Distributed Generation (DG) White Paper

Distributed Generation (DG) is one of the main components that will help solve the problems with the grid. DG is perfect for small to large scale commercial, industrial customers, multi-tenant properties, municipalities, and of particular benefit to power companies. I think everyone is concerned with the continuous power outages.

The grid only seems to have problems in the winter, spring, summer and fall, so yes all the time.

DG Explained

Distributed Generation, also distributed energy, on-site generation, or district / decentralized energy, is electrical generation and storage performed by a variety of small, grid-connected or distribution system-connected devices referred to as distributed energy resources (DER). Conventional power stations, such as coal-fired, gas, and nuclear powered plants, as well as hydroelectric dams and large-scale solar power stations, are centralized and often require electric energy to be transmitted over long distances. By contrast, DG / DER systems are decentralized, modular, and more flexible technologies that are located close to the load they serve, albeit having capacities of only 10 megawatts or less. These systems can comprise multiple generation and storage components. In this instance, they are referred to as hybrid power systems, creating a hybrid MicroGrid System. Power Companies that embrace the DG Systems will have more power stability, better ability to meet future power demands and build a reliable backup system that they own and control.

DG systems typically use renewable energy sources, including solar power, bioenergy, geothermal power and wind power and increasingly play an important role for the electric power distribution system. A grid-connected device for energy storage can also be classified as a DER system and is often called a distributed energy storage system (DESS). By means of an interface, DER systems can be managed and coordinated within a smart grid. Distributed generation and storage enables the collection of energy from many sources and may lower environmental impacts and improve the security of supply. In the battle of the batteries, we believe Lithium has already lost the battle. Newer, safer and more resilient technologies are superior. This includes Lead Crystal and Capacitor Storage Systems. Battery Storage Systems have a place in the MicroGrid systems but we feel that having more power generation capacity is more cost effective.

MicroGrids are localized, small-scale grids, contrary to the traditional, centralized electric grid (macrogrid). Microgrids can disconnect from the centralized grid and operate autonomously, strengthen grid resilience, and help mitigate grid disturbances. Microgrids increasingly employ a mixture of different distributed energy resources, such as solar hybrid power systems, which significantly reduce the amount of carbon emitted.

Energy Storage - *Grid energy storage*

A distributed energy resource is not limited to the generation of electricity but may also include a device to store distributed energy (DE). Distributed energy storage systems (DESS) applications include several types of battery including Lithium, Lead Crystal Batteries and Large Scale Capacitor Systems. Access to energy storage for commercial applications is easily accessible through programs such as energy storage as a service. (ESaaS). Energy Storage as a Service allows a facility to benefit from the advantages of an energy storage system by entering into a service agreement without purchasing the system. Energy storage systems provide a range of services to generate revenue, create savings, and improve electric resiliency. The operation of the ESaaS system is a unique combination of an advanced battery storage system, an energy management system, and a service contract which can deliver value to a business by providing reliable power more economically.

Energy Management System

An energy management system (EMS) is a system of computer-aided tools used by operators of electric utility grids to monitor, control, and optimize the performance of the generation or transmission system. Also, it can be used in small scale systems like microgrids. As electric vehicle (EV) charging becomes more popular smaller residential devices that manage when an EV can charge based on the total load vs total capacity of an electrical service are becoming popular.

Waste To Energy - *Waste-to-energy and Waste-to-energy plant*

Municipal solid waste (MSW) and natural waste, such as sewage sludge, food waste and animal manure will decompose and discharge methane-containing gas that can be collected and used as fuel in MCHP / CHP systems to produce electricity as a distributed energy resource. Companies like Impact Bioenergy has developed a process that transforms natural waste materials, such as sewage sludge, into biofuel that can be combusted to power MCHP / CHP systems to produce power. This power can be used in lieu of grid-power at the waste source (such as a treatment plant, farm or dairy). This is a way to reduce waste and associated costs like dumpster costs and pickup charges while generating power and repurposing waste heat.

Overview (Central Power Plants)

Historically, central plants have been an integral part of the electric grid, in which large generating facilities are specifically located either close to resources or otherwise located far from populated load centers. These, in turn, supply the traditional transmission and distribution (T&D) grid that distributes bulk power to load centers and from there to consumers. These were developed when the costs of transporting fuel and integrating generating technologies into populated areas far exceeded the cost of developing T&D facilities and tariffs. Central plants are usually designed to take advantage of available economies of scale in a site-specific manner, and are built as "one-off," custom projects.

These economies of scale began to fail in the late 1960s and, by the start of the 21st century, Central Plants could arguably no longer deliver competitively cheap and reliable electricity to more remote customers through the grid. CHP is a reliable and cost effective solution to supplement the Grid. The grid had become the main driver of remote customers' power costs and power quality problems, which became more acute as digital equipment required extremely reliable electricity. Efficiency gains no longer come from increasing generating capacity, but from smaller units located closer to sites of demand.

The development of DG Microgrid Systems arose out of:

1. concerns over perceived externalized costs of central plant generation, particularly environmental concerns;
2. the increasing age, deterioration, and capacity constraints upon T&D for bulk power;
3. the increasing relative economy of mass production of smaller appliances over heavy manufacturing of larger units and on-site construction;
4. Along with higher relative prices for energy, higher overall complexity and total costs for regulatory oversight, tariff administration, and metering and billing.

Capital markets have come to realize that right-sized resources, for individual customers, distribution substations, or microgrids, are able to offer important but little-known economic advantages over central plants.

DG will be instrumental in meeting future power demands and is a good mesh with the traditional power grid. Innovation, competition, and more flexible financing, make DG clean energy part of a more diversified future.

DG reduces the amount of energy lost in transmitting electricity because the electricity is generated very near where it is used, perhaps even in the same building. This also reduces the size and number of power lines that must be constructed.

Typical DER systems have low maintenance, low pollution and high efficiencies. Modern Embedded Systems can provide these traits with automated operation and renewable energy, such as solar, wind and geothermal. This reduces the size of power plant that can show a profit.

Distributed energy resource (DER) systems are small-scale power generation and / or storage technologies (typically in the range of 1 kW to 10,000 kW) used to provide an alternative to or an enhancement of the traditional electric power system.

Distributed Generation in the United States

The use of distributed generation units in the United States has increased for a variety of reasons, including:

- Renewable technologies, such as solar panels, have become cost-effective for many homeowners and businesses.
- Several states and local governments are advancing policies to encourage greater deployment of renewable technologies due to their benefits, including energy security, resiliency, and emissions reductions.
- Distributed generation systems, particularly combined heat and power and emergency generators, are used to provide electricity during power outages, including those that occur after severe storms and during high energy demand days.
- Grid operators may rely on some businesses to operate their onsite power generation to maintain reliable electricity service for all customers during hours of peak electricity use.

Distributed generation systems will provide the ability to meet future power demands, along with powering financial growth for power companies that embrace DG as a part of their business growth strategy.

Power (CHP) Generation

Does your industry need a lot of hot water, steam or heat? MCHP / CHP can help. CHP systems create heat in the power production process that can be repurposed to preheat water for boilers, space heating, water heaters or other heat applications to maximize energy efficiency. It's an easy way to help your organization save money and really move the needle toward your energy efficiency goals.

CHP: More usable energy from the same amount of fuel

Maybe you're struggling to lower your plant's greenhouse gas (GHG) emissions. Or having a hard time keeping up with demand because your current boilers are outdated and inefficient. Or you want to install a microgrid so your equipment doesn't go down when there's an unplanned outage, but you need constant energy to cover your base load. Perhaps the idea of training your team to maintain state-of-the-art power generation equipment seems like a hassle. Or maybe it's hard to get stakeholders onboard with large capital investments because typically those projects tie up resources without immediate benefits.

Whether you're manufacturing, compounding pharmaceuticals or providing hot water for a hospital or college dorm, CHP might be a good choice for you. It's a dependable technology and it's been used for more than 100 years. CHP (sometimes referred to as cogeneration) was used in 1882 as part of Thomas Edison's first U.S. commercial centralized power plant.

So how does it work? First, we evaluate your processes for CHP opportunities. Our engineers will see if byproducts from your processes can be used to generate other things you need. Then, we'll craft a solution and financing program that fits your needs.

What are the benefits of distributed generation? The U.S. Department of Energy released a report outlining some of DG's advantages. "See Attached Document".
Here's what they came up with:

- Increased electric system reliability
- An emergency supply of power
- Reduction of peak power requirements
- Offsets to investments in generation, transmission, or distribution facilities that would otherwise be recovered through rates
- Provision of ancillary services, including reactive power
- Improvements in power quality
- Reductions in land-use effects and rights-of-way acquisition costs
- Reduction in vulnerability to terrorism and improvements in infrastructure resilience

Increased reliability, better performance

One way to think about the benefits of distributed energy is to visualize your cell phone's network. Imagine for a moment that your carrier had only a few towers in just a few spots around the country. The towers would be massive and powerful, but you wouldn't have the same reliability and coverage that you have now. The reasons should be obvious. With a network of smaller, more evenly placed towers, cell-phone carriers are able to provide the best service possible to their customers.

Distributed generation is no different. When centralized power plants transmit energy over long distances, some of that energy is lost. With distributed generation, the generators are closer to those who use the energy. Thus, there's less waste and increased efficiency. In the old model, a loss in service at any point of the grid means everyone suffers. In the new model, that's less likely to happen.

DG can also serve as a backup to the grid, acting as an emergency source for public services in the case of a natural disaster. That kind of service could be invaluable after a tornado. And by producing energy locally, DG systems can reduce demand at peak times in specific areas and alleviate congestion on the main grid.

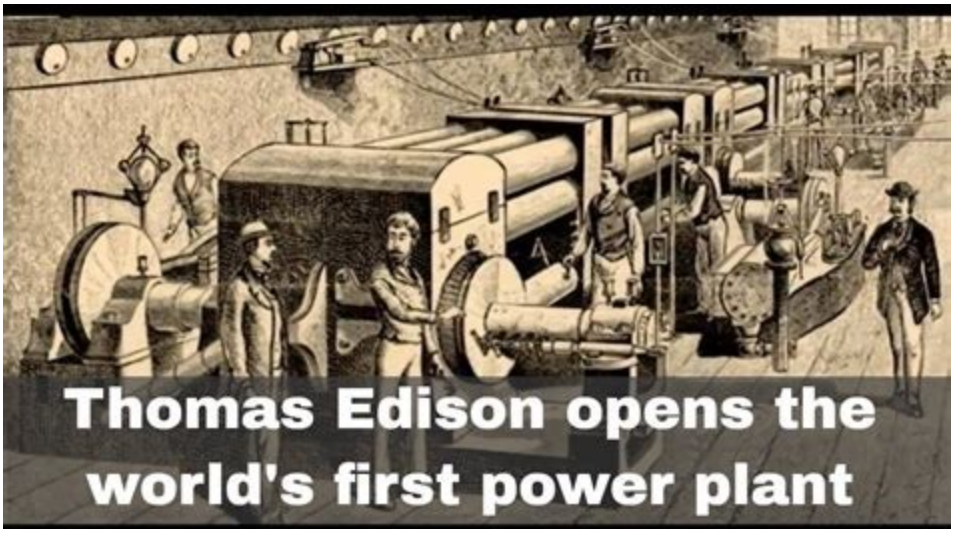
Finally, because distributed energy tends to come from renewable sources, it's good for the environment. Using more renewables means lowering emissions. And lowering emissions makes the world a more enjoyable place for all of us.

Don't worry. If you qualify, we'll finance your CHP project so you can boost efficiency, lower emissions and reduce your overall energy cost – without upfront capital. We can even help run and maintain your CHP plant. You won't need to train or add personnel to your team.

DG 101 for Utility Companies

I think everyone is concerned with the continuous power outages.

- The National Grid has problems with constant outages and can not keep up with demand. This summer there will be blackouts stemming from AC demand. The thought of adding electric cars in mass is just plain ridiculous without preparing for the increased power demand.
- Distributed Generation (DG) is the answer to supplement Grid Power. It can quickly add power generated from onsite power production to mesh with the grid. Power Companies can use Micro or large Combined Heat & Power (MCHP / CHP) and Solar to provide power for small to medium commercial customers and Large CHP and Solar Systems can transfer the load from the Grid to the power production at the customers location quickly increasing the ability to meet greater power demands.
- Building more large power plants is a long process and no income comes from these power plants until they go online. MCHP / CHP and Solar are quick to implement and thus quick to cashflow.
- Power Companies that adapt DG and mesh the technology with the existing grid will benefit greatly. DG is the next natural transition for power production. DG integrates well with the Grid.
- Power Companies that purchase and implement DG benefit from rapid deployment, up to 26% ITC Credits, bonus depreciation, a quick ROI, dependable power for their customers and still maintain the revenue from the customer.
- DG power has the potential to be a significant backup power source. Here is an example using just 100MW of power transferred from traditional power generation to DG. Using CHP and Solar in combination in a DG Microgrid would allow monitoring of the power being used and the capacity to draw in any unused power to the grid from the DG Microgrid. The cost of implementing a DG Microgrid is well below building new power plants. The cost would allow for putting in DG with future power needs in mind or as a backup when needed. In the example of 100MW implemented, it might have only a 50MW average demand thus leaving 50MW capacity for other needs. This is less costly than battery backup measures, operates “On Demand: and is very reliable and scalable as needed.
- There will be some challenges to meshing DG with the Grid. There will be much bigger challenges if you don’t.



Power Production has come a long way since 1882

…. and the journey is just beginning.

Utility Saving Solutions
Saving Money, Energy, and our Planet

Utility Saving Solutions
www.UtilitySavingSolutions.com
Phone: 678.820.4996