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iea wind

IEA WIND TASK 28

SOCIAL ACCEPTANCE OF WIND ENERGY PROJECTS

"Winning Hearts and Minds"

STATE-OF-THE-ART REPORT

Country report of: United States

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Content:

Abstract / Summary

Wind energy generally enjoys public and policy support throughout much of the U.S. However, social acceptance issues persist, most notably at the community or project-specific level. In addition, specific regions in the U.S. face much higher levels of social opposition than others, and large-scale transmission deployment may present additional social acceptance challenges. Much is known with regard to wind energy's impacts on the communities where projects are built, and successful models of public and stakeholder engagement to facilitate project development and land use planning do exist. However, an enhanced understanding of the impacts experienced by those living directly adjacent to wind turbines (i.e., within 1 mile, or 1.6 km) would assist in the continued development of siting best practices. Moreover, a better understanding of the linkage between community ownership and social acceptance could facilitate the development of new policy to support wind energy deployment.

Framing the issue

a. Introduction by the Operating Agent of IEA Wind Task 28

In 2009, many governments and organizations set new targets for CO2 reductions, renewable energies in general, as well as specific targets for wind energy deployment. All these targets require many single projects to be carried out both onshore and offshore that necessitate hundreds of siting decisions and therefore hundreds of communities accepting a wind project nearby.

Research and projects are ongoing in many countries on how acceptance could be fostered, but we need to look beyond national borders to learn from each other and to complement each other's approaches. While Denmark has one of the longest traditions of co-operatively owned wind farms, Japan may bring its expertise in generating additional benefits for the communities hosting the turbines. While Ireland and Canada know about the effects of wind parks on tourism, Norway has conducted actual research on communication between society and science, e.g. concerning bird risks with wind farms.

In the framework of the IEA Wind Implementing Agreement, Task 28 collects and disseminates the current knowledge on how to increase acceptance of wind energy projects with the aim of facilitating implementation of wind energy and climate targets.

Ten countries have officially committed to Task 28 and have provided an input for cross-national comparison and discussion by writing a national report such as the one on hand. The Irish report has been incorporated into the international State-of-the-Art Report by IEA Wind Task 28, available also on www.socialacceptance.ch.

b. The Issue: Social Acceptance of Wind Energy Projects in the U.S.

In recent decades, the debate over acceptance of wind energy in the United States (U.S.) has focused on socio-political and market acceptance. Politicians, policymakers, and the public have, at times, resisted the implementation of subsidies and incentives for wind power due to perceived costs while utilities have, at times, resisted wind power due to concerns regarding grid operations and the variable output of wind energy. There have been isolated cases of local opposition to wind projects in California (Pasqualetti and Butler 1987) as well as the notorious Cape Wind offshore project in Massachusetts (Kempton et al. 2005), but social opposition to specific wind energy projects has not been a large barrier to wind energy development.

Nevertheless, rapid growth (39% annually over the past 5 years) has increased the footprint of wind power in the U.S., and some parts of the country have begun to observe increasing numbers of conflicts between local communities and wind energy development (most notably in the Northeast and Mid-Atlantic regions).[1] Thus, while questions of economic viability and the ability of grid operators to effectively manage wind energy have become less significant over time, community acceptance issues have emerged as a barrier to wind energy projects and the transmission development that will be necessary to move valuable U.S. wind resources from remote locations to load centers.

[1] As observed in popular and local media as well as anecdotes throughout the industry.

1. Definitions

Before delving into the current knowledge of social acceptance in the U.S., it is important to establish some basic definitions.

a. Social Acceptance

The term social acceptance is widely used but has varied meanings for different individuals. This report relies on the three-tiered characterization of social acceptance articulated by Wustenhagen et al. (2007). Wustenhagen et al. (2007) break the concept of social acceptance into issues of socio-political acceptance, market acceptance, and community acceptance.

Socio-political acceptance is defined as broad-based support for wind energy among policymakers, the public, and other significant stakeholders. Wustenhagen et al. (2007) point to public opinion surveys as a sign of socio-political support, but one may also consider policy support as an indicator of broad-based socio-political acceptance.

Market acceptance refers to wind energy technology adoption by consumers, investors, and the power generation industry. At some levels, this is a reflection of technological maturity and reliability such that utilities and investors are willing to make significant investments in wind energy and consumers believe that wind energy will not jeopardize ready access to electric power.

Community acceptance is that element of social acceptance that deals with local opposition to individual wind power projects, particularly by residents and local government. Because local approval for a proposed wind project is required before construction can begin, community acceptance is a fundamental aspect of social acceptance of wind energy. This element of social acceptance typically comes to mind first when one reflects on the concept of social acceptance and wind power. Although this is the level of social acceptance from which the term NIMBY ("not in my back yard") has emerged, research has demonstrated that community acceptance of wind power projects cannot be reduced to simple NIMBYism but is actually a complex and dynamic social phenomena, influenced by an array of factors, including perceptions of justice and trust (Wustenhagen et al. 2007).

b. Onshore / Offshore

The U.S. wind energy market consists exclusively of onshore wind installations. More than 35% of total installed capacity is located in Texas and Iowa. A handful of offshore projects has been proposed (Firestone et al. 2009) but not yet realized.

Onshore wind turbines in the U.S. are generally larger than 1 megawatt (MW) in size. In 2008, the average installed turbine size was 1.67 MW (Wiser and Bolinger 2009). Tower heights range from 65 meters to 100 meters. While the industry is largely dominated by the GE 1.5-MW wind turbine, onshore turbines in the 2-MW to 3-MW size range have emerged in the U.S. market (AWEA n.d.).

Proposed offshore wind projects are located in state and federal waters off the shallow east coast of the U.S. Offshore installations are under consideration from Georgia to Maine. For the purpose of this report, offshore wind energy refers to a handful of east coast offshore wind projects that are in relatively advanced stages of development (i.e., developers have signed a power production agreement or are in negotiations with potential power purchasers).

c. Large Scale / Small Scale

The U.S. wind industry is primarily dominated by large, megawatt-scale turbines serving the utility sector. Average installed turbine size has exceeded 1 MW since 2002 (Wiser and Bolinger 2009). The number of small-scale turbine installations (generally defined as less than 100 kilowatts, or kW) is increasing, and at year-end 2008 there were more than 80 MW of capacity resulting from turbines less than 100 kW in capacity (Stimmel 2009).

This report focuses exclusively on social acceptance of large-scale turbines, generally more than 1 MW in size, serving the utility sector.

d. Transmission Lines

The best wind resources in the U.S. tend to be located far from load centers, requiring a robust transmission network to move power from valuable wind resource areas to regions of high electricity demand. The term "transmission" is used loosely in this report to refer to high-voltage transmission lines used in long-haul power shipments across state and regional boundaries.

Industry Status and Stakeholders

2. National Wind Energy Concepts

The U.S. wind energy industry added more than 9,900 MW of wind power in 2009. In spite of a major financial crisis and a notable recession, the industry set a new annual installation record and increased its 5-year average annual growth rate to 39%.This portion of the report highlights significant policy provisions impacting wind energy and examines policy's impact on community acceptance.

a. Wind Energy Policies, Strategies, and Incentives

Historically, the production tax credit (PTC) has been the primary federal policy incentive for wind energy in the U.S. (Wiser et al. 2007). In its current form, the PTC offers a 2.1 cent tax credit for every kWh of power production during a wind project's first 10 years of operation.

Significant enhancements to federal policy for wind energy were promulgated in the economic recovery legislation signed into law by President Obama in February 2009. Provisions especially valuable for wind energy include:[2]

- A 3-year extension (through 2012) of the wind energy PTC
- An option for developers to choose a 30%, refundable investment tax credit (ITC) in place of the PTC[3]
- A 1-year extension of the bonus depreciation for wind equipment[4]
- Expansion of the U.S. Department of Energy's (DOE's) loan guarantee program for developers and manufacturers
- A substantial expansion of DOE research, development, and deployment funding
- A 30% tax credit for advanced energy manufacturers
- Removal of the dollar limit on the 30% ITC for purchases of small wind systems.[5]

State Renewable Portfolio Standards (RPS) have been the primary state policy impacting the utility-scale wind industry. RPS require utility companies to obtain a minimum percentage of their electricity from wind and other renewable energy sources. RPS are in place in 29 states and the District of Columbia. Since 1998, 60% (16,500 MW) of new renewable energy projects have been installed in RPS states, and wind has amounted to 94% of those projects (Wiser and Barbose 2009). A national RPS has been included in legislation passed by the House and by the Senate Energy Committee but is still pending in Congress.

In addition to state RPS, various states also offer property tax abatements, sales tax abatements, and state production tax credits (which are in some cases refundable), and some states offer specific financial and financing incentives for community wind projects (Lantz and Doris 2009, Lantz forthcoming).

To ensure continued growth, transmission legislation is a key industry goal. The wind industry seeks policies to spread the cost of new power lines among all who benefit, speed transmission planning, and provide for "backstop" federal siting authority.[6] Arguably, new transmission investment would be offset by lower electricity costs and reduced fuel costs and would lead to greater energy independence (AWEA 2009).

The industry is also seeking climate legislation that includes an aggressive near-term goal, such as a 15% to 20% carbon dioxide reduction by 2020 to promote a near-term shift to renewable energy (AWEA 2009). The House of Representatives passed a comprehensive energy and climate bill in June that would reduce carbon dioxide emissions 17% below 2005 levels by 2020 and 83% below 2005 levels by 2050. Climate legislation is also still pending in Congress.

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[2] For additional information, see Wiser and Bolinger (2009).
[3] ITC refunds are, in actuality, direct grant payments from the U.S. Treasury Department. The ability to replace the PTC with the refundable ITC applies to facilities that begin construction by December 31, 2010 and are in service before January 1, 2013. In 2009, wind projects collected more than $2 billion in refunded ITCs.
[4] Bonus depreciation allows for project owners to depreciate up to 50% of their depreciable basis in the first year of operations.
[5] This ITC is available through 2016.
[6] In the U.S., transmission siting decisions are traditionally within the domain of states. However, as power markets become increasingly regional and wind energy continues to grow, "backstop" federal siting authority could allow the federal government to step in and authorize multi-state transmission projects that are in the national interest.

b. Spatial Planning

There is no comprehensive land use policy or planning process that applies to wind energy in the U.S. Moreover, siting wind projects in the U.S. is complicated by three specific types of land owners: (1) private; (2) public, either state or federal government; and (3) Native Americans. In working with any one of these entities, developers may be required to obtain approval from federal, state, and local authorities before moving forward on a project. Project siting is ultimately regulated on a case-by-case basis, and environmental laws, archeological considerations, and zoning requirements must be adequately addressed prior to construction of a wind energy project (AWEA 2008).

The federal government is primarily concerned with regulating land use and environmental impacts on federal lands. However, even when a project is under consideration on private land, federal oversight and approval may be triggered by impacts on wildlife, water, aviation, use of federally owned transmission lines, or the use of federal funds (e.g., grants) in a specific project (AWEA 2008). Much of the federal involvement determining appropriate land use is concerned with environmental impacts as regulated by the National Environmental Policy Act (NEPA). NEPA requires federal agencies to perform an environmental assessment or environmental impact statement in accord with any action in which the federal government participates. In addition, the federal government will become involved in a project if it threatens wildlife or critical habit for species on the endangered species list. Likewise, threats to migratory birds, bald and golden eagles, cultural and paleontological resources, water, aviation, and radar are assessed by the federal government, and excessive impacts can eliminate areas from wind power development (AWEA 2008).

While federal government agencies have been relatively efficient in dealing with regulatory issues that impact development on private land, project approval on federal lands has been slow. This is the case in spite of the development of agency-wide policies.[7] It has been argued that approvals have been stalled by local administrator concerns regarding increasing demands on public lands.

Regulation of wind energy projects at the state level varies widely. In some cases, states grant approval authority within a specific state agency or set of agencies. In other cases, states rely on local government and zoning policy to provide the authorization necessary to construct a wind energy project. Often state concerns are similar to those of the federal government. Environmental impact assessments or analyses are sometimes required, and state-level environmental regulations may be stricter than federal requirements. Likewise, states are interested in protecting the cultural heritage of their land and public safety. States with regulated energy markets typically require the approval of the public service commission (AWEA 2008).

In most cases, states require at least one local approval before a project begins construction, and final approval of a project often falls within the authority of local government.[8] Local regulatory approval may be governed by local zoning ordinances, local construction regulations, and/or local transportation infrastructure. In some cases, local ordinances may be developed either implicitly or explicitly to prohibit wind energy development. When this occurs, individual states may have the authority to establish a state approval process that can overrule such ordinances. However, such state approvals must generally demonstrate that there is no reasonable objection to the project (AWEA 2008).

A persistent and growing problem for the U.S. wind industry is moving valuable resources to the population centers. Developing new transmission infrastructure has pushed some states and regions to develop a more robust planning process. In its current form, this typically entails identifying high-value renewable energy regions or zones and developing a transmission plan to serve these areas. Texas is the most advanced in implementing its Competitive Renewable Energy Zone (CREZ) planning process, which provides for a $5 billion investment in transmission expansion serving specific high-value renewable energy zones (Texas PUC). Research evaluating the impact of the CREZ process on social acceptance of wind energy and transmission has not been conducted.

[7] The U.S. Bureau of Land Management approved a Programmatic Environmental Impact Statement (EIS) relating to the authorization of wind energy projects in 2005, and the U.S. Forest Service is in the process of developing its own internal policy.

[8] Even when final formal approval is not dependent on local authorizations, state regulators often defer to the desires of local authorities and are generally hesitant to approve a project without local government support .

c. Strategies: From Policy to Local Acceptance

Early in U.S. wind development history, there was a tendency among wind developers and clean energy advocates to assume that citizens who supported wind energy in the abstract would welcome commercial wind turbines into their communities. However, history shows us that, in some localities, citizen backing of wind energy declines markedly when someone proposes to erect modern megawatt-scale wind turbines in plain sight of dozens of residents who have probably never seen a wind generator. As a result, the prevalence of RPS and other wind energy supporting policies is not an accurate indicator of community acceptance.

The state of Wisconsin has struggled with the dichotomy between progressive renewable energy policies and community acceptance of wind power. It has taken the state many years to acknowledge and remedy the disconnect between state energy policy and local permitting culture. Lessons derived from experiences in Wisconsin suggest that when state energy policies supporting wind energy are passed, the state has an obligation to either (1) devise a process for state review of wind projects that balances public policy objectives or (2) devise uniform permitting standards for local governments to apply that accomplish the same objectives (i.e., a balance between impacts on local communities and state energy goals). By developing state-level review processes and/or state standards, the state performs its due diligence in considering the various impacts that can influence community acceptance and has taken the burden off of local governments to strike the appropriate balance.

Taking these steps is critical because experience indicates that local governments are acutely sensitive to organized local opposition. In addition, local governments have limited resources and expertise to evaluate technical wind turbine impacts studies. Thus, without predetermined standards, based in an objective balance of public costs and benefits, local governments may be easily influenced by local fears that may or may not be founded in an objective understanding of project impacts.

It has also been proposed that states with relatively high population densities and aggressive renewable energy standards should consider adopting policies and incentive programs that lead to smaller wind projects and/or an increased ability for host community and resident ownership. This approach offers two distinct advantages: by reducing scale, smaller wind projects may have a reduced impact on landscape and host communities, and by increasing resident opportunities for ownership, local communities would have a more direct participatory process in the project and increased influence over where and when wind energy projects are constructed.

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3. Stakeholders / Target Groups

a. Stakeholder's Perspectives on Wind Energy

The perception, and ultimate acceptance, of wind energy projects (and transmission) depends on the individual stakeholder's (or stakeholder group's) sense of how the benefits and costs of wind projects meet his value proposition, impact his job responsibilities, or change his lifestyle (i.e., "what's in it for me"). While wind energy has many benefits—price stability, economic development, cleaner air, water savings, climate change mitigation, energy security—it is also visible, creates sound, disturbs a small amount of land, and isn't dispatchable in the utility sense. Different stakeholders weigh these benefits and issues differently, and their weighting results in the stakeholder's level of "acceptance" of the wind project. For instance, recent polling indicated that utilities weigh economics, reliability, and load match as most important, while environmental advocates weigh clean air and climate change most heavily (Lantz and Tegen 2009). Local officials put the most weight on economic development, local environment, and energy security(Lantz and Tegen 2009), but such weighting can vary considerably depending on the region of the country. This chapter presents the perspectives and issues of different stakeholder groups, including two case studies that demonstrate the conflict that often exists among these perspectives.

b. Utilities / Grid Owners

Utilities don't share a single perspective.This section considers perspectives of investor-owned and regulated utilities, cooperative and municipal utilities, wind-resource-limited utilities, fuel-dependent utilities, utilities of limited size, and grid regulators. It briefly discusses distinctions specific to leading utilities.

IOUs under Regulation. The bulk of the U.S. electric power market, this market segment usually has rate base, rate of return incentives to invest equity in generation plants and earn a return. For this group, the prime consideration is to "build or buy," and the incentive is to build or own assets (i.e., power plants). These institutions are conservative because public regulators are likely to second-guessthem if they make bad generation choices, and they operate under monopsony market conditions with respect to purchasing wind power. This forces wind suppliers into fierce competition unless both equity investment (ownership) and monopsony conditions are adequately regulated in the public interest. Thus, wind has a hard time penetrating these markets. Moreover, utilities here can protect generation monopolies by maintaining transmission constraints that exclude wind resources from their markets, so system planning that includes best economics and external cost considerations (carbon, water, health, environmental) for generation and transmission are required to make room for wind.

Cooperative and Municipal Utilities. As institutions that do not pay tax, cooperative and municipal utilities do not have access to the PTC, so it is not favorable economically for them to own wind projects.[9] In addition, they have access to federally subsidized hydropower and are sometimes diversified into coal mine ownership, so additional financial incentives exist that discriminate against wind. They can be transmission dependant, rather than transmission owning, so transporting wind into these markets from remote wind resources can be particularly challenging. Finally, cooperative and municipal utilities tend to be smaller, with less public input into their marginal generation-expansion decisions, so often they are insulated from public policy and public pressure that supports wind. Wind leaders in this utility segment are few and far between.

Wind-Resource-Limited Utilities. Since much of the population lives in coastal regions, and the best wind resources on land are in the center of the country, the utilities without nearby, low-cost, on land wind resources often omit this resource from their planning and acquisition strategies. Offshore wind is much more expensive, and while there is no transmission solution to bring wind out of the center to the coastlines, a stalemate exists. Utilities distant from resources (with some important exceptions like Colorado, Texas, Iowa, Minnesota) haven't the resource availability and economics to justify massive wind build-outs.

[9] Low-cost public financing available for these entities is insufficient to offset the value of the lost PTC.

Fuel-Type-Dependent Utilities. Since the recent natural gas price-spike events, utilities that depend on a lot of gas have seen gas generation costs far exceed wind costs. These utilities are subject to the long-term gas price risks, and some of them are rapidly hedging these risks with wind. Texas, Oklahoma, Colorado, and Kansas utilities are examples. Some of these uitlties' gas resources can be put to use responding to wind variability. By contrast, utilities that depend on coal, which has been relatively more price-constrained than gas, have not seen wind economics that benefit them or their customers and have been slower to move toward wind. These utilities' coal plants are not as useful in responding to wind variability as gas-peaking plants, so there is also an operational challenge that heavily coal-dependent utilities confront.

Size-Limited Utilities. Since windy areas do not attract large populations, utilities serving the best wind resource areas tend to be small. Small utilities tend to have fewer staff to analyze the potential for wind to be a new "cash crop," to do the financial and resource modeling necessary to justify wind purchases, or to justify the investment risks for wind plants and needed transmission to move their region's wind to distant coastal markets at a profit. Smaller utilities tend to move more slowly on any new idea, although there are important exceptions here (Waverly, Iowa; Green Mountain Power; Lower Colorado River Authority) where small utilities made a virtue of their size to be first movers, usually with the leadership of some inspired individual making it happen.

Reliability Organizations. The following organizations are responsible for effectively integrating wind into the grids that they regulate and operate: The Federal Energy Regulatory Commission (FERC), which regulates electric wholesale and interstate markets; the National Electric Reliability Corporation (NERC), which sets standards for electric system reliability; NERC's regional reliability regulators, which provide both standards and enforcement for reliability standards; and Regional Transmission Organizations and Independent System Operators, which cover about half the electric loads in the U.S. A vast archipelago of acronym-labeled committees, projects, planning entities, legal proceedings, contracts, and efforts are made in these settings, much of which will determine the speed and extent of wind energy adoption.

Utility Leaders. Among investor-owned utilities, there are also some outstanding examples of wind energy acceptance. For example, the largest utility owner of wind turbines is MidAmerican, a utility holding company in Iowa. After fighting renewable energy standards for many years, MidAmerican accepted wind and has become a leader in owning wind. Other investor-owned companies with extensive wind include Xcel Energy, a Minnesota-based utility holding company that has some of the highest percentage penetration of wind, and Florida Power and Light, whose subsidiary NextEra Energy is the country's leading owner of wind projects. Many European utilities are developing wind in the U.S., including Iberdrola, Engerias de Portugal, E.ON AG, and others. There are also examples of outstanding public and cooperative utilities that are leading early adopters of wind. The Sacramento Municipal Utility District and the Los Angeles Department of Water and Power in California, along with the Lower Colorado River Authority in Texas, are examples of public utilities that are moving rapidly into wind.

c. Developers / Investors

As the U.S. wind industry ramps up to deliver 10,000 MW per year as it did in 2009, or even 16,000 to 18,000 MW a year to achieve the 20% wind future, all the issues experienced by the industry to date are exacerbated, and new issues are coming to the fore with increasing speed and force. This brings additional scrutiny to projects and results in new regulations or standards in many jurisdictions. Without broad and local social acceptance, this scrutiny can easily spin out of control and result in rejected or overly burdened projects. Such scrutiny will increase the importance of good project design, strong community relations, reasonable and thorough studies, and careful fulfillment of permitting requirements, as these are all necessary to achieve—and maintain—social acceptance. Developers who seek shortcuts will not only subject themselves to increased risk but will also harm the interests of the industry. Social acceptance of wind will only allow maximum growth in an environment where the industry is meeting high standards and communication with affected communities occurs early and often. It continues to be important to educate the public on wind in the context of other energy choices and environmental issues, but the industry must also look inward to its own behavior to ensure social acceptance in the future.

Extensive and high-quality communication in the early stages with stakeholders to answer questions and provide insight on local concerns and counter misinformation is critical. At a certain point, message fatigue begins to set in, and it becomes very difficult to change the direction of social acceptance. A key to countering misinformation is finding and supporting champions from within the community as well as bringing in credible third-party voices, and involving them early in the process is vital. Perhaps even more difficult, it is important to continue providing that support over the increasingly long development cycle and bringing in new supporters to supplement and relieve project champions.

Social acceptance will also increasingly be enforced by investors and lenders. The leaner economics of projects with today's low energy prices creates a flight to quality, as investors don't find projects lucrative enough to cope with flaws. Even balance sheet players seek higher-quality projects as their own credit committees are more conservative today and they fear that they may not be able to take projects to the financial markets if necessary. "Flaws" include poor social acceptance, and what may have been acceptable behavior by developers in previous years will be less acceptable going forward since it can encourage litigation and enforcement issues that can affect projects in construction or operation. Not long ago, the wind industry was small enough that its impacts could easily be dismissed by both advocates and more neutral parties. Today, that is a much tougher argument to make just because of the sheer number and geographic reach of projects. Birds, bats, sound, and even health impact questions will have to be addressed reasonably. Reasonable setbacks from residences and property lines will need to be observed. Environmental studies must be rigorous. Accurate information about impacts must be provided. Benefits must be communicated clearly. In short, development best practices will have to be followed, and the industry will have to help set reasonable standards and expectations for its members.

d. Financial Institutions

Many in the financial community think that the rate of return on wind power investments is insufficient when considered in context with the apparent risks, including market uncertainties; wind's variability and non-dispatchability; impacts on wildlife and landscape; integration costs; need for backup power; competitive economics with conventional generation; lack of supporting, long-term policies; the uncertainty of the climate change economics and policy; and the increasing risk that communities may reject wind power in their backyards. However, other investors are excited about wind power, as evidenced by the more than 9,900 MW of wind power installed in the United States in 2009.

The finance community is increasingly seeking investment opportunities that contribute to financial, social, and ecological capital. Such a "Triple Bottom Line" business practice adds value to business plans, shareholders, customers, and the communities served. Wind energy provides opportunities on all of these fronts and also provides significant tax benefits for institutional investors and corporations with a large tax burden. Moreover, the wind industry is advancing in terms of productivity, reduced risks, and lower costs, all of which contribute to increased attention from financial institutions.

Productivity gains are enhanced through the use of increasingly sophisticated, mescoscale meteorological mapping, instrumentation, and resource analyses. Risks are reduced through the use of proactive best practices, as well as comprehensive environmental studies and wetlands delineations, which can serve as an educational opportunity for local communities to become more informed about local environmental conditions.[10] This increased responsibility and professionalism in wind power project development has dramatically reduced risks to wildlife and aided in assuring the public and regulatory agencies that wind projects fully comply with local, state and federal laws (by lowering the risk of impacts to wildlife and habitats). Improved designs, logistics, construction, towers, blades, generators, power electronics, interconnection, and siting technologies and techniques also enhance industry productivity and subsequently the development of financial capital.

Social capital is enhanced by U.S. wind projects' contribution to clean air and water, as well as contributions to local economic development and energy security. Wind turbines in the U.S. today generate enough electricity to power the equivalent of 9.7 million homes, protecting consumers from fuel price volatility and strengthening our energy security. A 100-MW wind project can result in $100 million of local economic development, and these projects have already revitalized rural communities around the country.

Ecological capital is enhanced through the reduced emissions and water use. America's 35,000-MW wind power fleet will avoid an estimated 62 million tons of carbon dioxide annually, equivalent to taking 10.5 million cars off the road, and will conserve approximately 20 billion gallons of water annually, which would otherwise be consumed for steam or cooling in conventional power plants.

[10] Comprehensive environmental studies and best practices should be consistent with industry best practices as elicited from stakeholder groups, including the National Wind Coordinating Collaborative, the American Wind Energy Association, and the American Wind and Wildlife Institute.

e. National Policymakers: AWEA Perspective

For U.S. policymakers and decision leaders, the energy debate involves a variety of economic, environmental, security, and technical issues that face each energy resource. As one of the most common new energy resources in the U.S., meeting 42% of all new generating capacity in 2008, wind energy is often at the center of energy discussions. The following is a list of topics that are frequently part of the discussion around wind energy, energy policy, and energy resources choices.

Cost of Energy. The cost of power for new generation sources depends not only on upfront capital cost, fuel cost, and maintenance costs but also regulatory costs such as conventional pollutant control or greenhouse gas. Wind energy provides power at a cost that is stable over the entire life of the wind project. Hedging against the potential volatility of fossil fuel prices (such as price spikes in natural gas) with increased renewable energy has tangible value to utilities and ratepayers. Similarly, as climate legislation is implemented to stabilize global climate change, utilities and their ratepayers will be exposed to increased costs. Reducing a utility's reliance on volatile fuel prices and carbon-based resources by encouraging a shift to renewable energy will shield ratepayers from the subsequent cost impacts.

Jobs and Economic Development. The U.S. and global economy are climbing out of an economic recession and competing for jobs. The U.S. wind industry could support 500,000 jobs, according to the U.S. Department of Energy's 20% Wind Energy by 2030 report, which would include manufacturing, construction, operations, transportation, engineering, and many other wind-related jobs. Americans stand to benefit from the hundreds of manufacturing facilities that could come to the U.S. with proper market signals. Wind farms are predominantly built on the private lands of farmers, ranchers, and other landowners, providing them additional income through lease payment while allowing them to use their land for their original purposes. Similarly, property taxes or payments in lieu of taxes from the wind farms provide local towns and cities additional revenue for their schools, libraries, roads, and other infrastructure.

Environmental Impact. As the U.S. and world continue to address global climate change, the shift toward cleaner energy sources is imminent and necessary. Compared to conventional technology, wind energy produces no conventional air or water pollutants, no greenhouse gases, consumes no water for generation, and produces no waste byproducts. Environmental impacts of wind projects on surrounding ecosystems are minimized through extensive pre-construction studies, responsible project siting practices, and proactive engagement with environmental groups and concerned constituents.

Energy Security. Energy security in the U.S means supplying the U.S. with a diverse portfolio of domestic, clean, and economically competitive energy options. The current U.S. generation mix is 90% reliant on three fuel-based energy sources: coal, natural gas, and nuclear. Incorporating greater amounts of wind energy, whose potential is eight times greater than current U.S. power demand, will help diversify the U.S. mix toward an inexhaustible, domestic energy resource and reduce the reliance on volatile energy sources.

Transmission and Grid Integration. Integrating the renewable energy resources that are needed to meet greenhouse gas emission reduction and energy security goals will require expansion of our transmission system as well as reforms to power system operations. A number of studies by U.S. utilities and U.S. government agencies have found that wind energy at levels of 20% to 30% or more can be integrated into the power system reliably and cost-effectively. Updating policies that govern how transmission is planned, paid for, and permitted will allow construction of a "green power superhighway" to move electricity from high-resource areas to towns and cities, reducing consumers' electric bills and improving reliability. In addition, providing grid operators with tools such as wind energy forecasting, faster generator dispatch intervals, larger balancing areas, dynamic transmission scheduling, and other operating schemes will make the power grid more efficient for all users, benefiting consumers and facilitating wind integration.

f. Policymakers and General Opinion

The development of public opinion and policies related to wind power vary over time and space. At present, national-level policies favor wind power. There are several causes for this circumstance. One is that wind power by itself is not high enough on most political agendas to command ardent attention for or against. However, it does not take much to move the pendulum one way or the other. Lately, attention from the media and constituents has been favorable, and this has been reflected in the passage of legislation and the establishment of policies in support of the industry (e.g., tax credits). The present favorable climate for wind power, especially at the national level, developed in response to several factors, including:

- Wind power's environmentally safe nature, especially compared to uranium- and coal-based energy systems
- The absence of greenhouse gas emissions that could lead to climate change
- The positive lobbying campaigns by industrial, environmental, and other groups
- The passage, in many states, of renewable energy standards
- The perception by traditional energy suppliers that wind development does not threaten them
- The increased sentiment that wind power development improves our energy security.

The social acceptance of wind power at the national level, despite these favoring factors, does not predict reactions at regional and local scales. As a result, the approval process will in most cases proceed on a case-by-case basis, at least until a broad consensus is achieved that will influence future development more generically. Where predicted negative impacts are not realized in practice, or even where they pale in comparison with benefits, policymakers tend to move proposed projects through the approval process more quickly.

At the regional and local scale, the social acceptance of wind power is being influenced by categorical "test cases." One such case is the Cape Wind project in Nantucket Sound; what happens there will influence offshore project siting everywhere. The importance of test cases is being repeated in other circumstances, such as those along lakeshores or ridgelines, in picturesque areas, in areas of indigenous peoples, in farm lands, and in areas of low population density. In other words, precedence helps inform public opinion and policy.

Another factor informing opinion and policy is the increasing use of scientifically collected data. Examples include the work of Ben Hoen and Jeremy Firestone in the U.S. and Maarten Wolsink, Bernd Möller, and Simon Power in Europe.

A third factor informing opinion and policy is the impact of wind projects on economic development, whether positive or negative. This is reflected in places like Lamar County, Colorado; Dixon, Illinois; the Powder River Basin of Wyoming; and many other locations. Because these benefits are at the county, city, and family levels, they tend to vary from place to place, and they even change over time, as they have in Palm Springs, California, which originally opposed wind development and now embraces it.

g. Educators

Educators do not have the same deep or vested interest in wind energy as, for example, utilities, developers, and environmental organizations. Yet it is commonly held that they have a special obligation to inform their students about the issues of continued dependence on carbon-emitting forms of electricity generation and to promote the cause of alternate and renewable energy. Many educators take this obligation seriously, in part because they tend to be socially and politically more progressive, in part because the students, particularly as they grow older, demand that they do. These needs are best met if the students are encouraged to think about new ways in which wind power might be harnessed and not simply be conditioned to accept the emerging status quo.

Governments in many countries have aided the effort, supplying lesson plans, interactive learning tools, and special project ideas. One example of such a program is Wind Powering America's "Wind for Schools." It involves installing small wind turbines at rural and elementary schools and instituting Wind Application Centers at colleges and universities. The installation of wind turbines at schools trains college students who manage and evaluate the installations in deploying wind projects, provides a concrete and practical demonstration of how wind energy is converted into electricity, allows K-12 students to integrate data from the turbine into their theoretical understanding of how it works and provides a"hands-on" experience, and it helps offset the schools' demand for electricity.In addition, some schools, particularly colleges and universities, have already invested in large turbines, not only to extend research opportunities for students in engineering and related disciplines but to demonstrate a commitment to clean energy and to save on electricity costs.

Schools are at the very centers of their communities. The best way to promote the idea of "community wind," and with it the idea of distributed generation, local participation and control, and social acceptability, is to satisfy at least a large part of the school's demand for electricity in a site-sensitive way. This, as much as the classroom efforts of individual teachers, will "educate" the public, young and old, effectively.

h. National, Regional, and Local Administration

Wind energy development in the U.S. is challenged by a complex set of checks and balances at each level of government and the presence of "Home Rule" in many U.S. states. More than three federal agencies create rules that affect wind farm developments, with the most influential being two divisions within the U.S. Department of the Interior: the Bureau of Land Management and the U.S. Fish and Wildlife Service. The rules established by these agencies at the national level are often subject to loose interpretation by their regional and field offices, creating inequalities in the pace of wind development among U.S. regions.

There are significant checks and balances between federal and state agencies in interpretation of federal rights of "eminent domain" for issues such as transmission siting versus state sovereignty, over transmission sited within state boundaries. A good example is the opposition by states to having the U.S. Department of Energy establish transmission corridors that are in the public interest, as mandated by the Energy Policy Act of 2005. The U.S. Department of Energy has decided that intrastate high-voltage transmission for wind energy is in the public interest, yet states are opposing the Federal Government's right to usurp individual state processes for transmission siting by threatening lawsuits.

More than 30 U.S. states have enacted some type of "Home Rule" legislation that establishes local decision-making on projects affecting the local community, such as wind farm developments. This becomes problematic when states have not established clear guidelines for wind farm development and final permit decisions are left to local municipalities that may not have the experience or expertise to interpret developers' technical studies and become unduly influenced by local constituents' opposition to the wind farm.

A clear example of this tension between states and localities can be found in recent legislation introduced in Massachusetts. Massachusetts recently proposed the Wind Energy Siting Reform Act to provide clear guidance to municipalities for the timely development of wind energy projects. The bill gives local boards the authority to issue permits that meet statewide guidelines and to deny those that don't. It strengthens local authority by preventing small bands of opponents from blocking projects that have the support of local communities. The bill does, however, allow for a limited state override, which is also available for most fossil fuel power plants, if local officials reject a wind farm that meets statewide siting standards. Despite this fair and balanced approach, and the support of many national environmental organizations, the anti-wind "coalition" posted the following headline: "Massachusetts State Senate Set to Vote on Anti-Home Rule Wind Bill."

By contrast, the state of Texas, which has one of the most active wind markets in the U.S., put the entire puzzle together for wind developers by creating the state RPS and then facilitating the investment of $5 billion in new transmission by the private sector through the establishment of "Competitive Renewable Energy Zones" (CREZ) in the windiest areas of the state. The Texas CREZ transmission process is expected to allow the state to generate more than 18,000 MW of wind energy (LCRA n.d.) Texas was able to carry out this transmission plan because its electricity grid is operated only within the state of Texas, by ERCOT, and the wind farms were being developed solely within its state borders. In this case, the state of Texas acted almost unilaterally, without the interference of federal or municipal concerns.

As of January 2010, 29 U.S. states have RPS, yet the tensions described above continue to delay wind farm developments, with few states poised to meet their RPS goals. Progress is being made at the federal level, with collaboration now happening among agencies through a Federal Wind and Wildlife Advisory Committee. A Federal Renewable Electricity Standard or carbon cap and trade system would jump-start stagnant markets in states without RPS and provide more impetus for intrastate transmission development. But the problem of Home Rule will not go away easily. States like Massachusetts must take the lead in striking a fair balance between state authority and local input on decisions affecting local communities.

i. Local Population

A Montana Case Study. A Great Falls, Montana construction company, United Materials, owns the first utility-scale wind development permitted in Montana, the 9-MW Horseshoe Bend Wind Park. The highway construction company has been one of the community's largest employers for decades; its president even served as chairman of the school board. A commercial development permit for the wind park, after an overwhelmingly positive public hearing, was issued. No one spoke against the project.

Research suggests wind projects with community ownership enjoy greater social acceptance, and the local ownership of Horseshoe Bend endeared it to the community. The developer and owner leveraged this public support with their extensive local land-use expertise into a near-flawless permitting process. These companies were pioneers, bringing a new technology online, but within the context of a community culture that they understood, indeed even helped shape.

Further, studies show communities that understand and accept a first wind project are likely to accept more projects (Simon 1996). In the Montana market, large-scale absentee-owned wind projects that followed Horseshoe Bend have enjoyed public support. It appears that introducing community-owned wind to an area can lead to greater understanding and acceptance of larger-scale wind projects.

Obtaining 20% of our electricity from wind energy by 2030 will require a massive build-out of transmission. Interestingly, this same area that is seeded with public support for wind energy produced vocal opponents to a Canadian company's plans to build transmission to carry this new wind power. It would be difficult to imagine a community model for this infrastructure that spans so many communities and often states. Although the 215-mile Montana Alberta Tie Line (MATL) is now permitted and financed, hindsight indicates it would have been a smoother process if the area's first modern transmission developers had the strategic insights of local community members. As construction begins, executives acknowledge that they missed the mark with certain landowners. Although this foreign company had U.S. advisors, it struggled to understand farming operations and local cultures.

Transmission has a much larger footprint than even the largest wind farms. Landowners who yield land for transmission are compensated far less than landowners who lease property to wind developers. While community benefits are high for both transmission and wind parks, the individual benefits and impacts can vary widely. It is a subtlety to keep in mind when fostering support of transmission.

Certainly, there was public support for the MATL line, but it may have manifested itself in a detrimental fashion. The line and its accompanying 600 MW of wind energy will bring $1 billion of economic impact to north central Montana, an area with some of the highest out-migration and lowest wages in the nation. County commissioners, school administrators, and local legislators joined chambers of commerce in every affected community to support the power line and its many public benefits. This was similar to the public support for Horseshoe Bend.

The difference (that was missed by the company and was not obvious to community boosters) was the negative economic impact to farming operations in the line's path. Some landowners had direct impacts from poles placed in their fields, and they contended the offered one-time rights of way and annual per-pole compensation were insufficient relative to the costs they would be forced to bear. These economic concerns were not fully heard by the company until it took the unusual step of appointing acitizen advisory board to talk directly to the landowners.

Unexpectedly, an important handful of landowners were annoyed and offended by the community zeal for the power line. Their families had operated these expansive wheat and barley farms for generations, all the while supporting the local community through taxes, philanthropy, and individual service. During the permitting process, several landowners brought up their family's historic support of the community and decried as unfair the community's support for this Canadian company over their businesses. It was a fair point; once acknowledged by the company and community, tensions softened and negotiations proceeded. It was one of many important lessons in social acceptance provided by the MATL experience.

j. Municipalities

As leaders of their community and local government, municipal officials' perspectives often (but not always) mirror the perspectives of their constituents, and vice versa. If local residents raise concerns regarding aesthetics, noise, or safety, local government officials are more likely to be wary of allowing wind energy development in or around their community. Municipal utilities, however, are often more concerned with costs, reliability, or interoperability of the wind power; these concerns are not always shared by their constituents but may influence community acceptance of utility wind projects. The scale of wind power also influences perspectives, with many municipal leaders more supportive and accommodating of a few residential-scale wind projects as opposed to large, commercial-scale wind projects. In most cases, the perspectives of the municipal leaders are directly related to their experience and understanding about wind energy and how much information they have received from reputable sources.

A Utah Case Study. Until recently, the majority of municipal leaders and local government officials in the state of Utah had limited to no direct experience with wind energy due to Utah's relatively slow start to develop wind. In 2005, Utah had only 1 MW of privately owned commercial-scale wind installed at a National Guard facility. In 2008, Utah became home to a an additional 18.9-MW commercial wind facility, located adjacent to the small (but growing) community of Spanish Fork (population 31,497). Today in 2010, Utah is home to a total of 223 MW of wind with the addition of a 203-MW project located in a rural area in the southwest portion of the state. Over the past 9 years, the gradual increase in wind development and prospects for additional wind projects across the state have created a basic level of familiarity withh wind energy and its associated benefits and impacts among municipalities. Many municipalities are moving toward supporting responsible wind development, while others still express reservations about wind development near their communities.

As of 2010, the perspectives of Utah local government officials toward wind is generally positive, given wind energy's economic development benefits, educational opportunities, 'green' attributes, energy security, and tourism benefits. These perspectives have, in many cases, evolved from concern and uncertainty to support. For example, the Spanish Fork mayor and the city council were not initially supportive of the Spanish Fork Wind Project during the beginning phases of project development. Their concerns (as expressed by their constituents) centered around the aesthetic, noise, property value, and wildlife impacts of a large commercial-scale wind project located at the mouth of a canyon within a half-mile of local residents. However, after gaining an understanding of the significant direct and indirect economic benefits of the wind project to the community and local schools (coupled with relocating the wind farm a bit farther away from residents), the mayor, city council, and community of Spanish Fork embraced the project and continue to celebrate it with an Annual Wind Power Celebration.

Alternatively, in some instances, local government officials are proponents of wind energy but don't receive the full support of their community. For example, the local mayor of Park City is a long-standing champion of wind energy and would like to see his community tap into its local mountain-top wind resources. However, some local wealthy landowners and ski areas have expressed disapproval of installing wind turbines within the community, especially in or near the mountains, due to aesthetic and purported property value impacts. Within Summit County (home to Park City and adjacent to Wyoming), however, there is great support for wind among the county council and several large landholders who see wind as a great boost for economic development and education throughout the county. With more remote areas and large swaths of land, wind development in Summit County is more likely to occur than in Park City.

In the case of Iron County, which hosts a small school wind project and some of Utah's better wind resources, local planning and zoning officials are opposed to wind development near certain communities because of the aesthetic impacts (Iron County boasts some of Utah's more beautiful red rock landscapes and is close to several National Parks) and concerns over public health, safety, and property values.

In neighboring Beaver County, however, support for First Wind's 203-MW wind power project has been strong from the beginning, with local residents, schools, and county government officials enthusiastic about the economic benefits and jobs associated with the project. Beaver County is actively promoting the county as Utah's wind and renewable energy hot spot, with hopes for more development in the future.

A few key conclusions from Utah experiences include:

- Municipalities in more remote areas and with large swaths of land are generally more supportive of wind and interested in attracting development and the associated economic benefits.
- Local leaders are often concerned with aesthetic impacts, public health, safety, property values, wildlife impacts, and noise (these concerns are often shared by residents). Alternatively, in some instances, local government officials lead in supporting wind energy before receiving the full support of their community.
- Municipal utilities are often concerned with costs, reliability, or operational issues of integrating wind power into systems.
- Support for wind is often directly related to a municipality's direct experience, education, and access to reputable information about wind energy.
- Many municipalities are trending toward support of responsible wind development, while others still express reservations about wind development in their communities.
- Municipal officials' perspectives often mirror the perspectives of their constituents, and vice versa.

k. Environmentalists

As the United States transitions its economy from high-carbon to low-carbon fuels, wind energy is one of the most valuable of the suite of renewable energy resources to accomplish the transition. Yet despite wind power's many advantages, it has suffered from localized public opposition over scenic, wildlife, and land-use complaints. The large areas reserved for wind projects concern land conservation advocates, as does the transmission line construction needed to move the power from its often remote locations to load centers. Avian and bat mortality at wind farms – especially in California and West Virginia – has led to major research projects targeted at siting and management issues. These concerns are significant, but with proper planning, siting, research and policy work, they can be overcome.

Planning: Throughout the western U.S., the trend toward renewable energy and transmission zoning has great potential to identify less controversial sites within excellent resource areas. By utilizing publicly transparent and robust planning processes such as the Renewable Energy Transmission Initiative in California, wind generators can both identify more publicly acceptable sites and the least controversial transmission solutions needed to move their power to market.

Siting: Strong site identification processes to identify fatal flaws coupled with early dialog with conservation and community interests has proven to be a valuable strategy to improve public understanding of the willingness of wind companies to develop projects responsibly.

Research: Wildlife impacts draw enormous public attention and concern. Serious efforts, such as those of the American Wind and Wildlife Institute and the National Wind Coordinating Collaborative, to identify real impacts and both siting and management solutions to avoid, reduce, or mitigate for such impacts can build goodwill on the part of concerned members of the public.

Policy: Working with states and conservation organizations, efforts to establish guidelines for wildlife conservation at wind projects have been productive. Industry adherence to the guidelines should be emphasized.

I. Visitors / Tourists

One concern regarding wind power is its potential to negatively impact local tourism. Limited studies of tourism effects to date fall into two categories: studies of observed behavior in response to installed wind turbines and studies examining expected behavior in response to a proposed or hypothetical wind project. The former studies find either no effect or a positive effect on tourism, while the latter studies have more mixed results, with some suggesting an expected increase in tourism, others little to no effect, and others indicating a potential decline in tourism (e.g., Ladenburg 2010; Kuehn 2005; Aitchison 2004). In a recent study of expected behavior, a substantial minority of beachgoers reports that they would avoid beaches with visible offshore turbines, but their reported avoidance diminishes as wind turbines are located further from shore (Lilley et al. 2010). A larger countervailing effect is also noted. Respondents' reported attraction to offshore wind boat tours and to beaches that they do not typically or have never visited in order to see a wind power project is substantially greater than reported avoidance of beaches with visible wind turbines (Lilley et al. 2010). This countervailing impact has also been observed anecdotally at various land-based wind power projects around the country where interest in public education and tours is often high. Finally, it is important to distinguish the potential for *local* tourism effects from the general effect on tourism. If a wind power project decreases tourism in a given locality, tourism would presumably increase in another location. Nevertheless, these broader tourism effects also need to be considered. Indeed, even if overall tourism revenues do not change, those individuals who switch beaches would experience a loss in consumer surplus (by presumably switching to a less desired location).

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Variables Influencing Social Acceptance

4. Well-Being

Well-being can be defined in many ways. A general measure of well-being includes an assessment of health, wealth, and happiness. In principle, wind energy can both contribute to and detract from individual well-being. Justifications for those in opposition to wind energy projects are often rooted either directly or indirectly in concerns over well-being.

Well-being-related opposition to wind energy projects can be broken down into four broad categories: (1) fear that wind energy projects will reduce one's standard of living or quality of life, (2) fear that operating wind turbines will threaten human health, (3) fear that valued landscapes or places will be permanently degraded or changed, and (4) fear that wind turbines will permanently damage the environment or ecosystem in a specific area.

Aside from high-level concerns over electricity rate impacts, well-being-related concerns are most immediate for individuals living in the communities that surround wind power installations and especially critical for individuals whose homes are immediately adjacent to wind energy facilities. This portion of the report summarizes the current understanding of wind energy's impacts on well-being in the U.S.

a. Standard of Living / Quality of Life

At the socio-political level, standard of living and quality of life concerns are focused primarily on wind energy's impacts on electricity rates. Increased electricity rates are thought to place an extra burden on the economy, which could result in a lower standard of living and subsequently lower quality of life. Current evidence indicates that prices paid for wind-generated electricity in the U.S. are well within, and often below, the average prices paid for power in wholesale trading hubs (Wiser and Bolinger 2009). Moreover, state efforts to meet RPS requirements have not resulted in rate increases of more than 1.5% to date (Wiser and Barbose 2009). Integrating variable-output wind energy has also proven to be modest in cost, below $10 per megawatt-hour (MWh) and often below $5/MWh (Wiser and Bolinger 2008, Ela et al. 2009, Corbus et al. 2009). This evidence suggests that wind energy is unlikely to have a large detrimental impact on electricity prices at penetration levels foreseen in the near future.

At the community acceptance level, impacts on standard of living and quality of life are more nuanced. In many cases, wind power actually results in an increased standard of living for communities surrounding wind projects. Property tax payments are often on the order of $7,000 per MW and may fund local school and infrastructure improvements. Rural areas also frequently suffer from a dearth of jobs, and the six to eight permanent operations and maintenance jobs that might be associated with a 100-MW wind energy facility has a valued impact for many rural communities. Landowners can also expect increased incomes, either through land-lease agreements or owning a portion of a turbine, and local businesses may see a boost in activity during the short-term construction period.

However, aside from economic and conventional standard of living impacts, the literature has also identified potentially significant quality of life concerns for individuals. Recent research by Hoen et al. (2009) suggests dividing the local quality of life concerns regarding use and enjoyment of property into three non-mutually exclusive "stigmas":

- *Area Stigma:* A concern that the general area surrounding a wind energy facility will appear more developed and therefore less desirable for homeowners or potential homeowners
- *Scenic Vista Stigma:* A concern that use and enjoyment of properties will be decreased because of the view of a wind energy facility that will adversely impact the scenic vista
- *Nuisance Stigma:* A concern that factors that may occur in close proximity (e.g., within 1.6 kilometers) to wind turbines, such as sound, shadow flicker, and related or unrelated concerns for health and well-being, will decrease the quality of use and enjoyment of a property

To date, the literature measuring use and enjoyment issues in the U.S. is limited and has a number of shortcomings. Hoen et al. (2009), using a large dataset and comprehensive study design, attempted to address some of these shortcomings. They found unambiguous results across their multiple models, implying a lack of existence of Area and Scenic Vista Stigmas, yet more ambiguous results for Nuisance Stigmas. Therefore, they conclude that the greatest concerns regarding quality of life are likely to exist for those living very close to the turbines (e.g., within 1.6 kilometers), especially in the period prior to and immediately following construction when risks are hardest to quantify. For a more complete understanding of quality of life issues, Hoen et al. (2009) advocate for more research concentrating on those living closest to wind turbines.

b. Lights, Sound, Shadow / Health

Three elements are associated with the operation of wind turbines that are sometimes alleged to have a direct impact on human well-being.

Lights: The U.S. Federal Aviation Administration requires any structure higher than 200 feet to submit a Notice of Proposed Construction or Alteration (7460-1 form) to ensure air navigation safety.[11] Since utility-scale wind turbines generally meet this minimum height, they must submit a 7460-1 form and are subject to the lighting standards found in the Obstruction Marking and Lighting Advisory Circular.[12] Turbines that are painted white or off-white do not require day-time lights, but all projects require lighting at night. The night-time lights can be red (preferred) or white flashing, can be located on only the perimeter turbines, and they must all flash simultaneously so that the entire project appears as a single large obstacle.[13] Developers use these guidelines to create a marking and lighting plan that is submitted to the FAA for consideration before a final determination is made as to whether the project will be an obstruction to navigation. No research has been conducted in the U.S. to measure the impacts of the lighting policy described above on human well-being or social acceptance of wind projects; lighting has been noted as a nuisance in public meetings.

Sound: Wind turbines create sound. A swishing or whooshing sound is often described.[14] The sound from wind turbines is regulated at the local level, just like other environmental sounds, and there is nothing unique about wind turbine sound that warrants it to be treated differently from any other sound (Colby et al. 2009). Claims of health impacts from low-frequency sound have been made recently, and concerned residents often inquire about low-frequency sound during public meetings for new projects. Current evidence indicates that wind turbines can produce low-frequency sound but generally at levels below the hearing threshold and at levels similar to that produced from other environmental sources — including traffic, the ocean, and the wind itself (Colby et al. 2009, Leventhall 2004).

In 2009, the American Wind Energy Association and the Canadian Wind Energy Association gathered an advisory panel of audiology, acoustic, and medical professionals to investigate concerns that wind turbine sound could be harmful to human health. An extensive literature review, with a focus on peer-reviewed literature, was conducted. The panel concluded:

> "*there is no reason to believe, based on the levels and frequencies of the sounds and the panel's experience with sound exposures in occupational settings, that the sounds from wind turbines could plausibly have direct adverse health consequences*."[15]

The authors acknowledge that consistent with European work on this subject (Pedersen 2007, Pedersen and Waye 2004, Pedersen et al. 2009), individuals may be annoyed by noise from wind turbines, and as noise levels increase "an increasing number of those who hear it may become distressed." However, Colby et al. (2009) note that annoyance is a subjective response, and even at high noise levels there is variability in the extent of annoyance. Moreover, the subjective nature of annoyance becomes greater at low levels of sound such that even when most people are not bothered by noise, a small portion of the population may be bothered. As a result, some individuals may be annoyed and subsequently stressed by the sound from wind turbines, but there is no evidence of a direct physiological effect from sound at the levels emitted by wind turbines (Colby et al. 2009).[16]

[11] http://edocket.access.gpo.gov/cfr_2004/janqtr/14cfr77.13.htm
[12] Chapter 13 of the advisory circular outlines the specific requirements for wind projects.
[13] http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgAdvisoryCircular.nsf/0/b993dcdfc37fcdc486257251005c4e21/$FILE/AC70_7460_1K.pdf
[14] Descriptions such as this are generally considered to be the aerodynamic sounds created by the blades passing through the air.
[15] http://www.awea.org/policy/regulatory_policy/documents/AWEA_and_CanWEA_Sound_White_Paper.pdf - p.ES-1
[16] The authors are careful to distinguish between direct impacts of wind turbine noise and stress, which they treat as a reaction to wind turbine noise. Stress, they note, is also an additive concept, with a wide array of sources.

Shadow Flicker: Shadow flicker can be caused when any moving object obstructs a person's direct line of sight to the sun. A similar example that many people experience is travelling in a car as the sun dips below the tree line. However, shadow flicker from wind turbines occurs at much lower frequencies. A common 1.5-MW wind turbine's maximum rate of rotation is approximately 22 revolutions per minute. With this low rate of rotation, wind turbine shadow flicker does not exceed three flashes per second and does not pose a threat to people with photosensitive epilepsy. According to the Epilepsy Foundation, a frequency of 5 to 30 flashes per second is required to trigger photosensitive epilepsy.[17]

Additionally, shadow flicker from wind turbines will only fall on a single location for a short period of time and only a few days each year due to the sun angles in the latitudes of the United States. The duration of shadow flicker at any residence can be predicted by computer models during the planning stages of a wind project, and this is one of many factors that developers take into account when siting a project. Mitigation efforts can be undertaken to reduce the shadow flicker for a specific location, and vegetation is often used to block the moving shadows.

c. Dynamic of Regional Identity, Place Attachment

Local wind project opponents are often described as being motivated by selfishness—that is, opponents support wind power generally but oppose it in their backyards. Research suggests, however, that the NIMBY label incorrectly describes many project opponents, provides little insight into the underlying reasons for opposition (Kempton et al. 2005), and conflates attitudes toward wind power with attitudes toward wind power projects (Wolsink 2006). Indeed, survey research shows that attachment to a place, including the links people have to landscapes and seascapes (Short 2002), and their expectations that a place would remain unchanged (Pasquelleti 2002) appear to be more relevant than viewshed, *per se* to understanding opposition to wind power projects (Firestone et al. 2009). As a result, Devine-Wright (2005) contends that research in this arena ought to focus on how people come to make sense of the impact of wind power technology on the places in which they live. Research also suggests that individuals may regard seascapes differently than they do landscapes. On land, the perceived intrusion of a wind farm on a pristine natural area (such as unspoiled ridge lines) is thought to be greater than that on less pristine areas. At sea, the opposite may be true—place attachment is most strongly felt to semi-enclosed seas (sounds and bays), which are arguably less pristine than the open ocean (Firestone et al. 2009). Finally, irrespective of attachment to place, evidence indicates that individuals are more willing to accept in-view offshore developments if the offending project is part of a large, transformative renewable energy program (Firestone et al. 2009).

d. Valuation of Ecosystems

For many wind power advocates, the environmental benefits of wind power, most notably power generated with zero greenhouse gas emissions, are a primary justification for wind power deployment. However, disruption of local ecological conditions and wildlife habitat can impact local sustainability and recreation, both of which contribute to human well-being. Research has largely focused on measuring the environmental impacts with the assumption that no significant impact on the environment will result in no significant impact on human well-being. While one could perhaps debate this assumption, a brief survey of U.S. knowledge of wind energy impacts on the environment and wildlife is included here.

The first indication that wind energy technology resulted in avian impacts was contained in the 1992 publication of a study by Orloff and Flannery in northern California. The study evaluated wind turbine effects on the avian activities, habitat use, and mortality in the Altamont Pass Wind Resource Area (APWRA). The APWRA was one of the first large commercial wind energy facilities and, at the time of the Orloff and Flannery study, the facility consisted of more than 7,000 turbines of various designs (40 to 400 kW) in a 60-square-mile area. The APWRA was also home to high densities of small mammals, primarily ground squirrels, which resulted in high raptor use. The Orloff and Flannery study revealed relatively high raptor mortality, particularly golden eagles, red-tailed hawks, American kestrels, and burrowing owls. Based on studies at more modern wind facilities, characterized by much larger turbines located in landscapes outside of California, avian fatalities at most wind facilities appear to be much lower than at APWRA.

[17] http://www.epilepsyfoundation.org/about/photosensitivity/

Given that impacts do occur, a good deal of research has been focused on how impacts can be avoided, minimized, or mitigated. For example, micro-siting of turbines at a wind facility in Wyoming resulted in the avoidance of areas of high raptor activity (Young et al. 2003). Studies also suggest that changes in older facilities in California, including replacing numerous older turbines with fewer larger turbines, removal of overhead lines, and a reduction in roads, have resulted in raptor fatalities reduction, relative to APWRA. With the possible exception of APWRA, avian risk from individual wind projects is a risk to individual birds and not populations (Arnett et al. 2007).

Bat fatalities have been recorded at 19 facilities in five regions of the U.S. and Canada, and rates have ranged from 0.7 to 53.3 bats/MW (Arnett et al. 2008). Most of the fatality rates have been similar or only slightly higher than avian fatality rates, but some rates are much higher. The highest fatality rates have occurred in the eastern U.S., with the exception of a recent event in Alberta. Bat fatalities are heavily skewed to migratory foliage roosting species (hoary, eastern red, silver-haired) and peak during fall migration (Arnett et al. 2008). Little data exist on bat fatalities at facilities in the southwestern U.S., where the Brazilian free-tailed bat is most abundant. Some measures to mitigate bat fatalities show promise but must be evaluated.

Habitat impacts have been relatively small scale, with the largest potential impact resulting from behavioral avoidance of a facility by birds and other wildlife. Most studies indicate that avoidance distances are on the order of from 50 to several hundred meters. Nevertheless, there is a great deal of concern over the potential greater avoidance of wind energy facilities by prairie and sage grouse (Schaffer and Johnson 2008).

As the industry has matured and biologists have learned more, the concern over the avian issue has decreased in areas with facilities, but not necessarily where the development is new (e.g., Northeast, coastal areas). In addition, bat fatalities have emerged as an important issue, and habitat impacts, including displacement, are a major concern within the range of sage and prairie grouse. Moreover, data gaps remain in the Southwest and many coastal areas. Thus, in some cases it remains plausible that wind turbine impacts on the environment may be significant with a latent effect on human well-being. Biologists, however, are often quick to point out that without wind turbines and the clean power they produce, climate change may result in even greater environmental and wildlife impacts.

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5. Distributional Justice

The introduction of wind turbines into the landscape can impact the surrounding landscape in a variety of ways, both positive and negative. The concept of distributional justice considers how costs and benefits — those that are easily measured and those that are not — of wind energy are distributed within society. This portion of the report considers the typical distribution of costs and benefits associated with wind energy projects in the U.S., the importance of ownership models in the allocation of costs and benefits, and wind energy's economic value for states that pursue wind development.

a. General Patterns

For a typical wind energy project, a portion of the financial benefits resulting from a wind project accrue in the communities where wind projects are located. Wind energy advocates often point to the economic benefits from wind energy projects, including landowner lease payments, property tax revenues, and local jobs, as a justification for continued wind energy development. However, a notable percentage of wind energy's benefits accrue at the state and global level (e.g., jobs, energy security, reduced greenhouse gas emissions), while the negative impacts (e.g., aesthetic and spatial) are largely experienced at the local level. As a result, inequities, either perceived or real, are often felt in the communities that host wind power projects.

b. Ownership Models

In the U.S., the federal government has encouraged wind power development primarily through the tax code. Specifically, qualifying wind projects have historically been eligible for a 10-year PTC, as well as accelerated tax depreciation that allows the owner's investment to be deducted over a 5-year period.[18] In combination, the present value of these tax incentives is equal to roughly half of the installed cost of a typical wind project today.

For a variety of reasons, making efficient use of these substantial federal tax benefits has proven to be difficult for most individual investors and wind project developers (Bolinger 2010). As a result, many wind project developers have partnered with third-party "tax equity" investors, who invest in wind projects not only to monetize the value of these federal tax benefits on behalf of the developer but also to shelter their own taxable income derived from core business operations (e.g., banking or insurance). This symbiotic relationship between the project developer and tax equity investor most often manifests itself, in one form or another, in what is known as a "partnership flip structure," described at length in Bolinger et al. (2009).

In a typical partnership flip structure, all of the wind project's profits accrue to the partnership (consisting of the project developer and tax equity investor), while the local host community receives what the partnership considers to be "operating expenses" – i.e., property tax payments (or a negotiated payment in lieu of property taxes) and landowner lease payments. Although such property tax and lease payments can have a beneficial impact on local communities, they nevertheless pale in size compared to the profits generated by a typical wind project. And because most tax equity investors (and an increasing number of wind project developers) are based outside of the states in which they invest (or develop projects), much of the economic benefit of wind project ownership – i.e., the profit – typically does not stay within the local host community.

This profit exodus has been observed, at least anecdotally, to impact the public's acceptance of wind power. Even prior to the financial crisis of 2008 and 2009 (which hurt the reputation of most large banks and insurance companies, many of whom were also tax equity investors in wind projects), charges of "absentee ownership" have occasionally been levied at wind projects owned by corporate tax equity investors and/or foreign-owned wind project developers.

[18] *The American Recovery and Reinvestment Act of 2009* altered this incentive regime somewhat by allowing qualifying wind projects to choose between either a 30% investment tax credit (ITC) or a 30% cash grant in lieu of the PTC. This choice of federal incentives – intended to provide short-term economic stimulus – is currently only available to projects placed in service in 2009 through 2012.

In response to the perceived injustice associated with the partnership flip ownership structure, in some states, groups of local farmers and community members have promoted an alternative wind project ownership model, known as “community wind.” Though it faces the same challenges in making efficient use of federal tax benefits as mentioned above, community wind has nevertheless had some modest success using two ownership models. The first is similar to the partnership flip structures described above, but with local investors serving as the developer/minority partner. The second dispenses with a tax equity investor altogether and instead tries to maximize the capture of federal tax benefits by spreading ownership widely enough that the required tax liability for any single investor is not overly large. In either case, a greater degree of local ownership than is common results in a higher percentage of profits staying within the local community.

Attempts to measure the increased value for host communities from community wind ownership models abound (Constanti 2004, GAO 2004,Torgerson et al. 2006). Estimates vary; however, a comprehensive review and evaluation of completed projects found that economic development impacts associated with community wind projects may be increased by as much as a factor of 3 during the construction period and a factor of 1.8 during the operations period (Lantz 2009). Nevertheless, even within the community wind sector, the application of different ownership models has a large impact on the distribution of costs and benefits. Those community wind projects that rely on the partnership flip ownership model discussed previously see economic impacts increased primarily for the landowners but see much less added value for the host community (Lantz 2009). Further, although it makes intuitive sense that communities that are given the opportunity to invest in a local wind project would, on average, have a heightened awareness and acceptance of that project, to date there has been little if any research on this topic in the United States.

c. Welfare

The literature includes a great deal of research quantifying the economic impacts of wind energy (Goldberg 2006, Tegen 2006, Lantz and Tegen 2008, Reategui 2009). Work by the National Renewable Energy Laboratory (NREL) found that the first 1,000 MW of wind power installed in Colorado was responsible for Colorado economic impacts including 1,700 short-term construction jobs and 300 long-term operations and maintenance jobs. At the same time, this investment generated $226 million in Colorado-based economic activity during construction and will continue to generate more than $35 million annually in Colorado-based economic activity throughout the life of these projects (Reategui 2009). Similarly, projections of economic impacts from wind energy in Nebraska indicate that constructing 1,000 MW of wind power in the state of Nebraska could generate, over its lifetime, between $870 million and $1.6 billion in Nebraska economic activity while supporting an average of 350 to 650 Nebraska jobs.[19] In addition, Nebraska localities could increase property tax revenues by more than $3 million annually while Nebraska landowners could see revenues on the order of $3.2 million to $3.7 million annually (Lantz 2008). Such economic benefits can be significant in rural regions of the country and have been valuable in shaping U.S. state policy for renewable energy. However, benefits accrued at the state level may not always be significant in the local communities where projects are sited.

In addition to pursuit of community ownership models, some wind energy advocates have sought to increase welfare for host communities by encouraging developers to make community or good neighbor payments. Under this model, both landowners with turbines sited on their land and individuals immediately adjacent to wind energy projects would receive compensation for the costs they bear. While this concept has been discussed within the wind energy community, there is no known evidence that the concept has been applied to increase social acceptance of a specific project.

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[19] Assuming a 2-year construction period and a 20-year operations period.

6. Procedural Design

Individuals may resent and oppose a wind project on the grounds that they were excluded from the development process. The likelihood that such sentiments will persist is increased when host community members feel as though they have no control over whether or where wind turbines are sited (Pedersen and Waye 2007) or when local input is not adequately addressed during final project implementation. Moreover, if existing procedures do not adequately accommodate public concerns regarding well-being and quality of life for local residents, public acceptance of any given project will be at risk. At the same time, wind energy may be effectively prohibited from a given area by procedural or regulatory requirements that are excessive or vague.[20]

Developing regulatory processes and procedures that are fair to the public and reasonable for developers is fundamental to the continued development of wind energy. Educating the public about wind energy's impacts, positive and negative, can help the public and policymakers to make well-informed decisions about opposition or support for wind energy.

Research regarding the impact of specific regulatory or procedural requirements and their impact on social acceptance of wind energy projects has not been completed to date. Nevertheless, industry experience has revealed that some strategies are more effective when planning new regulatory regimes and planning new projects.

a. Effective Procedural Examples

Wind energy projects are permitted differently across the U.S. In some cases, a state body such as an energy facility siting board or public utility commission reviews and approves projects. In many cases, however, permits are obtained at a local level similar to other land use decisions. This has driven interest in state siting guidelines, usually in the context of wildlife issues.

The most successful efforts to develop siting and wildlife guidelines involve many stakeholders, and the resulting guidelines rely more on a suggested approach rather than prescriptive mandates for siting wind energy projects. This in large part reflects the need to take site-specific issues into account.

Perhaps the best example of this is the guidelines from the U.S. Fish & Wildlife Service (FWS). In 2003, FWS issued a voluntary guidance document drafted primarily by FWS with little input from stakeholders in the wind and wildlife conservation community. The resulting interim guidelines were immediately deemed problematic, especially by the wind industry for which they were intended. After years of attempts to set up a multi-stakeholder approach, a formal federal advisory committee was formed to make recommendations to FWS. This work is expected to conclude in the first half of 2010.

The FWS 2003 Interim Guidelines prescribed strict setbacks and blanket requirements such as: "Avoid locating turbines in known local bird migration pathways or in areas where birds are highly concentrated, unless mortality risk is low (e.g., birds present rarely enter the rotor-swept area)." While this type of guideline may appear reasonable, it may be quite difficult to prove a proposed project is not in a bird migration pathway or place where birds are highly concentrated. The terms are not defined and it appears that wind turbines would never be appropriate for such sites.

The alternative used by multi-stakeholder process such as the FWS Wind Turbine Guidelines Federal Advisory Committee (the FAC) in its current draft is to suggest a tiered approach of how to survey sites, refine questions, and identify appropriate mitigation measures if necessary to reduce impacts at a particular site. Processes in states such as Washington, Oregon, and Pennsylvania take a similar approach, and all of those states have seen significant wind energy development over the years while minimizing environmental impacts.

[20] Requirements that do not provide concrete evaluation criteria can limit development by increasing the risk of wind energy development to a level at which investors or lenders are unwilling to finance wind energy projects.

California's Renewable Energy Transmission Initiative (RETI) offers a similar example of such an approach in planning for transmission development. RETI was formed to build stakeholder support for approval of renewable generation and transmission projects. It is directed by a 30-member stakeholder steering committee that includes representatives of every utility company in the state, renewable generators, environmental groups, state and federal regulatory agencies, counties, consumers, tribes, and the military. Since beginning work in 2007, it has identified and ranked Competitive Renewable Energy Zones where generation development will be concentrated; developed a conceptual transmission plan to access those areas; convened many public meetings to hear comments on proposed generation-transmission development; and created the basis for broad stakeholder support of specific projects emerging from California planning processes.

RETI distinguishes stakeholders who are willing to work in good faith to resolve project planning, routing, and siting issues from others who will only oppose transmission for reasons of self-interest. Members of the RETI stakeholder steering committee agree to work in good faith to achieve consensus on key issues and to be willing to actively and publicly support approval of transmission plans and projects found by the committee to be responsibly designed and required to meet state needs. Steering committee members represent and actively communicate with large and diverse constituencies, who are called on to support projects that RETI stakeholders have helped plan. The support of such informed and credible stakeholders provides an effective counter to inevitable local opposition that challenges the need for or siting of transmission projects and facilitates decision-making by regulatory authorities who ultimately issue construction licenses.

As well, procedures and policy can be enhanced by adopting procedures that seek to mitigate wind turbine impacts on host communities. Because those living closest will experience the most direct impacts and therefore will take a risk-averse stance against a proposed facility, any efforts to quantify the risks prior to construction will improve public understanding of the project. In addition to traditional sound modeling and the like, such procedures could include organized visits to existing facilities during varying conditions (e.g., different seasons, time of the day, and wind conditions), interviews/surveys of homeowners at other facilities, and simulations/modeling of aesthetics. Further, requirements to address risks such as generous setbacks, property value protection plans, erection of screening (e.g., trees etc.), and community or non-participant payments can also support a smooth development process.

Developing procedures that allow regulators to revisit — by monitoring and managing — potential project inequities over time are also worthwhile. This is especially critical where cumulative impacts might exist or new information is likely to become available. Further, conducting a follow-up assessment of impacts, such as a survey and/or property value analysis, can help to allay individual concerns that might emerge after the turbines are installed.

Finally, as with any public process, involving the public in the process is fundamental. Perceived inequities are often inversely proportional to transparency and public participation.

b. Communication Strategies, Public Consultation

The amount of misinformation and resources put forth to stop wind power developments can be startling and overwhelming. Left unattended, the campaign to stop wind power developments will continue to erode public opinion and drive acceptance down in areas slated for projects. Ironically, in the U.S., the responsibility for educating the public is, by default, with the wind developers. Often the least-trusted source, developers are left to provide the most-needed information that will likely determine whether a host community accepts or rejects proposed projects.

Experience suggests that providing the public with an enhanced understanding of wind power technology and the benefits, flaws, and comparisons with other electricity sources can help policymakers and the public make informed decisions about wind energy projects. Procedures must ensure that trusted messengers deliver the facts, and procedures may include the development of a wind power speaker's bureau consisting of representatives from the scientific and medical communities that are trusted by the public.

Education must also address how local communities can benefit from wind power projects. There is a large gap in rewards to host communities associated with different states, different rules, and different developers. Clearly the landowners leasing property to developers benefit greatly (as they should), but the community at large also expects compensation for new developments many consider unsightly obstructions.

Potential avenues of government or regulatory action include:

- Provide a forum for communication among industry, government agencies, and stakeholders. Establishing a place for the exchange of valid, scientifically derived information between stakeholders and government can assist in developing a common understanding of developers' technical reports and ensure that decisions are made with the best available information.

- Develop educational materials and other creative ways to address common issues that concern people (for example, a series of regional videos using independent experts and citizens directly impacted by operating wind developments in that region).

- Create policies that encourage and incentivize partnerships (e.g., community ownership or community payments) between developers and those most directly impacted by wind developments. This will provide greater economic benefits for host communities and provide a sustainable revenue stream to local economies.

- Develop policy and procedures that reduce barriers among regulators, the wind industry, local government, and NGOs.

c. Cultural Relationship, Local Context

Culture may be defined as that system of ideas, images, and practices that allows groups of people to understand and interact with each other, the world, and themselves in a more or less coherent way. As such, it has many dimensions and incorporates certain normative ideals. Conflict arises within cultures whenever these ideals clash.

Within U.S. culture, the conflicts concerning the installation of ever-larger wind turbines frequently involve the clash between a particular ideal of landscape beauty and other economic, social, and environmental values. [21] Most people actively involved in the wind industry tend to dismiss this sort of resistance as merely "subjective," no more than a matter of taste. Even those who take it seriously think that it can be overcome if the right public process is implemented. Hoppe-Kilpper and Steinhäuser, for example, in their essay "Wind Landscapes in the German Milieu" (*Wind Power in View* 2002), argue that a combination of financial incentives, noise reduction, nonreflective paint, careful planning and siting, transparent decision-making, and local citizen input will effectively diffuse aesthetic opposition.

However, as populations increase and are more concentrated in urban areas, the desire for uncluttered open space grows apace. Our present ideal of beauty is not simply a reflection of the taste of a self-appointed elite but a concrete response to the crowded circumstances in which most of us find ourselves and the need, at least momentarily, to escape them. [22]

The wind industry has succeeded in passing RPS and other legislative mandates, in mitigating annoyances like noise and blade flicker, in improving the public processes at stake. But it has not yet succeeded in overcoming serious opposition. This opposition will only increase as people become more aware of the vast new transmission networks that will be required to achieve anything like the RPS that most states have instituted.

Experience indicates that the industry must be willing to consider policies and procedures that match wind development with cultural expectations, including variations in local topography and local history, and the value of traditional landscapes and communities. This may require policies and procedures that ensure turbines are deployed increasingly as distributed generation and allow for increased local ownership and control.

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[21] Many people do not want large wind turbines in their backyard because they, together with the transmission lines they require, "industrialize" or otherwise despoil the relatively remote and pristine areas in which they are most often sited.
[22] Even in Denmark, where there has been a national commitment to wind energy for over a generation and new standards of planning and participation have been set, wind turbines are placed farther and farther offshore and out of sight.

7. Implementation Strategies

Developers often face well organized, highly committed, and "noisy" opposition at public hearings and in the local news media. Public officials are usually not experts in wind energy benefits and impacts, and often this project is the first of its kind in their jurisdiction. This means that local officials are on a steep learning curve with most of the other interested local stakeholders, and distilling the "truth" from the claims (both positive and negative) is challenging.

The challenge for the wind developer and project advocates is to develop an effective and truthful campaign using the best, proven tools and techniques to represent the wind energy deployment process and its benefits and address its issues. This chapter reviews the key aspects and lessons learned in implementation tools, approaches, and strategies for successful wind development.

a. Visual Impacts, Photo Simulations, Communication Campaigns

Locations that have the best wind resources are often places with the highest scenic value. Potential visibility of dozens or even hundreds of turbines scattered across farmland or scenic ridgelines raises the public's interest regarding the possibility of an adverse impact on scenic resources. Failure to address this concern early on in the process can lead to misinterpretation, diminished public confidence, and project delay. Speculative claims by the public of the adverse impact on scenic quality can put the developer or planning organization on the defensive if they do not have the ability to factually represent what a wind project will look like at the conclusion.

State-of-the-art visualization and assessment tools should be used in the beginning of the planning process to reveal proposed conditions and allow stakeholders the ability to see the project's effect on scenic quality. To allay public concern, ongoing community outreach to factually address and discuss the aesthetic issues is required.

Tools available for aesthetic analysis include:

- *Photographic simulations:* Photographic simulations are a simple and cost-effective tool to illustrate the degree and character of project visibility.
- *Static image animations:* Static image animations allow digitally modeled turbines to include rotor movement and flashing aviation obstruction lighting. Utilizing this tool, one can depict the moving characteristics inherent to a wind project.
- *Drive-through animations:* Contemporary digital applications allow fully animated drive-through simulations along defined project routes, such as local roadways. In addition, other applications enhance 3D visualization to allow real-time virtual reality perspectives.
- *Video compositing:* Video compositing is a cutting-edge and highly cost-effective technology combining moving video and 3D project simulations. Video compositing illustrates a highly detailed spatial relationship, allowing the public to easily visualize the project.
- *Visual impact assessment reports:* Preparation of a visual impact assessment report early in the planning process provides a developer or planning organization factual information used to predict public concerns before community outreach begins.

The tools for aesthetic analysis have significantly advanced and allow for simple and cost-effective communication of the project's visual impact. Public interest in aesthetic quality is critically important in the development, planning, and decision-making process. To maintain public trust, there is a need to accurately forecast the project's visual impact early in the planning process and have factual discussions before speculation and misinformation influence public opinion.

b. Wind Energy Communication Strategies and Social Marketing

Continued implementation of wind power projects is believed to require action at the level of the general public as well as at the community level. Effective broad-based education efforts are thought to entail the development of educational information, coalition building, media outreach, and explaining how wind energy benefits society. Effective project-specific education frequently includes finding ways to provide support to pro-wind residents (usually the "silent majority") to organize and inform community members about proposed wind developments and the associated facts. However, industry experience also suggests that the steps in the community education process might include:

- *A site-specific audit and critical issues analysis:* Frequent site visits, conversations with landowners, town officials, local business owners, community organizations, and other key individuals often help to produce a site-specific community profile. Such background work can assist in outreach and education strategy development.

- *Strategic planning:* A site analysis like that noted above can be used to create a strategy for improving public education and outreach that increases the odds of success. A broad-based strategy might include grassroots organizing, message development, earned media, paid advertising, special events, and distribution of collateral materials to educate the public and elected officials.

- *Grassroots organizing and public outreach - third party representation:* Based on industry experience, one of the best ways to ensure public support is through volunteers that help for the duration of a project. An independent group can provide a clearinghouse for local residents to obtain factual, non-biased information about project benefits and help answer concerns. Professional organizers can assist the group in a strategic manner to provide information and outreach tools.

- *Open house events at a local venue:* Introducing the project and the developer to the community in a non-confrontational manner at a common area where people meet, such as the local school or fire hall may allow the opportunity for wind power experts to explain the technology and site specific considerations.

- *Promoting attendance at relevant public meetings:* Encouraging supporters to attend public meetings can assist in demonstrating community support for a wind project. Even when individuals don't speak out, a shirt, hat, button or other show of display in support of the wind development, may help to persuade other community members and public officials of the value of the project.

- *Earned media outreach:* Educating the public using press releases, editorial board meetings, public meetings and events, letters to the editor, and talking point preparation for media interviews are regular elements of a robust communication and outreach strategy.

c. Communication Strategies, Social Marketing for Transmission

To accomplish a robust wind future, thousands of miles of high-voltage transmission must be built to collect and distribute the wind energy. Because it is unlikely that many individuals will earn significant compensation for allowing transmission through their property, neighborhoods, and viewscapes, a strong case must be made for public benefit and community enrichment.

Practioners of social change in the U.S. have clearly recognized several best practices:

- Engage all stakeholders early and often
- Present broad and balanced information that all can agree is factual
- Identify and nurture “champions” among stakeholders
- Deploy those champions with messages resonant to their particular community.

Research clearly shows that citizens distrust both media and messengers, assuming both are bought and paid-for. Moreover, in an era of extraordinary “message clutter” and advertising saturation, the messages most likely to gain citizens' attention are those expressed by friends, colleagues, and neighbors who have not been paid to express their opinions. Such conversations are typically credible, memorable, and influential.

Educating influential citizens and then giving them the spotlight to in turn teach what they have learned has proven time and again the best way to engage community support, whether for a wind farm or the transmission to support wind farms. Public forums educate citizens about economic benefits as well as costs and liabilities, including wildlife issues and aesthetic impacts. Careful press coordination – traditional print coverage and especially radio spots and television features – continue and extend the education. Ongoing engagement (in person and through facilitated new media including “blackboards,” Facebook, Twitter, etc,) makes transmission truly a community issue.

When communities fully understand the benefits of transmission alongside its costs, they usually choose to move forward. And experience shows that communities that fully understand the issues surrounding transmission – from habitat impact to the disruption of farming operations – move more swiftly and easily through actual siting to create a more robust grid.

d. Checklists, Guidelines: Conclusions from Examples

Early experiences in the U.S. suggested that many conflicts between local communities and wind projects could be resolved by developers remaining flexible and adaptable throughout the development process. This approach ensures that the concerns of local regulators and residents are addressed before or during project construction (BBC Consulting & Research 2005). However, increased flexibility results in increased development risk because unforeseen or unexpected issues may arise that may result in an unfeasible project. The American Wind Energy Association (AWEA) addressed these types of concerns by establishing a set of industry siting best practices that will in principle minimize the likelihood of unexpected development costs. In addition, the absence of clear and specific regulations in state and local communities increases the risks for local communities that may not become aware of specific issues until projects have already been approved. As a result, state and local governments have developed state and local wind energy guidelines and ordinances to minimize the potential for conflicts between local residents and wind project developers. In other cases, wind energy advocacy groups have taken the lead in land use planning by reaching out to the environmental community and determining common areas that may offer potentially viable wind resources with minimal environmental disruption. Examples resulting from each of these efforts are discussed below.

Industry Best Practices: The development of industry best practices has been driven by AWEA as well as other industry groups, including the National Wind Coordinating Collaborative (NWCC), a consensus-based collaborative of stakeholders that includes representatives from industry, utilities, government, consumer and regulatory bodies. AWEA's primary effort in this regard is the *AWEA Siting Handbook*, a document that is designed to educate developers and others about siting-related issues relevant to wind energy. This comprehensive document provides technical information about impacts assessment and mitigation, as well as basic information about general regulatory requirements for wind projects at the federal, state, and local levels. The NWCC supplements AWEA's educational efforts by providing a forum for participating parties to identify potential issues relevant to wind energy projects and discuss ways to resolve issues. NWCC has led efforts to better understand the interactions of wildlife and wind energy by hosting seven bi-annual Wind and Wildlife Research meetings and also works to resolve siting and transmission issues.[23]

Developing Model Ordinances and State Guidelines: As a relatively new technology, the impacts of wind energy are not always adequately addressed in traditional zoning or environmental law. In addition, wind project siting on private land is typically within the final authority of state or local government. This has led many state and local government bodies to develop model ordinances or educational information for communities experiencing wind energy development. The most advanced model ordinances address environmental and wildlife impacts as well as visual, noise, safety, and construction-related impacts.

The New York State Energy Research and Development Authority (NYSERDA) first developed guidelines for local authorities in 2002. The most recent edition, published in 2009, entails a basic overview of the wind industry and potential in New York State, highlights economic and socio-economic impacts on host communities, describes current knowledge of environmental impacts, provides examples of options within local ordinances, and highlights community ownership opportunities. With respect to local regulations, the document advises on local public safety considerations, including setbacks that are noted to range from 1.5x the maximum tip height (MTH) to 1,500 ft for residences and the tower height to 3x MTH for setbacks from property lines.[24]

[23] More information is available regarding the NWCC at http://www.nationalwind.org/
[24] The New York Wind Energy Toolkit is available for download here: http://www.powernaturally.org/programs/wind/toolkit.asp

Pennsylvania has developed an actual model ordinance. This effort emerged out of collaboration between industry, state government, and local government organizations. Pennsylvania's model ordinance is a great deal more specific than New York's educational guidelines. This document covers many aspects of the regulatory process, from defining applicability to specifying allowable turbine colors. It also provides guidance on the application process and reasonable time limits for processing applications. Moreover it defines design safety standards, setbacks,[25] use of public roads, noise regulations (no more than 55 dBA at the exterior of any occupied building on a non-participating landowners property[26]), decommissioning, and provisions for public questions and complaints.[27]

Wisconsin's model ordinance is similar to Pennsylvania's in that it is relatively specific. The draft document compiled in 2007 specifies the general visual appearance of the turbines, the location of wiring and electrical infrastructure (underground or wireless, except at the point of grid interconnection), and notes that lighting should be no more than necessary to meet FAA requirements. In addition, the document lists setbacks,[28] sound levels,[29] minimum ground clearance, and basic safety requirements.[30]

In addition to model ordinances, some organizations have sought to mitigate potential conflicts with wind development by reaching out to environmental communities and agreeing on areas for wind development. The Virginia Wind Energy Collaborative, in conjunction with representatives from the local environmental community, sought to develop a publicly available document that could be used for planning wind development that would incorporate environmental factors. The final result was a geographic information system (GIS) data set that includes the Virginia wind resource and various layers of environmental exclusions. Layers include those areas that are unsuitable for development, either as a result of a poor wind resource or significant environmental concerns, and areas where potential environmental conflicts may occur.[31]

e. Cascading Effects

Wind energy has impacts at many levels. With respect to social acceptance, communities often focus on the immediate and direct impacts. However, in rural communities where wind projects are often sited in the U.S., additional income gained by landowners and operations and maintenance personnel often means increased economic activity for local retailers and service providers. Property tax revenues frequently assist local communities in funding schools or local infrastructure. Constructing more wind farms also results in increased domestic manufacturing demand due to the logistics constraints of transporting wind turbines over long distances. Moreover, increased reliance on locally generated electricity can indirectly reduce fossil fuel and petroleum imports. In the U.S., increased energy independence is a significant driver for wind energy development. Experience suggests that creating and communicating a clear connection between wind energy projects and the indirect benefits of wind energy can increase social acceptance of wind energy projects both at the community level and the socio-political level.

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[25] Setbacks from the nearest occupied building and from property lines are to be in accord with local zoning requirements or 1.1x MTH, whichever is greater. Setbacks from the nearest occupied building of a non-participating landowner are to be not less than 5x the turbine hub height. Turbines must be 1.1x the MTH from all public roads.
[26] Measurement methodologies are to conform to AWEA standard 2.1-1989.

[27] The Pennsylvania model ordinance can be viewed here: http://www.pawindenergynow.org/pa/Model_Wind_Ordinance_Final_3_21_06.pdf

[28] From inhabited buildings (two times MTH or 1,000 feet, whichever is greater), property lines (1.1 times MTH), and public roads (1.1 times MTH).
[29] Noise levels are limited to 45 dBA when measured at the property line of any residence, school, hospital, church, or public library. Recommendations are increased if ambient levels exceed 45 dBA.
[30] The Wisconsin Draft Model Ordinance is available.
[31] For more information on this effort, view the Virginia Wind Energy Collaborative's Landscape Classification System Web page at: http://vwec.cisat.jmu.edu/gis_lcs/gis_lcs.html

Summary and Conclusions

8. Conclusions

Generally, wind energy enjoys high levels of support from the public as well as the policy community in the U.S. This has resulted in record-breaking growth and a 5-year average annual growth rate of 39%. However, social acceptance issues persist at all levels, most notably at the community or project level. In addition, some U.S. regions face much higher levels of social opposition than others.

a. What We Know

Knowledge regarding social acceptance in the U.S. is based largely on experiences within the industry. However, wind energy impacts analysis is a well-established field, and there is a growing body of research focused on social acceptance. From this body of knowledge it is apparent that:

- National and state policies are critical to establish the framework for public acceptance.
- Wind energy offers many national, regional, and local benefits, often not completely evaluated by public officials in carrying out the limited scope of their duties.
- Stakeholder groups have highly different perspectives and thus value wind energy differently.
- There are successful models for engaging communities and stakeholders early and often in wind project (and transmission) discussions.
- There is quality information on and established procedures for evaluating impacts on wildlife, sound, property values, and view sheds. These methods can address local impacts and debunk myths about wind energy.
- Local officials (often with little wind development experience) are challenged to understand technical wind impacts studies.
- Non-participating project neighbors may bear a disproportionate share of wind energy’s negative impacts.
- Distributional injustice often undervalues the local residents’ opinions/inputs; deliberative polling is an example of ensuring quality stakeholder input.
- Transmission siting and permitting will likely be more difficult than wind projects because local benefits are less tangible.

b. What Needs to Be Done

Questions remain despite years of experience in developing and operating wind projects. With respect to social acceptance, a few areas require continued study.

- Individuals living immediately adjacent to wind facilities (i.e., within one mile, or 1.6 km) appear to experience the greatest direct impact from operating wind turbines. Improving our understanding of what impacts this group experiences will be critical to continued development of siting best practices.
- A better understanding of the impacts from specific turbines, rather than industry-wide characterizations, could assist in developing new standards for technology performance.
- In the U.S, it is not yet clear that there is a direct relationship between local ownership and levels of public acceptance. Establishing a clear quantifiable link could assist policymakers in developing new policy to support wind energy deployment.

In addition, continued implementation of existing knowledge with respect to procedural design and land use planning could further facilitate social acceptance of wind energy.

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