Electric Distributed Generation – A Challenge or Opportunity

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Introduction

Electric distributed generation (DG) or Distributed Energy Resources (DER) for many is a fairly new trend in the creation of heat and electric power. For others it is an opportunity for the implementation of new technologies that could change the electric industry and require consumers and utilities to be educated far beyond basic needs.

Distributed generation is the approach that employs small-scale technologies to produce electricity in close proximity to the consumers of power. DG technologies often consist of modular (and sometimes renewable-energy) generators and there are also a number of potential benefits that come with this technology because of its closeness to the consumer. In high cost areas, distributed generators can provide lower-cost electricity, higher power reliability and security with fewer environmental consequences than traditional power generators.

Distributed generation technologies also allow customers to receive energy from their own electric generation systems, rather than from traditional central power plants (i.e. coal, gas, or nuclear) at remote locations and then transmitted for miles to consumer load centers. What's more exciting about DG is that, customers can reduce their electric bills and be compensated for selling excess electricity on the grid through a Net Energy Metering (NEM) program or by contract.

When customers install distributed generation for personal use, they are required to coordinate the connection with their local utility company. To sell electricity to the grid, customers must comply with the local utility Interconnection Tariff and follow an Interconnection Process. An Interconnection Tariff details the regulations, conditions, and time frames associated with the Interconnection Process. The Interconnection Process ensures that the newly connected DG systems will have no adverse impacts on safety, reliability, and power quality of the utility's electric grid.

The recent dramatic growth and interest in distributed generation as well as efforts to connect to the distribution network has caused a surge in connection requests which makes many people nervous as they may impact the reliability of the grid. There are also a number of difficulties in navigating through the connection process.

There are many types and sizes of DG, including Combined Heat and Power (CHP) plants, solar, wind, hydro electric power, or one of the many new smaller generation technologies. Customers must work to ensure that the development of DG receives equal treatment through the way networks are operated and regulated.

New Technological Beginnings

The Carter administration worked with Congress to pass the Public Utility Regulatory Policies Act (PURPA) in 1978 in response to the 1973 energy crisis. This effort brought about many consequences for power companies by challenging the monopoly utility status. The creation of multiple advanced technologies led to further concerns with security, reliability and renewable energy. Secondly, electric deregulation had a profound impact on energy prices in higher priced states. Thirdly, PURPA challenged the control of the power company, allowing retail electric markets to become supermarkets for energy.

Therefore, PURPA has helped to create a change movement within the utility environment.

In addition to the PURPA law came research on technologies favoring the environment such as, water, wind or solar and recently battery storage. It has been successful for promoting reduced power costs, especially in solar energy. More significantly, it contributed to advancements in wind power technology further lowering costs to be more competitive.

These types of small-scale generation technologies have challenged the established model for the electric utility industry that for many years depended on large-scale use. Today, DG power can produce modest amounts of electricity that is now more economically viable. Also, because they are smaller, less time is needed to build them and less capital is at risk during periods of construction. Finally, with consumption growth rates down between 1 to 3 percent a year, consumers could use smaller boosts in power to match demand.

Technological advancements also foster increased competition which could also benefit stakeholders in the electric utility industry.

Some researchers and policy analysts believe that utility regulation is still important and traditional oversight is just as important. Natural monopolies created for and by power companies may no longer be needed, if non-utilities are allowed to produce power at a lower cost than larger monopoly companies. So the question may not be if electric monopolies will be needed in the future, but what will become of the electricity monopoly? What model or models will emerge if technology and price continue to converge? What policy changes will be needed at the federal and state level to usher in this new model?

The Energy Policy Act, passed by Congress in 1992 determined that competition and increased domestic fuel production would be allowed to expand. It was also meant to address the improvements needed in energy efficiency. More specifically, one provision gave states the option of conceptualizing a transmission network for use by competitive electricity providers. The network now serves as a common carrier so any electricity producer may sell power to any customer. In actuality, the law allows competitive electricity providers the right to compete at the retail level in the states or in different states.

Distributed Generation – The Era of Dynamic Growth

There are many types and sizes of DG expanding for quick and extended growth in the number of individuals and producers seeking to connect to the distribution network. There is also major concern for the protection of customers who are challenged with difficult choices. Numerous and difficult issues could prompt consumers to make bad and costly decisions that cannot be sustained. Some experts believe new technologies like rooftop solar and net metering can reduce the value of the traditional utility. In fact, distributed generation can be seen as a potential threat to the traditional electric utility model.

Distributed generation is seen as a disruptive technology in this time of aging infrastructure and the challenges include the current regulatory model and an aging workforce, declining revenue and growth prospects. Moreover, with new technology comes renewed growth and participation by consumers looking to control consumption. Now that solar panels and other small-scale technologies are more affordable, consumers may be able to produce energy and use it more wisely. This type of technology could save money and reduce consumer impact on the environment.

In fact, new technologies could reduce the amount of power purchased from the grid and the economic incentives could cause an increase in customer participation. This reduction in consumption would require the utility to maintain and operate the grid across a smaller customer base, causing the rates to remaining customers to increase. High deployments of distributed generation could lower utility revenues and profits which would make future dividend payments less certain. This is especially true for utilities with large base-load power generation assets including coal and nuclear power plants.

The theory is, the higher the participation in DG programs (i.e. solar rooftop programs, small wind generation systems, etc), the more vulnerable the utility is. Some of the main issues include:

1. Getting the policy right (e.g.net metering, tax benefits, cost shift, etc.) and technological innovation support,
2. Leasing, financing and tax incentives could increase the threat for utilities by decreasing upfront costs and increasing the potential DG customer participants, and
3. Fast ramping innovation, products and services for large scale deployment could build competitive advantage.

Pricing

Understanding the costs and benefits of distributed generation is a significant issue for the energy industry and according to the Federal Energy Regulatory Commission (FERC), balancing the cost and benefits will be what determines consumer cost for new energy infrastructure development or paying for costs that may be unnecessary. To translate the cost and benefits of DG energy services is a critical aspect to ensuring better technology integration and economic decisions for maximizing or minimizing functions facing constraints. When considering the costs and benefits of DG, it must be evaluated in its entirety to understand the tradeoffs among stakeholders and who will be affected the most.

Currently, NEM policies in many states allow customer generators to be compensated at the utility's full retail rate (using volumetric kilowatt-hour charges) for excess generation supplied to the grid. However, this allowance includes credits for the total cost of providing service (Customer, Distribution, Transmission and Generation charges) as these costs are included in the full retail rate charged by utilities.

This practice is considered a critical flaw by some because historically the costs for providing infrastructure and service has been bundled for simplicity into a single kilowatt-hour charge and its collection has been spread out over tens of years. However, noe these costs need to be separated to transparently show the actual costs incurred in order to properly compensate customer generators and utilities for the services that are provided.

Until the costs of providing service are properly allocated, providers cannot be properly compenstated and some customer groups will be inappropriately subsidizing others.

It is also important to include lost revenue from customers serving their own load with DG, the costs of utility incentives paid to DG customers, and the estimate of integration costs. Distributed generation is becoming more cost competitive with conventional generation technologies, but it is still more expensive and strongly dependent on mandates and subsidies for its economic viability.

Are There Benefits?

Distributed generation can be owned and operated by utilities or their customers and provide many long-term benefits to technology owners and the power grid. Experts at Oak Ridge National Laboratory examined the technical obstacles, deployment, and economic issues surrounding distributed generation and believe in the existing electric power delivery system and its importance to the U.S. economic and social infrastructure. The experts also proposed an increased role in distributed energy resources (DER). However, some system changes are not welcomed by many in the utility industry. Though change is nothing new for the industry, change may be good for regulation, securitization, and reliability.

There are approximately sixteen states and the District of Columbia implementing renewable portfolio standards with specific language addressing expanded DG provisions. Some of the provisions require a specific amount of retail electricity sales to come from renewable DG by 2020. Some utilities view DER as threats because of possible stranded costs, reductions in revenues and increased costs of safety and security issues. The potential for societal benefits of DER, include the following:

- Generation efficiency improvements from the use of waste heat;
- Reductions in transmission and distribution line losses;
- Increased energy security;
- Environmental improvements;
- Localized voltage and reactive power support.

These public policy benefits are deemed necessary and worthy of investment. However, an interest in the common good is not usually a good reason to invest. Investments which increase savings to the consumer are measured in value to the utility such as, reduced electric line losses; reduced upstream congestion; grid investment deferment; improved grid asset utilization; improved grid reliability; and ancillary services such as voltage and reactive power support, contingency reserves, and black start capability. These small cost improvements have low to no value in today's markets and the cost benefits are difficult to calculate.

It is important for some to assign an economic value to DER benefits because the assessment of these benefits can be used to attract ownership and expand the market and technical aspects of improvements made by DER deployment. Quantifying the benefits to utilities is needed to counter the sentiment that revenues could be reduced with deployment of DER. There are also social benefits such as green power and increased efficiency that helps quantify the benefits of new technologies.

The grid has and will continue to experience many challenges and opportunities in the near future; and its growth is not inevitable.

Policy and regulatory changes are key in certain areas including:

- Energy industry efforts and information sharing.
- FERC authority of effective transmission sitting.
- Measured adjustments to expand retail prices that echo actual costs.
- Fixed costs that are recovered by fixed customer billed charges.
- Focused, industry-led RD&D efforts & information sharing are necessary; and
- Grid cyber-security oversight.

Great Expectations

Electric utilities should expect changes to occur in the coming years that reflect these major issues. Utilities and generators should expect to see a continuation of plans to close inefficient coal-fired plants however, careful adjustments to new power supply as entering into power purchase agreements (PPA) or building new resources should be measured and approached very carefully.

When utilities opt not to build/invest, they forfeit future revenue also known as return on investments. Utilities do not profit from PPA's because they did not make the investment and therefore cannot receive a return the investment.

Also, state regulators must review policies like NEM that support customer sited generation. Utilities focus changes based on costs and their bottom line and carefully watch policies that accelerate any industry which supports distributed generation but shift costs to non-participants.

DER has the potential to increase reliability, however, the coordination and interconnection of specific resources at specific locations on the grid will determine whether there is improvement or degradation in the customer experience.

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