

Incorporating Wind into Resource Portfolios

Investments are seldom risk free, and investments in electricity generation are no exception. Power generators today face a variety of risks and future uncertainties when they invest in new energy resources. If power generators could invest in a cheap, reliable power source that could avoid negative environmental impacts and availability or price risks, then many of their worries would be eliminated. If one energy resource could satisfy all of their needs, the sole challenge for power generators would be forecasting consumer demand and supplying enough power to meet demand. Since no such power source exists, however, power generators today seek a broad range or "portfolio" of energy resources to offset risk.

Under today's regulated monopoly structure, electric utilities control the generation, transmission and distribution of power in their service area. They control their energy resources through direct ownership and through contracts with other power generators. Utilities typically plan additions to their power generation resource portfolios with the approval of state regulatory commissions or oversight groups.

Because of anticipated changes in the electric market, regulatory and policy reforms, and technological progress, wind and other renewable energy technologies may play important roles in future electric power resource portfolios. In a more market-oriented electric business, the following factors increase the importance of renewable energy technologies:

- Energy supply risks are likely to increase, making resource diversity more important.
- More non-utility owners and operators of power generation facilities implies less regulation, which may, in turn, undermine the reliability of some power sources.
- Power generators will have to meet increasing customer expectations.
- Changes in environmental regulation could affect the cost and reliability of fuel-based generation technologies.
- Increased demand for clean fuels such as natural gas for space and steam heating, vehicle fuel and electric generation could cause price spikes and temporary fuel shortages.
- Increased operating costs and system failures are causing some nuclear power plants used for utility bulk power to be shut down prematurely.

Measuring wind's benefits

Wind and other renewable energy technologies could play important roles in resource portfolios. As state legislators and public utility commissioners consider changes in electric markets and future additions to electric resource portfolios, they should be aware of the benefits of wind energy. Wind brings a variety of benefits to generation resource portfolios. Wind is one of the lowest cost renewable energy resources. Including wind in generation portfolios can contribute to lower long-term electricity costs. When considering resources for generation portfolios, state policymakers need to consider a number of issues associated with the benefits, costs and need for fuel diversity within their state.

One of the biggest challenges to be faced when considering wind and other renewable resources as additions to generation portfolios is that their greatest benefits -- such as the ability to generate power with minimal environmental impact -- are not easily quantified. Because of improvements in data and increased experience with renewable resources, however, assessing these benefits is easier today than in the past.

Air pollution

A number of states have analyzed impacts of various generation technologies on air pollutants such as SO_x, NO_x, particulates, CO₂ and CO. These studies clearly demonstrate the benefits of wind in resource portfolios. While the specific costs assigned to the various pollutants have been extensively debated, increased concerns about mercury and other air toxins should spur interest in non-polluting means of generation. In general, the trend over the last two decades has been toward increasing regulation of air pollution, more restrictions on fossil fueled power generation, and increased costs for controls on polluting technologies.

Water

Wind-generated power avoids many of the aquatic problems typically associated with traditional fossil-fuel power plants. The process of power plant cooling, in which power facilities take in water, use it to cool plant equipment and release water at a higher temperature, can be particularly harmful to the aquatic life, including both flora and fauna, which are impacted by the discharge of power plant cooling water. In areas where either water quality or the availability and cost of water for power plant cooling are issues, a resource like wind, which does not use water for cooling, has special value.

Future regulations

One of the main questions associated with electric generation in a restructured, more competitive electric industry is the possible disregard for environmental concerns that could arise in a price-driven, competitive market. State policymakers have discussed a number of ways to ensure environmental protection in a restructured market. States may require power generators to address the impacts of generation on air quality through a pollution cap or a requirement to bring existing plants in compliance with new environmental standards by a specific date, if they are to continue power production. Given the possibility of increasingly stringent environmental regulations, the benefits of pollution-free generation may become more important in the future. Adding resources such as wind to resource portfolios allows power generators to safeguard against having to mitigate the costs of poor investments later.

Every generating resource has some negative impacts, and wind is no exception. However, most of wind's impacts are confined to the area where the wind power plant is located and thus can be mitigated at that site. Where wind power development produces environmental problems that are not easily corrected, state siting authorities must weigh the environmental benefits and costs of renewables with those of other resources.

Resource diversity

Including wind in generation portfolios can reduce long-term electricity costs. Energy experts recognize resource diversity as the basis for resource portfolio management. Wind and other renewables help diversify both a power generator's product and a state's electricity portfolio. Diversity of fuel type safeguards against fuel supply shortages and volatility of fuel prices, which may improve the reliability of the whole power system. By diversifying power production technologies with the addition of renewables, power generators protect themselves against common system failures. Renewable resources tend to be smaller and more modular than traditional generation technologies; this modularity makes power generators less susceptible to the risk of over-investment in new power plants.

Dispatchability and other operational features

Too often, wind power is evaluated only in comparison with central station power plants, ignoring its ability to fulfill specific power needs and circumstances. Actual system requirements, particular operational features needed by a system, and alternative ways of meeting those requirements should be subjected to neutral evaluation, regardless of the technology and or its ownership. To the extent that operational requirements, such as reactive power, are clearly specified, projects can be designed to provide those features. Wind is an "intermittent" resource -- one that does not produce power constantly. Nonetheless, the resource still has value, particularly where its power production coincides with peak electricity demand or is complementary to the characteristics of other resources supplying a system -- such as hydro. The electricity generated by wind may have very high value in the right circumstances and if it is evaluated properly. Intermittency alone does not rule out the use of the wind resource.

Risk assessment

Wind and other renewables can play a key role in mitigating the risks of fuel price volatility and availability, changed environmental regulations, and state or regional siting and diversity requirements. If the correct risks are identified in the comparison of resources, a resource portfolio can be constructed to hedge against those risks. Wind generated electricity in effect protects consumers from many of these uncertainties. When comparing wind's "cost-effectiveness" as a technology with other resources, wind's ability to offset fuel supply risks and uneconomical power plant investments should be taken into consideration.

Resource location features

One problem with some renewable resources such as wind is that the windy areas are often situated away from load centers and transmission lines. If located close to load centers and transmission lines, the costs for developing wind would be lower. On the other hand, significant benefits can be obtained by adding smaller amounts of generation near remote loads within a transmission network. These benefits flow from the provision of power in parts of the utility grid that are expensive to serve from centrally located facilities due to distance and loss of power in transmission. Moreover, the transmission and distribution systems have been designed to accommodate utility-owned, central station, generation facilities. As the electric industry moves toward more competition in providing generation, it may be desirable to change the methods and assumptions for planning additional investment in the transmission and distribution systems to accommodate generation options such as wind. Locational and distributional benefits as well as costs should be considered in portfolio design, as should investments in transmission and distribution systems.

Portfolio managers in the future could be:

- *The distribution utility*
- *Aggregators and brokers for small customers*
- *Regional market portfolios*

The changing portfolio manager

Today, regulated monopoly utilities have "managed" electric generation portfolios, deciding what resources and fuels they would use to generate electricity. However, with the introduction

of greater competition in the electric industry, though the need will remain, this system of portfolio management is likely to change. Depending upon the industry model considered, the remaining "distribution utilities," electricity brokers or, in some cases, the individual customer may assume the portfolio management role. There are a number of possibilities for portfolio management in future electricity markets.

Distribution utility

For the immediate future, most experts expect that the remnant distribution utility -- the regulated electric utility entity that constructs and maintains the distribution wires connecting the transmission grid to the customer -- will serve as the portfolio manager for the majority of customers. Instead of planning a portfolio of the facilities the utility owns, the distribution utility would most likely be planning a portfolio of resource contracts. In acting as portfolio manager, the distribution utility may consider purchases from the short-term market as well as long-term contracts and financial instruments to hedge against various types of risks in the supply and cost of electricity. Indeed, risk assessment and hedges against future uncertainties are the central themes of portfolio management.

Diversity is the basis for resource portfolio management. Distribution utilities may decide to offer several resource portfolio options to their customers rather than the single portfolio option common today. Portfolio choices will allow customers to select the portfolio -- and the costs and risks associated with that portfolio -- most suited to their needs. Given that residential and commercial customers are the ones most likely to remain with the remnant distribution utility, and given the apparently strong support for renewables among these customer groups, it is possible that a stable rate portfolio with significant amounts of renewable resources such as wind would become one of the more popular portfolio options.

Aggregators and brokers for small customers

In the new, restructured electric market, a system of aggregators -- entities that bring together customers into buying groups for the purchase of electric service -- and brokers -retail agents who buy and sell power -- may develop. Given public opinion polls and other customer information, these aggregators and brokers, who target residential and commercial customer markets, are likely to offer renewable energy-powered or "green" portfolios as a way of attracting these customers. Experience in the home mortgage market, where customers prefer fixed to variable rate mortgages, indicates that residential customers who are faced with the risk of volatile electric prices over the long term, may tend to be more concerned with the stability of their monthly expenses than the opportunity for small immediate savings. Commercial customers who own rental property or for whom electricity is a regular business expense may value predictability of electricity costs above incremental short-term savings. Resource portfolios with stabilized rates combined with the environmental and diversification benefits of renewables may be attractive in these markets. In this market scenario, large customers with sufficient expertise may assume the role of managing their own portfolios. Including wind in the electricity portfolio of individual companies provides the same benefits to large customers as it does to small.

Regional market portfolios

The public interest issues associated with electricity generation could result in resource portfolio management on state and regional levels as well as at the distribution level. States and regions of the country may assume some resource portfolio responsibilities for environmental and economic development reasons. States may decide to establish minimum portfolio standards for environmentally preferred resources like wind and other renewables in order to improve air quality. States may also encourage a more diverse resource mix for economic development reasons, to help stabilize the state's economy and to balance the boom and bust cycles associated with fossil fuel development. Regional state compacts could evolve as a more practical way of encouraging environmentally sound resource choices than individual state actions alone. These regional agreement may include minimum portfolio requirements for environmentally preferred technologies, as well as regional siting criteria including resource priorities for new generating facilities. Environmental costs could be combined with short-term market costs in the dispatch of power from power pools. In these scenarios, environmental costs could be combined with short-term market costs.

Resource portfolio design questions include:

- *Separation of electricity costs*
- *Disclosure and licensing*

Future portfolio implementation issues

The ability of customers to select the resource portfolio which best suits their needs, instead of having to choose one portfolio offered by the utility to suit everyone's needs, should simplify portfolio design.

However, state policymakers may want to address a number of resource portfolio design questions in the future competitive market.

Separation of electricity costs

Most experts agree that the separation of electricity costs into smaller components is critical to introducing greater competition in the electric industry. However, the calculation and allocation of these costs will directly affect the ability of new technologies like wind to be included in resource portfolios. For example, the fixed operating costs of today's generation facilities could raise the short-term bid price of electricity, making wind a viable option. However, if power generators are allowed to compensate for these costs by raising prices on a broad range of customers, renewable technologies may not be able to compete, even if their total costs are lower.

Transmission systems could also present cost allocation problems. The complexity of today's transmission systems and the barriers they present to new power generators could pose problems for renewable resources, which are seldom located near existing utility generation plants. There is no simple answer for mitigating these problems except to calculate and allocate subsets of electricity costs carefully with the full knowledge that such allocations have serious implications for competition.

Disclosure and licensing

Consumer protection is an issue that increases in importance in a restructured electric industry. Not only can false claims about the benefits and costs of various resource portfolios hurt consumers, they can also harm legitimate distribution companies and brokers trying to market responsibly designed resource portfolios. Two strategies can be used to temper this problem: information disclosure and licensing.

Accurate information about fuel resources -- their costs, risks, benefits and other characteristics -- should be disclosed to all customers and potential customers.

As an additional consumer protection measure, brokers and marketers selling directly to end-use customers should be licensed by the state. Criteria for such licenses might include (in addition to the disclosure statement described above) a state approved dispute resolution mechanism, and identification of a backup electric service provider in case of contract default. Consumer protection is particularly important for renewables because they are relatively new technologies without an established track record. False claims either favoring or disfavoring renewables will slow their acceptance and use by the public.

Summary and Conclusions

Distribution utilities may offer their customers several resource portfolio options. Wind and similar renewable technologies have a variety of benefits for a generation portfolio. Wind is one of the lowest-cost new supply resources. Including wind in a generation portfolio will contribute to maintaining lower long-term electricity costs. Because renewables have fewer negative environmental impacts than many fuel based technologies, they are not susceptible to changes in clean air regulations, new pollution taxes, or to future restrictions on greenhouse gases and air toxics. Because they do not rely on a purchased fuel, the majority of their costs are known and stable over the lifetime of the project. This aspect of renewables has a stabilizing effect on electricity costs. Finally, popularity with residential

customers, as demonstrated by public opinion polls, indicates their potential in the more competitive electric market of the future.

With the introduction of greater competition and restructuring of the electric industry, the need for resource portfolio management will remain, but the identity and location of the portfolio manager is likely to change. This function may be performed by the distribution utility, aggregators, brokers or by large individual customers. State and regional entities will probably have the opportunity to influence the composition of generation portfolios.

States and regions can influence the composition of generation portfolios.

National Wind Coordinating Committee

The content and form of the papers in this series have been reviewed and approved by the National Wind Coordinating Committee. Committee members include representatives from investor-owned utilities, public utilities, state legislatures, state utility commissions, state land commissions, consumer advocacy offices, state energy offices and environmental organizations. The purpose of the National Wind Coordinating Committee is to ensure the responsible use of wind power in the United States. The committee identifies issues that affect the use of wind power, established dialogue among key stakeholders and catalyzes appropriate activities.

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