

## Review

## Exploitation of renewable energy for sustainable development and overcoming power crisis in Bangladesh



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## ARTICLE INFO

## Article history:

Received 1 October 2013

Accepted 1 July 2014

Available online

## Keywords:

Electricity generation

Fossil fuel

Renewable energy

Sustainability

## ABSTRACT

A developing country such as Bangladesh, where economic development without compromising the eco-friendly environment is a burning issue, needs huge supply of power. Having very limited fossil fuels, sources of renewable energy such as solar, wind, biomass and limited hydro power are the probable alternatives to offset energy crisis in Bangladesh and similar other countries. Over three-quarters (76 percent) of Bangladeshi people are out of on-grid connected electrical power supply. Undeniably, it has limited natural gas being used for a large variety of purposes. Energy demand is estimated to increase exponentially, implying alarming supply and demand gap. Despite prospects of huge renewable energy sources, presently, this country has only 0.3 percent of renewable energy share to the total energy supply. This paper reviews the renewable energy status and its prospective use in Bangladesh as well as renewable energy technologies obtainable in Bangladesh. It also attempts to provide future research directions and show ways to harness renewable energies to meet the future demand.

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## 1. Introduction

Present reserve of fossil fuel energy sources will be depleted in a few decades, basically due to high demand and, in some cases, extravagant consumption. Petroleum, natural gas and coal are generally referred to as fossil fuels [1]. Global energy consumption has increased at a geometric average of 5.6 percent from 1973 onward [2]. In terms of its growth, energy demand will rather increase rapidly by one-third from 2010 to 2035, where expectedly both India and China will need highest energy supply (from external sources) in the world, at a rate of around 50 percent during that period. It resembles a disquieting spectacle for growing energy demand in rapidly industrialized and economically emerging countries (Fig. 1) [3]. However, the most industrialized and largest oil importing country in last decade, the United States is expected to cut down its oil import by 2035 because of rising domestic output and gradual induction of fuel efficient transport system. On the other hand, China is supposed to be the largest oil importer by

2020 [3]. In addition, in 2010, around 81.1 percent of the total primary energy share was used from fossil fuel that precludes nuclear, hydro, bio fuel and other energy sources (Fig. 2) [4]. As per Fig. 2, in 1973, percentage of the total primary energy share was 86.7%. Over three eras, the share has reduced to 5.6%. On the other hand, globally, 57.7 percent of the energy is accounted for transportation system [1]. This certainly implies a concern for the policy makers for exploring alternatives that would be viable and regenerative to attain sustainability. Here, sustainability refers to maintainable provisions of energy that fulfill the contemporary energy demand without affecting future demands. To make it clearer we can refer to the definition of [5] which states-“development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. In order to maintain sustainability or in other words, in order to meet the needs of the present without affecting future demands; renewable energy opened up prospects for appropriate resource conservation and an eco-friendly solution directed to energy security [6]. However, both developed and emerging economies have already identified this window of opportunity and started diverting their energy mix with renewable energy resources [7,8].

Currently, around 18 percent of the global total energy consumption is exploited from renewable energy resources - biomass,

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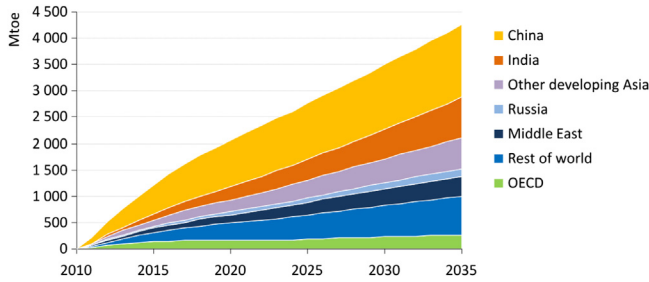


Fig. 1. Growth of primary energy demand. (Source: World Energy Outlook 2012: in-depth study on energy-efficiency<sup>©</sup> OECD/IEA 2012).

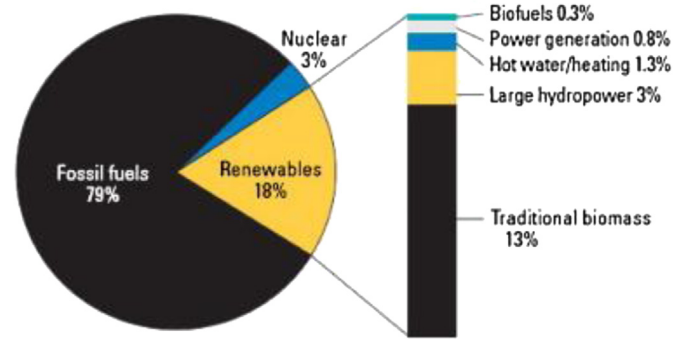


Fig. 3. Renewable energy share of global final energy consumption. (Source: World Energy Outlook 2008<sup>©</sup> OECD/IEA 2008).

biofuel, hydro power, and power generation from solar energy (Fig. 3) [1]. It is heartening to note global investment on renewable energy has increased by an annual growth of 17 percent, thus reaching a new record of US\$257 billion in 2011. Being the largest oil importer in the world, China is now massively investing on renewable technologies as well, with a record of US\$51 billion, which is higher than what is invested in Germany, the United States, India, and Italy. In terms of exploitation of conventional energy resources, such as coal, gas and nuclear power, China is also in the forefront of electricity generation from renewable energy sources; this is likely to exceed 5500 TWh by the year 2035 (Fig. 4) [9]. Similar pattern of investment is underway in new regions, especially in developing countries; however, at a much slower pace.

Renewable energy sources are becoming much sought-after as it has low CO<sub>2</sub> emission; they can provide an eco-efficient solution for developed and developing countries. European Union (EU) is generating 71 percent of its electricity from renewable energy sources [10]. Developing countries can also focus on use of solar, wind, biomass, and hydropower by taking advantage of favorable geographical locations. But there is still lack of adequate feasibility studies [11]. Traditional biomass energy is estimated to have 13 percent share of the total renewable energy, which is evident in agriculture-based developing countries where grid connected power is greatly inadequate or absent, and, notably, majority of the population, even at times as high as 80 percent, live below the poverty line [12]. The market opportunity and new entrepreneurship development in the sector potentially lead to higher income generation and economic growth, especially in developing countries [13]. It appears policy measures undertaken by the government and non-government organizations in Bangladesh are on track to take forward the renewable energy

drive in Bangladesh [11]. Therefore, more researches need to be undertaken to expand public-private partnership in order to implement the policies.

In this research, before we discuss further about Bangladesh, we will provide a broad brush about other developing countries having similar terrain like Bangladesh. As such we considered the neighboring countries such as Pakistan, India and Nepal. Till May 2011, Pakistan had an energy deficiency of 700 MW [14]. Pakistan is currently depending on fossil fuels, nuclear, hydropower and renewable energy [15]. Importing liquefied natural gas from Iran, Qatar and Turkmenistan can be one of the options for Pakistan. And then the remaining deficiency can be filled by exploiting renewable energy. Nepal is basically dependant on fossil fuel [16]. Currently, Nepal is exploiting various types of renewable energy sources. These are- biogas, biomass, biofuel, micro and pico-hydro technology, improved water mill, solar photovoltaic technology, solar thermal technology and wind energy [17]. Out of all these the dominant mode is biomass technology. The case of India is different from that of Nepal and Pakistan. India is a highly populated country having limited resources. Almost 400 million citizens in India do not have access to electricity [18]. India has a good reserve of poor quality coals which are not easily accessible [18]. In such a case, it is not wise for Bangladesh to import electricity from its neighboring countries. Like India, Bangladesh has a large population, and unlike India it has a small GDP. To resolve the simmering energy problem it must look for some other alternatives. Renewable energy can be one of such alternative to overcome the power crisis up to a certain extent.

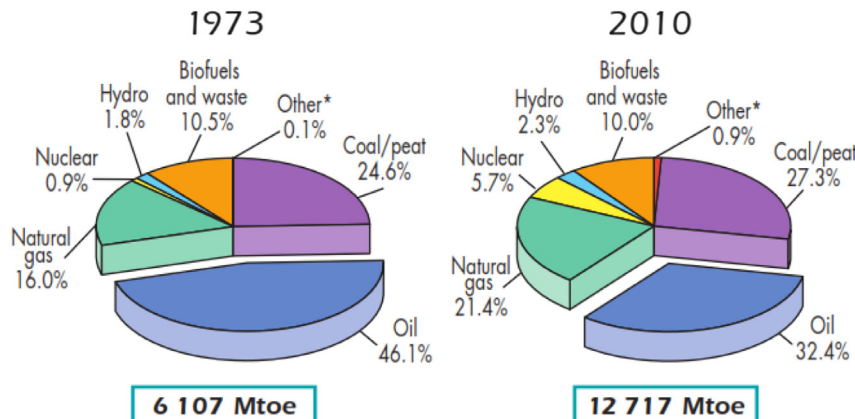


Fig. 2. World fuel share of total primary energy share. (Source: Key World Energy Statistics<sup>©</sup> OECD/IEA 2012).

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