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Energy Management and Smart Grids for Energy Productivity

Musa Yılmaz*

Department of Electronics and Communications Engineering, Technology Faculty, Batman University, Batman, Turkey

Email address:
musa.yilmaz@batman.edu.tr

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Abstract: The first stage to ensure effective energy efficiency is basically to use energy wisely. It is difficult to provide this, for all subscribers, in a network where everyone consumes energy. Therefore, it is necessary to manage this situation. All over the world, the smart grids appear to be the prominent management system about such situations. Effective management of the energy flow can be assured by monitoring and controlling the energy consumption and production plants. One of the most discussed topics in the research is energy efficiency which forms the basis for smart grids. Consumers, production centers and electrical devices in smart grids communicate with each other, and in this way power system can be operated in a more efficient way. Thus, it becomes possible that consumption values can be adapted very successfully to energy production available. In the system established, not only consumer's energy needs is reduced to lower degrees, but also it is ensured that all energy sources (renewable and power plants) are optimized. Consequently, this study provides suggestions to use energy effectively and to manage energy production and consumption by using smart grids in Turkey.

Keywords: Energy Management, Smart Grid Management, Electric Productivity

1. Introduction

Our world has limited energy resources (Fig.1). These resources are decreasing day by day due to the lack of available and new resources require efficient use of energy.

Energy which is an integral part of daily life, the country's socio-economic position within the structure and its importance is increasing day by day. Electrical energy systems, demand, timely, continuous, economical and are required to be met in a quality manner [1,2].

The country's technological and socio-economic development of the electrical energy demand forecasts prepared on the basis of data determined on the basis of the estimation of the production capacity and long-term production planning to be done in terms of reliability of the energy supply is very important. In addition, energy production, transmission and distribution technology-focused planning should be designed. New energy systems that can be controlled and monitored in real time adaptive interact with the consumer, it is desirable to have a structure [3]. In this context, "smart grids (smart grids)" concept has been raised. This network model are targeted by an energy management system more efficient and effective.

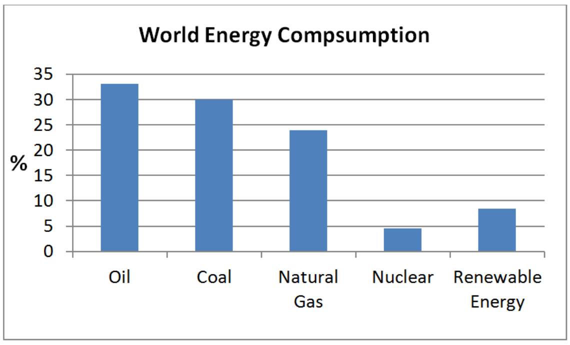

Figure 1. *World Energy Consumption*

Within the context of smart grid applications; figure 2. also the design of the smart grid system, as can be seen in the current energy system energy production and distribution management applications are used. Producers and consumers of energy from the center of the smart grid is managed. The infrastructure of these systems from the network by using a snapshot to be taken as the standard of evaluation of the quality of energy data in the range of the limit values can be maintained. Also provides the infrastructure for delivering uninterruptible power reliability. Thus, further reduction of the leakage rate and loss of energy, improving the quality and downtime could be reduced to a minimum.

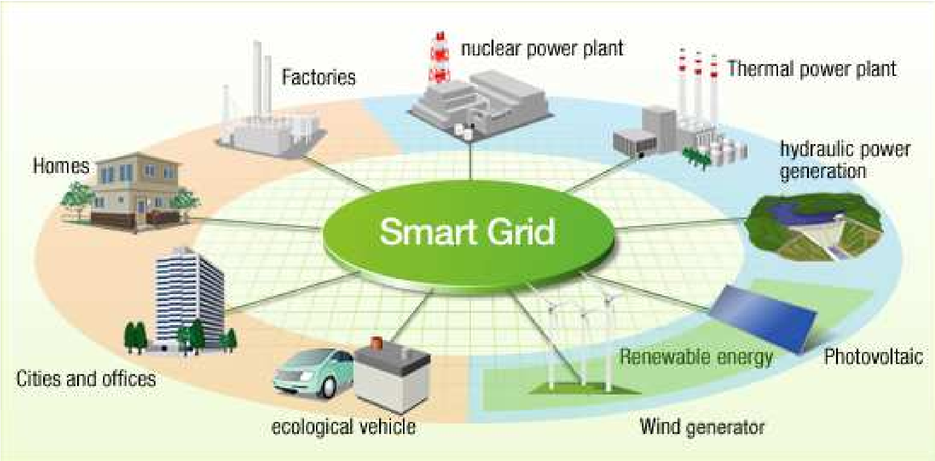

Figure 2. *Design of smart grid system.*

With the technology developing rapidly, the demand for electricity in turkey is increasing every day. 2013, according to data from 64,000 gwh per mw installed power and energy production of turkey has surpassed the levels of 240.000. [4]. Environmental factors and production resources to the limitations of electrical energy has made it indispensable to the efficiency. Constantly increasing energy demand and the installed capacity to control existing in our country in order to make most efficient use of the rapid realization of the transition to smart grids is of great importance. Looking at the literature in this area shows that many of the studies has been made. On behalf of management studies generally related to smart grids energy efficiency and demand-side management (demand side management), demand response (demand response, load displacement (load shifting) and load shedding (load shedding) studies have been performed on different approaches, such as [5-8].

The 20-20-20 target set by the commission of the European union by 2020, total energy production to 20% of to obtain from renewable sources, greenhouse gas emissions, reduce 20% energy efficiency and 20% increase in energy consumption, a 20% decrease). In line with this goal, the European union and the candidate countries ' infrastructure networks for smart grids of the future have begun work. It is one of the most important goals of smart grids; end-user distributed generation and energy storage more on the side that enables micro-networks of the establishment. Micro-power generation from renewable energy sources increased along with the expansion of power network applications and to meet the demand, energy efficiency, energy storage technologies and systems that will serve as the buffer in addition to the necessary energy has gained considerable importance in. Energy storage technology; improving their electrical power systems, renewable electricity in the transport sector, increase production and petroleum-derived fuels has great potential to offer alternatives to. In this context, the current situation of energy production and consumption in turkey, the rates of energy generation sources with the grid, energy distribution of consumption in the instant monitoring and load balancing issues have gained importance. They are also made regarding the planning in the world, and smart grids, in parallel with the creation of a smart grid infrastructure in terms of turkey and there is room for improvement.

The quality and security of supply of electrical energy from renewable energy sources, meets the requirements of today's needs, yet is insufficient.

The quality and security of supply of electrical energy from renewable energy sources, meets the requirements of today's needs, yet is insufficient. With regard to the storage of renewable energy, as long as the appropriate conditions are provided, especially in the peak energy demands energy to go forward in a significant supporting unit. In short, intelligent energy management, bi-directional, from the producer to the consumer as to the manufacturer and the consumer right from smart appliances, smart meters, smart stations, smart distribution, smart and smart production connected with a chain transmission, high-speed communication network with an active system requires.

Generally when it comes to energy management; and controlling charge of the battery showing the percentages of techniques, MGNI (maximum power point tracker) technique, more energy to be stored as hydrogen, renewable energy sources, the economic analysis of the studies performed, load forecast, such as smart grids research emerges. Apart from this, the measurement values received from the external environment is done by calculating how much energy the system can produce according to [9].

Shengtie and Zhiyuan their simulation in the study, wind and solar energy systems energy production system that is controlling this by making the necessary measurements. Spare batteries as the unit of energy production in the system are used. Chopper controller to control here. At the same time, according to the ambient conditions of the system that allows loads with MGNI how will feed in this control system is decided. Next mgni this system, load monitoring, control, and the car's battery to control the charge and discharge [10].

The battery charge that indicates the percentage of studies; FV solar panels and wind turbines to recharge the batteries a subject of extensive research. At any moment the batteries, how much more energy that can obtain the determination to protect the batteries charging and deep discharge conditions and the determination of these situations on the prevention of deep studies are performed. Studies in these systems, the control elements that control the charging of the active controls and controls that provides dec is based on advanced control techniques. Real-time control simulation studies are also frequently encountered as the work is done. Besides, the percentage of battery charge in electric vehicles, especially for vehicles of this type of control is vital [11].

FV MGNI only solar panels but also for the wind turbine is performed in [12]. Nabil and others in their simulation study, both the wind turbine and pv solar panels maximum power point according to ambient conditions tried to get her to start working on. Correct voltage obtained from both systems are combined in a bus. Here, too, intended to keep the bus voltage is high. At the same time designed as a backup unit, a fuel cell system, including active switching of the chopper are made with mgni in [13]. Similarly, using the method of Chen and concerns in the work others are doing and watch MGNI, multi-chopper input and multi-input inverter using hybrid wind/solar power generation system with energy obtained from feeding the loads. As a result of experimental studies, both from both the system and the maximum power from the wind turbine to try to get fv solar panels, wind speed, and solar radiation and ambient temperature is changed due to the voltage obtained from the generator in a wide range of the system when it has been observed that are not affected by these changes. The digital signal processor is controlled by control elements dec system check has been performed [14]. Apart from that MGNI and advanced control techniques for the determination of this point was used for the purposes of optimization techniques in we see. A study of Hong and others are doing this type of work. The gradient approach was used in this study are used to assess the maximum power point using this technique. This technique is used in the production of the chopper switching signals. It was stated in the article that used this technique gave very good results [15].

The more energy from the batteries in the battery as a backup unit or collection of loads to be stored as hydrogen fed in recent times as more energy is similar to a common method. Khan and Iqbal, wind turbines and fuel cells is obtained from their study with loads of energy and a load of feeding less, and more of the energy generated in the case where this energy is spent on the process of hydrogen production by the electrolysis of matlab/simulink simulation environment is observed in [16]. El-Shatter and others in another survey made by hybrid wind/photovoltaic/fuel cell energy flow in the energy production and management system are carried out. Here by looking at the load condition, in which there is an algorithm that decides that the system would be operational. Both wind turbine and pv solar panels are made to provide maximum efficiency operation of these systems by mgni. By controlling the chopper control technique using fuzzy logic MGNI are made. Hydrogen production via electrolysis and fuel cells are also being used in the system are also carried out. In this way, the loads remain energized in the case where the ambient conditions are available is tried to be prevented [17].

Are many ways to learn on the economic analysis of renewable energy sources and the victim's, this simulation study, the values of the power generated in a particular time period of money to build a resort and a big dump is performed. In addition, the Weibull and Rayleigh probability density functions are used for power account [18]. Barsoum and Vacent that they do to another survey, the hybrid optimization model for Electric Renewables (HOMER) is established using the package named in the economic analysis of energy production system [19]. Apart from these, there are studies where the daily energy planning is done for the house. Ammar and others without any auxiliary power unit in the research of the best management of the energy obtained from photovoltaic solar panels are examined. Designed the system, taking measurements from the environment and transfer data to the computer card through the information it receives are forwarded. Parameter estimation performed in this study, fuzzy energy planning algorithm is used. This power feeding system using different values of loads at the effectiveness of the energy management system is examined [20].

Nagnevitsky and others both in their work using adaptive neural fuzzy controller for the estimation of wind speed and load changes are trying to predict the price of. The giver study, long, medium and short term load forecast, and accordingly it is stated that should be made in administration and planning. The price is estimated in section of the same work; a load circuit of the generator is variable and affected by the natural conditions due to being out of energy, to change the amount of energy they produce, and the kind of energy that is provided to the consumers in terms of price is different because the consumers at the most affordable price without energy price forecast for deciding how to feed studied. Artificial neural networks and artificial neural networks-fuzzy logic techniques are used in research where short-term load and price forecasting is performed and the results compared. The results obtained are not satisfactory, although the wind pretty good about the forecast results have been obtained [21]. Pandal and others engaged in a similar study on the same topic in terms of working with that they get the results that you achieve better results when compared to observed. The difference of methods such as fuzzy logic and artificial neural networks are used in the events [22].

Liu, Song, Sasse and others, and others, are talking about the smart grid and Lu and others in their research. Added networks computer and network technology called intelligent networks, next generation networks are seen as. Remote-controlled, self-control and repair are capable of capable of capable of remote measurement and evaluation and pricing, and in doing so to achieve the maximum efficiency from the available resources that they can use to select the cheapest source of a network with advanced control system describes. Their own consumption and pricing, the values of users in this system can monitor as a snapshot in the internet environment. In this way, a control system for manufacturers to be able to follow the region in which consume more electricity when energy consumption is minimal and the system is costly in cases where the feed from the station or stations to close opportunities discusses how energy production can give. All over the world, many countries have tried to revert to the shape of the grid is observed. This type of system, which controls the network structure, and dec devices mentioned in this article are what might be considered [23,24].

In the near future, the smart grid (smart grid) renewable integration distributed resources into the distribution grid applications is expected to be realized [25]. At this point, the uncertainty and discontinuity of energy production energy sources (such as solar and wind energy) analysis of the effects of power distribution network is important. This system as a result of fluctuations in production will work to ensure that in case of acceptance of the conditions within the limits of network analysis and management in the development of methods is needed.

In summary this research; to investigate the use of new technologies in smart grid applications of energy efficient methods. For this purpose, renewable energy systems (especially solar and wind energy), new technologies for integration into the network of electric vehicle and electric devices are suggested. Smart grid technology also includes recommendations on the applicability of the Turkish electricity energy system.

2. Description of the Problem

Energy should be managed in order to ensure quality and the continuous provision of an energy supply service, charging stations for electric vehicles, integration of the renewable energy sources into the network, costs of production and consumption, and consumers' ability to produce their own energy. It is needed a fast and reliable network infrastructure which can overcome problems that may arise in this context.

Because each country has different network structures, system analysis should be sustained and optimal conditions should be sought during the integration of both smart systems and other renewable energy sources. By creating infrastructure for dynamic analyses of the existing network, dynamic structures as well as short circuit contribution and load flow of the renewable energy systems such as wind and sunlight should also be examined.

Considering the use of electric vehicles and renewable energy contribution, both will increase in the future, infrastructures for power flows which may change direction and protection coordination for group locations. In addition, communication protocols must be selected in accordance with the future network structure. In designing remote energy monitoring and measuring structures, it should be considered to be modern and fast. Appropriate points of the network and different scenarios should also be scrutinized for the network systems capable of active and reactive power control.

There are many factors that will lead to modernize the electric grid. These factors can be summarized under five main groups:

- Political and legal factors
- Competitiveness in terms of economics
- Energy reliability and safety
- Strengthening of consumers
- Environmental sustainability

The factors mentioned above differ by region and thus each region needs to be scrutinized.

3. Method and Material

Power flow analysis applications, which are vital for operating, planning and managing power systems, are constantly improved within the framework of new methods developed. Power flow analysis is performed after abnormal or unexpected conditions to obtain system parameters needed for normal operation. In literature, power system data are usually obtained by Busbar Testing System. The integration of renewable energy sources to the grid can also be solved by means of this method.

It is essential to do grid integration of electric vehicles and equipment using wireless communication methods and power flow analysis in coordination in a center (Figure 3). Thus; it is ensured that the charging time of electric vehicles is organized, the impact of devices on the network is reduced and a continuous and stable energy is provided.

Optimizing with intelligent management of the entire network of energy takes place. Figure 3 proposed in our system, the efficient use of energy production facilities is in question. To be included in the system of renewable energy sources, electric cars, the use of intelligent system and management system of the entire system of the house is our method of communication. In this way, instead of the increased energy
demand for investment in the new plant at certain times, you will be provided with the possible solution.

4. Conclusion

Smart grids appear to be the most appropriate system to respond today's energy needs. As a result of both environmental concerns and energy efficiency, studies and works related to the conversion of existing electrical systems to smart grids continue in many countries. Turkey also must take place in these studies. Turkey, along with her contribution to the solution of problems and the production of the necessary technologies in this field, should also not miss the opportunity to be one of the leading countries [1].

Smart grids are electrical networks that will work to provide efficient, continuous, affordable and reliable electricity to all users connected. By means of this system, consumers are provided an opportunity to play their role in optimization in the electrical system and smart home automation projects.

An energy system which will provide better quality and continuous supply of energy along with a more effectively share of renewable energy sources is among the priority targets.

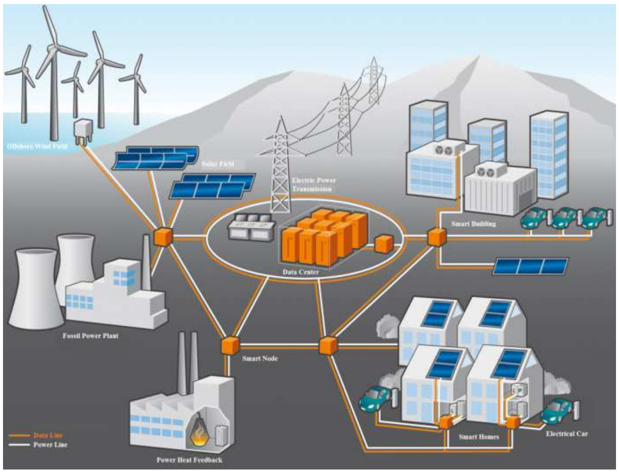

Figure 3. *Smart Grid Energy Management.*

For this purpose, new power plants and power lines should be included in current interconnected system, and our electricity system should be strengthened. In parallel, the electrical system should be made more intelligent through the integration of smart measuring and data transmission technologies into energy production, transmission and especially distribution systems. Thus, it will be possible to achieve demand adaptation according to the energy market conditions, predicting breakdowns and automatic removal of troubleshooting, and large-scale planning of renewable energy sources such as solar and wind.

The physical structure of smart grid systems alone is not sufficient for the energy management system. There should also be taken into account some other factors such as social structure, legal regulations, easy implementation of new technologies imported into the system, and information or data about the education level and usage habits of the consumers. This implementation of grid infrastructure should systematically be done within the framework of a specific calendar and plan [2,3].

This research is of great importance in terms of investigating the smart grid and renewable energy systems which developed countries in the world emphasize and transfer their transfer to our country.

The points such as quality and the continuous provision of energy supply services, charging stations for electric vehicles, integration of renewable energy sources to the grid and consumers' generation of their own electricity are issues on which our country and other countries in the world work.

In addition, research on the applicability of smart grid technology to electric power system in Turkey is needed.

Because each country has different network structure, system analyses integrated to both intelligent systems and renewable energy sources should be sustained and optimal conditions should be investigated. As well as the infrastructure of dynamic analysis of the existing network, load flow and short circuit contribution of renewable energy systems such as wind and solar, their dynamic structure is also troublesome. Apart from all these, considering the contribution of renewable energy which will increase in the future, infrastructures for power flows which may change direction and protection coordination for group locations and communication protocols are among the problems of the future network structure.

Therefore; adaptation of the network optimization of the Europe and United States to our country is one of the limitations in this research. Moreover, owing to the fact that the proportion of renewable energy and energy policies in the United States are different than those of our country, these elements need to be adapted to our systems.

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