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Strategies for Addressing New and Prospective Environmental Regulations: Planning Tomorrow's Generation Fleet

Estimates of coal retirements range from 25,000 MW to 65,000 MW over the next three years, affecting mostly old, baseload generators, many of which have continued operating because they were needed to keep the lights on for the past few decades. Most of those retired resources will have to be replaced, offering generation owners an opportunity to set the course for the technologies they will use to modernize their old fleets and to provide cost effective power for the next 30, 40, or more years. While utilities have always faced challenges and uncertainties when planning for long-term generation requirements, that planning challenge is exacerbated now by Renewable Portfolio Standards mandates and Environmental Protection Agency ("EPA") regulations that appear to narrow the viable choices. The near-term attractiveness of natural gas may be ephemeral, and there is likely to be a resurgence of demand – which has not grown recently at the same pace as in the past – based on economic recovery and technological developments (*e.g.*, requirements driven by increased use of electric vehicles and continued expansion of data processing and communications). Although many options warrant consideration, each has pros and cons that dictate careful assessment of full life-cycle costs. This article will address some of the factors utilities should consider in developing their new fleets.

Shale Gas Boom or Impending Bust?

The boom in shale gas production in the past few years has caused natural gas prices to drop dramatically. While the allure of abundant and cheap natural gas has been driving utilities to invest in natural-gas plants, reliance on only natural gas may not be a viable long-term

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strategy. Natural gas prices have historically been volatile, exposing utilities that over-rely on natural gas and their customers to significant price swings. Concerns about the extent to which hydraulic fracturing, or "fracking" – the process used to extract shale gas – contaminates ground water and contributes air pollutants (*e.g.*, methane) may take the bloom off of shale gas development. Recent reports also suggest that fracking may increase the risks of small earthquakes, with unknown ramifications. In light of these developments, future regulation in the shale gas industry will likely lead to higher production prices, which will be passed on to utilities that rely on gas-fired generators and their customers. Indeed, such regulation may not be too far off. In April, the EPA issued a final rule regulating air emissions from fracking, and it may issue additional rulemakings in the future. Due to the unknown risks associated with fracking, Vermont's governor signed the nation's first state-wide ban on hydraulic fracturing earlier this month. New York and New Jersey have not banned fracking, but have instituted moratoriums until the potential risks have been studied, and North Carolina and California are developing fracking regulations. Other states may follow and implement similar legislation. It is also likely that increased demand for natural gas, both domestically and internationally, will put upward pressure on prices. It would be prudent, therefore, for utilities to balance their supply portfolios and avoid an over-reliance on natural gas.

Solar Warrants More Aggressive Attention.

Solar power is one of the most promising sources of clean electricity. The sun provides an abundant electricity resource, particularly during high-peak load periods. Of particular importance with respect to impending EPA regulations, solar power can facilitate utilities' ability to better adapt to future environmental regulations because solar photovoltaic and concentrating solar power technologies generate electricity with no CO_2 emissions.

A further advantage of solar power is that solar energy technologies can be utilized at various scales, ranging from utility-scale generation to distributed generation, and solar panels may be located near homes and office buildings without the noise pollution usually attendant to power production. Distributed solar projects often do not require new transmission. They can be built adjacent to load or close to transmission and distribution lines so that projects can be directly connected to the existing grid, thereby reducing interconnection costs as well as line-loss issues. Moreover, the permitting process for distributed solar is generally faster than for larger-sized utility-scale solar projects.

Distributed solar in urban areas may, however, be constrained by space restrictions and by the need to upgrade distribution systems.

Certainly, a significant current downside to solar energy is the initial cost. The initial investment in solar panels is still relatively high on a per megawatt basis compared with fossil-fuelled plants, but the cost of converting sunlight to energy has been decreasing. According to the Solar Energy Industries Association, the average price of solar modules dropped by more than 50% in 2011.[1] While this price decrease is attributable, in part, to increased efficiencies in technology and production, a contributor to this price decrease has undoubtedly been Chinese manufacturers who have flooded the U.S. market with cheap solar panels. Prices are likely to increase if the Department of Commerce ("Commerce") confirms its recent preliminary determination that Chinese manufactures have been dumping solar panels into U.S. markets − *i.e*., selling solar panels priced below their manufacturing costs – and that solar products imported from China should be subject to tariffs ranging from approximately 31% to 250%. Commerce is expected to make its final determination in October.

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But even if forward prices for solar cells increase as a result of anti-dumping tariffs imposed on Chinese imports, the life cycle costs of solar are likely to become more attractive. Once installed, solar panels utilize a free source of power and have low maintenance and repair costs. Developers can also take advantage of local incentives and federal tax credits for solar generation investment.

Of course, solar generators cannot provide essential baseload capacity. Solar is only available when the sun shines, and there is no current way to efficiently store large amounts of solar power for use at night and for prolonged cloudy periods. This concern might be addressed, however, through advances in storage technology or through the use of hybrid renewable energy-fossil fuel plants, *i.e.*, generation plants that link the efficiency of solar power with the reliability of fossil fuels. On the other hand,

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[1] Solar Energy Industries Association, Solar Energy Facts: Year In Review 2011, at http://www.seia.org/galleries/pdf/Solar_Energy_Facts_Q4_2011.pdf

however, in most areas of the country, solar peak generation (when the sun is brightest) is coincident with peak load (when the temperature is hottest). Thus, solar can effectively shave peaks and reduce the need for gas-fired combustion turbines.

Wind Remains a Key Part of the Mix.

Utilities should also consider continued expansion of their renewable portfolios to include more wind generation. Wind has many of the benefits of solar: once a wind turbine is installed, operating and maintenance costs are relatively low. Wind is a sustainable energy source, wind turbines do not emit GHGs to produce electricity, and some wind energy technologies are suitable for distributed generation projects.

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Wind projects can also help to boost underdeveloped local economies. Because wind generally blows stronger and steadier − and is thereby more reliable − in areas that are remote from load (*e.g.*, rural and mountainous communities, offshore, and in the plains of the Midwest), wind projects can spur economic growth in these communities by creating construction, operation, and maintenance jobs and paying local taxes.

On the other hand, wind, again like solar power, cannot provide essential baseload capacity. The capacity value of wind is typically 10% to 20% of its nameplate value – although it can exceed 30% in the right locations – and therefore may not be available when needed. Further, wind is not load-following − the wind usually blows stronger at night when load is the lowest. Technological advances in storage technology are therefore needed before wind can be a reliable energy source during peak load periods. Also, because winds are typically stronger and more reliable in areas remote from load centers, new transmission may be required to make interconnections practical.

Despite these shortcomings, wind may be an integral part of generation portfolios because of its low operating costs and its environmental sustainability. The cost of wind power will continue to decrease as technology advancements continue and the market develops further.

Projects like the Google-backed Atlantic Wind Connection project – a proposed approximately 380-mile underwater transmission line that will stretch from the coast of New Jersey to Virginia and is expected to connect up to 7,000 MW of offshore wind turbines – could provide significant insight into a new approach to harnessing the benefits of this inexhaustible resource.

Nuclear Should Still Be an Option.

Because of their high capacity factors and relatively low and stable operating costs, nuclear plants can provide viable carbon-free baseload generation alternatives to fossil fuels. Nuclear plants emit far fewer GHGs than coal or gas-fired plants, positioning these plants to address any new environmental regulations.

The primary disadvantages of nuclear power plants are high construction and decommissioning costs and lingering reservations about their safety. The low operating costs for nuclear offset some of their higher costs, however. Extrapolating the current cheap natural gas prices over the long-term will, of course, make natural gas appear to be more economically attractive, but because gas prices are historically volatile, nuclear plants can add value and certainty in a portfolio as a low-carbon baseload generation resource in the face of increased environmental regulations. These considerations reinforce the attractiveness of nuclear as an alternative to natural gas or coal despite the high construction and decommissioning costs and the current depressed natural gas prices.

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The lack of a permanent spent fuel repository is often cited as a further disadvantage of building new nuclear plants, but this argument may be largely illusory. It is true that the federal government has not met its statutory obligation to site and construct a permanent repository for spent nuclear fuel, but the spent fuel dilemma exists regardless of whether any new plants are built and will not be materially exacerbated by the addition of incremental plants. Moreover, by necessity, nuclear owners have proven that other, on-sight storage options can be safe and economic for the foreseeable future.

From a safety or environmental perspective, the 2011 Fukushima accident should not be a deterrent to building new nuclear generation. The plants at Fukushima were early iterations of designs that have been superseded by advanced approaches in new plants that use passive safety mechanisms. Any new reactors built in the U.S. would incorporate features that are tailored to preclude the types of failures that occurred at Fukushima. For instance, the Nuclear Regulatory Commission ("NRC") recently approved the design of Westinghouse's AP1000® reactor. During its review, the NRC determined that the AP1000 incorporates many of the features necessary to avoid a Fukushima-type disaster − *e.g.*, the use of passive design features that will cool the core, containment, and spent fuel pool for at least 72 hours without any operator action and require minimal operator actions to continue cooling beyond those first 72 hours. Similarly, AREVA's EPR reactor provides quadruple redundancy, and has safety features to ensure that the facility will resist earthquakes, flooding, fire, and airplane crashes. Essentially, these reactors operate under the concept that, in the event of a total loss of power such as occurred at Fukushima, the plant will achieve and maintain safe shutdown conditions without any operator action and without the need for an external power source or pumps.

Where Can Coal Fit In?

Given the abundance of domestic coal, the U.S. is unlikely to abandon coal entirely as a fuel to produce electricity. Nevertheless, the era of traditional coal plants and even advanced pulverized coal plants is undoubtedly waning. Integrated Gasification Combined Cycle ("IGCC") plants can, however, provide a more environmentally acceptable alternative for producing energy from coal while preserving a relatively low operating cost that permits them to achieve the higher capacity and availability factors required for baseload generation. By combining IGCC technology with carbon capture for storage or other disposition, utilities may be able to operate advanced coal plants with fewer GHG emissions than natural-gas fired plants and can compete economically, even at current low natural-gas prices. Although there has been limited experience with IGCC and carbon capture on large scales, several developers are currently pursuing these technologies. Summit Power, for instance, is constructing a 400 MW IGCC plant – the Texas Clean Energy Project – that will capture 90% of the CO_2 and provide a revenue stream from sales of the captured CO_2 to Whiting Petroleum Corporation for secondary oil recovery. Similarly, Southern Company is constructing a 582 MW IGCC plant in Kemper County, Mississippi that it anticipates will capture 65% of CO_2 emissions. Southern Company plans to sell the sequestered CO_2 in Louisiana for secondary oil recovery. One of the more aggressive business models involving coal gasification technology combined with the capture and sale of carbon dioxide emissions is Leucadia National Corp.'s proposed projects that involve transporting captured CO_2 from Indiana, Illinois, and Mississippi to Texas for sale to oil operations along the Gulf Coast. These innovative approaches should provide invaluable insight into the economics and technical feasibility of new coal technologies.

Even if the "IGCC plus carbon capture and sale" model proves to be technologically viable, the costs will likely be much greater than traditional coal plants, and the business model and market for selling carbon to third parties is uncertain. Finding a CO_2 buyer may be challenging, and new pipelines may be needed to transport the captured CO_2. Nonetheless, these technologies are worth investigating further.

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It may also be possible to design natural-gas plants that can incorporate coal gasification technologies, as Tenaska has proposed for its Taylorville Energy Center. The abundance of domestic coal resources together with low natural gas prices currently make such plants attractive. They can provide utilities with much-needed flexibility, giving them the ability to take advantage of today's cheap natural gas prices while also serving as a hedge against the possibility of future increases in gas prices.

Possible Merger Synergies

Future environmental regulations and associated regulatory compliance costs will likely produce relative winners and losers. Some generation providers with a more homogeneous fleet may become less viable as stand-alone entities. Instead of radically adjusting its own mix of resources, however, it may be more attractive to seek a merger partner that will produce a diverse resource mix in the combined company. Utilities with coal-intensive fleets could, for example, dilute the impact of increased regulation of coal-fired generation by merging with a utility that has a large nuclear or renewable portfolio. Given the huge investment that will be necessary to develop new clean generation, companies may be driven to mergers or joint ownership in order to spread large capital costs across a broader customer base or to enhance access to capital markets. Merged companies may also be able to take advantage of synergies in developing new technologies (*e.g.*, companies with nuclear or IGCC experience could provide that expertise to a merger partner that needs new baseload capability but lacks that development experience).

The trend of recent consolidations is likely to continue, but not without potential problems. The merged companies must have a shared vision of the future and similar or complementary cultures. Mergers will require state and federal regulatory approvals, and regulators have used their leverage with the merger partners to extract concessions intended to benefit customers. Less tangibly, a combined company may not be as nimble in taking advantage of technological innovations and may be more prone to promote centralized generation facilities while neglecting small-scale distributed generation opportunities.

Conclusion

It is no surprise that the industry is in a crucial state of flux. In considering how to shape their future generation fleet, it would be wise for utilities to pursue a variety of strategies while preserving as much flexibility as possible (*e.g.*, in President Obama's words, we need to pursue "all of the above"). Utilities should expect that innovations, technology, and regulations will evolve. Technologies that are available and seemingly attractive today may not seem so attractive even five years from now. To the extent that decisions must be made now about energy resources for the next 30 or 40 years, utilities should not foreclose other opportunities (*e.g.*, by locking into one technology and committing resources that cannot later be repurposed). Utilities should also be attentive to develop a balanced generation portfolio so that new regulations or price swings in fossil fuels do not negatively affect their operating costs. Additionally, utilities should remain mindful that generation is just one piece of the puzzle, and that demand-response, energy efficiency, and transmission may also be attractive supplements and/or alternatives to constructing new generation.

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