Development of Renewable Energy Potential in Kuwait

¹Naser A. N. Muhaisen, ²Musse Mohamud Ahmed, ³Sheroz Khan, ⁴Mohamed H. Habaebi,
⁵Nabil A. Ahmed, ⁶Atika Arshad

^{1, 3, 4, 6}Department of Electrical and Computer Engineering, International Islamic University Malaysia, Malaysia

²Electrical and Electronics Engineering Department, Faculty of Engineering, UNIMAS, Sarawak, Malaysia

⁵Department of Electrical Engineering, Faculty of Technological Studies, Shurwaikh, Kuwait

¹failakawe75@gmail.com

Abstract— This paper is aimed at proposing an effective solution to enhance continuous power availability and to reduce the peak load demand in Kuwait electric grid system. The peak demand is made up from solar renewable energy sources. The potential of renewable energy as power generation sources in Kuwait has been studied and solar energy potential has been analyzed. In the pursuit of proposing a system based on a hybrid of solar and wind, this paper only discusses the solar energy part. In this paper, solar energy system performance has been simulated using PSIM software in order to examine the real justification of utilizing it as an alternative solution to Kuwait electricity demand during peak hours of a hot summer day.

Keywords—renewable energy; electric grid; solar; wind

I. INTRODUCTION

As the power demand increases rapidly due to the growing number of population in Kuwait as well as style life modernization, the peak load demand causes many problems in the utility grid. The hours of sunshine per day in Kuwait are quite significant and receives a huge sum of solar radiation particularly in summer [1]. The results and conclusions will be greatly affected by the weather conditions. The weather data used in this paper is that of monthly average solar radiation that has been collected over a period of ten years from the ministry of electricity and NASA. The amount of solar energy reaching the earth's surface is ten times more than the world's total fossil fuel energy resources. The Sun's irradiation on earth is 14,000 times higher than the world's energy consumption [2].

Fig. 1 shows the world's energy spending in contrast to all its remnant resources and its annual energy possible usage. It is important to know an estimate of the resultant daily total solar radiation on a fixed surface facing south for each month of the year [3].

Fig. 1. World's energy consumption in comparison to all its fossil resources and its annual energy potential

Fig. 2 shows the solar radiation for the horizontal surface in the years 2000, 2005 and 2013 as obtained from NASA [4]. The monthly average global solar radiation intensity on a horizontal surface in Kuwait area over 12 years is also given [5].

Fig. 2. Monthly global solar radiation intensity on a horizontal surface (KWh/m².day)

II. SOLAR CELLS EXPENSES AND EFFICIENCY

The solar cells are still too expensive to produce a significant portion of the world energy needs but the price