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Smart Grid Market Assessment, By Network Area [Home Area Network, Neighborhood Area Network, Wide Area Network, and Long-Range Wide Area Network], By Components [Hardware, Software, Services], By Applications [Distribution Automation, Conservation Voltage Reduction, Substation Automation, and Advanced Metering Infrastructure, Others], By Region, Opportunities, and Forecast, 2016-2030F

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Abstracts

The Smart Grid market has experienced significant growth in recent years and is expected to maintain a strong growth trajectory in the coming years. Valued at USD 52.19 billion in 2022, the market is projected to reach USD 218.58 billion by 2030, reflecting a notable CAGR of 19.61% during the forecasted period from 2023 to 2030. The market is expected to experience growth due to the rising investments in the industry and the implementation of advanced technologies like smart meters, electric vehicle chargers, and other infrastructure advancements. These technological developments are projected to propel the expansion of the market in the upcoming years. Moreover, the demand for smart grids is rapidly increasing due to factors such as growing energy demand, renewable energy integration, grid modernization initiatives, grid resilience, etc.

Many power grids around the world are outdated and face challenges due to aging infrastructure. Components such as transformers, substations, and power lines may need replacement or upgrades. Modernization initiatives help address these infrastructure issues by incorporating advanced technologies and more efficient

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equipment. One of the most prominent examples of a modernization initiative is Schneider Electric SE’s EcoStruxure Advanced Distribution Management System (ADMS). Schneider Electric SE's EcoStruxure ADMS offers a comprehensive network management solution that encompasses monitoring, analysis, control, optimization, planning, and training tools. It operates on a unified representation of the entire electric distribution network. By merging Distribution Management Systems (DMS), Outage Management Systems (OMS), and Supervisory Control and Data Acquisition (SCADA) functionalities, EcoStruxure ADMS combines over 50 advanced functions. This integration enables the maximization of benefits derived from intelligent grid devices, distributed renewable energy sources, advanced metering, and other smart grid components.

The Advent of Highly Advanced Smart Grid Technologies

The emergence of highly advanced smart grid technologies has revolutionized the energy sector. These cutting-edge technologies have significantly enhanced the capabilities of traditional power grids, enabling more efficient, reliable, and sustainable energy distribution. One of the most prominent examples of highly advanced smart grid technology is the implementation of Advanced Metering Infrastructure (AMI). AMI is mostly attributed to residential customers, and it consists of meters that measure and document electricity consumption at intervals of at least one hour. These meters supply the collected data to both the utility company and the customer daily. The range of AMI installations varies, starting from basic meters that record energy usage at hourly intervals, up to advanced meters with built-in two-way communication capabilities. These sophisticated meters could capture and transmit real-time data instantly. Moreover, the United States is regarded as the 2nd largest electricity producer in the world. As per the United States Energy Information Administration, in 2021, electric utilities in the United States had approximately 111 million installations of advanced metering infrastructure (AMI), representing around 69% of all electric meter installations. Most of these AMI installations, around 88%, were attributed to residential customers. Additionally, AMI meters accounted for approximately 69% of all residential electric meters. Hence it can be stated that the advent of highly advanced smart grid technologies like AMI is amplifying the Smart Grid market growth rate extensively across the globe.

Continuous Development of Smart City Projects

As smart city projects expand, the demand for advanced energy management systems, including smart grids, grows significantly. The integration of multiple systems and the

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need for real-time data monitoring and analysis drive the adoption of smart grid solutions. Moreover, the essence of a smart city lies in harnessing real-time data to elevate the standards of living and foster a sustainable future. One of the most appropriate examples of smart city projects is Songdo International City in South Korea. Once a coastal area reclaimed from the Yellow Sea, Songdo has rapidly transformed into a smart city, earning the reputation as the 'Smartest City in the World.' The concept of a smart city revolves around utilizing real-time data to enhance the quality of life and sustainability. At the heart of the city's Central Business District lies the G-Tower, serving as the central control hub. Equipped with an extensive network of CCTV cameras, the G-Tower monitors various aspects such as traffic flow, building temperatures, emergency response coordination, etc.

Asia-Pacific Dominates the Global Market for Smart Grid

Asia-Pacific has been dominating the global smart grid market. The region has been at the forefront of smart grid deployments, with significant investments and initiatives in countries like China, Japan, India, and South Korea. Factors contributing to Asia-Pacific dominance include government initiatives, increased demand for energy efficiency, improved grid reliability, and integration of renewable energy sources. The high investments in research and development drive innovation and market growth, thereby making the Asia-Pacific region a frontrunner in the smart grid sector. Governments in countries like China, India, and Japan are heavily investing in modernizing their energy infrastructure, fostering smart grid adoption.

The Asia-Pacific region is expected to dominate the global smart grid market by 2030, with a market value reaching USD 65.84 billion by 2030, registering a CAGR of over 20.36% during the forecasted period. This is due to the larger population density in countries like China and India, strong government support for smart grid infrastructure integration, and the region's focus on renewable energy.

Government Initiatives

The government of several nations has played a crucial role in fostering the growth of the smart grid market. By recognizing the significance of modernizing the electricity infrastructure and promoting sustainable energy practices, governments have implemented various policies and initiatives to support the development and adoption of smart grid technologies. For instance, the National Smart Grid Mission was issued by the Indian government. The objective of the Indian power sector's transformation is to create a secure, sustainable, and digitally enabled ecosystem. This includes

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implementing smart grid technology to facilitate distributed generation, especially rooftop solar, through bidirectional energy flow and net metering. The smart grid enables real-time monitoring, grid automation, and active consumer participation, fostering reliable energy access, sustainable growth of renewable resources, and energy conservation. Moreover, it aligns with the mission of providing reliable and quality energy for all stakeholders while promoting a greener energy ecosystem.

Impact of Covid-19 on Global Smart Grid Market

The COVID-19 pandemic had a positive as well as a negative impact on the worldwide smart grid market. On one hand, it has accelerated the digitization of energy systems, emphasizing the importance of remote operations and reliable electricity supply, leading to increased interest and investment in smart grid technologies. On the other hand, the pandemic also caused delays in project deployments due to disrupted supply chains and construction activities. The crisis has highlighted the significance of resilient energy systems, with smart grids recognized as essential for ensuring grid stability and quick response to disruptions. Moreover, financial constraints resulting from the economic downturn have affected the ability of utilities and governments to invest in smart grid projects, leading to some market slowdowns. Changes in electricity consumption patterns during the pandemic posed challenges for demand response programs but also emphasized the importance of demand flexibility. Moreover, increased awareness of energy efficiency and the adoption of smart meters and energy management systems has driven interest in energy-saving measures and smart grid solutions. Overall, while the pandemic has presented obstacles, the need for resilient and efficient energy systems remains paramount, and as economies recover, the demand for smart grid technologies is expected to rebound, driven by the focus on grid resilience, energy efficiency, and remote monitoring capabilities.

Impact of the Russia-Ukraine War

The Russia-Ukraine war led to disruptions in energy supply, which in turn has highlighted the importance of energy diversification and resilient infrastructure, prompting countries and energy companies to consider investing more in smart grid technologies. Geopolitical uncertainty arising from the conflict-affected investment decisions and business confidence, potentially impacting the overall investment climate for smart grid projects. Moreover, energy security concerns have been amplified, particularly in Europe, emphasizing the need for advanced energy management systems like smart grids to enhance security by diversifying energy sources and improving integration capabilities. Furthermore, policy and regulatory changes resulting

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from the conflict also influenced the smart grid market as governments prioritized grid resilience and diversification.

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