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ScienceDirect

Energy Procedia 106 (2016) 97 – 110

Energy Procedia

1st Energy Economics Iberian Conference, EEIC | CIEE 2016, February 4-5, Lisbon, Portugal, APEEN (www.apeen.org) and AEEE (www.aeee.es)

Solar Photovoltaics in sub-Saharan Africa – Addressing Barriers, Unlocking Potential

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Abstract

Africa is endowed with significant amounts of renewable energy (RE) resources, including solar energy. It receives some of the highest levels of annual radiation globally. Yet Africa remains the poorest region of the world, in terms of energy access – in contrast with its endowment. This reality, of abundant sunlight, leads some to have an almost fairy-tale idea about solar photovoltaic (PV) technology and its current role in enhancing access to energy in Africa. In this paper, some of the barriers facing solar PV energy systems development in most countries in Africa are discussed, and recommendation are made on how to address some of these barriers.

Peer-review by the scientific conference committee of EEIC | CIEE 2016 under responsibility of Guest Editors.

Keywords: Utility.scale PV systems, levelised cost of electricity, reserve margins, solar home systems, feed.in tariff

1. Introduction

The International Energy Agency (IEA) in 2014 estimated that about 620 million people in Africa, representing two-thirds of the continent's population of approximately 1 billion, do not have access to electricity [1]. In several countries, (Mauritania, Guinea, Burkina Faso, Niger, Chad, Central African Republic, D. R. Congo, etc.) more than three-quarters (75%) of the population has no electricity. With 15% of global population, Africa remains the most energy poor region in the world, contributing just

Peer-review by the scientific conference committee of EEIC | CIEE 2016 under responsibility of Guest Editors.
doi:10.1016/j.egypro.2016.12.108

about 2.4% of global GDP. As shown in Table 1, countries in the OECD region have average annual per capita electricity consumption of over 8000kWh, however, the average for Africa is just around 590kWh, 20% of the global average and 7% of what pertains in OECD economies. The picture becomes gloomier when the data is analysed to exclude the Maghreb Regions (Algeria, Egypt, Libya, Morocco, and Tunisia) and South Africa. These countries together constitute about 20% of Africa's population, but generate and consume more than 75% of electricity on the continent, and have a per capita consumption of over 2000 kWh/year. This leaves the rest of Africa, predominantly sub-Saharan Africa (SSA), with annual per capita consumption of around 170 kWh [3]. This energy situation stands in contrast with the vast energy resources that Africa is blessed with, both conventional and non-conventional.

Table 1: Key World Energy and Economic Indicators for 2014.

Region/Country/Economy	Population (Million)	% World Pop.	GDP (Bn 2005$)	Share of Global GDP (%)	Electricity Cons. Per Capita (kWh)	Cons per capita against global avg.(%)
World	7036	100	54588	100	2,972.57	100
OECD	1254	18	39490	72.3	8,090.11	272
Middle East	213	3	1430	2.6	3,708.92	125
Non-OECD Europe and Eurasia	341	5	1644	3.0	4,551.32	153
China	1358	19	4756	8.7	3,488.22	117
Asia	2320	33	3568	6.5	892.67	30
Non-OECD Americas	467	7	2369	4.3	2,096.36	71
Africa	1083	15	1331	2.4	591.87	20

Data source - [2]

Because of the triple and inter-connected effects of improved technology, reduction in photovoltaic (PV) module cost and policy initiatives, solar energy is expected to contribute substantially to the future global energy supply. Due to the geographical location of sub-Saharan Africa, its contribution to global supply of energy using solar could be more significant, if adequate infrastructure is available. The global cumulative installed capacity is noted to increase rapidly from 3700 MW in 2004 to over 177 GW in 2014 [4]. In terms of installed cumulative solar power, the top five countries as of the end of 2014 were Germany, China, Japan, Italy, and USA, with installed capacity of 38.2 GW, 28.1 GW, 23.3 GW, 18.5 GW and 18.3 GW, respectively. Despite the fact that most parts of Africa receive in excess of 2000 kWh (see Figure 1) of global solar radiation annually, the continent has not seen substantial development in solar energy power plants. It may be interesting to know that the cumulative installed solar PV power plant in Germany (a country located in a temperate region), in 2014 for example, was more than total installed capacity from all energy resources in individual countries in sub-Saharan Africa (except South Africa).

In view of this remarkable resource endowment, many have questioned why solar energy is not leading the way in Africa's electrification, particularly, in the face of rapid uptake of the technology at the global level. The objectives of this paper are to highlight and examine some of the factors that holding back the deployment of Solar PV technologies on the continent. The issues discuss in the paper would