Example of smart grid electricity market requirements literature review

Business, Marketing

Smart grids in the electricity sector are seen to be effective and reliable solution to the challenges that often face the industry. The electricity industry, over the past decades, has faced numerous challenges ranging from energy inefficiency, lack of privacy, to insecurity. The sector has seen increase in the number of electricity users, arrival of prosumers in the economy, energy efficiency becoming a necessity, and improvement in the supply of security across the globe. Information Technology solutions and equipment manufacturers are awaiting governments to invest on smart grids, as it is a sure way of realizing success in the energy sector (Korman and Mowrer, 2011). The article advocates the potential effects of smart grid technologies in transforming electricity market including its functionality, security, and privacy.

With the electricity sector facing the challenge of functionality, smart grids ensure that it monitors, protects, and controls the operations in the sector with the required efficacy. There is need to enhance real-time balancing between energy demand and electric generation, and smart grid provides effective storage options. Where the generation of electricity and its consumption are not well-balanced, heavy loading will result to power disruption. Quite often, power blackouts cascade the chain of outages in the equipments, which may result to serious default in the electric system. Smart grid functions effectively as it regulates the power supply, and controls over-using of power in a particular region. It is believed that the system would reduce power disturbance as the electric transmission systems are networked and interconnected—facilitating multiple redundant paths that ease the flow of energy (Hossain et al., 2012). As such, smart grids operate efficiently and optimize use of assets, provide the quality of power required by modern equipments, and provides opportunities for market of prosumers.

The often-mentioned strategy of smart grids is to enhance security of the electric grid. However, complete secure environments, networks, or applications do not exist in the modern world, and smart grids are not an exception (Hossain et al., 2012). In order to enhance the market of prosumers, reliability should be mapped in the information security principles of integrity and availability. When the system is secure, it will prevent all nature of denial of service (DoS) that includes environmental attacks and human initiated attacks (Sorebo and Echols, 2012). Smart grids aim at enhancing security controls that can either minimize or prevent the adverse effects of DoS; therefore, increasing the electricity grid’s reliability. Data analysis and accuracy plays a crucial role in smart grids. Effective security controls should be implemented to ensure the data collected is not tampered with. For instance, smart meters will send consumption statistics to the destined utility company for operational and billing purposes. A security system, for instance hashing, would be effectively used to ensure customers receive an accurate billing statement and the consumption data is validated by the utility company.

The increase of data transferred between the utility company and the consumers has been faced with privacy challenge. It is the utility company that is mandated to read customers meters remotely, and consumers may be worried on the use of the information by the utility companies. The information retrieved from individual meters can suggest the activities and operations of the owner, and it will impede an individual's privacy. For instance, high electricity bill can mean that an individual is using expensive electronics that consume large amount of electricity. This can be a challenge especially when the information falls in the hands of criminals. Smart grids also face the same challenge of lack of privacy. With the looming cyber insecurity, individuals can access information of a website via internet. It is, therefore, important for new privacy laws and regulations to be implemented in order to enhance privacy of prosumers (Ronan, Sudhoff and Glover).

Power transmission grids have add various developments in the past few decades that range from the initial design of local DC networks to the complex but well-controlled high voltage DC networks and an ultramodern bulk in, interconnected networks with a wide range of applicable components. Hence, during the transition there was a major concentration are ensuring the improvement in the areas of functional operations, security and privacy management, which requires a concrete study to understand what has gone well during the transition and what requires further improvement.

Divan and Sastry (2008) talk about the framework and characteristics of smart transmission grids where they discuss about the significant pressure from diversifying challenges that impact functional operations. Digitalization is discussed as one of the key areas where it is important to ensure that the platform used provides adequate computation, control, protection, visualization and the ability to facilitate maintenance whenever required (Divan and Sastry). The computer logical operator which is in the form of visualization creates a platform for sensitive situation awareness and helps to reduce the tolerance associated with man-made errors. Hossain, Han and Poor (2012) discuss about the use of sensors in order to create flexibility that ranges between the provision of expandability of capacity and compatibility with diverse generation of technologies and adaptability to multiple geographies. The flexibility is considered as a strategy which enables coordination of decentralized control structures that help to create specific scheme of operation within a particular span of substations and control centres. In order to ensure adequate functional operations it is important to maintain seamless compatibility with a wide range of progressive technology upgrades that interrelate with hardware and software so that any strategy to upgrade does not require manual intervention or a major transition (Hossain, Han and Poor).

Intelligence and resiliency create the next milestones of adequate functional operations and in order to empower transmission grid with these qualities it is important to ensure that there is adequate amount of intelligence and self maintenance ability that is driven with the help of coordinated protection and control schemes. The resiliency factor contributes more towards security and safety as it is important that from the perspective of a flawless delivery it is important to ensure that the reliability factor remains the same as these transmissions grids deal directly with allocation of power not only to commercial areas however also to residential areas. Sustainability is the last but the most importantly discussed area and this forms the backbone of the overall computer controlled smart transmission grid as this is one area where consistency really matters and in case of any rise or fall in the demand there must be an appropriate system of ensuring continuous supply through alternative channels of power production which may again be from manual resources however once transmitted or reached the smart transmission grid should be effectively controlled through the centralized control unit (Hart). Security in case of smart transmission and power grids is one of the most discussed factors and is primarily governed by mature power market regulation and policies, advanced computing and control methodologies and sensing and measurement of the overall transmission management. The mature power market regulation and policies define the controlled limit of transmission for various different commercial and residential transmission systems and therefore based on these policies, the overall transmission control system is set with appropriate control management in order to fulfill the requirements while taking adequate control of the limitations for power transmission.

The advanced computing and control methodologies help to automate the requirements related to power transmission and this advanced computing is nothing but programmed transmission guidelines that are based on the market regulation requirements and as further controlled with the help of smart chip-based systems that are capable of providing a homeowner genius transmission or heterogeneous transmission based on the dynamic requirements of the power allocation through the grid. Lastly, sensing and measurement are the most important factors of maintaining security as with the help of smart sensors the smart power grids are able to work according to the market requirements and at the same time the measurement which may be automatically controlled through the system be communicated through a dynamic channel to provide information about the regular operations and initiate emergency control in case of any noticed irregularities (Divan and Sastry).

Privacy may not be one of the major areas of concern as far as the smart grid electricity market is concerned however most of the computing automatically targets the privacy and therefore there is an adequate provision of maintaining closed loop network circuits that range from grid distribution to local power allocation has once again sensors play an important role in guiding the unique substation of allocation and the decentralization through computing contributes to customized and privatized delivery. Also, due to availability of all information online and the ability to directly manage billing through cloud-based systems, it becomes mandatory to ensure optimum cyber security and to manage the privacy to that level that none of the private information can be legal or they cannot be any intrusion in order to access or modify the billing system (Amin and Wollenberg).

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