



Solar electricity development and policy support in Ghana



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ABSTRACT

Limited fossil resources, the continuous increment in fuel prices and severe environmental problems require new sustainable electricity generation options, which utilize renewable energies. Solar photovoltaic generation is a proven renewable energy technology and has the potential to become cost-effective in the future, for it produces electricity from the solar radiation. In Ghana, the electricity demand is rapidly increasing at a rate of 10% annually. In the attempt to change the conventional energy intensive economical development and its negative impact on the environment, the government has begun to support the development of the solar photovoltaic technology strongly. In this paper, the state of solar photovoltaic, the challenges facing the industry, the potential of the technology, the policies and strategies to promote development of the technology have been presented.

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1. Introduction

More than 1.64 billion people in the world lack access to electricity, of which approximately 80% live in rural Asia and Africa. Less than 40% of the African population have access to electricity [1]. The electrification level in rural areas in Africa is about 51%, compared to 90% in urban areas, with the majority of the unelectrified areas located in rural and peri-urban areas where access to grid is financially unviable [2]. As the demand for energy continues to increase due to increasing population and economic growth, one of the world's greatest challenges will be how to meet the rising energy demand [3]. With the continues situation of increasing energy demand, unstable energy prices and reinforcement of counter measures for global warming, renewable energy sources have taken the spot light and have been widely exploited and developed in recent years [4].

Currently, the energy challenge ahead of human kind is to replace the fossil fuel with renewable energy sources while keeping pace with the worldwide increasing thirst for energy because of increasing population and rising demand from developing countries. This challenge has to be answered with a low-cost solution using abundantly available raw materials. The sun is an obvious source of clean and cheap energy, already used by nature to sustain almost all life on earth. Consequently, harnessing the power of the sun with photovoltaic technologies appears to be a reasonable large scale answer to the energy challenge [5].

The most abundant form of energy is solar energy. The greatest amount of solar energy is found in two broad bands around the earth between 15° and 35° North and South parallels. In most favorable regions between these parallels there is a minimum irradiation of 5 kW h/m²/day. These regions are on the equatorial side of the world's arid deserts. These have less than 25 cm of rain in a year. In some countries, in those regions, more than two-thirds of the area is arid and there is over 3000 h of sunshine per year, over 90% of which comes as direct radiation. These areas are particularly well suited for applied solar energy.

The next most favorable region for the purpose of solar energy application is in the equatorial belt between 15° North and 15° South parallels (Ghana lies between these areas). There, the humidity is high, cloud cover is frequent, and the proportion of scattered radiation is high. There are about 2500 h of sunshine per year with very little seasonal variation. Minimum irradiation ranges from 3–5 kW h/m²/day throughout the year [6]. Ghana's location in this region makes it natural that the application of solar energy should be given priority. The dependency on hydro energy and fossil based fuels for electricity generation has been far too long and the time has come to make use of the solar resource potential of the country [7].

To foster economic growth as well as improve quality of life of families, the Government of Ghana (GoG) recognizes the need to diversify the national energy mix to take account of renewables such as hydro, wind, solar, etc. The *national energy policy* of Ghana seeks to provide universal access to electricity by the year 2020. The policy aims at energy diversification and at increasing the share of renewable energy component to 10% of the national energy mix by 2020, however at the moment less than 1% of Ghana's electricity comes from renewable energy sources such as solar and biomass [8]. Hence the development of the renewable energy resource of the country, including solar, is therefore a key policy objective of the government. In the light of this, the paper presents the state of Solar Photovoltaic in the country and the strategies and policy instruments in support of the development and the dissemination of the technology.

2. Ghana's renewable energy policy

In order to promote economic growth and reduce poverty, the government of Ghana through the Ministry of Energy and the Energy Commission in January 2009, set objectives of increasing power generation capacity from 1810 MW (MW) to 5000 MW by 2015, and also make electricity accessible to every part of the country by 2020. To meet these goals, the Ministry set to work on enhancing the generation, transmission and distribution of electricity throughout the country [9].

The main policy issues in the renewable energy sub-sector include the low level of application of new renewables (small hydro, modern biomass, wind, solar, and bio fuels) in the national energy mix and the over dependence and inefficient utilization of woodfuel resources [10]. The policy goals of the renewable energy subsector are to achieve 10% contribution of modern renewables (excluding large hydro and woodfuels) in the electricity generation mix by 2020, reduce the demand on woodfuels from 72% to 50% by 2020, promote development and use of other biomass technologies including biogas, biofuels, gasification and waste-to-energy.

Currently solar and wind energy systems are exempted from both import and value added tax (VAT). However components for use with solar and wind generation systems benefit from preferential import duty of 5%

2.1. Key challenges to be addressed by the policy

There are number of challenges facing the energy sector in Ghana in general and the slow adoption and expansion of solar energy sources in particular. The increasing demand for energy for industrial, commercial and domestic sectors of the economy due to the rapid expansion of the economy coupled with growing population. This increasing demand has not been matched with a corresponding rate of expansion of the conventional energy sources. The traditional dependence on fuelwood, for example, means that the risk of fundamental imbalance between energy production and indigenous resources has become more imminent for all the major energy forms. The over reliance on energy imports to meet local shortfalls of conventional fuels, poses serious threat to the country's supply security, making it vulnerable to external pressures.

Another important underlying factor for the promulgation of the energy policy is the high levels of end-use inefficiency culminating in waste of final energy forms, coupled with inefficient pricing of energy services resulting in poor financial positions of the energy providers, threatening the country's growth. Solar energy, which is relatively abundant, is barely exploited to supplement the traditional energy sources [9].

2.2. Renewable Energy Act of Ghana

In November 2011, the Parliament of Ghana passed into law The Renewable Energy Act (Act 832). The Energy Commission is a statutory body established under Act 832 with the mandate to regulate and license all activities in the Renewable Energy sub-sector. The Act is intended to promote the development and utilization of renewable energy sources for electricity generation. It provides the framework for Government support for electricity generation and supply of electricity from renewable energy sources as well as create the enabling environment to attract investment into renewable energy sub-sector.

The Act aims at encouraging businesses, households and communities to adopt renewable energy technologies and also increase their use in their energy mix. Renewable energy use is expected to help diversify electricity supply sources and thereby safeguard energy security; and improve access to electricity for all categories of users. It will also lead to building indigenous capacity in technology for

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