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## Overview of energy portfolio in Pakistan

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### Abstract

Sustainable and affordable energy supply has strong correlation with the socioeconomic activities of developing countries. Pakistan is an energy deficient country with a shortfall within power output of around 6500MW in the form of load shedding. This paper aims to provide an overview of current energy mix, key dimensions, gap between supply and demand and potential of energy sources to meet the future demand in Pakistan. Except for the nonrenewable energy, Pakistan has a renewable energy potential of 2,900,000MW for solar, 346000 MW for wind 3000MW for biogas, 2000 for small hydropower and 1000MW for waste-to-energy, with its share in total present energy scenario being less than 1%. It is suggested to manage existing resources and infrastructures, optimize the energy planning, and enhance the partnership with private sectors and international agencies. Local policy makers and planners should also give priority to the renewable energy to increase its share in the total energy mix and promote the sustainable energy profile of Pakistan

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### 1. Introduction

Sustainable and affordable energy supply has strong correlation with the socioeconomic development of any country due to increasing population, urbanization and industrialization [1, 2]. Most of the countries throughout the world rely on Fossil fuel to meet energy requirement , 87% of which was met by non-

renewable fossil fuels such as coal, oil and gas, while 9% by renewable energy and 4 % by nuclear power in 2014 [3]. Pakistan is a developing country, where energy demand has risen dramatically due to population explosion and modern development. Like most other countries, Pakistan mainly relies on fossil fuel to meet its energy requirement. The exhaustion, accelerated demand and adverse effects on environment of non-renewable energy have forced policy makers and planners to think about environment friendly alternatives. Therefore, many innovations are undergoing to increase the renewable energy supply globally.

Unfortunately, in the current energy supply scenario of Pakistan, the renewable energy contribution is just a small part of the total percentage. In the past decades, very few serious and remarkable efforts for renewable energy sources have been made in Pakistan, which has resulted in great challenges: particularly in electricity and gas load shedding (more than 8-10 hours), price risen, law deterioration, unemployment and food deficiency are impeding the sustainable development of national economy. In fact, Pakistan has a great potential for renewable energy utilizations if a suitable infrastructure implementation is adopted as a possible option like those of Ireland and Denmark [4, 5].

This paper intend to present an overview of current energy portfolio of Pakistan in energy supply and demands, pinpoint energy crises in the context of energy shortfall, challenges, comparison of different sectors (domestic, commercial, agricultural and industrial), which are presented to rank the priority in terms of energy consumption, renewable and nonrenewable energy potential with possible recommendations. Various renewable energy sources including hydropower, solar, wind power have been explored to find an option for secure and sustainable energy.

## **2. Current energy status of Pakistan**

In Pakistan, primary energy sources are mainly thermal (87%), hydropower (11%) and nuclear power (1.7%). The total energy supply in 2013 was 64.5 million tons of oil equivalents (MTOE). The primary energy sources were Oil (20.96 MTOE), Gas (31.1 MTOE), LPG (0.3 MTOE), Coal (3.8 MTOE), Hydroelectricity (7.1 MTOE), Nuclear electricity (1 MTOE) and imported energy (0.08 MTOE) with different level of share. The share of gas was 48.2% in total energy mix of country, followed by oil 32.5%, hydro 11%, coal 6, nuclear 1.7%, Liquid Pressurized Gas (LPG) 0.5%, and imported energy 0.1%. In 2013, industrial sector was the largest energy consumer, which accounted 35.5% of the total 40.18 million TOE energy consumption, followed by transportation sector of 31.6%. Domestic sector was the largest consumer of electricity, accounting for 47% of the total 76789 GWh electricity consumption, followed by industrial sector with 29.05% [6]. Pakistan electricity generation capacity at the time of independence was only 10.7MW, which increased significantly from 7000MW in 1980 to about 16000MW in 2013-14, but this supply amount is still much less than the rising demand. Currently, Pakistan is facing serious electricity shortfall, about 6-8 hours in urban areas and 8-10 hours in rural areas in 2012. The electricity gap between supply and demand is depicted in Figure 1

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