

Consolidated Renewable Energy – A Future Hawk-Eyed Energy In India

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ABSTRACT

Energy is the key building block of economic growth of any nation. Today India facing energy crisis at alarming rate that impediments the economic development of nation. This paper draws on evidence from the last four decades of energy production and consumption in India, analyzing the overview evolution of renewable energy status and further potential at national and global level. Further, it explores the strength, weakness; opportunities and threats (SWOT) of renewable energy sector in India. The barriers and solutions to the renewable energy development in India are also outlined.

Keywords : Conventional Energy; Renewable Energy; Sustainable Development; SWOT Analysis; 4E concept.

1 INTRODUCTION

Energy is one of the most vital building blocks in human development and a key factor influence the sustainable development of any nation. India being a developing country faces multifaceted problems at alarming rate in energy sector due to the two most important transformations say industrialization and urbanization. It is very obvious that non-renewable energy sources (coal, lignite, petroleum and natural gas) alone may not be either sufficient or suitable to keep pace with ever increasing demand of the electrical energy of the nation. Though the renewable energy sources (wind, solar, small hydro, biomass, cogeneration bagasse etc.) contribute to a lesser extent at today's scenario, the potent for its future has to be envisioned and explored properly. In order to assess the nation's potential for meeting its future energy needs warrants the information on reserves of both non-renewable and renewable energy sources. Current scenario of energy demand and supply demands the research and development (R&D) activities in further exploration of new reserves; technological empowerment; effective conservation and management strategies, for optimal utilization of the energy resources to sustain the livelihood of inhabitants.

80% of the world population lives in the developing countries and their energy consumption is only 40% of the total world energy consumption. Remaining 20% of the population of the developed countries consumes 60% of the total world energy consumption. For instance, an American uses 32 times more commercial energy than an Indian. This kind of disparities between developing and developed countries also fuelled up the energy debates and raising its pressure over developed countries to utilize the energy efficiently. On the other hand, annual growth in energy demand reached 8% recently, doubling the historical average annual growth rates of the past 30 years. With gross domestic product (GDP) expected to grow by 7.5% along with annual energy demand of 8%, the energy demand expected to nearly doubled in the year 2030. Because

of this hefty energy demand, India is set to surpass Japan and Russia to become the world's third largest energy consumer after the U.S. and China.

2 CURRENT STATUS OF INDIA IN ENERGY SECTOR

Based on the analysis of trends in conventional energy consumption and production in India over last four decades (as shown in Fig. 1), one can expect the Indian power requirements will be increased in prodigious rate in near future. India is 11th largest economy and 4th largest purchasing power in the world, yet India bagged 29th position globally in terms of the primary energy consumption. This clearly revealed that Indians are already utilizing energy efficiently.

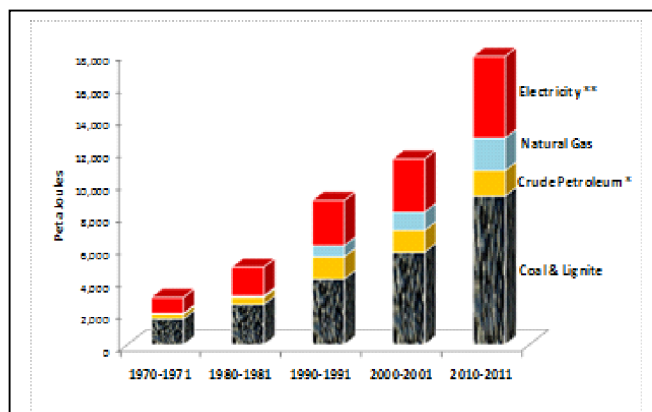


Fig. 1. Trends in production of conventional energy sources in India

Usual forms of energy produced such as electricity, natural gas, crude petroleum and coal. Among all conventional resources, coal stood first since India has proven huge coal reserves and ranked fourth at global level. It is the third largest

coal producing and consuming nation in the world and almost 70% of the electricity generation was achieved by coal fired thermal plants. Still India is in chimera state in Oil and Gas sector. Dominant rainfall is available in the northeastern part of the India. Annual average temperature ranges from 25°C – 27.5°C, and so, India has large solar potential. Sunniest lands are situated in southeastern coasts (Kolkata to Chennai) in India. Wind farms consist of several wind electric generator (WEG) and each costs about INR 4.5 – 5.5 crores. Wind mills erected where strong a dependable winds are available. Energy from wind resources is intermittent as it comes and goes. The operation and maintenance (O & M) costs are yet expensive in wind energy generation and there are certain difficulties in linking with power to utility systems. Electricity generated by thermal (Conventional) and Hydro (Nonconventional) has negative energy balance over the decades. In general, the power consumption surpasses the production and resulted in gap on the demand supply chain. Because of hefty deficit in energy segment (35%), compensation was done through the purchase of energy from outside the country.

Per capita energy consumption (PEC) and Energy Intensity (EI) are the two key indicators for analyzing the sustainable development in energy sector. The trends of PEC and EI of India for four decades were shown in Fig. 2. For universal comparison, PEC and EI were represented in terms of in Kilo Watt Hour (KWH) and KWH per Indian National Rupee (INR). The PEC for an average Indian raised four fold on the last four decades.

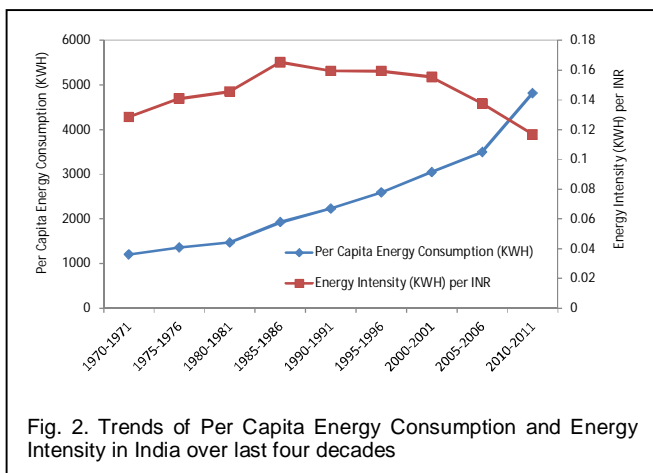


Fig. 2. Trends of Per Capita Energy Consumption and Energy Intensity in India over last four decades

Analyzing these two key indicators for India over last four decades leads to following discussion: The pattern of energy intensity as an entity followed the shape of a bell curve, raised first (i.e., economies use more energy per unit of GDP), then peaking, and eventually declined. Typically, the decline is slightly gentler than the initial increase. This pattern obviously reflects the real economic development pattern. In other words, the commercial energy intensity rises sharply as people and production activities are shifting from low energy intensive activities in agriculture to high energy intensive activities in industrial production. Therefore, it then declines more gently, as economic activity is transferred to the less energy intensive service sector. This analysis clearly revealed that the transformation of developing economies is the actual

driver of energy intensity.

3 SWOT ANALYSIS FOR RENEWABLE ENERGY SECTOR IN INDIA

The key external factors (Climate change, Technological development/ technological innovations and Price of Oil) and internal factors (Policy and Regulatory environment, Research & Development, Technology innovation & transfer) influence the renewable energy sector in India. An assessment of the strengths and weaknesses of the renewable energy sector in India has been carried out by the Ministry in consultation with key stakeholders (Central & State Government Agencies, Utilities & System Operator, Financing Institutions, Developers, Technology Providers/Manufacturers, Investors and End Users).

3.1 Strength

- ✓ Conductive policy and regulatory framework at central level
- ✓ Good resource potential
- ✓ Growing technology maturity in certain sectors such as grid connected wind power
- ✓ Emergence of indigenous manufacturers and developers
- ✓ Ability of renewable energy technologies to offer off grid/decentralized energy solutions

3.2 Weakness

- Absence of conducive policy and regulatory framework in some States
- High cost of certain technologies
- Current acceptability of end-users
- Inconvenience of use of certain renewable energy based applications vis a-vis conventional means
- Quality and therefore reliability of equipment – particularly for decentralized applications
- Lack of availability of adequately skilled, technical manpower
- Lack of adequate transmission infrastructure in states for evacuation of renewable power
- Lack of implementation infrastructure
- General lack of awareness of end-users

3.3 Opportunities

- Potential
- Favorable Policies
- Demand- Supply Gap
- Inadequate access to energy in rural areas
- Employment opportunities

3.4 Threats

- High subsidy on conventional energy
- Lack of low cost financing
- Lack of distribution and service network
- High cost vis-a-vis international markets

4 RENEWABLE ENERGY POTENTIAL IN INDIA

Though India has enormous potential for renewable energy, and as of today, renewable energy based power generation

constitutes 7% of the total installed capacity in the country for power generation from all sources. The Ministry of Non-conventional Renewable Energy (MNRE) has estimated an aggregate of over 150,000 MW and only 10 % installed capacity has been achieved so far as against the estimated renewable energy based grid connected power potential. This warrants the strong actions to be taken for achieving self-sustenance in energy requirements.

Figure 3 depicts the contribution of various renewable energy sectors in India. Out of total renewable energy resource potentials predicted in India, the tidal energy contributes to almost one-third of the net renewable energy potential. India has a long coastline with the estuaries and gulfs where tides are strong enough to move turbines for electrical power generation. Yet, the achieved power generation couldn't reach the predicted potential because of lack in technical know-how, robust in infrastructure construction and so the power generation from tidal energy is in infant stage. Next to tidal energy, wind energy also share almost one-third of the net RE potential. Solar energy, Bioenergy and Small hydro power shares remaining one-third of the net RE potential. In order to meet out the future demand wisely, efficient energy management has to be followed. The key solution rests in the actions of transforming the estimated potentials fully to reachable targets for compensation with the conventional energy resources to meet out our energy demand.

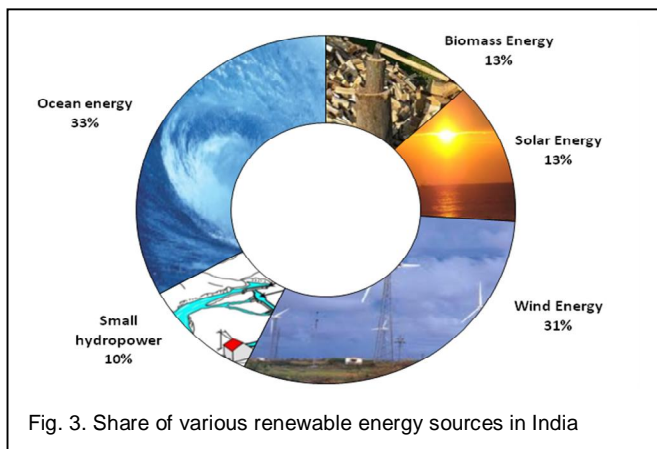


Fig. 3. Share of various renewable energy sources in India

The current status of India in world renewable energy sector is shown in Fig. 4. While analyzing the world renewable energy resources frame, it has been noticed that none of the countries in the world showed 50 Million Tonnes of Oil Equivalent (MTOE) in wind energy segment. In this global wind energy scenario, India is in better position and estimated up to 10 MTOE. Regarding Biomass energy, all countries are found to be having abundant potential in the world. While comparing with India, South America is one of the leading zones which estimated to 500 MTOE and above. Next to South America zone, North America, former Soviet Union, Asia and Sub-Saharan Africa counts to 250 MTOE. In this aspect, India's potential placed in and around 100-250 MTOE and comparable to China irrespective of 3 times higher area than India. In hydroelectric sector, India is in least position and estimated to be around 10 MTOE, which is far below than the other zones Copyright © 2012 SciResPub.

in the world. The status of Indian solar energy is in notable limit which is estimated at 50 MTOE and moreover higher than adjacent zones in the world.

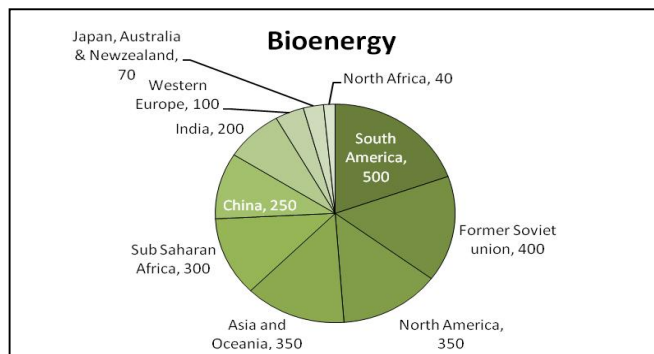


Fig. 4 (a). Status of India in bioenergy sector

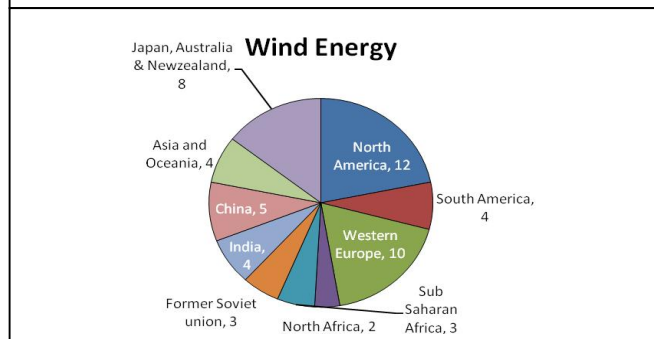


Fig. 4. (b). Status of India in wind energy sector

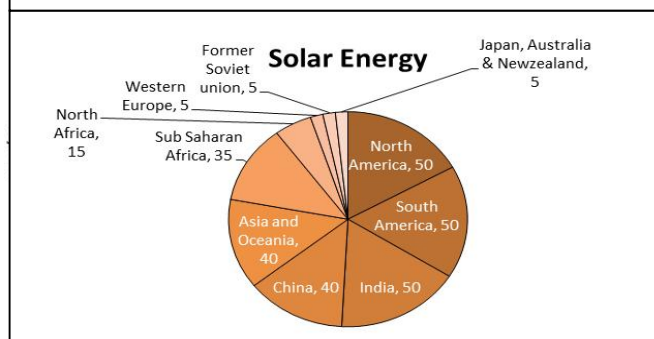


Fig. 4. (c). Status of India in solar energy sector

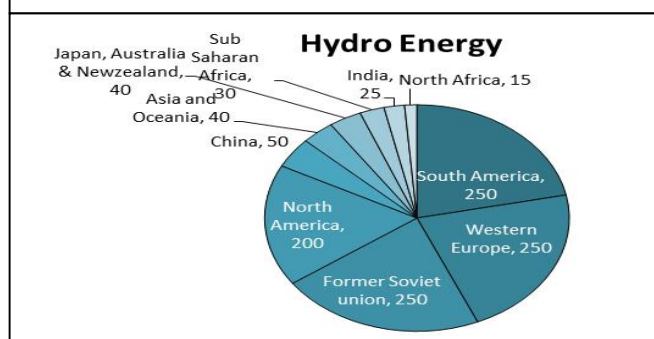


Fig. 4. (d). Status of India in solar energy sector

The overall status of renewable energy sources (state wise)

in percentage was also analyzed in this study and shown in Fig. 5. It has been noticed that almost half of the total available renewable energy potentials were contributed by four states viz, Gujarat, Karnataka, Rajasthan and Maharashtra. In the remaining segments, seven other states contributed to 36% of renewable energy. Out of which, Tamilnadu, Jammu and Kashmir and Andhra Pradesh is in equal range of contributions towards the renewable energy potentials. Rest of the renewable energy contributions were distributed among all other states in the nation. To resolve the disparities in the potential availability among states, the MNRE should impart necessary technical investigations on availability of renewable energy sources at region wise and reallocate sector wise planning instead of state wise.

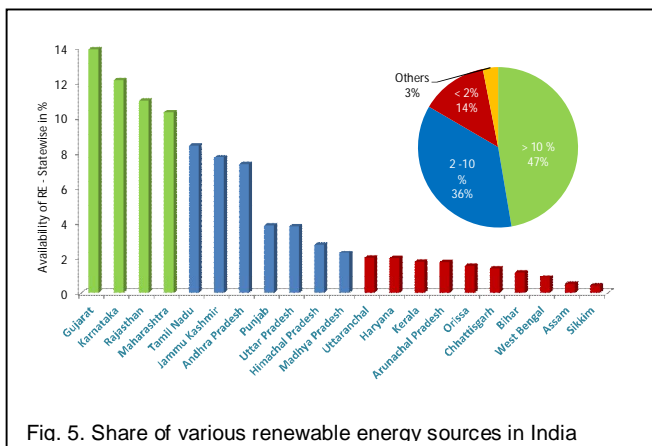


Fig. 5. Share of various renewable energy sources in India

The five key advantages that nonconventional energy offers as compared to fossil fuels and/or other renewable energy sources are widely available resource, Available on demand, Convertible to convenient forms, Potential to contribute to greenhouse gas reductions and other environmental objectives and Source of rural livelihoods.

5 BARRIERS TO RENEWABLE ENERGY DEVELOPMENT IN INDIA

Significant barriers to renewable energy development remain in India. Given the high upfront capital costs of renewable energy technologies, financial barriers are substantial. But nonfinancial barriers are equally important in limiting the growth of renewable energy. Barriers can be grouped into three categories as financial viability, support infrastructure, and regulatory approval.

- A. Issues related to financial viability
 - a. Skewed financial incentives for facilitating investments in renewable energy
 - b. Too many incentives program
 - c. Failure to adequately address long-term finances
 - d. Failure to develop least-cost resources first
 - e. Inadequate long-term funding sources
- B. Issues related to support infrastructure
 - a. Inadequate evacuation and access infrastructure
 - b. Lack of good-quality data
 - c. Underdeveloped industry value chain
- C. Issues related to clearances and approvals

6 CONCLUSION

The economic growth of any country depends only on the long term availability of energy from sources that are affordable, accessible and secured. India is the unique country in the world to have exclusive ministry for renewable energy development. Previously it was functioned as Ministry of nonconventional energy sources (MNES) and now it is renamed as ministry of new and renewable energy (MNRE). Trust is the basis of all achievements and so vision and mission plan for India has to be revised and should be insisted with 4E's concept such as "Education, Engineering, Enforcement and Evaluation". By allotting sufficient funds to promote the RE projects in time for our future demand to cater our energy needs. India witnessed the uneven development in renewable energy sectors; especially, in Tamilnadu has developed more than 70% of its rich wind potential when compared with other states. In order to avoid disparities, the ministry has to set achievable targets to tap out the available renewable energy potentials state wise and then only the nation may achieve the accelerated growth in renewable energy sector. Further, the MNRE along with Indian Renewable Energy Development Agencies (IREDA) has to resolve bottlenecks in consideration of acquisition of lands, lack of assessment of renewable energy sources at regional wise, delay in funding the project, construction of sufficient transmission infrastructure, 50% kickoff grants and subsidy after completion of the project. In this aspect, the Government of India has to liaison with South Asian Sustainable Development Energy (SASDE) forum for technical collaboration and financial assistance from World Bank to implement renewable energy parks and farms in the feasible zones for catering the future needs. To establish customized solutions in nonconventional energy sector by creating an effective and consultative forum to bring all stakeholders such as developers, corporations, utilities, consumer groups under one roof to march towards Indian journey on energy future. The nonconventional energy sector has a value, only if its value, is valued.

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