Microgrids and Energy Security: The Business Case

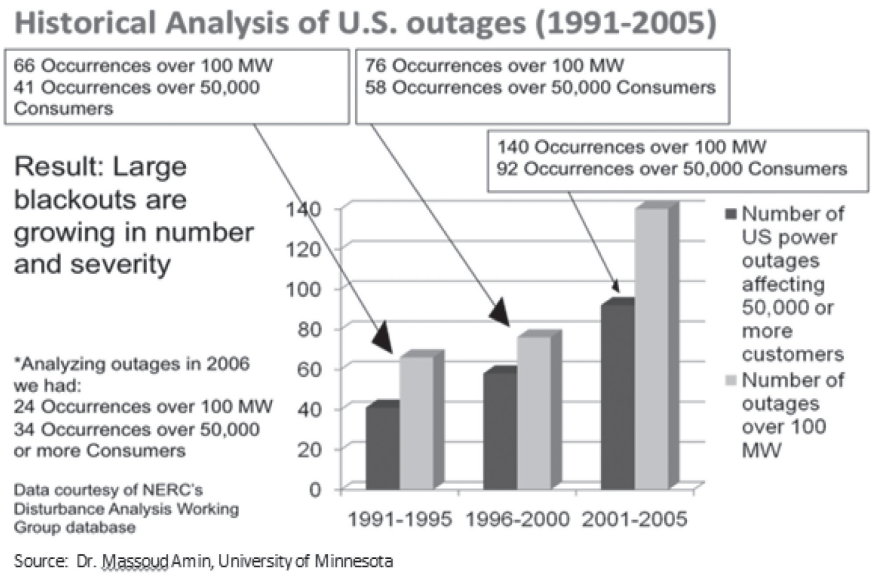
By Angelique Mercurio*

Introduction

In an increasingly technology-dependent society with growing energy needs, disturbances in electricity supply and quality can have severe implications daily. They can cause significant losses of information, efficiency and productivity as interruptions crash computers and the critical services reliant upon them, such as life support systems, or cause automated equipment to shut down completely.

Both power supply and quality play an important role for U.S. businesses and government agencies. Power outages cost the U.S. approximately $104-$164 billion annually, half of which are specifically felt by the industrial sector and digital economy. Even brief outages can damage equipment or idle labor, which wastes critical resources, and losses can have further effects for downstream firms.

Losses from outages are increasing over time due to congestion and a lack of investment in transmission infrastructure. In the second half of the 1990s, there were 41% more outages than in the first half affecting 50,000 or more consumers. Further, U.S. power outages affecting 50,000 or more customers rose from 197 to 312 from the 2001-2005 period to the 2006 to May 2010 period. There is a clear need for a stronger electrical grid. Microgrids offer substantial resiliency and cost-savings benefits. Governments, businesses, and educational institutions are exploring microgrid technology as a potential avenue to securing a more reliable energy future.



Source: Dr. Massoud Amin, University of Minnesota

Market Drivers

In the wake of increasing blackouts and brownouts, and particularly after facing the recent power outages caused by Hurricane Sandy, the need for a more reliant grid is undeniable. One solution is to consider isolated systems that consist of distributed energy sources, which can be conventional, renewable, storage, etc. These systems—microgrids—operate either independently or parallel to the main grid, and help ensure reliable energy supply for consumers while also reducing the stress felt by the larger transmission and distribution system.

Microgrids can offer efficiency benefits as resources are optimized independently, and can also increase security measures to protect against cyber and physical attacks, reducing how many consumers such attacks affect. In addition to these quality and resiliency benefits, microgrids can also accelerate deployment of cleaner fuel sources.

There are critical factors that drive demand for microgrids, including cyber security, growing energy demand, and the general need for more secure electricity. Reliance on modern technology continues to increase, which makes power systems vulnerable to cyber attacks with particularly drastic implications for research labs, educational campuses, and the military. Reducing outages and increasing quality of energy supply can significantly benefit sectors that are reliant upon constant power supply, such as data centers, infrastructure critical to national security, and critical service providers such as hospitals.

Market Trends and Potential

As prices for certain distributed renewables, particularly solar photovoltaics, continue to decline, interest in microgrids is rising. Dozens of pilot projects have proven successful, and as the ability to island from larger utilities when necessary is becoming increasingly apparent, the market is moving into full-scale commercialization.

The last few years have been characterized by an increase in microgrid uptake as new vendors enter the market. According to Navigant Research, a total

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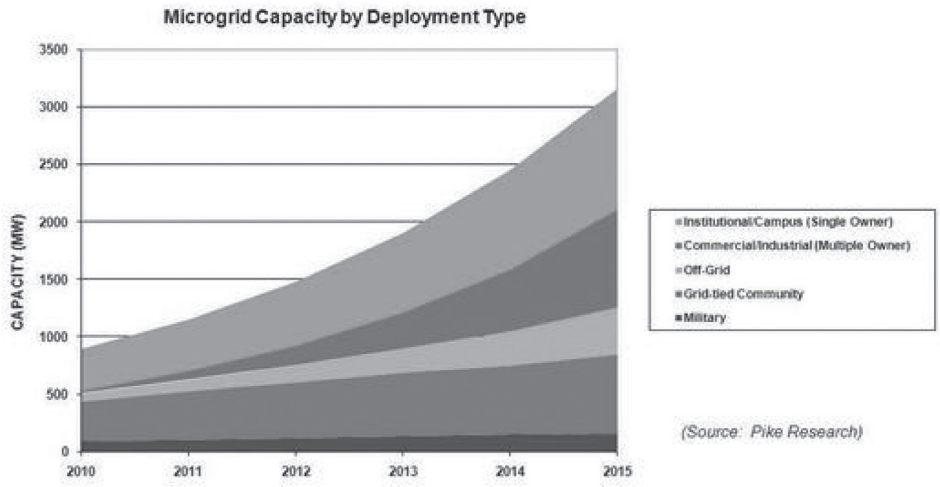
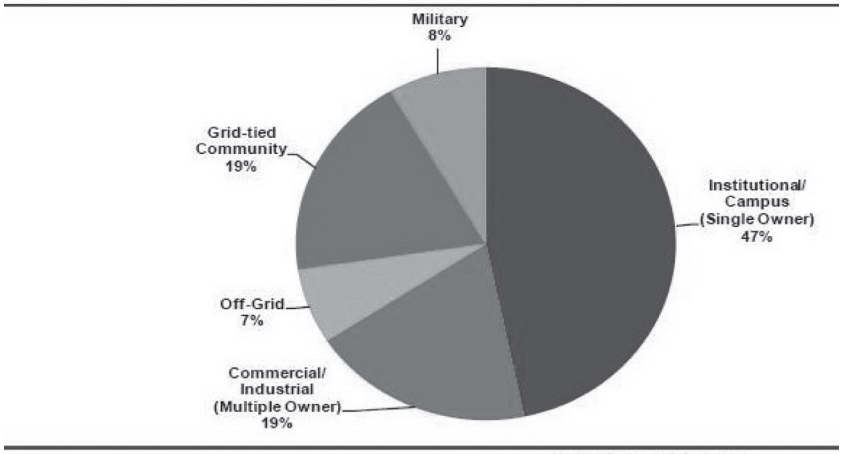


(Source: Pike Research)

of 3,793 MW of global microgrid capacity existed as of 2Q 2013 compared to 2,179 MW in 4Q 2012. Leading the world market, North America has a planned, proposed, and deployed capacity of 2,505 MW, 66% of global capacity, including an additional 55 projects from 4Q 2012 to 2Q 2013. North America currently has 1,459 MW online and more than 1,122 MW planned, proposed, or under development. In terms of aggregate capacity, the U.S. has particularly represented the best market for all microgrid segments. The following chart illustrates overall microgrid capacity by deployment type.

Market Sector Revenue Breakdown, North America: 2015



(Source: Pike Research)

While reliability and security are clearly energy priorities for the government sector, especially for the military, commercial institutions may find microgrids attractive also from a revenue generation perspective. Navigant Research projects that, globally, revenue from microgrid deployment could reach just under $10 billion in 2013, and potentially increase to more than $40 billion annually by 2020. The following chart breaks down revenue generation projections for 2015 by sector.

Recent Applications and Success Stories

The Military

Military bases are seeking to maintain operations despite disruptions in the larger grid as the U.S. Department of Defense (DoD) works to mitigate energy security threats. More than 40 DoD military bases currently either have operating or planned microgrids, or have pursued demonstrations or studies, according to the Secretary of Defense. Pike Research projections indicate that U.S. military microgrids for stationary bases could potentially reach 54.8 megawatts by 2018.

Fort Bliss, Texas

In May 2013, the U.S. Army launched its first grid-connected microgrid demonstration at Fort Bliss, Texas, integrating renewable resources and energy storage. The $2.4 million project, funded through the DoD's Environmental Security Technology Certification Program, will integrate 120 KW of solar, 300 KW of energy storage, grid interconnection, on-site backup generators, and a control system.

The project aims to reduce greenhouse gas emissions and energy costs while also offering energy security benefits by allowing the base to operate off the grid, reducing the risk of power outages and cyber security attacks. Costs will be lower and energy storage will enable peak-demand to be met. The demonstration phase is set to continue through July.

Campuses

Institutional campuses are also beginning to implement microgrids to help reduce energy use. According to Pike Research, total installed generation capacity strictly for campus microgrids will increase by 164 percent from 2011 to 2017. The market for campus microgrids could reach $777 million by 2017. The following chart demonstrates the potential increase in campus microgrid planned capacity from 2011 through 2017.

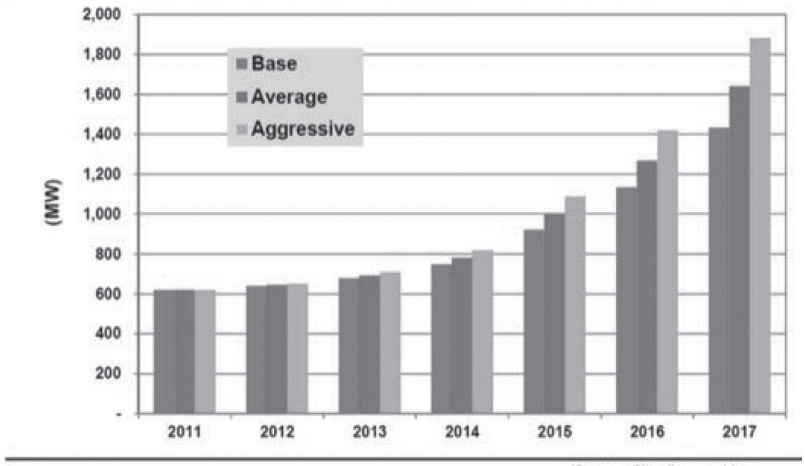
Santa Clara University

Santa Clara University became one of the first universities in the Bay Area to launch a smart microgrid, a project that is estimated to reduce energy consumption by 50 percent and to save approximately 20 percent in energy costs.

Consisting of a 1-megawatt solar PV system, a wind turbine, a 60-collector solar thermal system, and a smart microgrid system that regulates the campus sources, the Santa Clara University system will manage and optimize energy on the campus from production to storage to consumption.

Not only is the university able to better manage its energy sustainability and reliability, but the system gives them the best return on investment for its 106-acre campus. The university has been able to grow its campus size by 30% while still reducing energy costs and use.

Chart 1.1 Campus Microgrid Planned Capacity by Scenario, World Markets: 2011-2017



(Source: Pike Research)

Utilities

Electric utilities have approached microgrids in a variety of ways. While some remain skeptical, many have moved forward with projects despite significant obstacles. U.S. utilities that have pursued microgrid activities include San Diego Gas & Electric (SDG&E), American Electric Power (AEP), Sacramento Municipal Utility District, DTE Energy, and Consilidated Edison. However, because the most prominent obstacle for utilities in this case is justifying costs passed on to ratepayers, the business case still needs to be thoroughly explored and quantified.

Conclusion

The market for microgrids in the U.S. is moving towards full-scale commercialization. There are not only reliability and security benefits, but revenue generation and cost-savings opportunities as well. There remains tremendous potential particularly for industrial and educational campuses as well as the commercial and industrial sectors. As governments continue to aim to meet clean energy deployment goals while reducing energy costs, microgrids offer an attractive option.

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