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Energy situation, current status and resource potential of run of the river (RoR) large hydro power projects in Jammu and Kashmir: India

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ABSTRACT

Power is the critical infrastructure on which the socio-economic development of the country depends. The growth of the economy hinges on the availability of quality power at competitive rates. Therefore, it is imperative that electricity is made readily available for growth of infrastructure, economy and overall better quality of life of the people of the country. Hydro energy, when compared with other sources, including the renewable one, stands in the top position as it is one of the cheapest and convenient energy available. Being one of the oldest technologies adopted in the world for energy generation it comprises of large, medium and small hydro projects. In this research paper field survey is done in Jammu and Kashmir (J & K) state which has a huge potential for power generation from large hydro projects as when properly tapped will certainly boost growth considerably. A lot of research work has taken place throughout the world for the assessment of sustainability factors related to large hydro projects, but these are mostly for reservoir based projects. Less literature was available which highlight the factors related to the sustainability of without reservoir-based hydro projects especially in the western Himalayan regions of India. The main objective of this research article is to identify the factors which are responsible for the slow development of the large hydropower projects in Jammu and Kashmir. It is very important to utilize the state's water resources in an environment-friendly manner to provide a solution to the energy problems in remote and hilly areas of J & K.

1. Introduction

Energy is the lifeline of today's world [80]. India, which is the seventh largest energy consumer of the world, is facing great challenges in meeting its energy demand. There is a huge gap between the energy required and the energy availability which is further increasing and is a matter of great concern [1]. As per the estimation, up to the year 2011 about 400 million people of India were not having access to electricity and about 836 million were depending upon the traditional biomass for cooking. This shows that the majority is still devoid of modern and cleaner ways of living [2]. In order to maintain the desired growth rate for 25–30 years, the country has to improve its energy production at a reasonable price. For this supply has to be increased by 4–5 times and generation by 6–7 times than its 2012–2013 level. The policy therefore is required to be formulated in a manner so as to meet the future demand after taking into account the environmental concerns [81].

In India the viable hydro potential estimated to be about 84,000 MW at 60% load factor, which is equal to the capacity of 150,000 MW [3]. Jammu and Kashmir, Uttrakhand, Arunachal Pradesh and Himachal Pradesh consist more than 80% of the total hydro potential of the country. These 4 Himalayan states are also known as the water tower of India [5,6]. Fig. 1 shows the all India installed generation capacity till February 2014. The coal/lignite power houses have an installed generation capacity of 130,221 MW and where as the hydro energy powerhouses have installed capacity of 40,195 MW. This shows that hydro energy in India has installed generation capacity of about 17.7%, whereas the coal energy have installed generation capacity of 58%, followed by gas 9%, diesel 1%, Nuclear 2% and renewable energy 13%. So the hydro energy is having the second largest percentage share in the overall power generation and growth rate. The potential for renewable energy can also be explored by promoting innovation and research work in the field [82]. Global warming and climate changes are a waking call for the country to plan for augmentation of renewable energy's share [7,86]. The main thrust of the Indian government now a day is on developing its basic infrastructure as well as industrial sector so that the ever increasing unemployment problem of the country can be solved. To achieve this goal the country has to improve its energy sector to meet its growing demand. The hydro power potential of the country therefore needs to be fully exploited to its optimum limit in a sustainable way [83,84].

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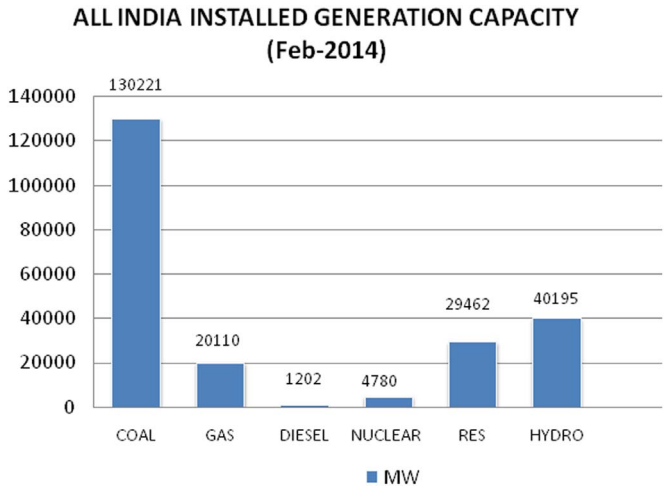

Fig. 1. Shows the all India installed generation capacity in India [4,67].

Among the hydro power projects, run of the river type is found to be more sustainable and economical when compared with the storage type projects because of the less submergence area involved and due to which less population gets dislocated. Therefore these types of projects are gaining more popularity now days in India, especially in the Himalayan regions because of its environmental benefits. In India the 75% of the available hydro power potential still remain untapped therefore central and state governments are interested to increase the power generation capacity of the country at the fastest rate in order to cater to the need of growing demand. To tap this available hydro power potential, the power developers are rushing to the government of concerned states for obtaining the allotment for the construction of hydro power projects. So, under the circumstances it has become very important that sustainability factors related to the hydro power projects do not get ignored in the process of speedy allocation of works. In the past these factors related to the sustainability of hydro power projects were not given much importance and due to which the recent floods in Uttrakhand and Jammu & Kashmir has become an eye opener for the researchers and planners. Construction of hydro projects in the fragile Himalayan zones without taking into consideration the environmental and ecological factors may cause catastrophe for the living beings of the area. For the rapid construction of hydro power projects in India it is becoming very important to have a detailed and comprehensive approach to study its impact on the environment and ecology for the long term sustainable progress [8]. Most of the countries have developed a system for assessing the impact of large hydro power projects on the local environment and this system helps in making their hydro power projects more sustainable and environment friendly. Sometimes power developers in connivance with the government authorities' manipulates by terming these processes as hurdles in the development of the hydro projects and get the environmental clearance. The hydro power projects whose rating is less than 25 MW are exempted from the environmental impact assessment process in India. Despite hydroelectric projects being recognized as the most economic and preferred source of electricity still the share of hydro power remained declining steadily since 1963 in India i.e. from 44% in 1970 to 17% in 2014.

The J & K is only state of India where all the hydro power projects which are already commissioned and under construction are based on the run of the river type, because of the Indus Water Treaty (IWT) between India and Pakistan. So, this is the main reason for selecting this region in western Himalayan for field survey in order to understand the major factors which are responsible for the slow development of large hydro power projects in the area. In this study the main focus is western Himalayan region. The most of the states in this region are gifted with very good hydro power potential and these states are attempting to develop large hydro power projects in their regions in order to improve their energy resources. So a case study of Jammu & Kashmir region has been discussed in this paper. Some authors in the past have highlighted environmental and social impacts of the large hydro power projects in this region but none of them highlighted the challenges which are faced by the power developers during the construction of large run of the river hydro power projects in this part of the country. Since the state is having power supply shortage therefore, it is highlighted in this article. The main objectives of the present study are: (a) to review the importance of Run of the River (RoR) large hydro power projects in terms of their ability to overcome the power crisis in the state (b) to undertake a case study of one large RoR hydro power project in the Chenab river basin of J & K from environmental, social and economic perspectives and (c) to know challenges faced by the power producers during the constructions of large RoR hydro power projects in the state.

2. Methodology

In this paper, we have adopted a subjective approach to perform a case study on one of the top most hydro rich state in the western Himalayan region of India i.e. Jammu and Kashmir (J & K). A study has been made in respect of policies related to large hydro power development in Jammu and Kashmir and assessment of various indicators related to the sustainability of without reservoir based hydro power projects in the state. It is seen that very less literature is available in respect of issues responsible for the slow development of these kinds of projects. The major problems faced by the power developers in J & K during the construction of these large hydro projects are identified and it is observed that inspite of huge hydro power potential, various factors like administrative, social, economical, geological, and environmental and security issues hampered the growth of these power projects. So the field study is conducted of some projects, technical persons which remained associated with these kinds of projects for the past 25 years were interviewed and gathered information for the secondary data like power generation annual report, economic survey report, research papers, international agreements, newspaper reports, detail project reports, environmental impact assessment reports, environmental management progress reports of large hydro power projects for the better understanding of the topic.

3. Validity of criticism against the reservoir based large hydro power projects in India

For some time now, environmentalists mostly from the developed countries as well as from the developing countries have been voicing concern about the adverse impacts of large storage type hydro power projects. These types of projects involve loss of property, economic, social, heritage and ecological resources, in the area where these are constructed. Therefore the question arises that whether storage type large hydro projects are sustainable at the generating end or not. So in order to answer this question, the various linkages and concerns of hydro resources development needs to be studied [9].

3.1. Submergence

The submergence of forest as well as agriculture land is often considered as the major concern in India and in developing countries where it is reducing rapidly. Moreover due to increase in the human population, natural resources have already been encroached to great extent [10]. Since most of the dams are located in the upper reaches of a river basin, the submergence of area is either on waste land or forest land. But it is seen that in India the large storage type dams are responsible for only 2% forest land losses during the period 1950–2000, whereas 98% forest area losses were due to other causes. Besides, above it is also seen that construction of storage type hydro power