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# Overview of the initiatives in renewable energy sector under the national action plan on climate change in India

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ABSTRACT

The increased fossil fuel use worldwide in past several decades has led to enhanced green house gas emissions leading to climate change issues. India is the fourth largest $CO_2$emitter in the world after China, USA and European Union. Its power sector is contributing nearly half of carbon emissions which is largely based on fast depleting fossil fuels with little share from nuclear, hydro and renewable energy sources. India's rapid economic growth is placing enormous pressure on its energy resources besides impacting the environment. The demand and supply imbalance in energy sector requires serious efforts to utilize renewable energy sources to reduce carbon emissions. In order to address these issues India has launched a National Action Plan on Climate Change (NAPCC) with eight "National Missions" to promote development while addressing climate change issues effectively. In this direction the Indian government has taken several steps recently for the promotion of renewable energy in the country under the National Action Plan for Climate Change. The main objective of the study is to review various initiatives in renewable energy sector with focus on climate change concerns and power generation under various components of NAPCC. The initiatives under the plan are critically examined and gaps in the implementation are identified. The current state of utilization of renewable energy sources namely solar, wind, hydro and bio-energy are presented considering technological developmental challenges. The need for effective inputs on resource and technological development mechanisms for renewable energy exploitation in the country are highlighted. The issues discussed in the study will be beneficial for long-term economic development of the country besides addressing climate change concerns.



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## 1. Introduction

The increased fossil fuel use in the past several decades has raised concerns about the depletion of fossil resources in future. This has also raised serious environmental concerns leading to climate change issues. Human activities are responsible for dumping about 8 billion metric tons of carbon into atmosphere every year out of which 6.5 billion tons is from fossil fuels and 1.5 billion tons from deforestation. Tropical deforestation in Africa, Asia, and South America are thought to be the largest contributors to emissions from land-use change globally. Climate change impacts are expected to affect agriculture thus endangering food security, increasing natural disasters, species extinction, spread of vector-borne diseases, rise in sea-level and accelerating erosion of coastal zones.

The top carbon dioxide ($CO_2$) emitters are China, United States, the European Union, India, Russian federation, Japan, and Canada based on the data which include $CO_2$ emissions from fossil fuel combustion, cement manufacturing and gas flaring [1]. However, changes in land-use are important-global estimates indicate that deforestation can account for 5 billion metric tons of $CO_2$ emissions, or about 16% of emissions from fossil fuel sources.

Power plants in the U.S.A cause about one-third of carbon pollution emissions and are the largest drivers of climate change. Recently U.S.A has announced clean power plan which will accelerate the transition to a clean energy in future to reduce its $CO_2$ emissions by 32% by 2030 below 2005 levels [1]. China has also offered to reduce its emissions by 2030 with the increase in the use of non-fossil sources to 20% by 2030. Based on these initiatives U.S. and China's per capita $CO_2$ emissions are likely to reduce to about 12–13 t by 2030.

India is the fourth largest $CO_2$ emitter in the world with 2000 million tons of emissions with power sector contributing nearly half of the country's carbon emissions. At present India is fifth largest power market in electricity generation in the world which is largely based on fast depleting fossil fuels like coal, gas and oil. The hydro and renewable power generation has a little share in comparison to the fossil fuels. The present status of power generation in India is shown in Fig. 1 [2].

India's per capita energy use has increased from 16.3 kWh in 1947 to 957 kWh in 2013–14 whereas the power generation capacity of India has increased from 1362 MW in 1947–271 GW as on March 31, 2015 [3]. However, the electricity generation has not been able to keep pace with rapid industrialization and population growth. As a result energy continues to be in short supply, with a shortage of 2.1% and peak shortage of 2.6% in the country. Even today, India has 75 million households without access to electricity and demand for electricity is expected to rise further. Considering the present scenario India's power sector is expected to rely on imported coal till 2030 [4]. Despite high coal reserves, the share of imported coal in the country has grown rapidly which may rise to over 30% in the next few years because of challenges in domestic production and the quality of coal [5].There is an increased environmental concern due to air pollution caused by coal-based power generation. The import of natural gas is also likely to increase from about 25% to over 60% by 2035 to meet the four times increase in the demand for the fuel [6].

This dependence on fossil fuel based power production needs to be reduced in view of carbon emissions and from energy security [7]. The green house gas emissions can further be reduced by adopting distributed generation (DG) technologies based on renewable energy sources for electric power generation [8]. The environmental concerns are drawing attention of policy-makers in implementing fossil based project development and operations [9]. The rapid industrialization and economic development in India are expected to increase the dependence on fossil fuel based energy sources [10]. Thus India needs to increase the share of renewables in the overall energy mix for electricity generation to meet its commitments to reduce its carbon emissions. Thus, large-scale deployment of renewable energy can help India in addressing three most important issues: energy access, energy security and GHG emissions.

India has recently committed to reduce the green house gas emissions by 20–25% by 2020 from 2005 levels. India has launched a National Action Plan on Climate Change (NAPCC) on June 30, 2008 with eight “National Missions” to promote development while addressing climate change effectively. The main objective of the study is reviewing various initiatives under NAPCC for addressing climate change concerns and promotion of renewable power generation and to identify challenges for renewable energy development in India.

The paper is organized as follows: in Section 2 outlines of NAPCC are presented. Initiatives taken for the promotion of renewable energy and Current status of renewable energy source utilization in the country are described in Section 3. Conclusions are drawn in Section 4.

## 2. Outlines of national action plan on climate change

The National Action Plan on Climate Change (NAPCC) outlines the policies to address climate mitigation from fossil fuel to non-fossil fuel based economy by utilizing renewable energy sources.

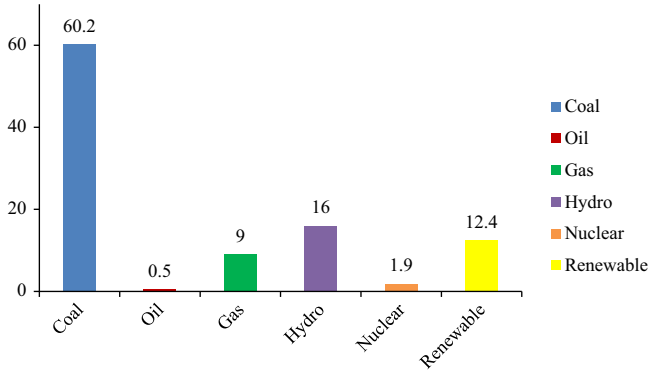


**Fig. 1.** Power generation from various sources of energy in India [2].