroughly. In many circumstances this change in perspective alone will produce significant improvements and a smoother path to consummating development plans because it would recognize the importance of social engagement in the process of energy development.

Second, social embededness should be a priority for renewable energy planning and implementation. Developers should strive for earlier and more complete understanding of the human landscape at the location of each proposed project. Such evaluation should include belief systems, land tenure, perceived personal costs and benefits, and local history. At present, such topics receive only glancing notice.

Third, impacted people need to perceive and receive meaningful and acceptable benefit from developments that are proposed for the landscapes they value. These benefits should accrue both to local families and to society at large. To circumvent this step is to risk losing time and money for the benefit of initial savings.

We should think of these three steps as part of a new order of renewable energy development, one that looks beyond the technical to the social, one that extends the usual temporal perspective past the point of grid connection to the point when these projects become an accepted, integrated, part of the local community. Once social and technical considerations of renewable energy are paired, contentious issues will be identified earlier, approval will be quicker, and success will be more likely. Achieving such parity will require that developers consult not just with their engineers and accountants but also with anthropologists, sociologists, historians, economists, geographers, and other social scientists. Without doubt, an early, inclusive analysis of this sort would have aided geothermal developers at The Geysers, wind developers in Palm Springs, Cape Cod, Scotland, and Oaxaca, and solar developers vying for land rights in the Mojave Desert.

At least one caveat comes with this call for a more balanced, integrated planning strategy: Even where the social and technical sides of a renewable energy development receive attention in equal measure, success still cannot be guaranteed. No matter what we do in advance, some projects will face public rejection for one reason or another. Such instances will need to be adjudicated, much as they have been in Scotland, but they cannot all be resolved to everyone's satisfaction. Simply put, in some places renewable energy development, regardless of how tempting the resource, will not be appropriate. On the other hand, renewable energy should not be banned from every place just because some group opposes it. In our crowded world, no shortage of the need for siting compromise and accommodations will ever arise.

Swifter progress for renewables requires that we promote a more inclusive perspective when we pursue their promise. Instead of considering how to integrate them with our lives as a technical exercise, we should first examine their potential through the lens of local identity and the one lens that can make everything else clear: the public sense of landscape permanence. In the end, if we are to soften public resistance to renewable energy and simultaneously give proper voice to public love for the land, it will be better to consider the challenges of development to be predominantly social matters with a technical component, rather than the other way around. Making this adjustment is the master key to unlocking the future contribution of renewable energy.

Notes

1. In his approval, however, Secretary Salazar stipulated that the number of turbines be reduced from 170 to 130 and that the entire turbine array be moved slightly to diminish visual intrusion. Anticipated lawsuits may delay the project further (Toensing 2010).

2. In the United States each turbine typically returns to the landowner between $3,000 AND $5,000 per year.

3. Chris Hawley asked the question in preparation for his 2009 article.

References

ADLT [Assembly in Defense of Land and Territory]. 2008. Protests in Juchitán against Wind Companies. anarkismo.net, 4 September. [www.anarkismo.net/article/9779].

AMDEE [Asociación Mexicana de Energía Eólica]. 2009. *Proyectos en México*. [www.amdee.org/Recursos/Proyectos_en_Mexico].

Bailey, R. 2008. Fighting Big Solar: Environmentalists Clash over Paving the Desert in Order to Save the Planet. Reason.com, 12 August. [www.reason.com/news/show/128044.html].

BBC [British Broadcasting Corporation]. 2008. Massive Wind Farm "Turned Down." *BBC News,* 25 January. [http://news.bbc.co.uk/2/hi/uk_news/scotland/highlands_and_islands/7208991.stm].

Bryce, R. 2009. Windmills Are Killing Our Birds: One Standard for Oil Companies, Another for Green Energy Sources. *Wall Street Journal,* 9 September. [http://online.wsj.com/article/SB10001424052970203706604574376543308399048.html].

CEC [California Energy Commission]. 2009. Federal-State Joint Environmental Process. California Energy Commission. [www.energy.ca.gov/public_adviser/joint_process.html].

COCEI [Coalición Obrera, Campesina, Estudiantil del Istmo]. 2010. Wikipedia.org, 26 December. [http://en.wikipedia.org/wiki/Coalition_of_Workers,_Peasants,_and_Students_of_the_Isthmus].

County of Imperial. 2006. Geothermal/Alternative Energy and Transmission Element. El Centro, Calif: County of Imperial General Plan. [www.icpds.com/CMS/Media/Geothermal-TransmissionElement -(2006).pdf].

Curry, A. 2009. Deadly Flights. *Science* 325 (5939): 386–387.

Elliott, D., M. Schwartz, G. Scott, S. Haymes, and others. 2003. *Wind Energy Resource Atlas of Oaxaca*. NREL/TP-500-34519. N.p.: National Renewable Energy Laboratory. [www.nrel.gov/wind/pdfs/34519.pdf].

Firestone, J., and W. Kempton. 2007. Public Opinion about Large Offshore Wind Power: Underlying Factors. *Energy Policy* 35 (3) 1584–1598.

Freking, K. 2009. Feinstein Seeks Block Solar Power from Desert Land, March 21. Physorg.com. [www.physorg.com/news156842404.html].

Galbraith, K. 2009. Homeowners Associations: The Enemy of Solar? *New York Times,* 15 May. [http://greeninc.blogs.nytimes.com/2009/05/15/homeowners-associationsthe-enemy-of-solar/].

Giordano, A. 2006. Don Marcos of La Selva vs. the Mega-Windmill of Capitalism: Confronting the Greedy Grabbers That Covet Oaxaca's Isthmus of Tehuantepec. *Narco News Bulletin,* February. [www.narconews.com/Issue40/article1607.html].

Girón-Carrasco, A. 2007. Carta del Grupo Solidario la Venta a Dr. Rodolfo Stavenhagen. Oaxaca Libre. Formerly available at [http://oaxacalibre.org/oaxlibre/index.php?option=com_content&task=view&id=502&Itemid=64].

Gorn, D. 2008. Battle Pits Solar Energy against Trees. *Morning Edition,* 12 February. National Public Radio. Audiotape. [www.npr.org/templates/story/story.php?storyId=18905405].

Gould, J M. 1993. Chernobyl and the Collapse of Soviet Society. *The Nation,* 15 March. Original version of the essay at [www.ratical.org/radiation/Chernobyl/ChernobylCoSS.html].

Gray, F. 2009. Wind Farm Threat Looms over Ancient Lewis Stones. *Scotland on Sunday,* 5 April. [http://scotlandonsunday.scotsman.com/alternativeenergysources/Wind-farm-threat-looms-over.5142997.jp].

Gupta, H. K., and S. Roy. 2007. The Cerro Prieto Geothermal Field, Mexico. In *Geothermal Energy: An Alternative Resource for the 21st Century,* by H. K. Gupta and S. Roy, 165–197. Amsterdam: Elsevier.

Harrison, D. 2010. Cape Wind Decision Propels Other Offshore Projects. *Stateline,* 7 May. [www.stateline.org/live/details/story?contentId=483168].

Hawley, C. 2009. Clean-Energy Windmills a "Dirty Business" for Farmers in Mexico. *USA Today,* 17 June. [www.usatoday.com/money/industries/energy/environment/2009-06-16-mexico-wind-power_N.htm?POE=click-refer].

IID [Imperial Irrigation District]. 2011. Water Transportation System. Imperial Irrigation District, Imperial, Calif. [www.iid.com/index.aspx?page=117].

Ittmann, N. 2005. URGENT Petition to Save Isle of Lewis from Massive Windfarm Development. *GoPetition,* 7 December. [www.gopetition.com/online/7650.html].

Johnson, G. D., M. K. Perlik, W. P. Erickson, and M. D. Strickland. 2004. Bat Activity, Composition, and Collision Mortality at a Large Wind Plant in Minnesota. *Wildlife Society Bulletin* 32 (4): 1278–1288.

Kempton, W., J. Firestone, J. Lilley, T. Rouleau, and P. Whitaker. 2005. The Offshore Wind Power Debate: Views from Cape Cod. *Coastal Management* 33 (2): 119–149.

Kennedy, R. F., Jr. 2005. An Ill Wind off Cape Cod. *New York Times,* 16 December. [www.nytimes.com/2005/12/16/opinion/16kennedy.html].

Kunz, T. H., E. B. Arnett, W. P. Erickson, A. R. Hoar, G. D. Johnson, and others. 2007. Ecological Impacts of Wind Energy Development on Bats: Questions, Research Needs, and Hypotheses. *Frontiers in Ecology and the Environment* 5 (6): 315–324.

Leonard, D., and D. Pasquale. 2009. Legal Tools to Protect Access to Solar and Wind Resources. *Nevada Lawyer*. [www.nvbar.org/publications/NevadaLawyer/2009/july/resources.htm].

Luengo, M. and M. Oven. 2009. *Estudio del potencial de exportación de energía eólica de México a los Estados Unidos.* Washington, D.C. PA Government Services, for the U.S. Agency for International Development. [www.amdee.org/LiteratureRetrieve.aspx?ID=44033].

Mallett, A. 2007. Social Acceptance of Renewable Energy Innovations: The Role of Technology Cooperation in Urban Mexico. *Energy Policy* 35 (5): 2790–2798.

Marx, L. [1964] 1970. *The Machine in the Garden: Technology and the Pastoral Ideal in America*. New York: Oxford University Press.

Mumford, L. 1967. *The Myth of the Machine,* vol. 1, *Technics and Human Development*. New York: Harcourt, Brace.

MWT [Moorland without Turbines]. 2010. Mòinteach gun Mhuileann – Moorland without Turbines. [www.mwtlewis.org.uk].

Nye, D. E. 1999. *Consuming Power: A Social History of American Energies*. Cambridge, Mass.: MIT Press.

O'Connor, L., and P. C. Kroefges. 2008. The Land Remembers: Landscape Terms and Place Names in Lowland Chontal of Oaxaca, Mexico. *Language Sciences* 30 (2–3): 291–315.

Pasqualetti, M. J. 1980. Geothermal Energy and the Environment: The Global Experience. *Energy* 5 (2): 111–165.

———. 2001. Wind Energy Landscapes: Society and Technology in the California Desert. *Society and Natural Resources: An International Journal* 14 (8): 689–699.

———. 2002. Living with Wind Power in a Hostile Landscape. In *Wind Power in View: Energy Landscapes in a Crowded World,* edited by M. J. Pasqualetti, P. Gipe, and R. W. Righter, 153–171. San Diego, Calif.: Academic Press.

———. 2011. The Next Generation of Energy Landscapes. In *Engineering Earth: The Impacts of Megaengineering Projects,* edited by S. D. Brunn, 461–482. 3 vols. New York: Springer Press.

Pasqualetti, M. J., and E. Butler. 1987. Public Reaction to Wind Development in California. *International Journal of Ambient Energy* 8 (3): 83–90.

Pasqualetti, M. J., and M. Dellinger. 1989. Hazardous Waste from Geothermal Energy: A Case Study. *Journal of Energy and Development* 13 (2): 275–295.

Pasqualetti, M. J., and B. A. Miller. 1984. Land Requirements for the Solar and Coal Options. *Geographical Journal* 152 (2): 192–212.

Pasqualetti, M. J., and C. Schwartz. 2011. Siting Solar Power in Arizona: A Public Value Failure? In *Renewable Energy and the Public: From NIMBY to Participation,* edited by P. Devine-Wright, 167–185. London: Earthscan.

Pasqualetti, M. J., P. Gipe, and R. W. Righter, eds. 2002. *Wind Power in View: Energy Landscapes in a Crowded World*. San Diego, Calif.: Academic Press.

Riley, M. 2009. Greens, New-Energy Backers at Odds over Use of Desert. *Denver Post,* 3 September [www.denverpost.com/commented/ci_13257517?source=commented-news].

La Ruta. 2009. Groene energie niet altijd schoon (Green Energy Is not Always Clean). *La Ruta 2015.* December. [www.laruta.nu/video/groene-energie-niet-altijd-schoon]. Video (in Spanish with subtitles in Dutch). 4 minutes. Also posted on YouTube, [www.youtube.com/watch?v=OV6qfOLm6fE].

Sanchez, S. 2007. Grassroots Resistance: Contesting Wind Mill Construction in Oaxaca. *National Wind Watch,* 8 November. [www.wind-watch.org/newsarchive/2007/11/08/grassroots-resistance-contesting-wind-mill-construction-in-oaxaca/].

Scottish Government. 2008. Decision on Lewis Wind Farm. Press release, 21 April. The Scottish Government – Riaghaltas na h-Alba. [www.scotland.gov.uk/News/Releases/2008/04/21102611].

Seccombe, M. 2009. Cape Wind Is Moving Ahead. *Vineyard Gazette,* 5 June. [www.mvgazette.com/article.php?21267].

Stevenson, M. 2009. Mexico Fires up $550 Million Wind Farm. *USA Today,* 23 January. [www.usatoday.com/money/industries/energy/2009-01-22-laventosa_N.htm].

Sullivan, C. 2009. RFK Jr., Enviros Clash over Mojave Solar Proposal. *New York Times,* 9 Sept. [www.nytimes.com/gwire/2009/09/08/08greenwire-rfk-jr-enviros-clash-over-mojave-solar-proposa-98645.html].

Tarr, J. A. 1999. Transforming an Energy System: The Evolution of the Manufactured Gas Industry and the Transition to Natural Gas in the United States (1807–1954). In *The Governance of Large Technical Systems,* edited by O. Coutard, 19–37. London: Routledge.

Thayer, R. L. 1994. *Gray World, Green Heart: Technology, Nature, and the Sustainable Landscape*. New York: John Wiley & Sons.

Thompson, J. 2009. Wind Resistance: Will The Petrocracy—and Greens—Keep Wyoming from Realizing Its Windy Potential? *High Country News,* 21 December. [www.hcn.org/issues/41.22/wind-resistance].

Toensing, G. C. 2010. Salazar Weighs Two Imperatives in Cape Wind Energy Proposal. *Indian Country Today,* 10 February. [www.indiancountrytoday.com/home/content/83644112.html].

Toke, D., S. Breukers, and M. Wolsink. 2008. Wind Power Deployment Outcomes: How Can We Account for the Differences? *Renewable and Sustainable Energy Reviews* 12 (4): 1129–1147.

Trejo, K. 2008. Wind Parks Take over Indigenous Lands. *Latin American Press,* 14 August. [lapress.org//articles.asp?art=5683].

Van der Horst, D., and D. Toke. 2010. Exploring the Landscape of Wind Farm Developments: Local Area Characteristics and Planning Process Outcomes in Rural England. *Land Use Policy* 27 (2): 214–221.

Warren, C. R., and M. McFadyen. 2010. Does Community Ownership Affect Public Attitudes to Wind Energy? A Case Study from South-West Scotland. *Land Use Policy* 27 (2): 204–213.

WGA [Western Governors' Association]. 2006. *Clean and Diversified Energy Initiative.* Solar Task Force Report. [www.nrel.gov/csp/troughnet/pdfs/kearney_wga_overview.pdf].

Williams, W., and R. Whitcomb. 2007. *Cape Wind: Money, Celebrity, Class, Politics, and the Battle for Our Energy Future on Nantucket Sound*. New York: Public Affairs.

Winner, L. 1986. *The Whale and the Reactor: A Search for Limits in an Age of High Technology*. Chicago: University of Chicago Press.

Wolsink, M. 1988. The Social Impact of a Large Wind Turbine. *Environmental Impact Assessment Review* 32 (8): 324–325.

———. 1989. Attitudes and Expectancies about Wind Turbines and Wind Farms. *Wind Engineering* 13 (4): 196–206.

———. 2007. Planning of Renewables Schemes: Deliberative and Fair Decision-Making on Landscape Issues Instead of Reproachful Accusations of Non-Cooperation. *Energy Policy* 35 (5): 2692–2704.

Woody, T. 2009. Desert Vistas vs. Desert Vistas. *New York Times,* 21 December. [www.nytimes.com/2009/12/22/business/energy-environment/22solar.html?_r=1&scp=1&sq=solar%20power%20feinstein&st=cse].

Wüstenhagen, R., M. Wolsink, and M. J. Bürer. 2007. Social Acceptance of Renewable Energy Innovation: An Introduction to the Concept. *Energy Policy* 35 (5): 2683–2691.

WWEA [World Wind Energy Association]. 2010. 16 Gigawatt Added in First Half of 2010. World Wind Energy Association. [www.wwindea.org/home/index.php?option=com_content&task=blogcategory&id=21&Itemid=43].

Zweibel, K., J. Mason, and V. Fthenakis. 2008. A Solar Grand Plan. *Scientific American* 298 (1): 64–73.