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Study of Impact of Government policies on SHP

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ABSTRACT

The industrialization of India and some countries in a south like these countries will make it to have energy crises of the numerousprograms are taking place. This growth in the demand of power might bring in high costs of power generation and destruction of environment if the sewage needs to be satisfied using thermal power plants which work with coal. Hence, making prudent option is to create small hydropower (SHP) and hydropower stations that will bring about everlasting benefits. Such a stock of resources largely met the criteria of being feasible to tap and being economically profitable, and there was a large abundance of them in India. Amazingly, hydropower lags just very slightly - behind the first largest energy productivity from numerous power industries in India. It has undergone massive improvement in the last years, becoming the justrenewable energy source that can be grow also on a small scale. Lately, water power and SHP have been considered the most accessible with the highest availability.

I. INTRODUCTION

In both industrialized and emerging nations around the world, energy is regarded as a critical component in the creation of prosperity, social advancement, and a higher standard of living .Global energy consumption is projected to outpace population growth, with fossil fuels currently constituting approximately 80% of primary energy usage worldwide. In India, a significant portion of electricity generation relies on fossil fuels, particularly coal, which accounts for nearly three-fifths of the nation's electricity production potential due to abundant domestic coal deposits. Despite this reliance, the Indian government has been actively promoting renewable energy production and seeking to decrease dependency on fossil fuels through various initiative implemented .

India's power sector is undergoing a significant transformation, transitioning from a vertically and horizontally integrated structure to an open market model characterized by multiple buyers and sellers. This shift is facilitated by the establishment of regulatory bodies such as the Central Electricity Regulatory Commission (CERC) and State Electricity Regulatory Commissions (SERCs), aimed at fostering competition, efficiency, and economic operations within the electricity industry. The regulatory framework is governed by the Electricity Act of 2003, which consolidates legislation related to electricity production, transmission, distribution, trade, and consumption. This legislation also allows for competition among retailers and bulk electricity suppliers in the Indian power market. As part of the reform process, several states have unbundled and corporatized their former State Electricity Boards (SEBs) and privatized distribution.

Hydropower plays a crucial role in India's competitive power sector, experiencing a steady increase in recent years due to growing energy demand while exerting minimal environmental impact. Leveraging readily available indigenous resources, hydropower holds the potential to provide sustainable energy solutions and address the nation's enduring energy challenges effectively.

The second-highest energy sources in India are hydropower and small hydropower, which can quickly adapt to changes in demand for electricity by satisfying both base-load and peak-load demands. As a result, they are crucial for maintaining grid stability .India's hydropower projects enable the country to attain self-sufficiency by utilizing water, a finite natural resource, in a decentralized, cost-effective, and efficient manner. With an existing capacity exceeding 40 GW, including 39.2 GW of large-scale hydropower as of August 31, 2012, India ranks sixth globally in total hydropower capacity. By the end of 2011, the capacity of small hydropower projects had increased by approximately 0.3 GW to reach 3.2 GW, with an additional 1.1 GW under construction as of early 2012. The 12th Five-Year Plan (2012–2017) outlines a target of adding nearly 90,000 MW of capacity, including 30,000 MW of hydroelectric power, thereby significantly contributing to India's energy landscape.

The development of Small Hydropower (SHP) projects in India falls under the jurisdiction of state governments, with oversight from the central Government of India. The Ministry of New and Renewable Energy (MNRE) provides policy, regulatory, and financial support for SHP growth, issuing guidelines to states for renewable energy development, including SHP. The Electricity Act of 2003 facilitated reforms in India's electricity sector, incorporating measures to promote renewable energy and rural electrification. SHP benefits from Renewable Purchase Obligations (RPO), Feed-in Tariffs (FIT), and Renewable Energy Certificates (REC) mechanisms. MNRE offers financial assistance for various SHP activities, including project planning, site identification, modernization of existing plants, and research and development. State-specific subsidies also support SHP initiatives. Since the liberalization of India's economy in 1993, the development of SHP has gained momentum, especially with increased private sector involvement in the power industry.. There has been an increase in the engagement of the private sector in the generation of SHP, and the growth is now driven by the private sector [18]. In spite of the fact that the country has reached a reasonable level of maturity in SHP, the growth of SHP has been hampered by the lengthy approval procedure and the failure to collect sufficient data.

This study provides a thorough review of India's hydropower development, with a focus on SHP availability, status, notable accomplishments, future plans, and promotion policies.

II. LITERATURE REVIEW

Indeed, the energy composition is undeniably undergoing a gradual transformation. However, the viability of the specific trajectory, whether in the immediate or far future, remains dubious. Clean technologies possess significant potential for power generation; nevertheless, their progress is hindered by various causes, including incentive schemes and technological challenges that must beaddressed.

Hydroelectricity is frequently considered an exception among clean technologies because its utilization remains consistent in many countries. Non-renewable energies are approaching the final stage of their life cycle, while there is a possibility that a latest technical breakthrough could temporarily enhance availability to a particular energy source. Indeed, novel technical breakthroughs have the potential to abruptly alter the process cycle of a given resource. Nevertheless, even if a technical breakthrough hypothetically prolongs the pan cycle of a any source, it would be prudent to delay its exploitation in order to ascertain the safety of the new technology. For example, some researchers, recommend safety in adopting soft gas as the non exhaustible as it has relations to the significant environmental implications due to hydraulic fracturing the environmental consequences of this gas, which include pollution of groundwater and surface water, generation of wastewater, release of methane, and levelled up earth activities, not thoroughly addressed. Additionally, the drilling operations associated with this gas have not beenregulated.

Other countries like China and India are exploring shale gas, but concerns about its negative effects may deter investment in the energy sector. The Energy Information Administration (EIA) predicted in 2013 that global energy consumption would rise by 56% from 2010 to 2040, primarily driven by non-OECD countries, leading to an expansion of the energy market where different energy sources compete.

Introduction to novel technical advancements can offset the departure of technology reliant on depleting energy sources. Simultaneously, emerging countries may experience an increase in market potential size due to the adoption of new technologies .New technological innovations often face challenges in gaining significant market share, as seen with green technologies. They struggle due to compatibility issues with existing electric grids and reliance on incentive schemes for competitiveness. Additionally, competitive dynamics impact the entry of new technologies and the life cycle of existing ones. Statistics play a crucial role in forecasting future market sizes of energy systems by analyzing historical data, typically using a single complex system approach for coping with these complexities. Received 1 July 2016; Accepted 29 May 2017 □ Corresponding author.

To effectively understand competition's impact, previous studies focused on individual energy sources in a univariate diffusion framework. However, recent efforts have addressed competition modeling, acknowledging its complexity, especially with nonlinear estimates. Initial studies examined competition between two contestants, typically in the modeling phase. Various studies, such as those in Italy and South Korea, utilized diffusion models considering competitors' prices. Others, like Duan et al., employed Lotka–Volterra models to assess the evolution of renewable technologies. In this study, we aim to comprehensively analyze competition between renewable and non-renewable energy systems. Specifically, we examine overall consumption from non-renewable (coal, oil, gas, and nuclear energy) and renewable (hydroelectric, wind, and solar power) sources. In this study, we examine the energy consumptions of the US, Europe, China, and India, significant players in global energy trade. Employing the Savin and Terwiesch model as our starting point, we generalize it to estimate distinct cross-product competition effects. This allows us to isolate internal growth contributions from external ones influenced by competitors for both COGN sources and Renewables. We consider non-uniform life cycles and successive waves in the diffusion process to enhance description accuracy and forecast reliability, following the approach described. Six-year projections until 2020, with 3σ predictive bands established based on heteroscedasticity, are presented, focusing on short-term forecasts due to current high levels of uncertainty in the energy sector. This uncertainty stems from various factors including uranium depletion, feasibility of shale technology, challenges with renewable energies, rising electricity demand in developing countries, and the imperative to reduce CO_2 emissions. The paper is structured as follows: Section 2 introduces the competition models used, while Section 3 presents and discusses the results of the model fitting to the energy consumptions of the aforementioned countries.

III. OVERVIEW

Energy layout in India

India is the 5th largest producer of electricity globally, contributing 4% to the annual global electricity generation. As of August 31, 2012, at the conclusion of the 12th Five-Year Plan (2012-2017), India's total installed capacity stands at 207,006 MW. It is projected that nearly 100,000 MW of additional capacity will be added. Thermal-based electricity generation accounts for 67% of the total, while generation from large dams contributes 19%. Nuclear energy plants make up the remaining 2% of electricity generation in India.

Hydropower in India

Hydropower is a significant component of India's energy portfolio, leveraging the country's abundant water resources to generate electricity. India ranks among the top nations globally in terms of hydropower potential, with its extensive network of rivers and reservoirs offering ample opportunities for harnessing hydroelectric energy. The nation's large-scale hydropower capacity stands as the sixth-largest worldwide, reflecting the scale of its hydroelectric infrastructure.

In addition to large-scale projects, small hydropower (SHP) plays a crucial role, particularly in decentralized energy generation. SHP projects, often located in remote or rural areas, contribute to local economic development and provide electricity access to communities previously underserved by traditional grid infrastructure. These projects typically have lower environmental impacts compared to large dams, making them a sustainable option for meeting energy needs while preserving ecosystems.

The Ministry of New and Renewable Energy (MNRE) spearheads efforts to promote hydropower development in India. MNRE provides policy support, financial incentives, and technical assistance to facilitate the growth of both large-scale and small-scale hydroelectric projects. Through initiatives such as the Small Hydro Power Program, MNRE aims to unlock the vast potential of SHP by streamlining regulatory processes and offering financial incentives to project developers.

Hydropower also plays a crucial role in India's renewable energy targets and climate change mitigation efforts. As the nation seeks to reduce its reliance on fossil fuels and transition towards cleaner energy sources, hydropower offers a reliable and environmentally friendly alternative. By tapping into its hydroelectric potential, India can diversify its energy mix, enhance energy security, and reduce greenhouse gas emissions.

However, hydropower development in India is not without challenges. Environmental concerns, social impacts, and regulatory hurdles pose significant barriers to project implementation. Addressing these challenges requires careful planning, stakeholder engagement, and adherence to sustainable development principles.

Overall, hydropower holds immense promise for India's energy future, offering a renewable and reliable source of electricity that aligns with the nation's sustainable development goals. With continued support from government agencies, private sector investment, and community participation, hydropower can play a pivotal role in India's transition to a greener and more resilient energy system.

SHP development in India

Small hydropower (SHP) development in India has gained momentum, contributing to decentralized energy generation and rural electrification. Leveraging India's abundant water resources, SHP projects offer a sustainable solution for meeting local energy needs. The Ministry of New and Renewable Energy (MNRE) provides policy support and financial incentives to promote SHP development, streamlining regulatory processes and facilitating project implementation. With lower environmental impact compared to large dams, SHP projects play a vital role in India's renewable energy transition, providing clean and reliable electricity to underserved communities while contributing to national energy security goals.

Government initiatives to promote SHP in India

Indian government has launched several initiatives to promote the development of small hydropower (SHP) projects across the country. The Ministry of New and Renewable Energy (MNRE) has been at the forefront, providing policy support, financial incentives, and technical assistance to facilitate SHP implementation. MNRE's Small Hydro Power Program aims to unlock the vast potential of SHP by simplifying regulatory processes, offering financial incentives, and promoting private sector participation. Additionally, the government has introduced schemes such as accelerated depreciation benefits, concessional finance, and tax incentives to encourage investment in SHP projects. These initiatives seek to harness India's abundant water resources for decentralized energy generation, promote rural electrification, and contribute to the nation's renewable energy targets while ensuring sustainable development practices and minimizing environmental impact.

IV. CONCLUSION

From the inference established from the study above, it is concluded that low impact hydropower development in the above identified sites in India could be separated from the SHP definition.

Some of the negative ramifications that the SHP sector faces due to inadequate scrutiny include low public involvement, the submission of irrelevant reports touching on the project, and the tendency to amplify social conflicts between this sector and other segments of the community.

As the goals of development for this industry have been set high and before further targets are set, it will be pertinent to carry out more research for assessing the social-physical consequences of SHPs.

In order to design low impact SHPs and see the huge potential that this industry has to fuller extend, experts have to look at the current policy and introduce the science based knowledge to this aspect of the matter, while still sticking to the standard guidelines of sustainability as is seen in IHA Sustainability Assessment Protocol and keep a check on the entire process.

This is a good study that provides some light on the fact that there is a gap between the real or implementing social benefit of SHPs both on the local people and identified or expected and for this reason the author opines that there is need for the laws governing the SHPs.

Adding to this some of the other advantages of SHP including its high conversion efficiency and flexibility, and its lower cost than conventional power stations such that the initial cost of SHP is economically cheaper than 25MW the Indian Ministry of New & Renewable Energy sources regards SHP as ecological friendly.

Environment affects various aspects in SHP projects at any phase, thus EIA is to be included that addressability the Indian Ministry of Environment & Forest’s standards.

The areas pinpointed include identifying the benefits associated with SHP, important factors that may influence the growth of SHP, the Indian EIA process and its related legislations on SHP projects and their effects on ecology and ecological resources To regarding the impacts of SHP projects on ecology and ecological resources, this paper examines six actual SHP projects in Uttarakhand.
They do established that refined and more sophisticated planning and management strategies can offer ecological neutral or nearly neutral SHP projects. The analysis of moved SHP projects in Uttarakhand revealed that they had moderate level of impact in all, they were not highly impactful.

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