

Improving Sustainability Concept in Developing Countries

Libyan Electric Network Requirements

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Abstract

Since decades there has been no basic changes in this century for electrical power grid that cannot be fulfilled by the additive technologies of the past one. The emergence of the smart grid new concepts addresses a challenge for the existing electrical networks. The new technologies and infrastructure that enhance efficiency, performance, and reliability of electrical power grid, is the definition of the smart grid. This can be accomplished by new control automation techniques and modern communications infrastructure, that based on having a sensing, metering, monitoring and modern energy management technologies considering the demand optimization, and energy system availability. Libyan Electrical Network as any other electrical system suffering many problems and should be modernized to meet the smart grid requirements or at least to be ready for interfacing with the modernized electrical networks. The main objectives of this paper is to provide a contemporary look at the current state of the Libyan power grid, and to discuss as well, the requirements that should be considered for this network to be a smart grid. Also to initiate an open research issues in this field applications for Libyan power grid among the research community, and to start a practical steps for the smart grid Road-Map of Libyan electric system.

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1. Introduction

Electricity has proven to be the convenient and efficient means of delivering energy. There is no means to store the electric energy without converting it to another form of energy. So the demand for power produced by suppliers must match the power driven by users [generators, and energy storage devices [3].

The utility industries now facing the challenges in the design and operation of the future power grid, where the

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other non-linear loads [5], leads to a modelling shift in the way that power systems are designed and operated. This trend increases the need for smart grid.

Smart grid systems are based on communications between ISO (independent system operators) ,and RTO's (regional transmission organization), and consumers [5], that results in more efficient use of the renewable energy, which leads to better reliable power system and reduction of carbon emission.

2. Smart Grid Historical View

Smart grid can be considered as a young idea, since it is named in the late 1990's, and practically introduced early 2000's. The first implementation for smart grid was in Italy, that starting in 2000's, where about 30 million smart meters were installed across the country [5]. In 2003 United States began setting up its smart grid project in Austin Texas with installing about 300,000 new smart devices, and Boulder city in Colorado State chosen to be the project of smart grid city [6].

After 2003 many countries in Europe and North America take early steps towards implementation of smart grid systems [7]. Some countries like China, India, and Brazil, also prepare the road-map and take some early steps for the smart grid, also Egypt, Thailand, Korea, and Iran start working on the road-map for smart grid systems, and deviated there research force towards smart grid technologies [9].

Now, the number of country's projects for smart grid cities are in progress, but still long way for the smart grid to be the major electrical grid [3].

3. Smart Grid Definition and Applications

Smart grid given many different definitions even though it seems its coming from the same source or idea: Generally, Smart Grid is a type of modern grid that supports all parts of national grid [9]. Smart grid is the next generation of power grid to resolve the problems of the of current power grid systems [1].

Application of smart grid in developed and developing countries, goes through different directions according to their national grid requirements, understanding of smart grid technologies, availability of smart communications means, quality of the their national grid, and scientific and technical force and budgets availability.

According to the definitions of smart grid, which is considered as the tool to increase the power system efficiency with an environmentally friendly way[2], that can be achieved by upgrading the electrical power infrastructure and efficiency of generators, transmission, consumption, and conversion.

Some applications concentrating on the using of the smart devices as the base for smart grid, and others concentrating on the generation and transmission systems upgrading to achieve the highest quality and reliability of power system based on new technology applications of information and communications systems. But the most important part for application of smart grid is the Distribution system or so called Smart Distribution Grid, where the renewable sources taken in consideration for energy integration and consumers attentions.

4. Libyan National Electric Grid and Requirements

Libya is one of the largest countries in North Africa; its area is about 2.0 million square kilometer, with coastline stretched on the southern shore of the Mediterranean Sea for about 2000 km length.

Libyan electric power network systems are linked between the high voltage (220kv and 400kv) networks and low voltage (11kv) networks, through a medium voltage transmission circuits of 30kv, and 66kv. The average demand growth rate over the past three decades was 8% per annum. Accordingly, the generations and network expansions to meet the requirements of this growth have always been the consequent result. The cables and overhead lines for power transmission are about 22,258 km long, and the number of 30kv network installed substation is 355, and 175 substations for 66kv network besides the low voltage substations and transformers. The peak load is about 6000 MVA [10]. Libyan power grid is one of the best grids among North African countries, it's always updated and renewed until

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