УДК 621.31

R. Strzelecki, Prof. D.Sc.
Electrotechnical Institute Warsaw
S. Denysiuk., Prof. D.Sc.
V. Opryshko, As. Ph.D student,
National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute"

DEMAND SIDE MANAGMENT AND MODERN POWER ELECTRONIC INSTALLATIONS IN SMART GRID CONCEPT

Smart power grid is an intelligent electrical grid used for improving efficiency, sustainability, flexibility, reliability and security of the electrical system by enabling the grid to be observable, controllable, automated and fully integrated [1].

In contrast with the existing electrical grids, the intelligent electric grids have digital structure, two-way communication, distributed generation, numerous sensors, self- monitoring, self-healing capabilities, remote checks/tests, pervasive control and many customers [2].

The transition from the grid we know today to the grid of tomorrow will be as profound as all of the advances in power systems over the last hundred years, but it will take place in a fraction of that time. It will require a new level of cooperation between industry players, advocacy groups, the public and especially the regulatory bodies that have such immediate influence over the direction the process will take. In the end, though, a fully realized Smart Grid will benefit all stakeholders [3].

Renewable energy systems cannot directly replace the existing electric energy grid technologies. The latter are far too well established to abandon, while the new technologies are not sufficiently developed to meet the total energy demand. Therefore, it is sensible to gradually infuse renewable energy sources into existing grids and transform the system over time [4].

Relevance of the change in strategy of supply companies due to the new level of grid management, ensuring guaranteed efficiency and reliability of the distribution electric grid complex [6]. The key to the success of any energy company is its customer-oriented strategy. As any services must meet customer needs, market allows the client to choose. Preferences motives may be different, but the determining factor is the ratio between the electricity price and the risk level. Everyone chooses a risk level that may afford. An example of such balancing is demand management programs, Demand Side Management (DSM) that do not require significant investment from the energy supply companies. DSM is traditionally seen as an instrument to reduce peak demand in electricity grid.

By reducing the overall load in grid, DSM can reduce the number of accidents by reducing the number of disconnections and increase system reliability [7].

DSM allows customers to make informed decisions regarding their energy consumption, helps the energy providers to reduce the peak load demand and reshape the load profile [8]. DSM is carried through demand task scheduling, usage of stored electric energy and real-time pricing [9]. DSM techniques increase the operational complexity of the power system, redistribute the load but do not reduce the total energy consumed by the appliances [10, 11]. In case of loading the system with its max capacity, the value of DSM is high.

One of the basic conditions of transforming a traditional grid to Smart Grid is the wide-spread use in electrical power grids of modern power-electronic installations (PI), in which there are installations of the Flexible AC Transmission System type and High Voltage DC [3–5], either Medium VDC or LowVDC, as well as a great many installations of the Custom Power Supply type [6]. Widespread use of PI is recommended also in modernized traditional grid. For example, switchgear equipment used up to the present is in the majority of cases mechanical devices. Their speed of operation is satisfactory for the control of European power network in given situations, but is inadequate in situations demanding reactions to unexpected changes in voltage and flow conditions. This negative feature of mechanical devices is particularly demonstrable in response to ever-increasing

demands in the area of quality of electrical energy [7–9]. A wider application of PI in grid today would allow for a fuller exploitation of existing distribution and transmission resources, while maintaining the status so far, and even improving the safety of the power supply and energy efficiency.

Conclusion

In terms of market reforms any energy company that aims to be popular, requires modern IT technologies, which ensure it highly competitive and effective management of business processes. Implementation of enterprise informational platforms can quickly obtain the necessary data on the current affairs in the company, develop tactics and strategy of its development, manage personnel and predict future sectoral changes and prepare for them in time. Realize DSM by providing various services according to the usage situation and contract terms such as data cooperation with demand side and provision of supply and demand forecast and power saving information.

A wider application of PI in grid today would allow for a fuller exploitation of existing distribution and transmission resources, while maintaining the status so far, and even improving the safety of the power supply and energy efficiency.

References

1.UK Department of Energy and Climate Change. Smarter grids: the opportunity, December [Online]. Available: ⟨http://www.techuk-e.net//Portals/0/ Cache/(DECC)Smart Grid_web.pdf⟩; 2009.

2.US Department of Energy. Smart Grid system report, July [Online]. Available: ⟨http://energy.gov/sites/prod/files/oeprod/DocumentsandMedia/SGSR_Annex_A-B_090707_lowres.pdf⟩; 2009.

3.Smart grids European Technology Platform. Strategic deployment document for Europe's electricity grids of the future, April [Online]. Available: ⟨http://www.smartgrids.eu/documents/SmartGrids_SDD_FINAL_APRIL2010. pdf⟩; 2010.

4.Eduardo F. Camacho, Tariq Samad, Mario Garcia-Sanz, and Ian Hiskens Control for Renewable Energy and Smart grids

5.CEN-CENELEC-ETSI Smart Grid Coordination Group Smart Grid Reference Architecture November 2012.

6.Denysiuk S.P. Opryshko V.P Assessment of energy sector companies innovation management effectiveness promising problems of economics and management Montreal, Canada, 2015

7.[International Scientific Conference: Energy savings, energy efficiency and energy audit in Ukraine. 21st October. Modern problems of energy efficiency in Ukraine and building of energy management system.

8.Logenthiran T, Srinivasan D, Shun T Z. Demand side management in Smart Grid using heuristic optimisation. IEEE Trans Smart Grid 2012; 3 (3) :1244–52.

9.Koutsopoulos I, Tassiulas L. Challenges in demand load controlfortheSmart Grid. IEEE Netw 2011; 25 (25): 16–21.

10. [Strbac G. Demand side management: benefits and challenges. Energy Policy 2008;36(12):4419–26.

11. [Khodayar M E,Wu H. Demand forecasting in the Smart Grid paradigm: features and challenges. Electr J 2015; 28(6): 51–62.