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Energy Scenario and Vision 2020 in India

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Abstract

India is a country with more than 121 Crore people officially for more than 17% of world's population. It is the seventh largest country in the world with overall land area of 3,287,263 sq kilometres. India measures 3214 km from north to south and 2993 km from east to west. It has a land frontier of 15,200 km and coastline of 7,517 km. India has 28 states and 7 union territories. It faces a formidable challenge in providing adequate energy supplies to users at a reasonable cost. It is expected that India's nominal GDP will exceed day by day as compare to developed countries like UK, US. India's nominal GDP crossed the annual growth rate of nominal GDP during the period is dramatic 22 percent. Thus the energy challenge is of primary importance. In the last six decades, India's energy use has increased 16 times and the installed electricity capacity by 84 times. In 2013, India's energy use was the fifth highest in the world.

Nevertheless, India as a country suffers from significant energy scarcity and persistent electricity deficits. In recent years, India's energy consumption has been increasing at a relatively fast rate due to population growth and economic development, even though the base rate may be somewhat low. With an economy projected to grow at 8-9% per annum, rapid urbanization and improving standards of living for millions of Indian households, the demand is likely to grow significantly. The supply challenge is of such extent that there are logical apprehensions that severe shortages may occur. Increasing demand and meeting demand with supply by current position. Distribution network and Current Problem of Power shortage, Light Cut-off and Load Shading of Indian Power/ Energy Scenario in Rural and Urban Indian. Creating it with Green Environment friendly/helpful option is big Challenge.

Introduction to Energy

Energy is Capacity of body to do work. There two forms of Energy as follows:-

Non-Conventional source of energy is energy sources obtained from sources that are essentially infinite. Examples of Non-Conventional include wind power, solar power, geothermal energy, tidal power and hydroelectric power. Previously these were Conventional energy source before James Watt invented the steam engine in the eighteenth century. In

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fact, the New World was explored by man using wind-powered ships only. The non- conventional sources are available free of cost, are pollution-free and inexhaustible. Man has used these sources for many centuries in propelling ships, driving windmills for grinding corn and pumping water, etc. Because of the poor technologies then existing, the cost of harnessing energy from these sources was quite high. Also because of uncertainty of period of availability and the difficulty of transporting this form of energy, to the place of its use are some of the factors which came in the way of its adoption or development. Conventional energy is the conventional fossil fuels such as coal, oil and gas, which are likely to reduce with time. The use of fossil fuels and nuclear energy replaced totally the non-conventional methods because of inherent advantages of transportation and certainty of availability; however these have polluted the atmosphere to a great extent. In fact, it is feared that nuclear energy may prove to be quite hazardous in case it is not properly controlled. India is blessed with an abundance of sunlight, water and biomass. Enthusiastic efforts during the past two decades are now bearing fruit as people in all walks of life are more aware of the benefits of Non-Conventional energy source, especially decentralized energy where required in villages and in urban or semi-urban centers. India has the world's largest programme for Non-Conventional source of energy.

Supply Options for Non-Conventional Energy

Strategies to meet India's energy requirement are constrained by country's energy resources and import possibilities. Unfortunately, India is not well endowed with natural energy resources. Reserves of oil, gas and Uranium are meager though India has large reserves of thorium. While coal is abundant, it is regionally concentrated and is of low calorie and high ash content, though it has the advantage of low sulphur content. The extractable reserves, based on current extraction technology, remain limited. Hydro potential is significant, but small compared to India's needs and its contribution in terms of energy is likely to remain small. Further, the need to mitigate environmental and social impacts of storage schemes often delays hydro development thereby causing huge cost overruns.

Coal

It is the most important and abundant fossil fuel in India. It accounts for 55% of the country's energy need. The country's industrial heritage has been built upon indigenous coal. Commercial primary energy consumption in India has grown by about 700% in the last four decades. Considering the limited reserve potentiality of petroleum & natural gas, eco-conservation restriction on hydro projects and geo-political perception of nuclear power, coal will continue to occupy centre-stage of India's energy [production?]. With hard coal reserves around 246 billion tonnes, of which 92 billion tonnes are proven, Indian coal offers a unique

eco-friendly fuel source for the domestic energy market for the next century and beyond. Hard coal deposits, spread over 27 major coalfields, are mainly confined to eastern and south central parts of India. Lignite reserves stand at around 36 billion tonnes, of which 90% occur in the southern State of Tamil Nadu. Out of a total of 171926 MW of electricity generated, coal powered thermal power plants accounted for 92418 MW as of February, 2011 indicating that most of India's electricity needs are dependent on coal. It has been estimated that at current levels of consumption the proven reserves of coal will last for 80 years and if all the inferred reserves also materialize it can last for over 140 years at the current rate of extraction. However, the coal consumption will increase as India tries to meet its energy requirements and thus the reserves will last for fewer years. If domestic coal production continues to increase at a rate of 5% the extractable reserve will run out in around 45 years. Further, it is difficult to predict the long term demand for coal owing to rapid changes in the prices and relative availability of other fuels as well as the technological advancements and new policies in the end use sector. Further, the coal deposits in India are concentrated in the Eastern regions. The setting up of a coal fired power plant in Western or North-west India, entails transporting coal over distances exceeding 1000 Km. and at such distances the economics of coal power become unfavourable. It is estimated that the coal deficit in India will increase to 400 million tonnes in Financial Year (FY) 2017 from around 50 million tonnes in FY11, according to a Credit Suisse report. Further, as per the Planning Commission report it is expected that demand for coal will rise to around 937 million tonnes by 2021-22 and to more than 1415 million tonnes by 2031-32. India has a total installed capacity of 1199.75 MW of oil based power plants which is not substantial and the price per unit of kwh ranges from INR 7.60 to INR 8.00. In 2009-10, the total expenditure incurred on import of 159.2 million tonne of crude oil was $79,552 million and this is increasing each year putting substantial pressure on Indian economy leading to continuous increase in import dependence in this sector.

Natural Gas

India has total reserves (proved and indicated) of 437 billion cubic meters of natural gas as of 1st April 2010. Gross Production of Natural Gas in the country at 47.51 billion cubic meters during 2009-10 was 44.63% higher than the production of 32.85 billion cubic meters during 2008-09. The total installed capacity of gas fired plants as of February 2011 stood at 17706 MW. The flaring of Natural Gas in 2009-10 at 2.09% of gross production is lower than the 3.29% in 2008-09. Natural gas can replace existing fuels in various sectors both for feedstock as well as for energy purposes. However, this substitution will depend upon the relative price of gas with respect to other fuels. Therefore, it may be stated that the demand for gas will depend upon the price of natural gas relative to that of alternatives, mainly Naphtha for fertilizer and petrochemicals and coal for power. With domestic production of just over 140 million standard cubic meters per day meeting barely half the demand, India is importing 10 million

tons of liquefied natural gas per annum and is looking at unconventional sources like shale gas. One of the major issues with use of natural gas in India is that of the discriminatory pricing and fiscal policy adopted for oil and gas where oil produced from domestic fields is priced at international rates while the government caps natural gas price at artificially low levels. This is due to the fact that the Indian fertilizer sector, which is a dominant user of natural gas, is highly subsidized. The cost of power obtained by using natural gas varies from INR 2.90 to INR 4.60 per KWh and power obtained through natural gas is mainly used as peaking power. Besides this India has around 0.5 million vehicles running on auto gas and per vehicle consumption is 451 Kg per annum compared to the world average of 1428 kg per annum. This is, however, constrained by a lack of appropriate distribution networks. Natural gas has been recognized as a bridge between the more polluting fuels based on hydrocarbons and cleaner Non-Conventional sources of energy. India Vision 2020 has estimated the demand for gas to be between 65 and 71 Billion Cubic Metres (BCM) for the year 2020.

Nuclear Energy

Nuclear power is the fourth-largest source of electricity in India after thermal, hydroelectric and Non-Conventional sources of electricity. As of 2010, India has 20 nuclear reactors in operation in six nuclear power plants, generating 4,780 MW while 5 other plants are under construction and are expected to generate an additional 2,720 MW. India's nuclear power industry is undergoing rapid expansion with plans to increase nuclear power output to 64,000 MW by 2032. The work of generating and maintaining nuclear power plant lies with "Nuclear Power Corporation India Limited" and it plans to build five nuclear power parks each with a capacity of eight nuclear reactors of 1000 MW. The nuclear power parks are planned at Kudankulam in Tamil Nadu, Jaitpur in Maharashtra, Mithi Virdi in Gujarat, Haripur in West Bengal and Kovvada in Andhra Pradesh.

Despite all the advantages that nuclear power is supposed to offer it is a very costly affair. In defence of nuclear power it is said that it is the initial capital cost that is very high and thereafter it is not a very costly business. It should not be necessary to impose a high tariff for supplying power from nuclear plants. But it will still not make nuclear power cheaper than hydro or thermal power that currently meets the bulk of electricity supply demand in the country. Further, there is considerable resistance from locals in view of the associated dangers with any nuclear plant and this has been further heightened with the recent damage to nuclear installations in Japan caused by an earthquake and subsequent tsunami. This needs to be factored into the locating of nuclear power plants and the federal Minister of Environment and Forests has cautioned to carefully tread the path of nuclear energy by planning smaller nuclear plants instead of leapfrogging to 1600 MW plants. India with its growing population and burgeoning energy needs has limited options, otherwise it will be forced to resort to more imports of coal and as of today nuclear energy is available at INR 3 to

INR 4 for each KWh compared to solar energy at INR 20 per KWh. Another critique of nuclear energy in India is that it will be importing four different types of light water technology making it the most diverse in the world. Further, India with its secretive nuclear establishment has very little public debate on the safety and security related issues.

Non-Conventional Energy in India

India has been making continuous progress in conventional as well as Non-Conventional power generation. The trajectory of growth of installed capacity since 2002 (start of the 10th five year Plan), 2007 (start of 11th Plan), and as of 30 November .2010, Providing energy access and energy security for the poor would, therefore, continue to be a major issue and problem. Solutions to this simply have to be found but which no longer appear possible from conventional sources. It is clear that India's need for secure, affordable, and environmentally sustainable energy has become one of the principal economic and development challenges for the country. It is also clear that while energy conservation and energy efficiency have an important role to play in the national energy strategy, Non-Conventional energy will become a key part of the solutions and is likely to play an increasingly important role for augmentation of grid power, providing energy access, reducing consumption of fossil fuels and helping India pursue its low carbon developmental pathway.

Policy for Grid Non-Conventional Power

The development of grid interactive Non-Conventional power essentially took off with the Electricity Act 2003 – which mandates the State Electricity Regulatory Commissions (SERCs) to (i) promote cogeneration and generation of electricity from Non-Conventional sources of energy by providing suitable measures for connectivity with the grid and sale of electricity to any person, and (ii) fix certain minimum percentages for purchase of Non-Conventional power in the area of each Distribution licensee. Section 61(h) mentions that these should be guiding factors while specifying the terms and conditions of determination of tariffs. The National Electricity Policy 2005 has further provided for progressive increases in these levels and purchases by distribution companies through competitive bidding processes. The Tariff Policy 2006 requires fixation by SERCs of a minimum percentage for purchase of energy from such sources taking into account availability of such resources in the region and its impact on retail tariffs and procurement by distribution companies at preferential tariffs determined by the SERCs. As of date, most of the SERCs have specified percentages for purchase of electricity from Non-Conventional sources of energy. Preferential tariffs for grid interactive Non-Conventional power are being given in most potential States like Rajasthan, Gujarat, Tamil Nadu etc. Due to various measures taken by electricity regulatory commissions open access has been facilitated, thereby enabling buyers to choose their suppliers which not only fosters healthy competition but suppliers are forced to be innovative in quality and pricing to rope in customers. It has also

led to more stable and secure grid operations which have led to decrease in outages due to grid failures. Depending on the availability of the Non-Conventional power in different states purchase obligations have been fixed in their respective distribution areas. Various states which have met their Non-Conventional purchase power obligations include Kerala (5%), Tamil Nadu (10%), Andhra Pradesh, Karnataka and Maharashtra (5%), Gujarat (2%) and Delhi (1%).

Impact of Policy and Vision 2022

During the last many years the share of Non-Conventional energy has steadily increased due to the initiative taken by Government of India and as indicated in Table 5. The share of various types of Non-Conventional energy is indicated in Table 6. All figures are in MW. It is estimated that total share of Non-Conventional energy will be 15.9% by 2022. In the larger perspective of grid power an innovative scheme is being tried in India called as tail-end grid. So far the emphasis has been on large plants whether they are wind, solar, hydro or biomass. Locations for wind and hydro are fixed. However, for biomass the difficulties of ensuring collection and transportation of fuel are leading towards smaller plants. For solar PV, a total of 100 MW capacity is being set up with smaller plants of 100 KW to 2 MW, which are connected to grid through 11 kV feeders. It is expected that small plants would reduce the transmission losses by 5-7% with respect to large capacity plants of 50 - 100 MW size and improve both voltage and frequency at the tail end. The same approach is being planned for biomass based power plants of up to 2 MW capacity as the logistics of fuel management would become much more manageable and more environmentally friendly. It is envisaged that hundreds of such plants will be built in the next few years thus improving the transmission infrastructure.

Biomass Power and Bagasse Cogeneration Program

This program aims at the utilization of biomass, such as agro-waste in the form of straws, stalks, stems and fibres; agro-industrial processing residues such as shells, husks, deoiled cakes, wood from dedicated energy plantations and bagasse from sugar mills, for power generation using combustion technology. The current potential for power generation from surplus agro and agro-industrial residues is estimated at 17000 MW. With efficient power cogeneration plants in new sugar mills and modernization of existing ones, the potential of surplus power generation through bagasse cogeneration in sugar mills is estimated at 5000 MW. Thus the total estimated biomass power potential is about 22,000 MW.

Wind Power

The wind power program is the fastest growing Non-Conventional energy program [in India] and is almost entirely coming through private sector investments. India has a potential of around 48,500 MW. With a capacity addition of 12,800 MW, it contributes to around 75% of the grid-connected Non-Conventional energy power installed capacity. The major wind power capacity is in the states of Tamil Nadu, Gujarat, Maharashtra, Karnataka and Rajasthan. Wind electric

generators of unit sizes between 225 kW and 2.10 MW have been deployed across the country. Wind Electric Generators of unit capacity up to 2.10 MW are being manufactured India. An ambitious target of 9,000 MW was set for 11th Plan, of which 5,715 MW had already been achieved by September, 2010. This has been possible because of the multidimensional approach of central and state governments. The main driving force for development of wind sector has been the provision of accelerated depreciation of 80%, an incentive also available to many other sectors. This provision has enabled large profit making companies, small investors and captive users to participate in the sector. However, independent power producers (IPPs) and foreign direct investment (FDI) were not able to benefit from the accelerated depreciation provision. The effort is to do 2000 MW or more annually.

Small Hydro Power

The estimated potential for power generation in India from small hydro plants is about 15,000 MW from 5718 identified sites. So far over 760 small hydropower projects aggregating to 2,803 MW have been set up in various parts of the country and 285 projects of about 940 MW are in various stages of implementation. At present, a capacity addition of about 300 MW per year is being achieved, of which about 70% is coming through the private sector. Attention is being focused on States with the maximum hydro potential and improving environment policies to attract private sector investments.

Solar power

Among the various Non-Conventional energy resources, India possesses a very large solar energy potential; most parts of the country are blessed with good amounts of sunshine. There are about 300 clear sunny days in a year in most parts of country. The average solar radiation incident over India varies from 4 kWh/day - 7 kWh/day. The solar radiation received over the Indian land area is estimated to be about 5,000 trillion kWh/year. In June, 2008, a National Action Plan on Climate Change was announced, which included eight major national missions with the one on solar energy being the centre piece. This mission visages a major step up in the utilization of solar energy for power generation and other purposes. The Jawaharlal Nehru National Solar Mission (JNNSM) was launched by the Prime Minister of India in January 2010, with a target of 20,000 MW grid solar power (based on solar thermal power generating systems and solar photovoltaic (SPV) technologies), 2000 MW of Offgrid capacity including 20 million solar lighting systems and 20 million sq.m. solar thermal collector area by 2022. The Mission will be implemented in three phases. The first phase will be of three years (up to March, 2013), the second up to March 2017 and the third phase will continue until March, 2022. The target for phase-I is to set up 1,100 MW grid connected solar plants including 100 MW of roof top and small solar plants and 200 MW capacity equivalent off-grid solar applications and 7 million sq. m solar thermal collector area. A new architecture has been designed for the 1000 MW projects. These will be implemented through NTPC Vidyut

Vyapar Nigam (NVVN). NVVN will sell the solar power to the State utilities after bundling solar power with the equivalent capacity of thermal power. CERC has announced tariffs for the purchase of solar power by NVVN. The tariff for 2011 for PV is Rs.17.91 per unit and Rs. 15.31 per unit for solar thermal power. The main objectives of the mission are to help reach grid parity by 2022 and help set up indigenous manufacturing capacity.

Financing of Non-Conventional Energy

Non-Conventional power generation capacity in India has been set up largely through private sector investments and has been possible due mainly to a conducive, strong and clear policy framework and investor friendly environment. New investment is the most potent indicator of growth of the sector. It is estimated that, in 2009 the total financial investment in clean energy in India was at US $ 3.2 billion out of which more than US $ 1 billion is in the form of FDI. Ernst and Young ranked India the fourth most attractive country for Non-Conventional energy investment in the world, only behind the United States, China, and Germany. Although the government provides support in the form of easy finance, institutional mechanisms still need to be strengthened. Further, Non-Conventional energy is central to climate change mitigation efforts. The Government of India has also created a "Clean Energy Fund" by imposing a surcharge of INR 50 (US $1.11) on the sale of every tonne of coal to finance clean energy projects.

Employment Opportunities

Non-Conventional energy has vast potential in terms of creating new job opportunities in India where there is high rate of unemployment and disguised employment. The report estimates that implementation of the National Action Plan on Climate Change could create an Additional 10.5 million direct green jobs.

Conclusion

Energy is important for development and this means that if India is to move to a higher growth path than is now realistic, it must ensure the reliable availability of energy. The present energy scenario in India is not satisfactory. The power supply position prevailing in the country is characterized by persistent shortages and irregularity and also high prices for industrial consumers. There is also concern about the position regarding petroleum products. India, with its vast population and limited natural resources for meeting its energy requirements, needs to maintain its momentum of growth and this can be made possible only with a clear strategy for use of best possible energy options available. India needs to have a long term strategy for meeting its energy needs by 2050 and a short term goal of 2020 which can be small steps towards attaining energy security by year 2020. The world community also needs to understand the challenges being faced by India and help by putting in place innovative financial instruments for financing the energy needs of India and lifting of technical barriers. Finally, India needs to wake up and respond by improving efficiency, boosting infrastructure development and promoting private

equity participation as the government cannot raise capital on its own for this purpose. India needs to realize the vast potential of Non-Conventional energy and need to step up effort for attaining the goal of "20 11 20 20" by 2020. These targets are attainable and not only provide cleaner energy but also open a new field for providing employment opportunities to millions of people who are unemployed or disguised employment. This momentum then needs to be maintained so that India attains a target of having 70% Non-Conventional energy use by 2050.

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