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Energy Policy in India

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***Abstract**: This paper is related with the importance of the energy policy and renewable energy which play a great role in the development and environmental benefits. India has a vast supply of renewable energy resources and it is one of the largest countries in the world for deploying renewable energy. This paper attempts to review the policies and planning measures undertaken by the Indian government for promotion of renewable energy. Low impact renewable energy (LIRE) technologies offer important benefits compared to conventional energy sources, such as fossil fuels or nuclear power. However due to their uncertainty different kinds of renewable-energy resources need to be operated in an integrated way, which complement each other. Global electricity demand is expected to increase considerably during the next decade and at the same time environmental pollution is also increasing with the development of conventional energy source. To meet the challenges for global energy demand various support schemes, policies and planning to promote use of renewable energy sources are discussed in this paper.*

***Keywords:** renewable energy policy, energy planning*

I. Introduction

This paper contains the need to extract energy from renewable sources. The development of such an energy infrastructure needs proper planning. Energy system planning and development involves the effective utilization of energy resources and technologies for meeting energy demand in a sustainable manner. Today's markets for low impact of renewable energy (LIRE) technologies range from specialized niche markets, where the technologies are already cost-effective, to centralized energy production. For centralized energy production, LIRE systems are relatively capital intensive compared to competing conventional technologies.

However, operating and maintenance costs are low compared with those for production of conventional fuels. However, the demand of electricity has always been overstepping the supply. The importance of electricity as a prime mover of growth is very well acknowledged in order to boost the development of power sector. So there is a great need of renewable energy source in Indian power sector to meet future energy demand with consideration of the sustainable development and pollution free environment. For inclusion of renewable energy sources in competitive electricity market India have adopted various supports schemes and policies to promote renewable energy sources in their restructured power sector.

II. Need of energy policy

A favorable policy framework, motivated players (e.g. energy service companies), and adequate incentive structures are key. Energy policy must create a level playing field to stimulate competition between options of energy supply and of demand-side energy efficiency that provide the same level of energy services. It is not the upfront price, but the total cost over the whole life cycle of an energy systems solution that is decisive for profitable investment decisions. Even if the investment costs of advanced technologies are higher at the beginning, the lifecycle costs (including running costs e.g. for power, maintenance and waste disposal), especially for efficient end-use technologies, are often cheaper compared to conventional technologies when used in an integrated operation.

Therefore, the policy and regulatory framework must create supportive incentive structures, raise awareness for lifecycle cost (LCC) analysis and enable good practice projects and innovations to become the market standard. The next sections of the paper deal with the important aspects those need immediate attention to foster use of LIRE technologies so as to achieve sustainable energy system. [1], [2], [3].

III. Overview Of Low-Impact Renewable Energy Technologies

LIRE sources generally include small-scale hydro, sustainably harvested biomass, wind, solar, earth and waste energy. Examples of LIRE technologies include:

- Wind-generated electricity;
- Solar heating or solar-generated electricity (e.g., photovoltaic);
- Biomass resources (if harvested and utilized in a sustainable manner);

- Water velocity energy (e.g., run-of-river, free stream, tidal or wave turbines); and
- Geothermal (earth) energy (including thermal energy in aquifers).

IV. Energy Planning Tools

Comprehensive energy analysis entails the evaluation of alternative configurations of the energy system that will balance energy supply and demand. Many different nation energy models have been developed over the year for energy policy planning world-wide. [4], [5].

The advent of cheap and powerful personal computers and international sharing of energy planning tool such as ENPEP, MARKEL, MAED and LEAP have facilitated the advancement of energy model based research and planning. A brief description of these tools as follows.

A. Energy and Power Evaluation Program (ENPEP)

ENPEP is a tool that lets researchers and planners compare alternatives quickly to determine the most cost-effective and environmentally safe solutions for a country's energy needs. [6]. The balance module of ENPEP uses a non linear equilibrium approach to determine the energy supply and demand balance. For its simulation, the model uses an energy network that is design to trace the flow of energy from primary source to energy demand. Demand is the sensitive to the price of alternatives. Supply price is sensitive to the quality demanded. In its operation, balance simultaneously tried to find the intersection for all energy supply form and all energy uses that are included in the energy network. The equilibrium is reached when the model finds a set of prices and quantities that satisfied all relevant equation and inequalities. The model is typically used to analyze a 20-30 year forecast period. [7].

B. Market Allocation Program (MARKAL)

MARKEL is a linear programming (LP) model of a generalized energy system. It is demand drive for which feasible solutions are obtained only if specified end-use demands for energy are satisfied for every time period. The end-use energy demand for each demand sector and for each time period is exogenously forecast. The objective is to determine the optimum activity levels of processes that satisfy the constraints at minimum cost. [8], [9].

C. Long-Range Energy Alternative Planning System (LEAP)

LEAP is an energy accounting framework. It contains a full energy system which enables consideration of both demand-side and supply-side technologies and accounts for total system impacts [10].

D. Model for Analysis of Energy Demand (MAED)

MAED model evaluates future energy demand based on medium- to long-term scenarios of socio-economic, technological and demographic developments. The model relates systematically the specific energy demand for producing various goods and services identified in the model, to the corresponding social, economic and technological factors that affect this demand [11].

E. Comparison of Energy Modelling Tools

ENPEP, MARKAL and LEAP are economy level models. They are used to facilitate the decision to provide the economy with energy supply to satisfy the future energy demand by least cost by taking into consideration issues such as energy security, new technologies and environmental problems. There are no set rules as such for selecting a model to be the ideal model for an economy's energy planning. However, MARKAL is a good choice if technical and statistical data are relatively plentiful and assumptions of optimizing models are reasonable in the study context. ENPEP-BALANCE is a good choice in similar situations to MARKAL, particularly if there is need to take a market- simulation approach, and optimization assumptions are not appropriate.

V. Energy System Planning For India

ENPEP-BALANCE has been chosen for carrying out the current study. The interactive network designing features of BALANCE were used to build the integrated power and energy network for India. The market-sharing algorithm of BALANCE allows the simulation of market operations with multiple decision end makers, as opposed to least-cost optimization approaches that simulate a single decision maker. BALANCE has the flexibility to utilize forecasts from other sources. In this study future energy demand obtained from MAED and elasticity projections for energy and electricity were used in BALANCE.

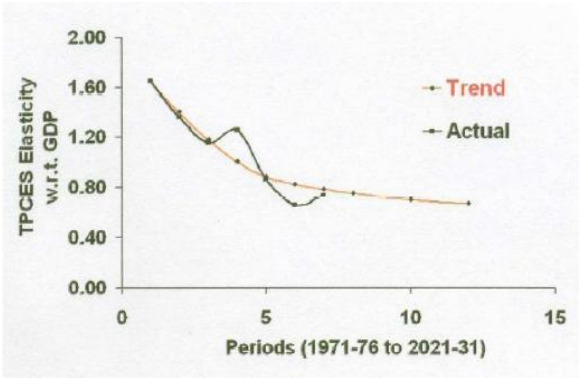

Fig: 1. Elasticity of Total Primary Commercial Energy Supply (TPCES) with respect to GDP
(Source: Sustainable Energy Future by AD2030 - India Case Study)

A. Commercial Energy Requirements

The Total Primary Commercial Energy Supply (TPCES) projections have been carried out using MAED and also using elasticity of total primary commercial energy supply (TPCES) and Electricity with respect to Gross Domestic Product (GDP). Making use of the statistical data of the past three decades, the future elasticity (ratios of rates of growth) of total primary commercial energy supply and that of electricity requirements with respect to GDP have been evaluated through trend analysis [12]. The results are given in Figs. 1 above.

VI. Policy Framework For Promotion Of Renewables In India

The policy framework is the key to the success of renewable energy in any country. Policies aim at overall development and promotion of renewable energy technologies (RETs) and its applications. Policy initiatives encourage private sector to take part in renewable business as per provision of fiscal and financial incentives for a wide range of renewable energy (RE) programmes. Policies are largely financial, fiscal incentives or special directives aimed to encourage or enforced utilities to buy RE power, promoter companies to set up RE projects, equipment companies to manufacture RE equipment or private and government entities to undertake R&D relating to RE. In India, policy initiatives encourage domestic private investments with a provision of fiscal and financial incentives such as tax holidays, accelerated depreciation and duty rebates. At the central level, policy measures are administered through the Ministry of New and Renewable Sources (MNRE). The state governments contribute by making available infrastructural facilities for wheeling of power and buying power from renewable units. A comprehensive RE Policy for all-round development of the sector, encompassing all the key aspects, has been formulated by MNRE. The broad objectives envisaged in the draft policy are as meeting the minimum energy needs through RE, Providing decentralized energy supply in agriculture, industry, commercial and household sectors in rural and urban areas, and providing grid quality power. The policies targeting of 10% of additional grid power Generation capacity to come from RE by 2012[13]. Some of the policies and fiscal incentives in India for renewable energy developments are discussed in later sections.

A. Foreign Investment Policy

Foreign investors can enter into a joint venture with an Indian partner for financial and/or technical collaboration and for setting up of RE-based power generation projects. Proposals for up to 100 per cent foreign equity participation in a joint venture qualify for automatic approval and with this 100% foreign investment as equity is permissible with the approval of the Foreign Investment Promotion Board (FIPB). The Government of India encourages foreign investors to set up RE-based power generation projects on Build, Own and Operate (BOO) basis [14]. Government also encourages foreign investors to set up power projects based on other nonconventional energy sources also. Investors are required to enter into a power purchase agreement with the concerned state government. [15].

No prior approval of the government is required to set up an industrial undertaking with Foreign Direct Investment (FDI) by Non-Resident Indians (NRIs). The Reserve Bank of India (RBI) has permitted Indian companies to accept investment under the 'automatic route' without obtaining prior approval from RBI to set up such renewable based projects. [16]

B. Foreign Investment Implementation Authority (FIIA)

The FIIA has been set up in the Ministry of Commerce and Industry to translate FDI approvals and implementations. It is headed by the Secretary (Department of Industrial Policy & Promotion) and is serviced by the SIA. FIIA would provide a one-stop after-care service to foreign investors by helping them to expedite

approvals and clearances and to sort out operational problems with other government agencies. It will act as a single-point interface between the investors and government agencies including administrative ministries, state governments, Pollution Control Boards, Directorate General of Foreign Trade, regulatory authorities, tax authorities and Company Law Board among other and the approval holders have been requested to get in touch with respective officers in FIIA Hence the provisions in FIIA are directly or indirectly linked with renewable promotion. [17].

C. Industrial Policy

In industrial policy, MNRE is promoting medium, small, mini and micro enterprises for manufacturing and servicing of various types of RE systems and devices. For setting-up of an RE industry, industrial clearances as well as no clearance is required from Central Electricity Authority (CEA) for power generation projects up to Rs 1,000 million. [18].

For RE power generation projects government is allowed five year tax holiday and for RE equipment manufacturing, Soft loans are available through IREDA .Financial support is also available to RE industries for R&D projects in association with technical institutions. Private sector companies can set up enterprises to operate as licensee or generating companies. Customs duty concession is available for RE spares and equipment, including those for machinery required for renovation and modernization of power plants. They are also expected to convey the government's decisions on applications filed and for assisting entrepreneurs to set up projects and monitoring implementation [19].

D. Joint Ventures Policies

Joint ventures are a financial as well as technical collaboration and they are used by foreign investors as it provides maximum visibility and presence in the country. A foreign investor can enter into a joint venture not only for manufacturing RE products and systems, but also in setting up RE-based power generation projects. Usually joint ventures are in the form of takeovers or strategic alliances with the existing reputed companies with a niche market. A foreign investor can set up a liaison office as an intermediate step before entering into a joint venture.

E. Policies for Small-Scale Industries

Renewable energy technologies (RETs) provide one of the best options for first-generation entrepreneurs and small-scale industries (SSIs). MNRE and Indian Renewable Energy Development Authority (IREDA) have drawn up financial and fiscal incentives to suit technology of varying sizes and scales for small- and medium-sized investors and entrepreneurs. An industrial undertaking is defined as a small scale unit if the investment in fixed assets in plant and machinery does not exceed Rs.10 million. Small-scale industries (SSIs) are not permitted more than 24 per cent equity in its paid up capital from any industrial undertaking, foreign or domestic. SSIs are free to manufacture any item including those notified as exclusively reserved for the small scale sector and these are free from location restrictions, which are mandatory for large industries. The National Small Industries Corporation (NSIC), under the Ministry of Industry and Commerce, also provides assistance through a number of schemes, which include financial and marketing services, technical services and training, and exports facilitation

VII. Challenges And Constraints

The 11th Five-Year Plan (2007-2012), aims to add over 78,500 MW of new capacity to achieve the Indian Government's ambitious mission of 'Power for All by 2012'. To meet its large and growing power needs, there are many constraints and key imperatives are required.

A. Limited fuel reserve

In the Indian Power sector, 64.6% of electricity production is from thermal power stations. The main fuel used is coal. Though India has at least 84,396 million tonnes of proven recoverable coal reserves (at the end of 2003), amounting to almost 8.6% of the world reserves, they will however last for about 230 years only at the current Reserve to Production (R/P) ratio.

B. Higher fuel transportation cost

India is a wide spread country and the coal mines are scattered. Though roads and rails connect all parts of the country, the conditions of the roads and rails are not ideally suited for quick and safe transportation of coal to the demanded sites. So the transportation of coal to the power stations is an expensive and time-consuming task. As the transportation cost forms a major portion of the fuel cost, the energy production cost increases, which in turn affects the industrial growth of the country.

C. Aging Power Plants

Since most of the power plants have been installed immediately after the independence, they have become old and inefficient. This is the main reason for low growth rate in electricity generation during the recent years. Old and inefficient plants need to be replaced or renovated and modernized to achieve the electricity production target.

D. Rationalization of Power Tariff

Prices of electricity and some of the other energy sources are highly subsidized thereby promoting inefficient end-use and sometimes even inefficient energy choices. For example, power, kerosene and domestic gas are highly subsidized. All subsidies on fossil fuels should be phased out.

E. Operational efficiency of the Power sector

• In India, the primary energy resources, i.e. coal and hydro potential are concentrated in a few pockets. This necessitates transfer of bulk power to the far off load centers through long distance transmission lines. Loss of energy during transmission/distribution is unavoidable. On an average T & D losses are 40 percent out of which 15 percent are technical losses and 25 percent are nontechnical losses. These are very high compared with the international average of less than 10 percent from advanced countries. Some of the causes of non-technical losses are: direct tampering /by passing/in correct operation of the energy meter / direct tap off from distribution network.

• The inefficiencies in the end-use systems are due to irrational tariffs, technological obsolescence of industrial processes and equipment, lack of awareness and inadequate policy drivers (such as energy efficiency standards and labeling system, financial incentives).

• Increasingly planning and implementation of transmission system is becoming complex these days. De-licensing of generation, uncertainties in load growth, unbundling of the utilities, the move towards a competitive power market and the increasing right of way concerns also present some unique challenges. [17], [20], [21].

VIII. Conclusion

While summing up the discussion this paper has identified some potential policy instruments for fostering the generation of electricity. It can be pointed out that LIRE sources will remain a focal point of discussion for the future energy policy as they contribute to overall aims of energy policy. Further with the increasing import dependence, the use of renewable energy will remain on the agenda in a medium- and long-term energy policy strategy. There is an immediate need for the change in planning strategies for power generation to meet the future demands and for the environmental benefits. The contribution of renewable energy sources, through small in magnitude is yet significant from the perspective of sustainability of energy and environment.

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