Markets for Sensors for the Smart Grid-2014
Nano-731

NanoMarkets, LC
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OBJECTIVES AND SCOPE OF THIS REPORT

- The "smart grid" is still in an early stage of deployment, but is evolving to suit advanced sensor technologies. Smart grids require multiple sensing, monitoring, and control functions at various levels—thus presenting several opportunities for smart grid sensors going forward. Not all these opportunities are available immediately. Also, once developed, these sensing devices will do not only smart grid functions but also other industry functions.

- Smart grids will become more interdependent on increasingly complex systems including renewable energy integration, energy storage, and electric vehicles. In this report, these interdependencies and their implication for sensor opportunities are brought out clearly and objectively.

- Multiple technologies are being developed by different vendors for solving a common problem. This report attempts to disseminate some of those technologies and their solutions, and how they are aiding to build a smarter grid.

- The main objective of this report is to thoroughly study and identify sensor opportunities in each domain of smart grid functionality. The requirements of sensing technologies are analyzed and quantified for business opportunities in detail. This report also discusses the product and technology opportunities for sensors, categorized by the function they serve.

- The report also extensively covers the activities and strategies of major players, including those playing a disruptive role in shaping the sensors and smart grid industries.

- The scope of this report does not conform to any particular geographical confines; however, discussions are largely focused on countries where smart grids are currently installed or where there are major plans and funding for their installation.
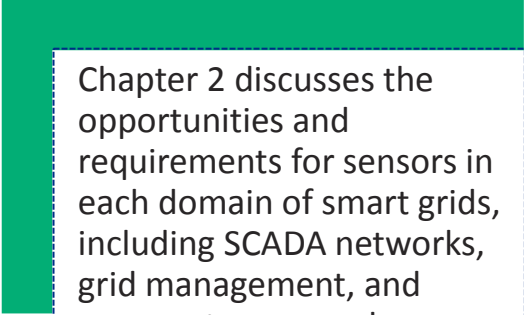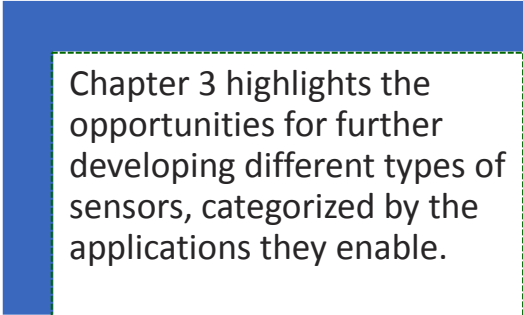
METHODOLOGY OF THIS REPORT

- The research is based on both primary and secondary data sources. The primary research data sources included interviews with industry sources. Secondary data is culled from the Web, commercial and government databases, trade press articles, technical literature, information learned at technical conferences and trade shows, SEC filings, and other corporate literature.

- The forecasting approach followed is explained-in detail in Chapter 4. The basic approach is to identify and quantify the requirements and markets that are served by sensors in smart grid applications. The competitive landscape is assessed to arrive at the suitability and likely volume of each of the sensor types over the next eight years. The projected plans of the key firms are also considered while estimating the market size and growth.

- The market is estimated for segments such as SCADA networks, advanced metering infrastructure, grid management, energy storage, renewable energy generation and microgrids. The market is also segmented broadly based on sensor application, sensor types and geographic locations.
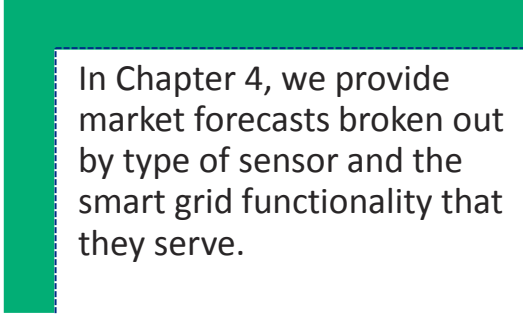
PLAN OF THIS REPORT

Chapter 2 discusses the opportunities and requirements for sensors in each domain of smart grids, including SCADA networks, grid management, and energy storage, and generation-related applications.

Chapter 3 highlights the opportunities for further developing different types of sensors, categorized by the applications they enable.

In Chapter 4, we provide market forecasts broken out by type of sensor and the smart grid functionality that they serve.

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Chapter One: Introduction

MAJOR INDUSTRY TRENDS 2013-2014

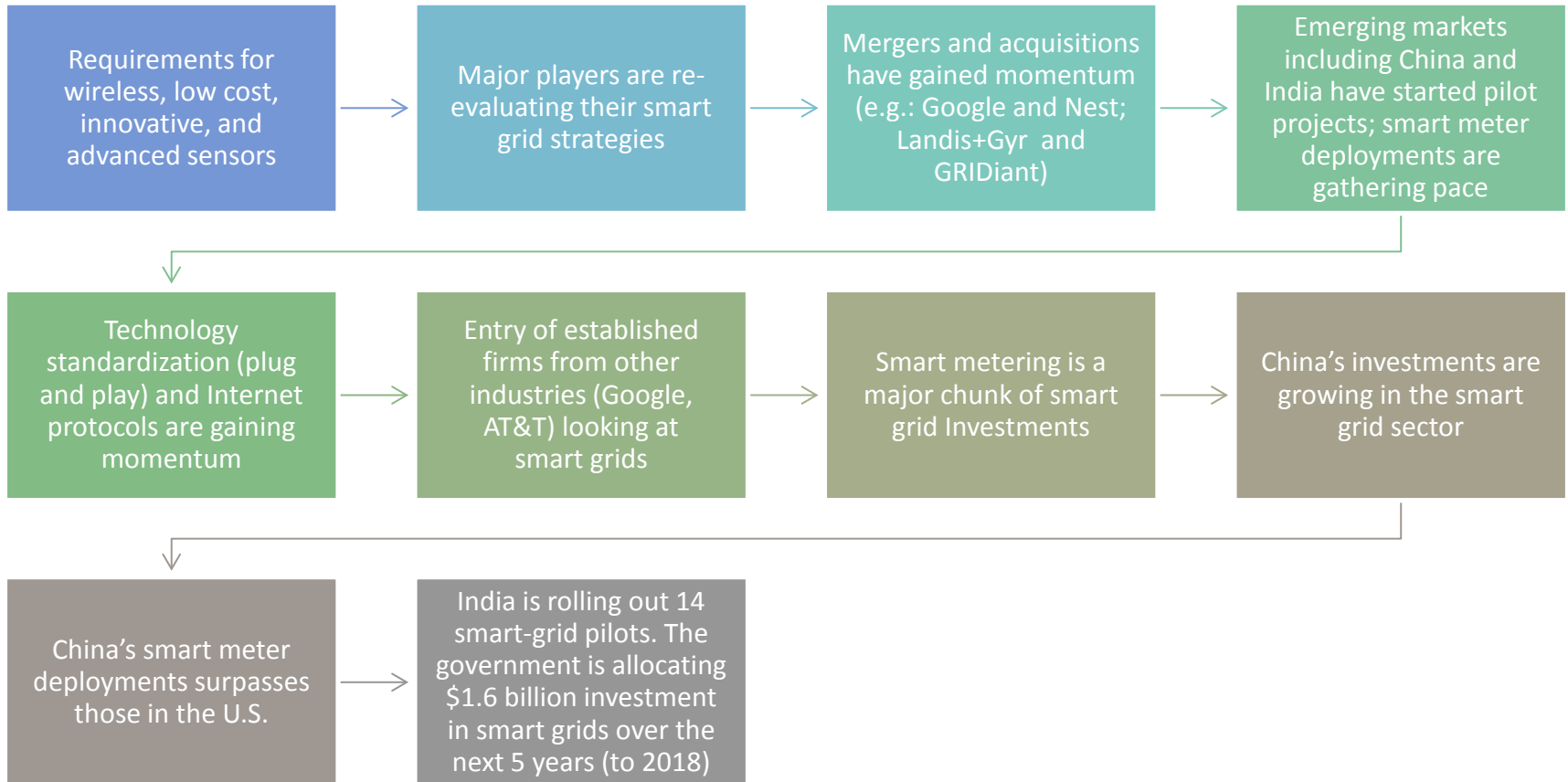Requirements for wireless, low cost, innovative, and advanced sensors → Major players are re-evaluating their smart grid strategies → Mergers and acquisitions have gained momentum (e.g.: Google and Nest; Landis+Gyr and GRIDiant) → Emerging markets including China and India have started pilot projects; smart meter deployments are gathering pace

Technology standardization (plug and play) and Internet protocols are gaining momentum → Entry of established firms from other industries (Google, AT&T) looking at smart grids → Smart metering is a major chunk of smart grid Investments → China's investments are growing in the smart grid sector

China's smart meter deployments surpasses those in the U.S. → India is rolling out 14 smart-grid pilots. The government is allocating $1.6 billion investment in smart grids over the next 5 years (to 2018)

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EXCITING DEVELOPMENTS, PRODUCTS & PLAYERS 2013-2014

Smart Metering and Analytics

- **Elster Solutions** released a new version of its REXUniversal meter, expanding the smart meter line's interoperability and interchangeability with other smart grid vendors. The new meter offers point-to-point cellular communications technology which greatly expands the number of rural and remote residential utility customers who can be served by smart meters and modern smart grid systems.

- **Schneider Electric** launched PowerLogic ION8650 switchboard meter for grid revenue, power quality, and substation automation applications. PowerLogic is offered as an affordable smart meter and could target the markets in the developing countries.

- **Landis+Gyr (part of Toshiba)** has acquired PowerSense, a manufacturer of optical based medium voltage sensors. PowerSense's patented optical sensor technologies and smart grid monitoring and controller products will complement Landis+Gyr's portfolio. Landis+Gyr plans to integrate PowerSense into its European operations.

- In the smart meter analytics field, **IBM** has been selected by E.ON Metering to operate its Smart Metering IT infrastructure in a private cloud. E.ON Metering will use IBM's Intelligent Energy Service Enablement Platform (IESEP) to improve the deployment and management of smart meters.

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EXCITING PROJECTS, PRODUCTS & PLAYERS 2013-2014

Time Synchronization

- **GE's Digital Energy** business has launched an IEEE 1588 capable solution for time synchronization of protection and substation-automation control devices. It provides accurate time synchronization over packet-based communications networks, better time synchronization across the power system, and has a lower cost of installation versus traditional methods.

SCADA Applications

- **Toshiba** is working on Micro Energy Management System (µEMS) as a smart grid solution. Landis+Gyr also is involved in this project; its S650 Smart Grid Terminal is integrated into the µEMS solution, communicating with µEMS controllers and sensors.
- ABB has launched new grid interconnection technology applications for wind farms. Symphony Plus is a SCADA offering designed for monitoring and controlling wind plant fleets.

Outage Management and Feeder Automation

- **Schneider Electric** announced its Intelligent Loop Automation solution to reduce outage restoration time and costs. It manages fault location, isolation and service restoration (FLISR) automatically on distribution feeders in response to network conditions, including faults, outages and load imbalances.
- Tollgrade's Lighthouse product line is suitable for unmonitored substations, or those lacking dedicated SCADA network. Lighthouse MV Sensors quickly clamp directly onto overhead conductors; they are inductively powered.

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EXCITING DEVELOPMENTS, PRODUCTS & PLAYERS 2013-2014

Wireless Sensing & Internet-Of-Things (IOT)

- **Silver Spring Networks**, a networking platform and solutions provider, announced the SilverLink Sensor Network, a new approach to organizing, programming, and using any data from any sensor network to fuel any application at up to 10× the speed and 1/10th the cost of traditional utility IT infrastructure.
- **Cisco** plans to open a new center in Barcelona dedicated to "Internet of Things" research, through a partnership with the city's government. Cisco already operates similar Internet of Things research centers in Brazil and South Korea and is planning two more in Germany and Canada. Researchers are expected to create new technologies such as smart lighting and energy management.
- **Google** has shown some interest in the IOT space by acquiring Nest Labs for $ 3.2 billion. This acquisition will give it an edge in the home automation business where Nest's Learning Thermostat is doing well.
- **FreeWave Technologies** announced its new WavePoint family of secure, high-speed wireless networking solutions, to help energy, oil and gas companies enable critical M2M, broadband and SCADA applications over long distances.

Equipment Monitoring

- **IUS Technologies** launched a new line of monitors that combine three measurements of distribution transformer health (temperature, power, and total combustible gas) into a single unit. These monitors will help utilities reduce transformer maintenance costs and to achieve optimized asset lifecycles.

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EXPECTATIONS 2014-2015

Market Trends

- Smart metering will be a requisite for capturing consumer data
- On-grid distributed generation will gain pace (subject to policies and regulation)
- Increase demand for grid safety and security (a primary concern for regulators and utilities)

Sensor Opportunities

- Smart metering & meter data analytics
- Grid management
- Outage management system, feeder & substation automation, load balancing and advanced SCADA will gain momentum
- Renewable energy integration at distribution and sub-transmission voltage levels
- Wide area management system with synchrophasors
- Demand response, renewable energy grid integration, home area network, energy management systems—the best days for these applications are yet to come

M&A Activities Will Gain Further Traction

- Activity in smart metering, outage management systems, SCADA, data computing & analytics, feeder automation
- More consolidation is expected in the SCADA market—bigger players acquiring smaller niche players

Wireless Sensing and IoT

- Opportunities for development of new sensors
- Mobility solutions (mobile apps) will gain interest
- Technology standardization, plug and play interoperable devices, and M2M communication protocols for IoT are expected to show good progress

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EVOLUTION OF THE SMART GRID INDUSTRY

The smart grid industry has evolved a lot in the last three years in terms of its better suitability for advanced sensor technologies. In response, manufacturers worldwide are trying to meet these diverse monitoring, sensing, and control requirements with newer technologies.

New Sensor Technologies

- Advanced sensor technologies will expand the addressable market base for smart grid sensors.
- Sensor makers can cross-sell their products into other industries such as water, gas, transportation, telecom, and process industries.

Sensor Manufacturers

- Broad sensor manufacturers are showing a keen interest in developing sensing solutions for smart grid applications.
- Fulfilling the requirements of sensors for successful smart grid is both a challenge and an opportunity.

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SENSOR MARKET TRENDS

Sensor Market Trends: A Reflection of Opportunities in the Smart Grid Industry

Smart grids have gained significant traction, and growth is expected to accelerate in the next 5-8 years. A large number of companies across the world are consolidating their positions in developing various sensing requirements for smart grid applications. The current market trend indicates that big players are acquiring smaller sensor players to create competitive advantages in the smart grid industry.

Emerging economies including China and India are gearing up for smart grid technologies.

Developed countries/regions such as the U.S., Japan, and Europe will lead in development and deployment of smart grid technologies.

- Sensors are required for generation, transmission, distribution, and consumption for smart grid technologies.

- NanoMarkets believes the distribution and consumption areas of the electricity value chain will be the next focal point and will drive new growth for sensor manufacturers.

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SENSOR MARKET TRENDS

| Sensors and Their Applications	
Type Of Sensor	**Applications**
Voltage, Current, Phase measurement, Inductance, Intelligent Electronic Devices (IEDs), etc.	Transmission and distribution data sensing and monitoring, SCADA, smart meters, power quality devices, outage management systems, grid management, distribution automation, energy management, energy storage, renewable integration, relay and switching operations
Temperature	Power and distribution transformer monitoring, line monitoring, HVAC and heating systems sensing, building management system
Time Synchronisation	Internet of Things, GIS mapping, asset management, smart metering, outage management
Chemical/Gas Sensors	Transformers, relay operation, switching operations, energy storage
Humidity and Moisture Sensors	Line monitoring, weather forecasting, energy management system
Electric/Magnetic Sensor	Outage management, distribution automation
Wireless Sensing	Outage management, smart meter, SCADA, Internet of Things
Air Quality, Motion Sensing and Other Status Sensors	Building automation, energy management system, distribution automation
Equipment Monitoring	Home area automation, distribution automation, industrial automation, energy management

Sensor Market Trends

Big players such as GE, Siemens, Alstom, and ABB are concentrating on sensor opportunities that will give them an edge in the next generation of SCADA deployments. Products like GE's PowerOn Fusion SCADA and DMS, Alstom's e-Terra platform, and Siemens' D-SCADA already have made their presence felt in the market. Toshiba, though a new player in SCADA, may also shake up the market with its advanced SCADA and EMS products. Another notable trend is the arrival of new entrants who are bringing in new technologies and taking away the share from traditional sensor suppliers, especially in the feeder line sensor and transformer monitoring markets.

- We expect that competition will become severe, as a lot of technology companies are eyeing next-generation SCADA products.

- These next-generation SCADA opportunities translate into a need for sophisticated, advanced and real time sensing devices that can be deployed in energy chain. Once developed, these also could be deployed in telecom, process, manufacturing, and industrial SCADA to improve processes and reduce costs by way of better monitoring and control.

- Continuous improvement in manufacturing methods including microelectrical mechanical systems (MEMS) have reduced the size of sensors and made them easier to use. NanoMarkets believes that these advances in electronic technologies, which have lowered costs and added functionalities with least added costs, will drive sensor market growth in future.

- Digital, smart, and networked sensors that operate in the Internet of Things (IoT) to achieve seamless delivery of smart grid data and objectives, are expected to be the future trends in the sensor industry.

- As smart grid sensors are fast replacing feeder line sensors, NanoMarkets believes that feeder lines present a significant revenue generating opportunity for smart grid sensors.

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SENSORS AND DISTRIBUTION AUTOMATION

Sensor opportunities are not uniform across smart grid components. As traditional electricity distribution migrates to automated systems, there is an immediate requirement for distribution automation and a simultaneous requirement for sensors for enabling applications such as substation automation, feeder automation, and load balancing. Further, given the vital role that it plays in maintaining energy efficiency, distribution automation is emerging as the topmost priority of electric power utilities. Hence, NanoMarkets expects that smart sensors, an indispensable part of distribution automation systems, will be deployed on a larger scale.

Sensors and Distribution Automation

Sensors and WAMS

ROLE

Sensors and SCADA

Sensors and Smart Meters
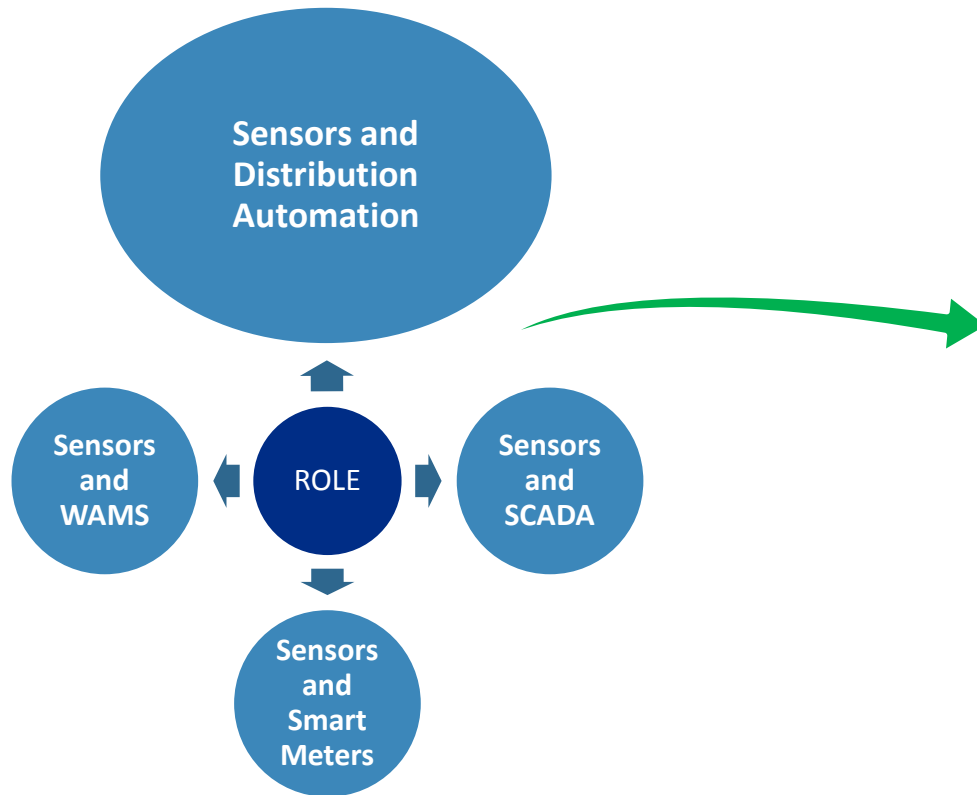
- With the distribution automation market taking off, new entrants such as IUS are beginning to find their niche with smart sensors for distribution automation networks.
- IUS Technologies, the US subsidiary of South Korean SCADA company Vitzro, has launched new sensing devices for transformer monitoring.
- Tollgrade's LightHouse distribution monitoring platform is another example.
- Established players such as General Electric, Siemens, and Alstom are making their presence felt.
- The growing interest of large and small players in the distribution monitoring market lends further evidence about the market potential of sensor technologies to manage transformers, feeder lines and other components the distribution systems.

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SENSORS AND SCADA

What is still more significant is the fact that this level of intelligence—an immediate requirement of the industry for the next-generation SCADA systems—can be achieved only by deploying various networked sensors. Thus, next-generation SCADA networks are proving to be one of the most potent applications for smart grid sensors.

SCADA systems are available in most of the utilities. However, they are primitive and not evolved to host smart sensors.

Major players such as ABB, Siemens, GE, Alstom and Schneider Electric that supply hardware and software components for this segment are expected to support the advancement of the present day SCADA networks.

We also expect that Toshiba will play a major role in shaping up this market with its end-to-end SCADA and distribution automation systems.

Conventional large players are acquiring smaller hardware and software players to gain cost leadership and develop a comprehensive solution.
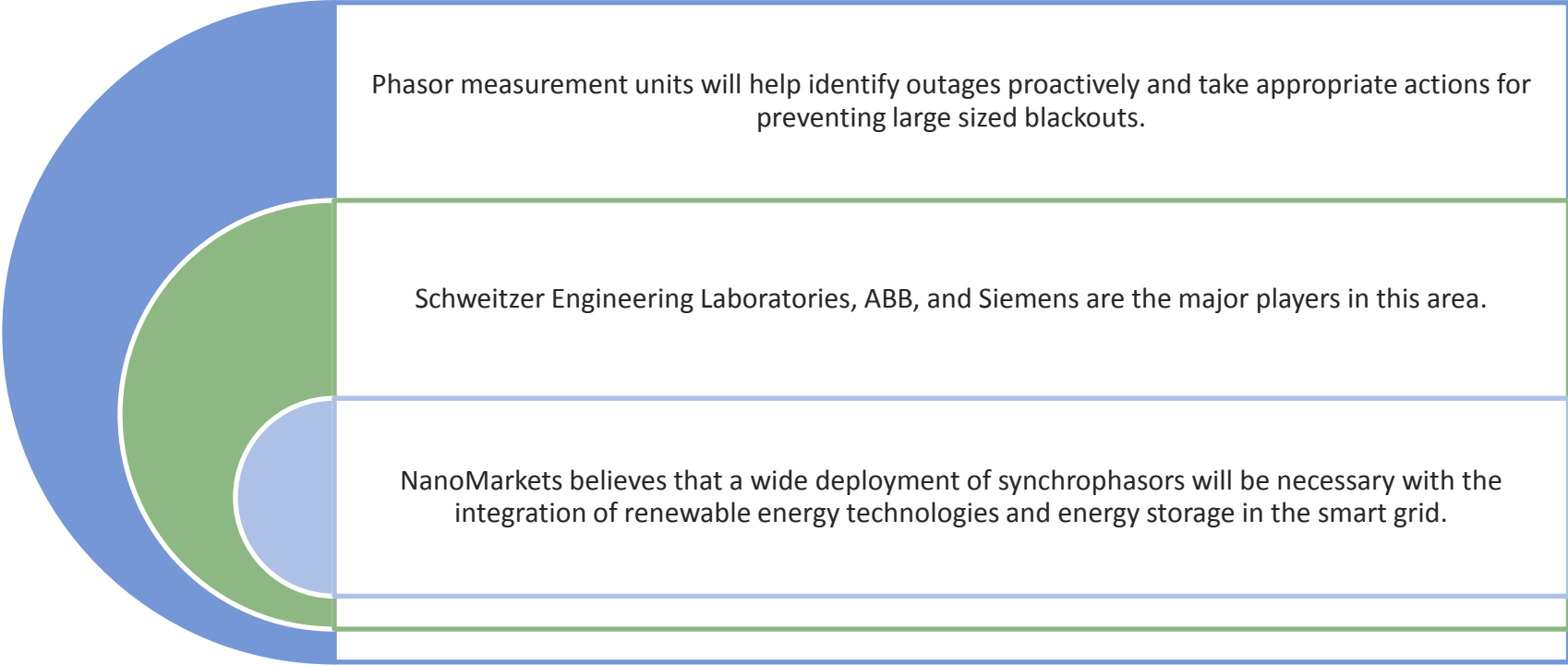
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SENSORS AND SMART METERS

Smart meter technology are advancing rapidly with the aid of sensors. Because of their increasing complexity, smart meters need sensors to perform useful and needed functions. With utilities and consumers demanding smarter, more reliable, and cost-effective meters, sensors are evolving to help next-generation meters meet these needs.

- There are several types of sensors found in smart meters. These include thermistors, shock sensors, accelerometers, Hall sensors, anisotropic magneto resistance (AMR) sensors, and reed sensors.
- These allow the meter to have new functions—such as tamper detection, a hidden switch to change meter operating modes, and PCB temperature sensing—and permit current functions to become more reliable, smaller, and cost-effective, in turn making the whole meter more robust and less costly.
- As the smart meter market expands and the technology advances, NanoMarkets expects to see exponential growth in consumer demand for remote energy control in the form of sensing systems.
- With this need comes the challenge of designing low-cost and reliable smart meters with robust functions, such as tamper detection, switchable operating modes, and PCB temperature sensing.

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SENSORS AND WAMS

As synchrophasors are incorporated on a large scale, wide area management systems (WAMs) in transmission infrastructure are immediate and near term opportunities for sensor players.

Phasor measurement units will help identify outages proactively and take appropriate actions for preventing large sized blackouts.

Schweitzer Engineering Laboratories, ABB, and Siemens are the major players in this area.

NanoMarkets believes that a wide deployment of synchrophasors will be necessary with the integration of renewable energy technologies and energy storage in the smart grid.

SENSORS AND OTHER APPLICATIONS

Future Opportunity in Various Technology Sectors

NanoMarkets believes that over the next 5-8 years, there will be a pick-up in the opportunities for sensors in demand response and management, home automation, and factory automation.

Demand response
Demand-side management
Home automation
Factory automation
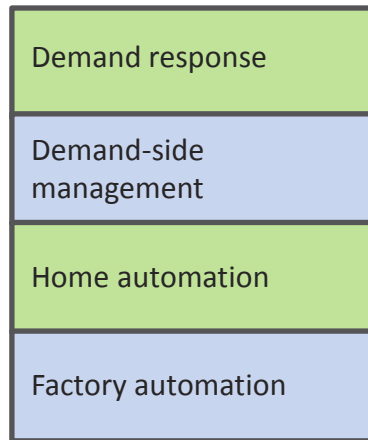
- Full potential can be achieved when these equipment integrate with smart meters, advanced SCADA, and related hardware and software.

- These opportunities are expected to pick up in next 5-8 years.

- Electric vehicles and energy storage sectors will become sizeable business opportunities for sensor markets.

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