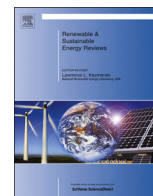




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Barriers to renewable/sustainable energy technologies adoption: Indian perspective

Sunil Luthra ^{a,*}, Sanjay Kumar ^b, Dixit Garg ^c, Abid Haleem ^d^a Department of Mechanical Engineering, Government Polytechnic, Jhajjar 124103, India^b Department of Mechanical Engineering, International Institute of Technology and Management, Murthal 13103, India^c Department of Mechanical Engineering, National Institute of Technology, Kurukshetra 136119, India^d Department of Mechanical Engineering, Faculty of Engineering and Technology, Jamia Millia Islamia, New Delhi 110025, India

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ABSTRACT

Rapidly increasing energy demand and growing concern about economic and environmental consequences call for renewable/sustainable energy technologies' adoption in India. Renewable/sustainable energy technologies have faced a number of constraints that have affected their rate of adoption. In this paper an attempt has been made to identify and rank the major barriers in the adoption of 'renewable and green' energy technologies in the Indian context. Twenty-eight barriers have been identified from an extensive literature review. These identified barriers have been categorized into seven dimensions of barriers, i.e. Economical & Financial; Market; Awareness & Information; Technical; Ecological and Geographical; Cultural & Behavioral; and Political & Government Issues. Analytical Hierarchy Process (AHP) technique has been utilized for ranking of barriers to adopt renewable/sustainable technologies in the Indian context. All pair comparisons in AHP have been made based on experts' opinions (selected from academia and industry). Sensitivity analysis has also been made to investigate the priority ranking stability of barriers to adopt renewable/sustainable technologies in the Indian context. This paper may help practitioners, regulators and academician focus their future efforts in adoption of 'renewable/sustainable energy technologies' in India. Further, this understanding may be helpful in framing the policies and strategies towards adoption of renewable/sustainable energy technologies.

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* Corresponding author. Tel.: +91 9466594853.

E-mail addresses: sunilluthra1977@gmail.com (S. Luthra), skbhardwaj19711971@gmail.com (S. Kumar), dixitgarg@yahoo.co.in (D. Garg), haleem.abid@gmail.com (A. Haleem).

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1. Introduction

Due to the rapid consumption of conventional energy resources such as crude oil, coal, and natural gas, many initiatives taken all over the world have addressed towards the efficient use or replacement of these resources. Several renewable energy sources have been introduced and argued as alternatives to traditional sources to protect environmental resources and improve the quality of life. With the growing concerns about Green House Gas (GHG) emissions and consequent climate change, renewable energy sources have become more attractive options for power generation around the world as well as in India.

India accounts for 17% of the world's population but only 4% of the world's primary energy consumption. Modern renewable resources account for a small portion of the total energy mix. India is the only country in the world that has a separate ministry – 'Ministry of New and Renewable Energy' (MNRE), earlier known as the Ministry of Non-Conventional Energy Sources [1].

India has tremendous energy needs and increasing difficulty in meeting those needs through traditional means of power generation. On July 30 and 31, 2012, the world's largest blackout – The Great Indian Outage, stretching from New Delhi to Kolkata – occurred due to the failure of the northern power grid and affected nearly 700 million people (twice the population of the United States) [2]. Renewable energy sources such as small hydropower, wind, solar, biomass, and geothermal may in principle meet many times the world's energy demand; and provide sustainable energy services, based on the use of routinely available, indigenous resources [3].

Renewable energy has the potential to play an important role in providing energy with sustainability to the vast populations in

developing countries who as yet have practically no access to clean energy [4]. High population and subsequent increase in energy demand in developing countries highlight and emphasize the urgent need for renewable, sustainable, affordable and environmentally sound energy systems [5]. India is generously endowed with renewable energy sources widely distributed across the country and the overall potential is more than the current total energy consumption [6]. In the context of the global warming and climate change problem, there is an urgent need for India to plan and expedite implementation of strategies for augmenting the renewable energy share in the energy mix [1] for economic and environmental reasons; and India needs to shift to non-polluting renewable sources of energy to meet future demand for electricity justifying investment in this sector of renewable energy as the most attractive because it may provide long-term economic growth for India [2]. Despite technological developments and economic viability for several applications, renewable energy has been used to a small fraction of its potential due to the existence of several types of barriers to adoption of renewable or green energy technologies varying across countries [4]. Therefore, it calls for the need to identify major barriers to the adoption of renewable or sustainable energy technologies in the Indian context. The two main objectives of this paper are to:

- identify various barriers to adoption of renewable or sustainable energy technologies in the Indian context and
- rank identified barriers to the adoption of renewable or sustainable energy technologies in the Indian context.

We have identified Analytic Hierarchy Process (AHP) as an appropriate methodology to rank various barriers to the adoption

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