

RESEARCH REPORT

Executive Summary:

Remote Microgrids

Commodity Extraction, Physical Island,
Village Electrification, and Remote Military Microgrids:
Global Market Analysis and Forecasts

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Section 1

EXECUTIVE SUMMARY

1.1 Remote Microgrids Overview

The fledgling electric utility companies that emerged after Thomas Edison opened his small Pearl Street, New York City power station in 1882 originally focused on microgrids, small-scale electricity networks that operated as if an island of power service. Edison envisioned the electric utility industry would involve small firms generating power for individual businesses through such networks. By 1886, Edison’s firm had installed 58 microgrids – all running on direct current (DC) – and some 500 isolated DC lighting plants in the United States, Russia, Chile, and Australia.

During the course of the early 20th century, these remote microgrids, which were not interconnected to a larger grid network and were offered by competing entrepreneurs, gave way to a monopoly system featuring centralized power plants that distributed power over radial high-voltage transmission lines owned by utilities. While the world has changed during the past century, one could argue that the same kind of remote microgrids first developed by Edison now represent one of the largest markets for smart grid innovation and distributed energy resources (DER). However, today’s remote microgrids target niche markets such as commodity extraction facilities not connected to an existing grid, physical islands burning diesel fuel for power, rural villages in the developing world, and mobile and tactical applications for military agencies.

The key market drivers of today’s remote microgrid market are as follows:

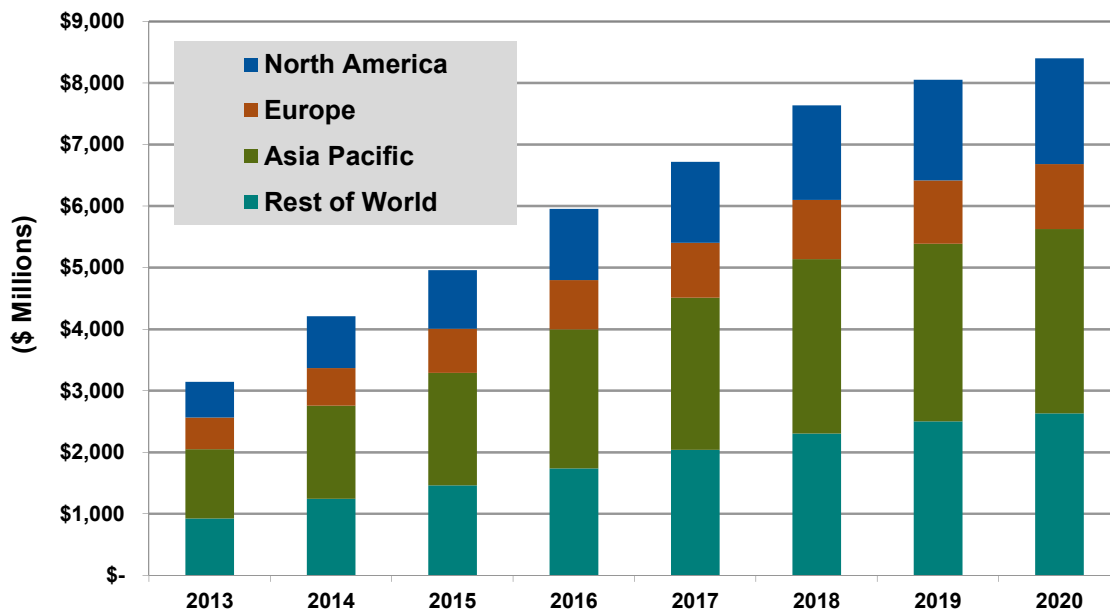
- » Declining cost of solar photovoltaic (PV) technologies
- » Rising costs of diesel fuel, the default generation choice for much of the developing world and for physical and commodity extraction off-grid applications
- » Investments in more advanced energy storage options, many of which are ideally suited for remote microgrid applications
- » Efforts by non-governmental organizations and governments to provide universal access to energy in the developing world
- » Efforts by large technology companies, such as ABB, Boeing, General Electric (GE), Lockheed Martin, Siemens, Samsung, SMA, and Toshiba, to secure a place in the emerging microgrid market
- » Growing interest among financial institutions on new business models for energy delivery, including onsite power generation
- » The proliferation of cell phone usage, which is prompting demand for electricity in remote regions of the world, providing a model of technology dispersal that mimics the Internet and is more aligned with microgrids than traditional utility distribution systems

The International Energy Agency (IEA) estimates that by 2020, developing countries will need to double electrical power output. Demand for energy, especially electricity, is growing more rapidly in these nascent economies than the rate of expansion of conventional electricity grids in the major industrialized world. All told, the developing nations will represent 80% of total growth in energy production/consumption by the year 2035. One could safely assume that the majority of these new power supplies will be produced and distributed via remote microgrids and other related forms of DER.

The remote microgrid market epitomizes the promise and the perils attached to new business models that shake up the status quo. Although the term microgrid once applied almost exclusively to off-grid hybrid systems, it now refers more commonly to grid-tied systems that deploy smart grid technologies. From a vendor revenue perspective, remote systems are remarkably robust because of assumed 24/7 performance, which requires significant investments in both hardware and software. On a per-kilowatt basis, remote microgrids represent a 50% to 100% cost premium over equivalent grid-tied microgrid installations; therefore, the smaller the system, the higher the per-unit value.

Just how valuable is the remote microgrid market? As illustrated in Chart 1.1, the conservative scenario created by Navigant Research suggests that this market already exceeds \$3 billion in hardware and software sales and will grow to more than \$8 billion by 2020. Until then, Asia Pacific and the Rest of World regions, including Latin America, Africa, and the Middle East, will increase their respective market shares.

Chart 1.1 *Total Remote Microgrid Revenue, All Segments, Conservative Scenario, World Markets: 2013-2020*



(Source: Navigant Research)

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Section 10

SCOPE OF STUDY

Navigant Research has prepared this report to provide participants in the remote microgrid market, including project developers, utilities, hardware and software vendors, equipment vendors, utilities, software companies, installation and service providers, and other balance of system component manufacturers, with a study of the market potential for remote microgrids – the least understood and least visible of all microgrids. The major objective of this report and market forecast is to determine the status of this emerging industry and the potential future growth of four distinct segments: commodity extraction systems, physical island systems, village electrification systems, and remote military microgrids. The report pulls together a review of proposed and currently operating projects globally and identifies the major demand drivers. Navigant Research also profiles key industry players operating within the competitive landscape, with a special emphasis on unique firms focusing specifically on huge opportunities for growth in the developing world.

This report's purpose is not to provide an exhaustive technical assessment of all of the technologies and industries that may be deployed in microgrids – renewable distributed energy generation, storage, inverters, and other components. Rather, it aims to provide a strategic examination of the market for remote power systems that integrate variable renewable energy resources into the component and deployment mix.

Navigant Research strives to identify and examine new market segments to aid readers in the development of their business models. All major global regions are included (North America, Europe, Latin America, Asia Pacific, and the Rest of the World) and the report looks out through 2020. While the market forecast is shaped by updates to the Navigant Research *Microgrid Deployment Tracker*, estimates of existing capacity are also based on projections from leading companies revealing projected project portfolios during the forecast period. Since there is no available public database of microgrid projects, this report draws on original Navigant Research interviews and secondary research to make market forecast projections under three different scenarios: base, conservative, and aggressive.

SOURCES AND METHODOLOGY

Navigant Research's industry analysts utilize a variety of research sources in preparing Research Reports. The key component of Navigant Research's analysis is primary research gained from phone and in-person interviews with industry leaders including executives, engineers, and marketing professionals. Analysts are diligent in ensuring that they speak with representatives from every part of the value chain, including but not limited to technology companies, utilities and other service providers, industry associations, government agencies, and the investment community.

Additional analysis includes secondary research conducted by Navigant Research's analysts and its staff of research assistants. Where applicable, all secondary research sources are appropriately cited within this report.

These primary and secondary research sources, combined with the analyst’s industry expertise, are synthesized into the qualitative and quantitative analysis presented in Navigant Research’s reports. Great care is taken in making sure that all analysis is well-supported by facts, but where the facts are unknown and assumptions must be made, analysts document their assumptions and are prepared to explain their methodology, both within the body of a report and in direct conversations with clients.

Navigant Research is a market research group whose goal is to present an objective, unbiased view of market opportunities within its coverage areas. Navigant Research is not beholden to any special interests and is thus able to offer clear, actionable advice to help clients succeed in the industry, unfettered by technology hype, political agendas, or emotional factors that are inherent in cleantech markets.

NOTES

CAGR refers to compound average annual growth rate, using the formula:

$$\text{CAGR} = (\text{End Year Value} \div \text{Start Year Value})^{(1/\text{steps})} - 1.$$

CAGRs presented in the tables are for the entire timeframe in the title. Where data for fewer years are given, the CAGR is for the range presented. Where relevant, CAGRs for shorter timeframes may be given as well.

Figures are based on the best estimates available at the time of calculation. Annual revenues, shipments, and sales are based on end-of-year figures unless otherwise noted. All values are expressed in year 2013 U.S. dollars unless otherwise noted. Percentages may not add up to 100 due to rounding.

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