WINDFALL: THE RECENT LANDSCAPE OF ALTAMONT PASS

Shelby Sampson Hall*

The rush to implement technologies of renewable energy, supported by environmental concerns and governmental subsidies in the wake of the "energy crisis" of the early 1970's, resulted in the installation of experimental laboratories for wind energy development which transformed the landscapes of several California sites. This is a history of one of those sites—the Altamont Pass in eastern Alameda County.

Until the mid-nineteenth century, California's landscape was only lightly touched by man, escaping the centuries-old legacy of land-use patterns seen in so much of the world today. Even with post-World War II population growth and development, large portions of California's rural countryside remain almost pristine in appearance, and lie within easy access of urban areas.

Since the 1970's, the Bay Area has experienced massive growth, with unrestricted development resulting in vast urban sprawl reaching along established transportation corridors into areas once considered hinterlands. Development north along Highway 101 into Sonoma County, Interstate 80 northeast into Solano County, Highway 4 east into Contra Costa County, and Interstate 580 east into Eastern Alameda and San Joaquin Counties are some North Bay areas drawing public concern (Figure 1).

*Shelby Sampson Hall is a Masters Candidate in geography at the University of California, Davis.
Figure 1. Map of Greater Bay Area showing range of urban development along transportation corridors and location of Altamont Pass—based on information from Greenbelt Alliance.
Currently, in hope of designating a protected "greenbelt," several organized movements seek to foster public appreciation of the existing open space surrounding the urban Bay Area. In the public mind, the idea of "natural" landscape is highly valued as beautiful, good, and desirable. Nostalgia for preserving "pristine" open land illustrates the popular misconception that California's open lands are untouched. Although steep slopes, geologically unstable areas, and flood plains remain generally undeveloped, most of these lands—despite their appearance—are in use for agriculture, watershed, parks, or buffers between cities. They bear obvious signs of alteration at human hands, ranging from introduction of new plant species that have wiped out native flora, to cattle terracing, to nineteenth-century windmills and fences. More recently, application of radar, microwave, and other technologies has resulted in the appearance of a new breed of high-tech structures in the rural landscape. This paper attempts to explain the purpose of one specific type of these new high-tech structures, "windfarms" or wind energy developments. In doing so, it will focus on Altamont Pass—one of the three major wind development sites installed in California during the 1980's.

Due to a combination of geographic factors, the rolling grazing lands of Altamont Pass—along the Interstate 580 corridor of eastern Alameda County—have recently experienced a unique and lasting form of development as a designated site for windfarming. Though the ravages of rampant urban development characteristic of the Livermore and Tracy areas to the west and east have been avoided, turbines and related structures installed since 1980 for generation of energy through renewable wind power have impacted the landscape in a different and unique manner. The visual intrusion of 7,000 "windmills"—their benign and positive purpose as well as minimal impact on land use notwithstanding—has prompted environmentalists to reassess priorities. In the process, open space advocates, somewhat ironically, occasionally find themselves pitted against advocates of renewable
energy development, as the companies actually applying wind energy technology seek to expand their territory. Public perception of the environmental changes resulting from wind energy development is just beginning to be studied, and no conclusions have been reached for the future.

History and Description of Altamont Pass

Interstate 580 leaves the urban East Bay Area at Hayward, turning east through Livermore, over the Altamont Pass, and on into the Central Valley. Archaeological evidence shows this area was traveled by California Indians. The earliest explorers and settlers also followed this easy route through the coastal hills. Early topographic maps show the Altamont Pass and Patterson Pass roads where they still stand, and by the 1880’s two major rail lines traversed Altamont. By the late 1800’s, the land was parcelled out in small units, used primarily for cattle grazing. A small service settlement appeared at Altamont. A water tank and railroad yard, a gas station/garage, and a one-room schoolhouse can still be seen (Figure 2). As U.S. Highway 50, Altamont Pass road became a respectable, two-lane portion of the Federal highway system. It was supplanted in the 1950’s by an adjacent, four-lane freeway. That in, turn, was supplanted by the divided-roadway of Interstate 580, which links the East Bay to Interstate 5 and its connections to much of the rest of the state. The rolling, treeless hills of the pass reflect many signs of use. The terracing of cattle paths is quite apparent, as are fences, windmills, water tanks, and wooden utility poles; and like an alien army on the march, an occasional phalanx of electrical transmission towers crosses the landscape—a sight that has been with us since the Sierra foothill hydroelectric projects of the 1930’s.

The windswept, treeless hills which have discouraged either intensive settlement or development in this area, make Altamont Pass a prime site for wind energy development (WED); and since 1980, an amazing and unique transformation has taken place in the Altamont Pass
unique in its function and significance. For people who’ve driven through Altamont Pass in the last nine years, seeing “undulant grazing land bristling with 6,000 wind turbines”\textsuperscript{1} raises many questions. Some people know that wind power is one approach to developing renewable energy sources; others know that investment in wind development gives a tax break, and can also be used as a scam; local residents know Pacific Gas and Electric (PG&E) is involved; and practically everyone has noticed that the machines often don’t spin, even when the wind is blowing. So, what is going on here?

**History of Wind Energy Development**

Serious efforts at wind energy development (WED) were “made possible by a set of favorable economic and political conditions in the 1970’s.”\textsuperscript{2} In response to the energy crisis of the early 1970’s, the federal Department of Energy supported research and development on large,
wind-powered generating turbines, with disappointing results. Private companies, sensing the trend, began research and development on more successful mid- and small-size turbine units, commonly (though inaccurately) called windmills. In 1978, the United States Congress passed the Public Utility Regulatory Policies Act (PURPA), which mandated established utilities to purchase electrical power from small, private-generating operations at a price equal to the utility’s “avoided cost,” that is, “the cost a utility can avoid by purchasing a certain amount of power from a qualified facility instead of generating . . . an equivalent amount of energy itself.” Suddenly, the small WED companies were in business.

Wind Energy Development in Altamont Pass

According to some observers, California was the ideal site for early application of this new technology:

Wind is simply air in motion moving from an area of high atmospheric pressure to one of low pressure. In some areas, small scale pressure patterns develop on a daily basis. Many coastal areas experience a daily ‘sea breeze’ as the wind blows from the colder waters to the warmer land. The combination of the local scale with the large scale phenomena can result in exceptionally windy conditions, especially when the air must flow through a naturally constrained area. There are several areas in California, including the Altamont Pass, where this occurs during the summer months.

Surveys by the California Energy Commission and public utilities in the late 1970’s identified six major mountain passes which met the basic requirements of a wind resource area: (1) winds averaging 17 miles per hour, and (2) inexpensive range acreage. California also offered a plentiful supply of people willing to provide investment capital.

In 1981, federal and state tax incentives stimulated widespread investment in WED. From 1980-1985 the industry sought financing via the medium of venture capital, soliciting investors through limited partnerships, which were packaged and marketed through established financial investment agencies. One investor’s experience
was typical. Early in the heyday of WED, on the recommendation of his broker, he invested $10,000 as part of a limited partnership in a wind energy development at Altamont Pass. The developer and broker supplied attractive brochures and gave tours of the development sites. Solicitations were totally candid about "the significant risks associated with this offering" and had stringent "economic suitability standards" for potential investors. Through a combination of tax credits and depreciation, 50 percent of his investment was returned in the first year. Today, tax credits have expired and the developer is about to go bankrupt. The investor, however, isn't worried. In addition to a positive feeling about having contributed to the search for alternatives to fossil fuels, he notes that: "It's been five years, and I've only lost 5 percent."6

By February, 1984, twelve large developers had massive installations of generating turbine structures at Altamont Pass, riding the crest of investment popularity due to tax incentives on the one hand and, as the technology was refined, increasing efficiency on the other. PG&E brochures reported eleven developers in January, 1985; fourteen in May, 1986; and twelve in August, 1987. In 1983 and 1984, WED was "hot," receiving generally positive worldwide technical and popular media attention. Articles on the new phenomenon of windfarms were featured in publications as diverse as Smithsonian, Solar Age, Sunset, Scientific American, Time, Technology Review, Omni, Environment, Newsweek, Esquire and Modern Technology. The entrepreneurial opportunities did attract some shady developers, generating criticism as "tax farms"—not wind farms. Indeed, some sites were installed and never productively operated. The poor performance of some early machines also tainted the industry's development, as a few "manufacturers rushed products to the field that were commercially unproven."7

Expiration of the tax incentive programs at the end of 1985 began a new phase of WED. Developers not wholly committed to WED began to be weeded out. One local developer—featured in a June, 1986, Image Magazine arti-
cle—a year later, according to a loan officer at Livermore’s agricultural bank, was about to go bankrupt. The three largest firms, with 4 percent of the turbines and 58 percent of the energy produced, seem likely to survive. They are also the companies with long-standing commitment to WED, established as research and development firms in the mid 1970’s, long before WED offered any real potential for attractive economic return. In January, 1985, the California Public Utilities Commission issued requirements for independent power producers designed to “ensure that only serious developers are allowed to maintain transmission in priority.”

Organization of a Wind Energy Development

A WED is a cooperative venture involving several parties and a set sequence of events. The principal participants are:

1. The Developer, a private company in the wind energy business, which provides the technology, equipment, installation, and maintenance of the WED. Some developers design and manufacture wind turbines, others do not. Financing plans are developed and offered through the developer.

2. The Landowner, who leases his property to the developer for use as a WED, and also continues uninterrupted in his previous use of the land for grazing cattle.

3. The County Planning Department, which reviews applications and grants the conditional use permits allowing non-agricultural land use. The Planning Department monitors the installation and operation of wind energy installations.

4. The Utility, which purchases the electrical energy produced and links it into its own grid for delivery to consumers. It also promotes support of WED through its public relations activities.

The process of site development starts with preparation, by the developer and land owner(s), of a proposal
describing the planned development and its environmental impact. This is presented to the county planning department as an application for a "conditional use permit" and a "negative declaration," which exempts projects felt to have negligible impact on the environment from having to prepare a formal environmental impact report (EIR). The county reviews the application which, as far as the policy of Alameda County's Planning Department indicates, is usually routinely granted.

Installation and maintenance of each development site is carried out by the developer, who also finances the venture. Additionally, the developer contracts for sale of energy to PG&E, which provides linkage of electrical energy production into its system for delivery to the utility customer.

Operation of Wind Energy Developments

By 1987, 6,857 wind machines had been installed in the Altamont area, covering forty-seven square miles. Among these were twenty different types of machines, some manufactured in the United States, others in Belgium, Denmark, Holland, Germany, and Scotland. They differ in design, with size classified by "rated output"—the lowest windspeed at which generating capacity (in kilowatt-hours) is achieved—and rotor diameter. Size varies widely and affects the conditions of operation. Each design has a cut-in and cut-out wind speed, between which the blades spin and power is produced. "The primary winds blow through the Altamont between May and September... In fact, about 80 to 85 percent of the power... comes during those months—and about two-thirds of that comes when the sun is not shining. So it's only for about 20 to 30 percent of the hours in a year that the turbines actually turn." Actual production of power takes place in the "nacelle" unit directly behind the blades (Figure 3). Here, mechanical energy of rotation passes through a transmission to a generator, which converts it to electrical energy. In a typical, recent installation described in the literature of US Windpower, 480 volts produced in one turbine
Figure 3. Wind energy developer US Windpower has over 3,000 of this model turbine structure installed in the Altamont Pass area. The rotor diameter is 56 feet.

passes to a transformer serving five to twelve turbines, combining and increasing voltage to 21,000 volts, which is passed into collection lines connected to a substation. The substation then converts the voltage for entry into the utility’s system, after which it can be delivered to the consumer.

A 1986 Newsweek article stated that, on a good day, Altamont generated “enough energy to supply the city of
San Francisco with roughly half its residential energy needs." Another article states: "Taken together, the 6,000 turbines around Altamont produce about half as much as an average-sized nuclear power plant." In still another assessment, it was indicated that a new development of 107 mid-sized machines on 1,080 acres could meet the electricity need of "10,000 typical homes."

Measures of electrical energy are often expressed in kilowatt-hours (kwh), or "the power it takes to light a 100-watt bulb for 10 hours." There are, however, more precise expressions of goals for wind energy production. A June, 1984, article in Solar Age reported the California Energy Commission's expectation of 1,000 megawatts (MW) generating capacity from California's WEDs by 1986. A more current goal is PG&E's "long-term resource plan," which expects an operational wind energy capacity of 1,000 MW by 1995. As of September, 1987, PG&E reported over 700 MW capacity from its wind plant contracts. A 1984 article assessing the state of wind energy development reported that installation of windfarms cost under $1,700 per kilowatt of production capacity compared with $3- to $5,000 for nuclear generation facilities. The article also pointed out that due to inherent constraints—wind machines operate only when there is wind—the "capacity factor," or ratio of actual energy produced to maximum potential, is about half that of nuclear plants. The California Energy Commission then anticipated that windfarms would remain competitive, expecting a 50 percent decrease in cost by the year 2000.

The nine years of application and demonstration of this new technology can be readily traced in the pattern of placement, or array, of turbine units. An examination of installations developed by US Windpower, a major developer, shows how real-life experience has led to refinements in patterns of installation. The earliest arrays were installed in rows, oriented toward the prevailing winds without regard to contours (Figure 4). Monitoring of these early installations revealed that each turbine produced a wake, or wind shadow, which seriously interfered with
the operation of successive arrays. Looking at a map or on site in the field, installations can be visually dated. Early sites are in orchard-like rows, while later developments were installed with regard to the contours of the site. The most recent and efficient arrays are situated only along crests of the more westerly hills (Figure 5). The demise of some developers is attributed to the location of their turbines in the eastern portion of Altamont Pass. As development took place to the west, the westerly winds were literally used up by the time they reached the eastern end of the pass. Refinement in the design, size, and maintenance of individual machines has resulted in vastly increased efficiency of operation of today’s WEDs.

Environmental Impact of Wind Energy Development

Because of the widespread feeling that WED has no really detrimental effect on the land, negative declarations
are almost routinely granted for wind energy permits. The “Initial Study”—part of the conditional use permit application—contains a project description, and this is reviewed by the county planning department for potential effects on the following factors: geologic, hydrologic, biotic, noise, air and energy, natural resources, cultural/aesthetic, public service, public utility, socio-economic, and planning policy. To the landowner, wind energy development is also a windfall. Actual installation, including turbine sites, access roads, fences, and associated structures, takes up only 5 percent of the land, allowing its previous use for cattle grazing to continue unchanged. The construction of roads is widely regarded as positive, for they provide better access to the land (range) and thereby facilitate erosion control. No changes in cattle management have been needed, and no changes in cattle behavior or health have been observed. A very small reduction in herd size has
been more than offset by income from the lessee. Conditional use permits granted in 1982 were up for renewal in 1987. The Alameda County Planning Department kept detailed records on each installation, including complaints, and it has considered this information in renewal decisions—along with a new study of each development's performance and impact as re-submitted by the developer and land owner.

Potential, negative environmental impacts of WED include "aesthetic degradation," noise, wildlife disruption, and erosion. As noted earlier, WED is seen as an aid in erosion control. Complaints about noise have been registered by some of the few people who actually live near installations, and it is documented in Alameda County Planning Association files and widely acknowledged that wind turbines are noisy when spinning. Detailed research on wildlife disruption has yet to be undertaken; and the long-term, subtle effects on the livestock living among the auditory and visual distractions of the installations has not yet been addressed.

The aesthetic aspect of windfarming has been the subject of recent study by Robert Thayer, a member of the Environmental Design Department at the University of California, Davis. In his study, *Altamont: Public Perceptions of a Wind Energy Landscape*, Thayer examined two areas: "[1] measurement of the perceived meanings of the total landscape (beyond the elementary visual character of the wind machines), and... [2], the beliefs, attitudes, and characteristics of the public regarding Altamont in relation to perceived meanings. [It was]... anticipated that results from the study would be helpful to all parties involved in wind power developments, including the public who must look at them, the agencies who must regulate them, and the wind industry who must survive from their profitability." Thayer's methodology involved sending mail survey questionnaires to residents (randomly selected) of the Livermore-Tracy and Hollister-Gilroy areas where, apart from there being no wind installations in the latter, the landscapes are similar. The questionnaire solicited re-
response to six representative photographs of the Altamont Pass WEDs, as well as demographic and biographic data. Thayer found that, aside from being perceived as conspicuous and man-made, there was little agreement about the windfarms. People living outside the Altamont area had a slightly more positive attitude toward them; but expressions of "liking windfarms" tended to be based on symbolic attributes, while dislike was based on visual perceptions. Less-educated subjects appreciated visual qualities of wind installations, while more educated subjects saw their value as tax shelters and appropriate technology. The most serious perceived problem was unreliability: the rotors were often not spinning, even on windy days. Reliability is associated with a show of operation, leading Thayer to suggest that the installation of a mechanism allowing blades to spin in any wind, regardless of energy production, might increase public acceptance of windfarms, even if it jeopardized their reputation as a clean and aboveboard new industry.20

The only serious challenge to WED was mounted recently, by The Greenbelt Alliance (formerly People for Open Space/Greenbelt Congress), a coalition of environmental activists. As part of their efforts to maintain existing agricultural lands in a designated Bay Area Greenbelt, they challenged a proposed WED in eastern Contra Costa County, just north of Altamont. For the first time they demanded preparation of a full EIR by the developer, who eventually dropped out of the project. Yet even these determined opponents found only minor and speculative potential negative impacts: threats to birds of prey from spinning rotor blades, presence of Native American petroglyphs on nearby rock formations, and noise (ironically considered as a possible bother to future recreational users of a proposed new reservoir, which would affect vastly more land area than the windfarm).21

This controversy was misperceived and misreported by the media as environmentalists objecting to development of wind energy resources. According to Mark Evanoff of Greenbelt Alliance, however, this is not true:
This is not a story of land conservationists battling wind enthusiasts. It only appears that way because the issue is land use planning and determining appropriate uses for agricultural and natural landscapes. Open space advocates are asking wind developers to prepare an EIR before land use compatibility is determined. None of the environmental groups requesting the conducting of an EIR . . . are (sic) taking a position on wind energy.22

If nothing else, the controversy did serve to bring out some of the more subtle issues involving the ultimate value of such conspicuous landscape alterations.

Future of Wind Energy Development

The region of eastern Contra Costa and Alameda counties slated for further WED is an area of rich and unique biological and archaeological value. A 1981 California Department of Fish and Game study recommended that it become a game preserve where prong-horned antelope and tule elk could be reintroduced. The East Bay Regional Park District sees it as an ideal nature preserve. The rarest invertebrate in the world, the fresh water shrimp, is found only in the ephemeral pools of eastern Contra Costa’s rock outcroppings, which also exhibit petroglyphs of the Native Americans who apparently once used the area for religious gatherings. An anthropologist studying the area has recommended it be placed on the National Registry of Historic Places. Acknowledging the damage to the environment, some wind power supporters privately suggest calling the Altamont Pass a “National Sacrifice Area,” believing further development “is justified as part of California’s transition over the next 30 years to renewable energy.”23

The problem, of course, is how to balance economic development and environmental integrity. Long-time environmental activist Patrick Agnello now works for Howden Wind Parks, the developer challenged by Greenbelt Alliance. Pitted against Mark Evanoff of Greenbelt Alliance, his comrade-in-arms from earlier environmental battles, Agnello defends WED as a less destructive solution to the need for energy to serve inevitable suburban
growth. He feels Howden's willingness to spend thousands of dollars studying the environmental impact of their development, and agreeing to appoint "a land steward to look after the wildlife and cultural resources on the site," represents a positive alternative that environmentalists should be willing to support. "Switching to renewable energy sources involves building something new, not just stopping projects from being built." Tony Souza, whose family owns the land Howden planned to develop, criticizes the environmental purists: "Their positions are always extreme . . . they go for utopia—and utopia means everybody goes away."

Another factor affecting the future of WED is increasing criticism of PURPA, the 1978 federal law designed to encourage alternative energy development. Its requirement that public utilities purchase privately-generated power made WED economically feasible, and was the basis for the industry's rapid growth. This policy has achieved its aim of lessening the need for construction of additional large and expensive plants by major utilities. Many of the "alternatives" developed to take advantage of this policy, however, are contributing to air pollution by burning coal, natural gas, and wastes. Although originally intended to help decrease the nation's dependence on fossil fuels, PURPA's regulations now find PG&E required to purchase private power, 45 percent of which is produced from coal and natural gas. Twelve years after PURPA, our energy demands no longer seem to exceed available supplies. Indeed, a tremendous number of independent projects are producing energy at a time when there is no prospective demand for all that power. Consequently, PG&E has asked the Federal Energy Regulatory Commission to cut the rates it must pay to private plant owners and also to grant permission for the company to buy only the power which it needs.

With the expiration of tax credits and the benefit of experience, WED is now "dominated by companies that are committed to wind power (and) financed through investment bankers . . . instead . . . of venture capital [a]
testament to [their] growing reliability."27 US Windpower summarizes industry progress in its 1987 brochure:28

Operation and maintenance costs have dropped dramatically, and approach 1 cents/kwh, comparable with hydroelectric and nuclear plants.

Modularity and quick construction time give utilities the maximum degree of flexibility in responding to uncertain future load growth and scheduling sizeable capital commitments.

Capital costs of wind equipment have dropped by 60 percent, resulting in fixed costs per kilowatt-hour that approach an acceptable range today.

Renewable energy options reduce utilities’ and rate payers’ exposure to the risks of sharp, future oil and gas price increases and the generally significant environmental costs of fossil fuel facilities.

US Windpower has developed a new wind machine, claimed to be viable 95 percent of the time. Flowind, another developer which seems to have survived the initiation trials of the early years of WED, sees future development supported in European and Asian joint development ventures, due to available financing and foreign interest in acquiring land in the United States. Flowind’s joint engineering projects with Spain and Japan demonstrate worldwide interest in WED. Leland Bright, Flowind’s Director of Investor Relations, says his company “is here to stay.” (Figure 6.)

Conclusions

Wind energy production began dramatically. Sparked by the 1970’s “energy crisis,” the search for renewable alternatives to fossil fuels was supported by government incentives to investment. This made the fledgling wind energy industry economically viable in practical application. As a result, the testing and refinement of this new technology has taken place not in small demonstration sites, but in full-scale commercial installations. Such a peacetime rush into production of new and untried equipment and techniques has no parallel, and has left an unprecedented visual legacy on the California landscape, best seen at Altamont Pass, the site of the world’s largest wind-
farm. Altamont Pass windfarms now cover forty-seven square miles, bristling with almost 7,000 wind turbines, a ten-fold increase since 1982. The twenty different types of turbines, the variation in installation patterns, and some already-abandoned stands of machines attest to the experimental origins of the area and document the history of wind energy's early development.

With the removal of artificial financial supports at the end of 1985, wind energy development has been put to the real-life test. Only a few of the fourteen developers involved at Altamont will survive. Those that “have an established reputation in developing windfarm projects and raising capital, are using reliable machines and have the ability to provide power at a relatively low cost.”29 The unequivocal acceptance of WED as positive and benign is coming under scrutiny. Long-term and subtle aspects of its environmental impact are being examined. The industry appears reliable, and here not only to stay, but also to
spread out of Altamont and a few other initial sites. As developers seek permits in other areas, the public is taking notice of windfarms and their intrusion into open lands. In addition to The Greenbelt Alliance's demand for EIR's, Solano County residents recently demanded and won county regulation of wind turbine installation to areas not visible from either major highways or existing or proposed residential developments. This public aesthetic concern eliminated 60 percent of the county's potential wind resources, "ironically, a loss of power . . . equivalent to the residential energy demand for the entire County."^{30}

Wind energy development is a promising source of renewable energy, important in the inevitable transition from dependence on fossil fuels. California's geographical situation insures it will always be a major site for generation of wind energy. Regardless of the appearance or location of future WEDs, the transformation of the landscape in Altamont Pass is total and permanent. It stands as a testament to brave and innovative searchers in the quest for responsible solutions to the pressing problems of the world's growing energy demands, and a symbol of hope for the future.

NOTES

2. Ibid., p. 2.
10. Everett, op. cit., note 3, p. 68.
17. Post, op. cit., note 8.
18. Thayer, op. cit., note 1, p. 4.
23. Ibid.
29. Everett, op. cit., note 3, p. 68.