Generating Economic Development from a Wind Power Project in Spanish Fork Canyon, Utah: A Case Study and Analysis of State-Level Economic Impacts

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Introduction

Utah is at an "energy crossroads." Electricity demand and prices are rising, but expanding capacity by relying on Utah's dominant source of electricity (coal) may result in increasing risks associated with shifts in state and regional energy policy, dwindling low-cost coal reserves, carbon emission restrictions, water limitations, mine safety and demands for stricter mining regulations, and future production costs. Developing Utah's wind resource is a means for diversifying Utah's electricity resource portfolio and could help to mitigate the aforementioned risks while providing new opportunities for economic development and jobs, especially in rural communities.

Utah's first commercial wind power project, located at the base of Spanish Fork Canyon (18.9 megawatt [MW]-capacity facility), began producing electricity in summer 2008. This wind project faced a variety of challenges before and during the development process. Understanding the hurdles along with the policy solutions and the economic benefits of the Spanish Fork Canyon wind project can provide strategic insight to policy makers, county commissioners, and other decision-makers about setting an appropriate course for Utah's energy future.

The purpose of this report is to provide a brief overview of Utah's electricity market, explain how emerging regional policy and market forces are changing it, and outline the role wind power could play in addressing those changes. Specific attention centers on (1) the 4-year process to develop the Spanish Fork Canyon's wind resources and (2) the estimated economic impacts (job opportunities, new tax revenues, and lease payments) that may accrue to the state from the new wind power facility. These economic impacts are based on the Jobs and Economic Development Impact (JEDI) model developed by the U.S. Department of Energy's National Renewable Energy Laboratory (NREL).[1]

Report Overview

This report is organized as follows: First, Utah's electricity market is described. Second, a detailed case history of the Spanish Fork Canyon project is presented, followed by an overview of the project's projected state-level economic impact. The report concludes with considerations for policy makers and developers concerning wind power projects in Utah.

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[1] See Mongha, Stafford, and Hartman (2006) for a previous report that detailed the *county-level* economic impacts of the Spanish Fork wind project. This report employs updated project size, cost and tax figures, and a newly revised version of the JEDI model to project *state-level* economic impacts.

Part I: Understanding Utah's Electricity Market

To understand the hurdles to development of the Spanish Fork Wind Project, it is instructive to consider the characteristics of Utah's electricity market. The following section provides a brief overview of important policy and market forces shaping this industry.

Regulated Monopoly

Utah's electricity market is a *regulated monopoly*. This means that while several utilities provide electricity to Utah customers, each has a designated service territory in which the company is the sole electricity provider (or "seller"), and the utilities agree to adhere to government oversight on their activities — setting rates, building and expanding power plants, and negotiating power purchase contracts from independent producers — to maintain this monopoly status. Consequently, Utahns cannot choose an electricity provider, and consumers cannot select utility providers based on cost or cleanliness of energy resources. However, the largest utility in the state, Rocky Mountain Power, offers a voluntary Blue Sky program in which customers may buy 100-kilowatt blocks of wind power for a $1.95 premium per month. (Spanish Fork City is not served by Rocky Mountain Power but is part of the Utah Municipal Power Agency, or UMPA). The premium applies to the purchase of renewable energy credits from projects developed within Rocky Mountain Power's six-state market and a grant program for community-based renewable energy projects within the utility's service territory. The voluntary program is one of the largest in the country in terms of subscriber numbers.

As a regulated monopoly, Utah's electric utilities are controlled by a variety of federal and state laws and government bodies. At the federal level, for example, the Public Utility Regulatory Policies Act (PURPA) requires electric utilities to buy power from non-utility electric power producers, such as small independent wind power developers of less than 80 MW (deemed to be "qualifying facilities"), at the "avoided cost" rate, which is the cost the electric utility would incur if it were to generate or purchase that power from another source (typically, the fuel costs incurred in the operation of a traditional fossil-fuel-fired power plant). Although a federal law, the implementation of PURPA is the responsibility of the states.

At the state level, the most important regulatory entity is the Utah Public Service Commission (the Commission), whose primary responsibility is "to ensure safe, reliable, adequate, and reasonably priced utility service" (Public Service Commission 2008). The Commission conducts hearings and investigates utility company operations to determine just and reasonable rates for power. Regulatory decisions and rules adopted by the Commission strive (1) to ensure efficient, reliable, reasonably priced utility service for customers and (2) to maintain the financial health of the utility companies.

In Utah, the Commission is responsible for determining avoided cost rates for qualifying facilities. As will be noted later, the Spanish Fork Wind Project was the first qualifying facility using wind generation in Utah, and a key hurdle involved the Commission determining the method for estimating avoided cost (i.e., the price Rocky Mountain Power would pay for wind power generated from the proposed Spanish Fork project).

Additionally, Rocky Mountain Power provides its Integrated Resource Plan (IRP) to the Commission, specifying a plan for its future electricity resource development and commitment to renewable energy sources. Rocky Mountain Power's 2007 IRP includes plans for the utility to add 2,000 MW of renewable energy by 2013.

Utah's electric utilities also take directives from the Utah State Legislature and Governor's Office. Two recent pieces of legislation related to wind power development include (1) the 2007 reauthorization of a renewable energy tax credit that was modified to include 0.35 cents for each kilowatt-hour produced, and (2) a voluntary Renewable Portfolio Standard adopted in 2008 requiring that utilities pursue renewable energy to the extent that it is "cost effective" based on long-term and short-term impacts, risks, reliability, financial impacts on the affected utility, and other factors determined by the Utah Public Service Commission (DSIRE 2008). Utah's goal is to have 20% of its electricity sales produced by a variety of renewable energy sources, including wind, solar, and geothermal, by 2025.

Governor Jon M. Huntsman, Jr. declared, "Utah should position itself as a leader in renewable energy technologies and not lose opportunities to other western states like New Mexico and Colorado who are pushing this area aggressively" (Governor's Energy Policy 2008). In 2007, Utah became a member of the Western Climate Initiative, joining California, New Mexico, Arizona, Washington, Oregon, Montana, and the Canadian provinces of British Columbia, Manitoba, Ontario, and Quebec. The members have agreed to set regional standards to reduce greenhouse emissions under a market-based cap and trade program expected to be implemented by fall 2008 (Fahys 2007). Utah's electric utilities will be required to participate in the cap and trade program.

Electricity Demand Outstrips Supply

Electricity consumption in Utah is on the rise. Demand increased 5.2% in 2007, a new record high (Economic Report to the Governor 2008), and Utah's demand for electricity during peak periods increased from about 3,000 megawatts in 1996 to more than 4,000 megawatts in 2007 (Bauman 2008). Increased electricity demand is the result of the state's rapid population growth and increases in per-capita electricity use (Utahns' increased use of air conditioning; construction of larger-sized homes; and adoption of more electronic devices, such as cell phones, flat-screen televisions, and iPods). Rocky Mountain Power estimates that unless new electricity sources are developed, it will have a power-generating deficit in its six-state service territory of 750 megawatts by 2010. Should the trend continue, the deficit will surge to 3,000 megawatts by 2016. These deficits will require the utility to buy power on the open market, and as growth continues, purchased electricity can become scarcer and more expensive (Bauman 2008). To meet expected growth, Utah could increase electricity production but faces risks from expanding use of its main source of electricity: coal.

Potential Risks Associated with Coal-Fired Electricity

In 2006, coal-fired power plants provided about 90% of the electricity generated in Utah (Utah Geological Survey 2007). This has allowed Utah to enjoy some of the lowest-cost electricity in the country (Anderton 2007b). Recent supply estimates, however, suggest that Utah's low-cost coal reserves are dwindling (Gorrell 2007). Although there is some debate regarding the longevity of Utah's coal supplies, at a recent Utah Geological Association meeting Jim Kohler, chief of the federal Bureau of Land Management's minerals section in Utah, proclaimed, "Whether it's 12 years or 40 years, there's an end in sight" (Gorrell 2007). Should Utah be forced to import coal from Wyoming in the near future, railroad reliability and rising diesel fuel and transportation costs could greatly impact electricity rates for Utah consumers (Hartman and Stafford 2007).

Aside from dwindling economic coal reserves, emerging climate change public policy could pose another significant risk for Utah's reliance on coal-fired electricity. Given the predominate scientific consensus and political acceptance of carbon (or greenhouse gas) emissions from coal-fired power plants as key contributors of climate change, analysts predict the inevitability of "carbon taxes" or regulatory "cap and trade" restrictions on carbon emissions at the regional and/or federal levels (Bauman 2007). Consequently, in December 2007 Rocky Mountain Power announced that due to the inability to evaluate future costs because of the uncertainties of federal restrictions on carbon-dioxide emissions, it would place three proposed coal-fired power plants on hold (Henetz 2007c). For future development, Rocky Mountain Power will pursue wind and natural gas resources. Although natural gas prices have been volatile in recent years, natural-gas-fired electricity emits only about half the carbon emissions of coal-fired power. Furthermore, natural gas plants are much easier to modulate when combining energy from a variable resource such as wind; that is, electricity output from natural gas power plants can be easily increased or decreased to meet demand if wind power output is low (Lee 2007b). Coal plants are much more difficult to modulate.

Finally, a tunnel collapse (or "bump") at the Crandall Canyon Mine in Emory County, Utah, entombed six miners in August 2007. Three more men were killed in a subsequent wall implosion during a failed rescue effort. The tragedy brought to focus the human safety risks associated with coal mining to support Utah's electricity production. The Crandall Canyon disaster resulted in heightened demand for more stringent mine safety regulation at the state and federal levels that are likely to increase costs on coal mining and coal-fired electricity (Gorrell 2008).

In sum, although Utah's customers enjoy some of the lowest-priced electricity in the nation, potential future risks associated with Utah coal supplies, carbon taxes/restrictions from the burning of coal, and miner safety warrant the state expanding its portfolio of electricity resources into lower-risk alternatives.

Regional Policy and Market Influences

Because Utah exports electricity to southern California cities, Utah's electricity market is impacted by California state policies. In September 2006, for example, California Governor Arnold Schwarzenegger signed into law the Global Warming Solutions Act, the first-of-its-kind state-imposed carbon emissions cap mandating a 25% reduction of carbon dioxide emission by 2020 (Anderton 2006). This motivated officials from five southern California cities and the northern city of Truckee (near Lake Tahoe) to notify the Utah-based Intermountain Power Agency (IPA) that they would not renew their contracts for coal-fired electricity after their expiration in 2027, and they would seek alternative power sources (Anderton 2006). By February 2007, the Southern California Public Power Authority (SCPPA) — acting on behalf of the Los Angeles Department of Water and Power and some other cities that rejected IPA's coal-fired electricity — signed a 20-year purchase agreement with UPC Wind (now called First Wind) to buy 200 MW of wind-generated electricity (enough to power about 43,000 homes) in a proposed wind project located in Utah's Beaver and Millard Counties (Henetz 2007b). A proposed new IPA coal-fired power plant initially intended to serve California and 30 other Utah cities and communities was ultimately postponed indefinitely because of California's refusal to accept power from the proposed coal plant.

While California's policy is a setback for coal-fired power in Utah, this could be an opportunity for Utah to develop and export wind power and other renewable energy sources to California. Although Utah's wind resource ranks 26th among the 50 states, the Utah Geological Survey has identified numerous areas of the state that have sufficient wind resources for commercial development (see http://ugs.utah.gov/sep/wind/anemometerdata/sitedata.htm). Additionally, a recent study indicates that Utah has nearly 2,500 MW of developable wind resources (U.S. Department of Energy 2008). Interviews we conducted with Utah wind developers indicate that developing these locations and selling wind power to California would be profitable, given California's energy policy requiring more renewable energy resources and the California utilities' willingness to pay a premium for wind over what Utah utilities are willing to pay due to Utah's lower avoided cost.

Utah's electricity market can also be influenced by other states' policies and regulations due to Rocky Mountain Power's operations across its six-state service territory, which includes Utah, Idaho, Wyoming, California, Oregon, and Washington (in California, Oregon, and Washington, Rocky Mountain Power operates as Pacific Power). In January 2007, for example, the Oregon Public Utility Commission denied a request by Pacific Power to open a competitive process for building coal-fired power plants in Utah and Wyoming, concluding the utility overestimated its resource needs (Anderton 2007a). The Oregon Commission demanded that the utility fully explore conservation, demand response resource, and renewable energy resources before acquiring new thermal base load resources. This ruling partly contributed to Rocky Mountain Power's later decision to pursue wind and gas-fired power plant generation throughout its entire service territory, including Utah.

Utah Public Opinion

Finally, public opinion is also increasingly influencing Utah's electricity market. Ongoing local opposition to proposed coal-fired power plants in Sevier County and in Nevada near the southern Utah border due to public health issues delayed approvals on those projects. With regard to renewable energy, two recent *Deseret Morning News/KSL-TV* polls conducted by Dan Jones & Associates indicate that Utah citizens are supportive of developing renewable energy as a means of addressing the state's energy and environmental challenges. The first poll, conducted in January 2007, found that 92% of Utahns believed "Utah should be investing more in renewable energy" (Loftin 2007). In June 2007, the second poll showed that Utah residents want to fight global warming and enthusiastically favor government investment and incentives for all forms of renewable energy, including wind, solar, geothermal, biofuels, and energy efficiency (Bauman 2007). Regarding wind power, 90% of Utahns favored government investment and incentive to encourage its development in the state.

In terms of Utah residents' willingness to pay more for their electricity to combat climate change, about 52% would pay 1% to 10% more, 18% would pay 11% to 20% more, and 3% would be willing to see power bills increase by more than 20%. Only 22% of Utahns would not pay more for electricity to address climate change (Bauman 2007). As mentioned earlier, many Utahns are already buying renewable energy voluntarily through Rocky Mountain Power's Blue Sky program, and in 2007, Utahns' purchase of Blue Sky increased 21% (Henetz 2007a). As of

April 2008, more than 23,448 Utahns and 530 businesses participated in the green pricing program (R. Rasmussen, Blue Sky Manager for Rocky Mountain Power, personal communication, April 2008).

More recently, as gasoline prices surpassed $4.00 per gallon in the summer of 2008, a David Binder Research survey conducted in Arizona, California, Montana, New Mexico, Oregon, Utah, and Washington found that 92% of voters supported the idea that states should encourage new technologies and develop clean alternative fuels (Henetz 2008). With major car manufacturers, including General Motors and Toyota, announcing plans to release plug-in electric cars by 2010, wind power may become an increasingly important source of new electricity resources for the transportation sector in the coming decade.

Summary

In summary, Utah's electricity market is a regulated monopoly controlled by both federal and state government bodies. Utah's electricity demand is accelerating, but the state's dependency on coal-fired electricity could expose ratepayers to significant economic risks in terms of carbon taxes/restrictions, dwindling economic supplies, and mining safety regulations. Utahns appear to be supportive of developing alternatives to coal-fired power generation and willing to pay more for those alternatives. One of those alternatives may be wind power development, which is why understanding what it takes to develop a wind power project in the state can provide useful insights for policy decisions. The next section outlines the story of the Spanish Fork project.

Part II: The Story of the Spanish Fork Wind Project

The Spanish Fork Wind Project is Utah's first commercial wind development, and it became fully operational in summer 2008. Over a 4-year period, Wasatch Wind grappled with evolving municipal, state, and federal policies; siting issues; market uncertainties; turbine availability; investment commitments; and resistance from local residents. The following provides a discussion of these trials and their eventual resolution. They provide important lessons for future wind development in Utah.

Utah's Winds of Opportunity

In fall 2004, Wasatch Wind installed an 80-meter anemometer in Spanish Fork Canyon to collect 6 months of data (Conlon 2006a). At the same time that measurements were being taken, the project developer began researching transmission availability, access, land use ordinances, and nearby residential development. Wasatch Wind had plans to begin erecting turbines in summer 2006 after expending adequate effort on the planning process to determine the viability of the wind project and to ensure compatibility with zoning ordinances, municipal and state policies and practices, and acceptability by Spanish Fork residents (Warnock 2005a). If the wind resource proved to be economically viable, the project was destined to become the most urban commercial wind development in the United States.

First Hurdle: Gaining Local Approval

The project developer organized a town hall meeting in April 2005 and passed out flyers to residents living within 1 mile of the wind project site. Although more than 3,000 fliers were distributed, only about 50 residents attended the public forum (Warnock 2005b). At the meeting, several types of documentation about the proposed wind project were presented (including aesthetics, noise level, avian impact, and economic and environmental benefits) to inform Spanish Fork elected officials, administrators, and residents. The meeting was televised on the local Spanish Fork channel. Wasatch Wind's initial plan was to install seven 1.5-MW turbines at a cost of $13 million with the potential of meeting 74% of the electricity needs of Spanish Fork's 6,600 residential customers. The proposed site was an abandoned gravel pit located about 1 mile from the mouth of Spanish Fork Canyon.

When Wasatch Wind showed virtual images of the project on the landscape, residents voiced divided opinions about their appearance. Each of the seven turbines in the wind project would stand 213 feet tall with a wingspan of 252 feet (Hollingshead 2005a). Some meeting participants found their size objectionable while others expressed preference for wind projects over coal plants (Warnock 2005b). Findings from other studies including noise levels and avian impact were also communicated to attendees. The noise level from the turbines was estimated at 50 decibels, equivalent to the level produced by traffic on the nearby highway, US 6, between 1 a.m. and 4 a.m. The avian study suggested that the slow movement of the wind turbine blades would not create significant threats to birds. Additionally, the proposed tubular turbine towers would be placed around the lattice-like towers of the past to prevent birds from building nests there.

During the meeting, the developer also highlighted economic and environmental benefits that could result from the wind project development, including royalties to landowners who might lease their land for placement of the wind turbines, property tax revenues paid by the developer to the city and school district, and dividends to investors. Producing this amount of electricity from wind rather than coal could also prevent several categories of pollutants, including 59,000 pounds of sulfur dioxide and 77 million pounds of carbon dioxide (Warnock 2005b).

Following the town hall meeting, Wasatch Wind applied for a zoning amendment to allow the development of the wind project. At its June 2005 meeting, the Spanish Fork city council considered the application. Residents were allowed to participate and, as at the town hall meeting, opinions were divided. Some residents were concerned with aesthetics and noise. As one person stated, "My first concern was that it's going to detract from our mountains" (Hollingshead 2005b). Other residents, however, saw the project as more desirable to other land uses; for example, an improvement to the view of a gravel pit that is "already an eyesore" and a better alternative to "mass suburban development" (Toth 2005). One citizen believed that it would give the city of Spanish Fork a "progressive, environmentally friendly look" (Toth 2005). After considering the issue, the city council unanimously approved the zoning change.

Second Hurdle: Negotiating Financial Agreements and Securing Investors

After approval of the amendment to add wind turbines to Spanish Fork's industrial zoning, the developer began pursuing different financial arrangements. Wasatch Wind negotiated a power purchase agreement (PPA) with Rocky Mountain Power, the utility formerly known as Utah Power/PacificCorp, with approval from Utah's Public Service Commission. Additionally, Wasatch Wind needed equity investors.

Negotiation of the PPA extended over a 2-year period from 2004-2006 with various entities with competing interests entering the discussion. Because the Spanish Fork Wind Project is a qualifying facility, Rocky Mountain Power had to adhere to the Public Utility Regulatory Policies Act of 1978 (PURPA) in setting the purchase price at the avoided-cost level. However, as Spanish Fork would be Utah's first wind qualifying facility, the Public Service Commission had to establish the method that electric utilities would use to determine avoided costs.

Rocky Mountain Power had negotiated PPAs with qualifying wind facilities in other states on an individual basis considering the level of resources, the timing of the power produced (on- or off-peak), and the cost of alternatives such as coal and natural gas. After 2 years of deliberation and testimony from utility executives, lawyers, and other expert witnesses, the Utah Public Service Commission approved the use of a "market price proxy," defined as the "most recent executed wind contract," for determination of avoided costs for wind qualifying facilities (Public Service Commission 2005, p. 33). The utility would be allowed to make price adjustments warranted by differences in wind characteristics between project sites. The latest PPA that the utility signed was with Ridgeline Energy for 64.5 MW of wind power from an Idaho project with a schedule of rates moving from 5.1 cents per kWh in 2005 to 8.2 cents in 20 years (Foy 2005). This would be considered the market price proxy for Spanish Fork. However, when Rocky Mountain Power and Wasatch Wind could not agree on price adjustments to the avoided-cost amount, the Commission interceded to resolve their dispute.

The Commission does not determine the base rate for power but decides which costs (e.g., transmission) must be borne by the utility rather than the energy developer (Foy 2005). By legislative mandate, the Commission is required to consider cost, risk, reliability, financial impact on the affected electrical utility, and other factors deemed relevant in evaluating energy alternatives (Utah Code, Title 54: Public Utilities 2008). The Commission used the cost of generating electricity from coal in comparing energy alternatives, as 90% of the electricity generated in Utah is from coal-fired power plants. In testimony, however, Wasatch Wind contended that considering present-day coal costs did not reflect the likely future introduction of carbon taxes, and wind energy's cost predictability and stability could be a hedge against these future increases in costs (Kern 2005).

During the negotiations, Utah had neither an energy policy nor a renewable portfolio standard that would enforce the development of a certain percentage of electricity from wind energy. Market support for wind development, nonetheless, was evident from the number of subscribers to Rocky Mountain Power's Blue Sky program. In 2005, the program was ranked third in the nation in the amount of renewable energy purchased with 44,000 customers (Twitchell 2006a). Additionally, Rocky Mountain Power's 2003 Integrated Resource Plan (IRP) called for acquiring 1,400 MW of wind on its system by 2015.

Finally, in June 2006, Wasatch Wind signed a 20-year PPA with Rocky Mountain Power. Although John Deere Wind Energy, a subsidiary of the agricultural equipment manufacturer, participated in the negotiation of the PPA (Public Service Commission 2006), the company withdrew from the project when Utah's Renewable Energy Tax Credit was not renewed later in 2006.

Third Hurdle: Re-Gaining Local Approval

Despite the efforts by Wasatch Wind to inform local residents about the wind project and to give them an opportunity to comment, 7 months later, when a local channel re-televised the April 2005 town hall meeting, citizen outcry erupted. The group of complainants included Mapleton residents who lived close to the wind project and who had not received information about the town hall meeting. The citizens rose to the podium at the December 2005 Spanish Fork city council meeting to request a 6-month moratorium on the project to gather more information on safety, noise, and maintenance issues of the wind project (Conlon 2006a). The city council tabled the citizens' request for a moratorium until its February 2006 meeting.

In preparation for the February city council meeting, concerned residents launched their own "information" campaign, distributing 400 flyers to urge support of the moratorium (Hollingshead 2006a). Residents worried about the visual impact of the turbines, describing them as "monstrous, colossal, and shocking" (Ashton 2006a). Others were convinced the values of their homes "will plummet … if turbines are erected" (Hollingshead 2006a).

At the February meeting of the Spanish Fork city council, the mayor allowed residents and Wasatch Wind to present information and asked each side to "open your mind up and let one word in … think – options" (Ashton 2006b). Residents claimed that they were not against "green energy" but had been "poorly informed" (Conlon 2006a). They asked for information concerning zoning/setback allowances, liability, landscaping, and provision for eventual clean-up of abandoned towers. Wasatch Wind contended that its public education/outreach campaign (including distribution of thousands of flyers, ads in the local newspaper the *Provo Daily Herald* for 3 days, coverage on the local news channel KSL, and an independent noise study) had provided ample opportunity for public response and that citizens "… should accept the consequences of their non-participation in the process" (*[Provo] Daily Herald* 2006). Wasatch

Wind also reported that it had spent more than $300,000 on all of the pre-planning effort (Hollingshead 2006a). The mayor and city council concluded that the citizens had valid claims. They did not make a final decision on the moratorium but appointed a three-member resident board to continue researching potential issues and asked Wasatch Wind to look for a site farther away from residential development. Both sides were asked to present their findings at the next city council meeting.

At the March 2006 city council meeting, Wasatch Wind agreed to move the wind project to a new site closer to the mouth of the canyon, away from the residential area (Hollingshead 2006b). Ironically, the new site was the original location proposed by the developer. It had been rejected by the city due to a concern over contamination of a municipal water well. To resolve this issue, Wasatch Wind hired an outside engineering consultant to investigate. He determined that the wind turbines would not create problems for the Spanish Fork water supply, and the city engineer accepted this finding.

The new site required the repetition of numerous steps in the planning process, including obtaining zoning approval, commissioning construction surveys, drawing up a site plan, signing lease contracts with three different landowners, and completing a 4-month annexation process of the land by Spanish Fork (Twitchell 2006a). Even though Wasatch Wind estimated spending another $300,000 to analyze the new location, the company believed the move was financially advantageous and wanted community acceptance of the project (Twitchell 2006b). The new site was closer to the mouth of Spanish Fork Canyon with higher wind velocities that could produce a higher level of electricity. The resident group believed that the new location resolved their concerns with aesthetics (Conlon 2006b) and formed a high level of trust and confidence in the project (*[Salt Lake City] Deseret Morning News* 2006).

Fourth and Final Hurdle: Re-Negotiating Financial Arrangements and Investors

On June 20, 2006, Wasatch Wind signed a PPA with Rocky Mountain Power, giving them 5 to 6 cents per kWh with annual price adjustments on the basis of avoided costs (Twitchell 2006b). Also on that day, the Spanish Fork city council agreed to annex the remaining portion of land for the project. The final site covered 107 acres with the number of turbines increased from seven to nine and an increased turbine capacity from 1.5 to 2.1 MW. It seemed as if arrangements for the project were finally in place; however, another financial challenge was on the horizon.

In 2006, due to the debate over instituting a flat income tax in Utah, the legislature decided not to renew the state tax credit for renewable energy. Due to the non-renewal of the tax credits, one prospective investor, John Deere Wind Energy, decided to invest in wind power elsewhere. It became difficult for Wasatch Wind to finance the wind project without this tax credit, but the company started negotiations with a new equity partner.

Simultaneously, the Renewable Energy for Rural Economic Development (RERED) project at Utah State University conducted a study on the estimated economic impact of developing the Spanish Fork Wind Project using 2005 cost data and tax rates. Findings suggested that for the first year of operation, property tax revenues for Utah County would be $290,000 and land leases to private landowners would be $67,500 (RERED, Memo to Utah State Legislature, 2006). [These estimates have been affected by construction cost increases and a negotiated property tax decrease. State-level impacts are presented in the next section of this report].

In 2007, the Utah State Legislature reinstated the renewable energy tax credit. While the tax credit lowered the total construction costs, the savings were obliterated by increases in other costs (e.g., wind turbine costs rose 17% in 2006 with another 14% in 2007) (Oregonian 2007). The higher wind project construction costs forced Wasatch Wind to seek a property tax reduction from the city of Spanish Fork, Nebo School District, Central Utah Conservancy District, and Utah County. With the agreement of all parties, the company was granted a 70% property tax rebate for the first 10 years of project operation. While property tax revenues to Nebo School District generated by the gravel pit were $4,600 (Peterson 2007), with development of the wind project, economic projections indicated the property tax revenues would increase by over 1,800% (see page 19 of this report). The arrangement was a net benefit to the schools, local community, and county.

That year, Edison Mission Energy (EME), a subsidiary of California Edison, became the developer/owner of Bridger Butte, a 200-MW wind project near Evanston, Wyoming (Lee 2007a). The close proximity of Bridger Butte to Spanish Fork made it economically feasible for EME to acquire the Spanish Fork Wind Project. Wasatch Wind sold the Spanish Fork Wind Project to EME to provide the investment return rate required by EME. Wasatch Wind developers had approached EME as a potential investor earlier in 2005; however, as EME did not have any projects located near Spanish Fork, Utah, the company could not lower operating and maintenance costs of the development by taking advantage of economies of scale, and the deal did not go through (C. Watson-Mikell, personal communication, June 2008).

Lessons Learned

The 4-year process to develop the Spanish Fork Wind Project highlights several important lessons for wind development. The first is **the importance of creating awareness, interest, and acceptance among relevant groups** – policymakers and citizens. Those affected by a wind project may not be defined only by municipal or utility boundaries but also by stakeholders in other communities who share the "viewscape" of the project. Consequently, it is imperative to engage and inform the community about the project and maintain transparency throughout the approval and construction process.

The second lesson is **the significance of building relationships with local champions**. Several citizens and community leaders played an important role in educating and informing others about the Spanish Fork project as well as wind energy's potential opportunities and benefits.

The third lesson is **the value of being flexible, responsive to community concerns, and open to compromise**. When concerned citizens demanded a moratorium on the project after it was already well underway, Wasatch Wind demonstrated a willingness to work with those critics to examine options and resolve differences, despite time delays and added costs. Concerned citizens perceived that their voices were heard, and ultimately, they became comfortable with the compromises and supportive of the project.

Finally, the fourth lesson is understanding that **key approvals, policies, or access to resources might not be permanent or "cast in stone."** Wasatch Wind learned that developing a wind project in Utah is not a straightforward, linear process: ***state and national tax incentives might not be renewed, city administrations can change, approvals can be reversed, access to turbines***

can be lost, and negotiations and delays can drive up costs and scare away investors. All of these factors can potentially threaten the viability of the project at any stage.

Wasatch Wind hurdled many challenges (e.g., establishing the method of calculating avoided costs) that will possibly pave the way for new wind projects in Utah. The development of the Spanish Fork Wind Project made an impact in the community, not only from a sociopolitical perspective, but also from an economic development perspective. Next, we provide an estimation of the state-level economic impacts of the Spanish Fork Wind Project.

Part III: Economic Evaluation Using JEDI

This section highlights the estimated state-level economic impact attributed to the development of the 18.9-MW wind project in Spanish Fork, Utah County. We believe it is imperative to inform stakeholders and decision makers about the economic impact wind development could potentially bring to the state so that informed decisions regarding the adoption of wind energy can be made.

Estimates were generated using the Job and Economic Development Impact (JEDI) model, an economic projection tool developed by the U.S. Department of Energy's National Renewable Energy Laboratory (NREL). The results of this analysis are presented in three sections. The first section provides an overview of the JEDI model. The second and third sections provide details of the expected economic impacts during **construction** and **operations**, respectively. For this evaluation, economic data were obtained in spring 2008 from three sources: (1) the Utah County Government; (2) IMPLAN (IMpact Analysis for PLANning) multipliers for Utah supplied by NREL (details discussed below); and (3) two wind developers working in Utah and Idaho (who will remain anonymous for confidentiality reasons).

General Overview of the JEDI Model

The JEDI model has been used extensively by the U.S. Department of Energy, state economic development departments, and wind researchers and analysts throughout the United States and is considered the standard when analyzing the economic impacts of constructing and operating wind projects (Goldberg, Sinclair, and Milligan 2004). Users enter basic information about a wind project (i.e., state, construction year, and facility size) to determine project costs (i.e., specific expenditures) and the income (i.e., wages and salaries), economic activity, and number of job opportunities that will accrue to the state or local region from the project. The more project-specific the data, the more localized the analysis.

This model enables users with limited or no economic modeling experience or spreadsheet to identify county-level, regional, and/or statewide economic impacts associated with constructing and operating wind power generation facilities (i.e., "wind farms" or "wind parks"). The base model contains state-specific industry multipliers derived from IMPLAN (Impact Analysis for PLANning). These multipliers serve as the default multiplier values for all 50 states. IMPLAN was developed by the U.S. Forest Service to perform regional economic analyses. Presently, IMPLAN software and data are managed and updated by the Minnesota IMPLAN Group, Inc., using data collected at federal, state, and local levels (IMPLAN 2003). The JEDI model also includes a "user add-in" feature that allows users to conduct county-specific analyses using county-level multipliers (not included in the base model).

JEDI is an "input-output" model, an analytical tool developed to trace supply linkages in the economy (Goldberg, Sinclair, and Milligan 2004). JEDI measures spending patterns and location-specific economic structures that reflect expenditures supporting varying levels of employment, income, and output. For example, JEDI reveals how purchases of wind project materials, such as wind turbines or other materials, not only potentially benefit local turbine manufacturers but also the local fabrication metals industry, concrete rebar, drop cable, wire, etc., given that such industries exist in the county or state, and expenditures will be made locally.

Input-output analysis is a method of evaluating and summing three economic impacts: (1) direct effects, (2) indirect effects, and (3) induced effects. These are defined below with respect to wind park development:

> **Direct effects:** Direct effects are the on-site or immediate economic impacts created by expenditures. In the construction of wind parks, they refer to the on-site jobs of contractors and crews hired as well as the jobs at turbine, tower, and blade factories.
>
> **Indirect effects:** Indirect effects are the increases in economic activity that occur when a directly affected business involved in the wind project (e.g., a contractor or manufacturer) that received payment for goods and services buys goods and services that support their business. This could include a banker who finances the contractor or an accountant who maintains a manufacturer's accounts. Other indirect effects may include steel manufacturers that supply towers, legal firms that write contracts for the project developer, hardware stores that provide building supplies for construction crews, or electric-utility suppliers that procure goods, such as high-voltage transmission lines (Costanti 2004).
>
> **Induced effects:** Induced effects are the change in wealth and income that are induced by the spending of those businesses and persons directly and indirectly employed by the wind project. Induced effects would include spending by those directly or indirectly employed by the project on food, clothing, retail services, public transportation, gasoline, vehicles, property and income taxes, medical services, and the like.

The sum of these three effects yields the total economic effect that results from expenditures on the construction and operation of a wind park (Goldberg, Sinclair, and Milligan 2004). In determining economic effects, the model considers 14 aggregated industries that are impacted by the construction and operation of a wind park (agriculture, construction, electrical equipment, fabricated metals, finance/insurance/real estate, government, machinery, mining, other manufacturing, other services, professional service, retail trade, transportation/communication/public utilities, and wholesale trade). Estimates are made using state- and county-level multipliers and personal expenditure patterns. Multipliers for employment, wage and salary income, output (economic activity), and personal expenditures are derived from IMPLAN data (IMPLAN 2003).

The JEDI model contains default data for virtually every input field and for each of the 50 states. Default values represent average costs and spending patterns derived from a number of sources (including project-specific data published in reports and studies) and research and analysis of renewable resources undertaken by the model developers during the past 12 years. However, not every project follows this exact "default" pattern for expenditures; project-specific information will yield more localized impact results. Project size, location, financing arrangements, and numerous site-specific factors influence construction and operating costs. Similarly, the access to local resources, including labor and materials, and the availability of locally manufactured project components can have a significant effect on the costs and the economic benefits that accrue to a state.

Project-specific data include costs associated with actual construction of the facility and supporting roads, as well as costs for equipment, annual operating and maintenance, and expenditures spent locally, financing terms, and tax rates. Specifically, the model requires the following project inputs:

- Construction costs (material and labor)
- Equipment costs (turbines, rotors, towers, etc.)
- Other costs (utility interconnection, engineering, land easements, permitting, etc.)
- Annual operating and maintenance costs (personnel, materials, and services)
- Other parameters (financial, debt and equity, taxes, and land lease).

Input parameters for the Spanish Fork Wind Project include:

Year of Construction: 2008

Project Location: The JEDI Model allows an analyst to use either state-level IMPLAN data (as a default) or to incorporate regional- or county-level IMPLAN (or other) multiplier data to determine localized economic impacts. The default state-level IMPLAN data for Utah were used for this analysis.

Project Size: 18.9 MW, nine turbines

Turbine Size: 2.1 MW (2,100-kilowatt) turbine size

Project Construction Costs: Construction costs were compiled and aggregated from data provided by two wind developers operating in Utah and Idaho (who will remain anonymous) and overall cost figures reported in the news media. For instances in which developer data were organized differently from JEDI categories, estimates were used and verified with the developer informants.

Annual Operations and Maintenance Costs: As with construction costs, operations and maintenance costs were compiled and aggregated from data provided by two wind developers operating in Utah and Idaho who will remain anonymous.

Current Dollar Year: 2008

Other Parameters: In addition to the above input parameters, the JEDI Model allows users to input local taxation parameters, local ownership percentages, and land lease easement payments, among other inputs.

The JEDI Model generates the following outputs for a given set of inputs:

- Jobs: Refers to the full-time equivalent employment for a year
- Output: The economic activity or “production value” in the state, region, or county economy
- Earnings: Refers to annual wage and/or salary compensation paid to workers involved with direct, indirect, or induced effects

- Local Spending: Refers to the actual annual dollars spent on goods and services in the area being analyzed (state, regional, or county economy where the wind park is built)
- Annual Lease Payments: Provides an annual total of lease payments to landowners
- Property Taxes: Represents the annual property taxes the project will generate, exclusive of any available property tax exemptions.

JEDI Evaluation Results during Construction

Table 1 presents the cost estimates for constructing the wind project and the share (i.e., percentage) of project costs spent in Utah. Using 2008 developers' data, the total cost for the construction of an 18.9-MW, nine-turbine wind project located in Utah County is estimated to be just over $32.1 million. The column titled Local Share details the percent of expenditures expected to be made in Utah. For example, it is expected that all construction materials will be purchased within the state (100% local share); however, the project's transformer will be purchased from outside the state (0% local share).

Table 1. State-Level Economic Impact from the Spanish Fork/Utah County Wind Project: Detailed Project Data Costs

Construction Costs	Cost	Local Share
Materials		
Construction (concrete rebar, equip, roads and site prep)	$1,687,995	100%
Transformer	$426,410	0%
Electrical (drop cable, wire)	$199,972	100%
HV line extension	$367,595	100%
Materials Subtotal	**$2,681,972**	
Labor		
Foundation	$147,038	100%
Erection	$147,038	0%
Electrical	$161,742	0%
Management/supervision	$88,223	100%
Labor Subtotal	**$544,040**	
Construction Subtotal	**$3,226,012**	
Equipment Costs		
Turbines	$17,649,009	0%
Blades	$5,883,003	0%
Towers	$3,694,950	0%
Equipment Subtotal	**$27,226,962**	
Other Costs		
HV Sub/Interconnection	$1,176,303	0%
Engineering	$385,560	0%
Legal Services	$29,881	10%
Land Easements	$0	100%
Site Certificate	$85,282	100%
Other Subtotal	**$1,677,026**	
Total Project Costs	**$32,130,000**	

Table 2 summarizes the total state-level economic impact during the 1-year construction period. It is estimated that the $32.13 million investment will generate slightly more than $4 million in direct, indirect, and induced state economic activities during the construction period of 1 year. This wind project will also support approximately 38 jobs (direct, indirect and induced) for Utah residents with a total payroll of almost $1.4 million; 19 out of the 38 jobs will be available in the construction sector only.

Table 2. State-Level Economic Impact from the Spanish Fork/Utah County Wind Project: During Construction Period

	Jobs	Earnings	Output
Direct Impacts	21	$857,726	$2,493,811
Construction Sector Only	19	$815,558	
Indirect Impacts	9	$301,169	$831,365
Induced Impacts	8	$240,146	$756,606
Total Impacts (Direct, Indirect, Induced)	**38**	**$1,399,041**	**$4,081,782**

JEDI Evaluation Results during Operations

This section contains detailed expenditure data as well as the state-level economic impacts expected during each year of operation. Table 3 provides a description of the Spanish Fork Wind Project and a summary of the annual operational expenses. The wind project is expected to generate more than $74,000 in annual land lease payments to the landowners of the project site. It is also expected to generate approximately $112,000 in new property taxes for Utah County (paid by the developer), with almost $84,000 accruing to the Nebo School District. These estimates are calculated using Utah County's property tax rate of 1.2327% and the Nebo School District property tax rate of .9203%. An agreement among the developer, the City of Spanish Fork, and the Nebo School District granted a 70% property tax rebate for the first 10 years of project operation. In addition to land lease payments and tax revenues, the JEDI analysis estimates that direct operating and maintenance costs will total almost $293,000 per year, of which more than $220,000 will be spent in Utah.

Table 3. State-Level Economic Impact from the Spanish Fork/Utah County Wind Project: Project Data Summary

Year of Construction		2008
Project Location		UTAH
Project Size - Nameplate Capacity (MW)		18.9
Turbine Size (kW)		2,100
Number of Turbines		9
Construction Cost ($/kW)		$1,700
Annual Direct O&M Cost ($/kW)		$15.50
Money Value (Dollar Year)		2008
Project Construction Cost		$32,130,000
Local Spending		$2,579,093
Total Annual Operational Expenses		$5,311,698
Direct Operating and Maintenance Costs		$292,950
Local Spending		$222,860
Other Annual Costs		$5,018,748
Local Spending		$186,396
Debt and Equity Payments		$0
Land Lease Payments		$74,177
Property Taxes	(1.2327%)	$112,219
Nebo School District Tax	(0.9203%)	$83,780

Table 4 presents the state-level economic impact from the wind project's first year of operation. The total direct, indirect, and induced effects of the project's operations will result in more than

$576,000 in economic activity within Utah, with more than $240,000 in salaries and wages. It will also support seven jobs (direct, indirect, and induced), of which four will be affiliated directly with wind project operations.

Table 4. State-Level Economic Impact from the Spanish Fork/Utah County Wind Project: Economic Impact during the First Year of Operation

	Jobs	Earnings	Output
Direct Impacts	4	$160,091	$318,705
Project Workers Only	2	$96,813	
Indirect Impacts	1	$36,977	$115,827
Induced Impacts	2	$44,924	$141,537
Total Impacts (Direct, Indirect, Induced)	**7**	**$241,992**	**$576,069**

Table 5 outlines the estimated annual operation and maintenance cost of the wind project. It is estimated that more than $5.3 million will be spent on the annual operation of the wind project with just more than $104,000 paid in salaries and wages to Utah workers. Utah landowners would also receive payments of more than $74,000 annually.

Table 5. State-Level Economic Impact from the Spanish Fork/Utah County Wind Project: Annual Operating and Maintenance Costs

	Cost	Local Share
Personnel		
Field Salaries	$75,734	100%
Administrative	$7,840	100%
Management	$20,658	100%
Personnel Subtotal	**$104,233**	
Materials and Services		
Vehicles	$7,966	100%
Misc. Services	$13,406	80%
Fees, Permits, Licenses	$2,689	100%
Misc. Materials	$10,877	100%
Insurance	$37,990	0%
Fuel (gals)	$5,717	100%
Tools and Misc. Supplies	$80,053	100%
Spare Parts Inventory	$30,020	2%
Materials and Services Subtotal	**$188,717**	
Debt Payment (average annual)	$3,727,080	0%
Equity Payment – Individuals	$0	100%
Equity Payment – Corporate	$1,105,272	0%
Property Taxes	$112,219	100%
Land Lease Payments	$74,177	100%
Total Annual Operating and Maintenance Costs	**$5,311,698**	

[2] This estimate is based on an hourly wage of $38.19 per hour.

Table 6 provides more detailed information on annual payroll costs as well as financial, tax and land lease payments. For example, the operation of the wind project will require a skilled labor force, including managers who will earn almost $80,000 per year.[2]

Table 6. State-Level Economic Impact from the Spanish Fork/Utah County Wind Project: Other Parameters

Financial Parameters		**Local Share**
Debt Financing		
Percentage financed	80%	0%
Years financed (term)	10	
Interest rate	10%	
Equity Financing		
Percentage equity	20%	
Individual Investors (percent of total equity)	0%	100%
Corporate Investors (percent of total equity)	100%	0%
Return on equity (annual interest rate)	16%	
Repayment term (years)	10	
Tax Parameters		
Local Property/Other Tax Rate (percent of taxable value)	1.2327%	
Assessed value (percent of construction cost)	100%	
Taxable Value (percent of assessed value)	30%	
Taxable Value	$9,103,500	
Local Taxes	$112,219	100%
Land Lease Parameters		
Land Lease Cost (per turbine)	$8,242	
Land Lease (total cost)	$74,177	
Lease Payment recipient (F = farmer/household, O = Other)	O	100%
Payroll Parameters	**Base Wage per Hour**	**Annual Wage**
Field Salaries (technicians, other)	$20.00	$41,600
Administrative	$14.49	$30,139
Management	$38.19	$79,435

Part IV: Conclusion

Our economic analysis indicates that wind development could potentially benefit Utah by supporting construction and ongoing skilled technical and service-related jobs. Local landowners could also benefit from land lease payments. Similarly, local communities and schools could benefit from additional property tax revenues. Because most of Utah's wind projects are likely to be located in rural areas, wind power has the potential to be an important new industry for reviving the state's rural economies and generating new funds for rural school districts.

As Utah's first commercial wind development, the Spanish Fork Wind Project marks a significant milestone in Utah's history. The project will set a precedent for future wind projects in the state. The 4-year effort to establish the Spanish Fork Wind Project points to some important considerations for policymakers and developers.

Considerations for Policymakers

First, **understanding Utah's electricity market** is paramount for the enactment of sound energy policies. Utah's power market is a regulated monopoly that has offered some of the lowest electricity rates in the country due to the state's reliance on inexpensive, fully depreciated coal resources. However, all new electricity generation, whether fossil-fuel-based or renewable, is at least three to four times the cost of electricity from these fully depreciated coal plants. Furthermore, coal faces impending risks associated with dwindling local reserves, emerging regional and state climate public policy restrictions, and increased mining safety regulations that are likely to increase the cost of coal-fired electricity. Wind power could offer a viable, price-stable alternative resource to meet Utah's growing energy demand.

Second, **energy policy consistency is important for energy project decisions**. The non-renewal of the state tax credit for renewable energy in 2006 delayed the procurement of investors and threatened the economic viability of the Spanish Fork Wind Project.

Third, **local citizens within the "viewscape" of proposed wind projects may also need to be informed and involved in the development**. The Spanish Fork Wind Project was nearly cut short when local citizens (many from outside Spanish Fork city) demanded a moratorium on the project 7 months after it had already been approved due to the project's likely visual impact. Although a compromise to move the project away from homes resolved the issue, the delays increased development costs.

Finally, **consulting and adopting the "best practices" of other communities that have allowed local wind development could be useful**. Issues such as wind turbine setbacks from homes, more transparent citizen engagement, and an established approval protocol could have averted some of the local resistance to the wind project.

Considerations for Wind Developers

Engaging in education and outreach in communities contemplating wind projects could benefit not only the developer but also the community. This could be accomplished by connecting the economic and environmental benefits of wind energy to the core values of the community (e.g., increased job opportunities, land lease payments, property tax revenues for schools and communities, clean air, energy independence, entrepreneurship, improved quality of life for children). Because of their novelty, most Utah communities will not have experience with wind projects, and citizens will likely want information on how a nearby wind project may impact their community.

Building partnerships with institutions and groups that provide technical knowledge could be helpful. On the local level, the Utah Geological Survey, Utah Clean Energy, and the Utah Wind Working Group can be instrumental. On the national level, groups such as the U.S. Department of Energy's Wind Powering America and the American Wind Energy Association can also provide technical resources. Staff members of the Wind Powering America program are often willing to visit local communities to answer questions and address concerns posed in forums.

Finally, the support wind developers could potentially obtain from individuals willing to champion wind development in local communities cannot be overlooked. For the Spanish Fork Wind Project, this involved local citizens, city officials, state representatives, and local universities. Given the land lease payments and property tax revenues afforded by wind projects, landowners and school administrators may be interested in supporting local wind projects as well.

Appendix A. Applying the JEDI Model

The model is programmed in Microsoft Excel, and it requires four sets of inputs: (1) Project Descriptive Data, (2) Project Cost Data, (3) Annual Wind Project Operating and Maintenance Costs, and (4) Other Parameters.

The Project Descriptive Data consist of eight parameters:

- Project location (county/state location)
- Year of construction
- Project size (nameplate capacity)
- Turbine size (kilowatt or kW size)
- Number of turbines
- Project construction cost (dollars per kilowatt capacity or $/kW)
- Annual operation and maintenance cost ($/kW)
- Money value – current dollar year.

The Project Cost Data consist of 16 parameters organized into three categories:

- Construction costs
- Equipment costs
- Other miscellaneous costs.

Annual Wind Project Operating and Maintenance Costs consist of 11 parameters organized into two categories:

- Personnel
- Materials and services.

The Other Parameters section is the last section of inputs, consisting of 17 inputs organized into five categories:

- Debt financing
- Equity financing/repayment
- Tax parameters
- Land lease parameters
- Payroll parameters.

Regarding the expenditure pattern and the local share of expenditures for a particular county, region, or state, assumptions play a significant role in determining the economic impact of a wind project. The JEDI Model provides two options: (1) default values or (2) new values entered by the analyst.

The default values represent a "reasonable expenditure pattern for constructing and operating a wind power plant in the United States and the share of expenditures spent locally… based on a review of numerous wind resource studies (Goldberg, Sinclair, and Milligan 2004, p. 3). Not every wind project, however, will follow this exact "default" pattern for expenditure. Consequently, analysts are encouraged to incorporate project-specific data and the likely share of spending in a given county, region, or state to reflect localized economic impacts. In our analysis, we've consulted with two local wind developers to determine reasonable local spending levels for specific costs associated with the Spanish Fork Wind Project.

Appendix B. JEDI Model Limitations

As with other economic forecasting tools, JEDI has several assumptions and limitations (Costanti 2004). For example, JEDI is not intended to be a precise forecasting tool. Rather, it provides a reasonable profile of how investment in a wind project may affect a given economy. Additionally, JEDI offers a gross analysis rather than a net analysis; that is, the model does not account for the net impacts associated with alternate spending of project funds or replacement of existing electricity generation facilities that may exist within a given local economy (e.g., electricity generation by wind replacing electricity generated by an existing gas-fired generation plant). JEDI also assumes that adequate revenue exists to cover all debt and/or equity payments and annual operations and maintenance costs associated with a given project. Consequently, while JEDI can provide analysts with the reasonable benefits associated with a given project, wind developers, utility managers, and government officials need to ensure that a given project is an acceptable investment.

References

Anderton, D. (2006). "Sun, Wind Replace Coal?" *(Salt Lake City) Deseret Morning News*, 23 November 2006. Available at: http://www.deseretnews.com/cgi-bin/cqcgi_plus/@plus.env?CQ_SESSION_KEY=VRMYABSBMWAN&CQ_CUR_DOCUMENT=1&CQ_TEXT_MAIN=YES (Last accessed August 2008).

Anderton, D. (2007a). "Doubts Cloud Coal-Plant Plan," *(Salt Lake City) Deseret Morning News*, 7 February 2007. Available at: http://www.deseretnews.com/dn/view/0,1249,660193324,00.html (Last accessed February 2007).

Anderton, D. (2007b). "Utah's Power Prices Among 10 Lowest," *(Salt Lake City) Deseret Morning News*, 20 March 2007. Available at: http://www.deseretnews.com/dn/view/0,1249,660204662,00.html (Last accessed March 2007).

Ashton, K. (2006a). "Winds of Change May Blow into Spanish Fork," *(Provo) Daily Herald,* 18 February 2006. p. D1. Available at: http://www.heraldextra.com/content/view/166263/17 (Last accessed June 2008).

Ashton, K. (2006b). "Wind Farm Project on Hold in S.F.," *(Provo) Daily Herald,* 22 February 2006. p. D1. Available at: http://www.heraldextra.com/content/view/166536/17 (Last accessed June 2008).

Bauman, J. (2007). "High Mercury Levels in Fish at 14 Sites," *(Salt Lake City) Deseret Morning News*, 4 February 2007. Available at: http://deseretnews.com/dn/view/0,1249,660192653,00.html (Last accessed February 2007).

Bauman, J. (2008). "Energy Alternatives Exist, But at a Higher Price Tag," *(Salt Lake City) Deseret Morning News*, 15 January 2008, p. A1.

Conlon, G. W. (2006a). "Citizens Seek Moratorium on Wind Farm Towers," *(Provo) Daily Herald*, 15 February 2006, p. A1. Available at: http://www.heraldextra.com/content/view/165985/9 (Last accessed June 2008).

Conlon, G. W. (2006b). "Windmill Talks Go Round and Round at Recent City Meeting," *(Provo) Daily Herald*, 5 March 2006, p. A1. Available at: http://www.heraldextra.com/content/view/170428/999999 (Last accessed June 2008).

Costanti, M. (2004). *Quantifying the Economic Development Impacts of Wind Power in Six Rural Montana Counties Using NREL's JEDI Model.* Report NREL/SR-500-36414. Golden, CO: National Renewable Energy Laboratory.

(Provo) Daily Herald. "Ill Wind Blowing in Spanish Fork," 5 March 2006, p. A5. Available at: http://www.heraldextra.com/content/view/168649/57 (Last accessed June 2008).

(Salt Lake City) Deseret Morning News. "Spanish Fork Still Working Out Wind Farm Details," 22 March 2006. Available at: http://deseretnews.com/dn/view/0,1249,635193525,00.html (Last accessed June 2008).

DSIRE. (2008). “Utah Incentives for Renewables and Efficiency,” Available at: http://www.dsireusa.org/library/includes/map2.cfm?CurrentPageID=1&State=UT&RE=1&EE=1 (Last accessed August 2008).

Economic Report to the Governor. (2008). Governor’s Office, State of Utah. Available at: http://governor.utah.gov/dea/ERG/ERG2008/2008ERG.pdf. (Last accessed August 2008).

Fahys, J. “Lawmakers In No Rush for Nuclear Plant,” *The Salt Lake Tribune*, 20 September 2007, pp. B1, B2.

Foy, P. “Wind Farmers Want to Sell ‘Green’ Power: Utah Power Won’t Buy from Utah Farms,” *(Salt Lake City) Deseret Morning News,* 21 October 2005. Available at: http://www.deseretnews.com/dn/view/1%2C1249%2C635155302%C00.html (Last accessed June 2008).

Goldberg, M.; Sinclair, K.; and Milligan, M. (2004). *Job and Economic Development Impact (JEDI) Model: A User-Friendly Tool to Calculate Economic Impacts from Wind Projects.* Prepared for the 2004 Global WINDPOWER Conference, March 2004. NREL/CP-500-38010. Golden, CO: National Renewable Energy Laboratory.

Gorrell, M. (2007). “Accessible Coal Getting Scarce,” *The Salt Lake Tribune*, 11 December 2007. Available at: http://proquest.umi.com/pqdweb?did=1396251661&sid=2&Fmt=3&clientId=1652&RQT=309&VName=PQD (Last accessed August 2008).

Gorrell, M. (2008). “State Mine-Safety Monitor Sought,” *The Salt Lake Tribune*, 12 January 2008. Available at: http://www.sltrib.com/ci_7951452.

Governor’s Energy Policy. (2008). Governor’s Office, State of Utah. Available at: http://www.utah.gov/energy/governors_priorities/renewable_energy.html (Last accessed August 2008).

Hartman, C.L.; Stafford, E.R. (2007). *Utah Perspectives from the Second Annual Harvesting Energy Summit (2007) Outcome from the “Dialogue Diner” and Stakeholder Panel Sessions*, U.S. Department of Energy: Energy Efficiency and Renewable Energy. Available at: http://www.eere.energy.gov/windandhydro/windpoweringamerica/pdfs/wpa/ut_harvesting_energy_summit.pdf (Last accessed August 2008).

Henetz, P. (2007a). “Blue Sky Program Shines on Five Utah Projects,” *The Salt Lake Tribune*, 7 February 2007, p. C2.

Henetz, P. (2007b). “UPC Wind Heads West,” *The Salt Lake Tribune*, 24 February 2007, pp. E1, E7.

Henetz, P. (2007c). “PacifiCorp Unplugs Coal-Plants Plan,” *The Salt Lake Tribune*, 8 December 2007, pp. A1, A7.

Henetz, P. (2008). “Voters Urge End of Oil Dependency,” *The Salt Lake Tribune*, 30 July 2008, p. A4.

Hollingshead, T. (2005a). “Energy Project Seeks to Harness Canyon Winds,” *The Salt Lake Tribune,* 26 April 2005, p. C3.

Hollingshead, T. (2005b). “Cheap Power or Big Eyesore? Some Are Fighting Windmills,” *The Salt Lake Tribune,* 11 June 2005, p. B4.

Hollingshead, T. (2006a). “Wind Farm Could Face Delay,” *The Salt Lake Tribune*, 17 February 2006, pp. B1, C5.

Hollingshead, T. (2006b). “Spanish Fork Canyon Wind Farm Move Pleases Residents,” *The Salt Lake Tribune,* 13 March 2006, pp. B1, B4.

IMPLAN. (2003). IMPLAN. Minnesota IMPLAN Group, Inc. Stillwater, MN. Available at: www.implan.com. (Last accessed September 2008).

Kern, P. (2005). *Wind Farm Slated for Utah’s Spanish Fork Canyon*. Energy Prospects. June 29, 2005. Available at: http://www.energyprospects.com/static/66-13-print.html. (Last accessed June 2008).

Lee, J. (2007a). “Wind Power – New Wyoming Plant Generating Plenty of Interest,” *(Salt Lake City) Deseret Morning News,* 28 October 2007. Available at: http://www.Deseretnews.com/article/1,5143,695222108,00.html (Last accessed June 2008).

Lee, J. (2007b). “PacifiCorp to Fuel Plant with Wind, Gas – Not Coal,” *(Salt Lake City) Deseret Morning News*, 8 December 2007. Available at: http://www.deseretnews.com/article/content/mobile/0,5223,695234256,00.html (Last accessed June 2008).

Loftin, J. “Renewable Energy Gets Thumbs-Up from Utahns,” *(Salt Lake City) Deseret Morning News*, 15 January 2007. Available at: http://deseretnews.com/dn/view/0,1249,650223027,00.html (Last accessed January 2007).

Mongha, N.; Stafford, E.R.; Hartman, C. L. (2006). *An Analysis of the Economic Impact on Utah County, Utah from the Development of Wind Power Plants*. U.S. Department of Energy: Energy Efficiency and Renewable Energy. Available at: http://www.windpoweringamerica.gov/pdfs/wpa/econ_dev_jedi.pdf. (Last accessed June 2008).

Oregonian. (2007). “Wind Turbine Demand Increases Cost in NW.” Available at: http://www.blachlylane.coop/news/story.php?ID=278 (Last accessed June 2008).

Peterson, J. “Preliminary Work Begins on Utah’s First Wind Farm.” *(Provo) Daily Herald*, 18 November 2007. Available at: http://heraldextra.com/content/view/244114/17 (Last accessed June 2008).

Public Service Commission. (2005). Docket No. 03-035-14. Salt Lake City, Utah. October 31, 2005. Available at: http://www.psc.state.ut.us/utilities/electric/ordersindx/2005.html#october (Last accessed June 2008).

Public Service Commission. (2006). Docket No. 06-035-42. Salt Lake City, Utah. May 15, 2006. Available at: http://www.psc.state.ut.us/electric/06docs/0603542/Test-Todd%20Velnosky (Last accessed June 2008).

Public Service Commission. (2008). Available at: http://www.psc.state.ut.us/aboutus/index.html (Last accessed August 2008).

Toth, H. "Spanish Fork OKs Windmills," *(Provo) Daily Herald*, 7 June 2005, p. D1. Available at: http://www.heraldextra.com/content/view/139335/17 (Last accessed June 2008).

Twitchell, J. (2006a). "Deal Would Move Planned Wind Farm," *(Salt Lake City) Deseret Morning News,* 7 March 2006. Available at: http://deseretnews.com/dn/view/0,1249,635190214,00.html (Last accessed June 2008).

Twitchell, J. (2006b). "Wind Farm Developers Scramble to Gain Leases." *(Salt Lake City) Deseret Morning News*. 21 March 2006. Available at: http://deseretnews.com/dn/print/1,1442,635193265,00.html (Last accessed June 2008).

Utah Code, Title 54: Public Utilities 2008. Available at: http://le.utah.gov/~code/TITLE54/TITLE54.htm. (Last accessed June 2008).

Utah Geological Survey. (2007). *U.S. Electricity Net Generation by Energy Source, 2006.* http://ugs.utah.gov/emp/energydata/statistics/electricity5.0/pdf/T5.8.pdf. (Last accessed June 2008).

U. S. Department of Energy. (2008). *20% Wind Energy by 2030: Increasing Wind Energy's Contribution to the U.S. Electricity Supply*. Report available at: http://www.20percentwind.org/20p.aspx?page=Report. (Last accessed June 2008).

Warnock, C. (2005a). "Company Hopes to Open Wind Farm in Spanish Fork," *(Provo) Daily Herald*, 24 April 2005, p. A1. Available at: http://www.heraldextra.com/content/view/145411/99 (Last accessed June 2008).

Warnock, C. (2005b). "Wind Farm Debate Splits Spanish Fork," *(Provo) Daily Herald,* 27 April 2005, p. A1. Available at: http://www.heraldextra.com/content/view/134362/17 (Last accessed June 2008).