ANALYSIS OF THE EFFECTIVENESS OF MODERN ENERGY GRID MANAGEMENT SYSTEMS

Musadjanova Dilobar

ANNOTATION

Energy management systems can efficiently increase the balance between supply and demand while reducing peak load during unscheduled periods. The energy management system can handle distributing or exchanging energy among the many energy resources available and economically supplying loads in a stable, safe, and effective manner under all power grid operating situations. This article examines the energy control system's structure, goals, benefits, and challenges through an in-depth investigation of the various stakeholders and participants involved in this system. This review provides a detailed essential analysis of the operation of several programs used inside the power management system, such as demand response, demand management, and energy quality management. It also includes a summary of the smart grid's functionalities, features, and related techniques and has discovered research gaps, challenges, and issues. Furthermore, in this article, the authors review the literature on the enabling technologies of smart grid and investigate the energy management system, which is among one of the major emerging technologies and quantifications of the various uncertainty techniques. In this paper, the authors also discussed the comprehensive review of researchers' efforts and contributions to the smart energy management system in the smart grid.

Keywords: Tashkent, Uzbekistan, University, Private University,

The intermittent nature of RES can be eliminated by combining numerous RES and the ESS and backup sources. On the other hand, this intermittency can dramatically alter the system's voltage profile, interfere with standard on-load tap changer control systems, and negatively impact the power grid's performance. As a result, in addition to GHG mitigation, the technologies impose a slew of challenges, such as uncoordinated grid parameters, increased system complexities, intermittent renewable generation, and high PEV price requirements, all of which exacerbate serious issues such as power quality issues, energy imbalance, resilience, loss of reliability, system security, and regulatory issues such as unequal benefit distribution to consumers. Furthermore, with the advancement of renewable energy sources, a shift from a historically passive to an active distribution system has occurred. When there are many energy sources and a storage system, energy flow must be managed. An energy management system (EMS) is critical for maximizing the potential of new resources and new types of loads on the electricity network while minimizing their negative effects, ensuring load continuity in all conditions, and improving the electricity network's stability. The International Electrotechnical Commission's IEC 61970 standard defines an EMS as "a computer system that consists of a software platform that provides essential support services and a set of applications that provide the functionalities necessary for the efficient operation of generation and transmission system to ensure energy supply security at a minimal cost." In the smart grid (SG), energy management guarantees supply and demand balance while adhering to all system restrictions for cost-effective, dependable, and safe electrical system operation. It also contains optimization, which ensures that power generation costs are reduced. Thus, by grouping all systematic procedures, the EMS maintains and reduces the quantity and price of energy required for a particular application to the lowest. Although energy management in a distribution system improves system performance, it also has constraints and obstacles, including client confidentiality, large-scale operations, frequent system upgrades, and EMS dependability issues.

The energy management system of SGs is the subject of this research. This review is chosen to assist the readers in grasping the role and application of each EMS-based method more clearly and have a clearer vision. As a result, it will assist us in determining the scope of our issue. The following issues are addressed in this paper: smart grid and all its technologies and techniques, its challenges and advancements, SG roles and responsibilities of the various parts participating in the

EMS, and a detailed study of the DER's behaviour; general overview of the EMS in the SG and its numerous aspects; and uncertainty management, demand response, demand-side management, and power quality management, which are all subjects of critical analytical investigation. Approaches to EMS solutions are compared and criticized. The definition, benefits, and overall overview of the SG are presented in Sections 1 and 2. Section 3 examines EMS's structure, benefits, and limitations through a detailed examination of the system's distracting investors and players.

In spite of the popularity and increasing number of related research work, smart grid definitions do not exist. Rather than what occurs in many other developing areas, various other definitions are suggested in the literature. One of its examples is the definition by the Electric Power Research Institute about the smart grid: "the overlaying of unified communications and control system on the existing power delivery infrastructure to provide the right information to the right entity." Various other authors have different perspectives on the smart grid, such as, e.g., consumers' commitment to other stakeholders, the part of ICT, the exposure of market opportunities with new value-added services, and so on. The term smart grid characterizes the combination of sensors, digital technologies, and ICTs to allow and make the system more efficient, reliable, and manageable on the use of electricity. Smart grid is an integration of technologies for the customer and the grid. Smart grid technologies combine software and hardware including creations and essential services, from generation to transmission and distribution. A smart grid is an intelligent and intellectual network in which the current power system blends with information technology. The increasing complexity of the power grid results in the high potential of the smart grid network. The problem is the old infrastructure supporting current energy requirements.

AMI is the term that enables the gathering and transfer of energy usage information from smart meter to two-way communication networks in near real time. It has several advantages such as AMI upsurging efficiency, decreasing loss and cost, and controlling load and theft protective capability like Vattenfall's and

Fortum's intelligent system. Automated metering infrastructure employs smart meters in homes that monitor and measure electricity consumption. The main goal of AMI for homes is to take benefit of smart meters to examine the consumption of energy, battery storage, generation of solar or wind connected with an on-site grid, and electric vehicles (plug-in). Furthermore, AMI enables configuration of remote meter with dynamic tariffs and monitoring of power quality. AMI also plays an important role in smart homes and smart appliances. Smart homes are outfitted with a home automation system that connects security, lighting, and other appliances using an AMI system that modulates and controls their operation.

REFERENCES

1 S. Bruno, S. Lamonaca, M. La Scala, G. Rotondo, and U. Stecchi, "Load control through smart-metering on distribution networks," in Proceedings of the 2009 IEEE Bucharest PowerTech, IEEE, Bucharest, Romania, 2009.

2 J. A. Momoh, "Smart grid design for efficient and flexible power networks operation and control," in Proceedings of the 2009 IEEE/PES Power Systems Conference and Exposition, IEEE, Seattle, WA, USA, 2009.

3 E. Santacana, G. Rackliffe, L. Tang, and X. Feng, "Getting smart," IEEE Power and Energy Magazine, vol. 8, no. 2, pp. 41–48, 2010.