SCOPE OF COMPETITION IN RENEWABLE ENERGY SECTOR IN INDIA

INTERNSHIP PROJECT REPORT

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COMPETITION COMMISSION OF INDIA
NEW DELHI

JANUARY 2012
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ACKNOWLEDGEMENT

My sincere thanks and regards to Mr. Vijay Kumar Singh, Deputy Director (Law), Competition Commission of India, Government of India, for giving me the opportunity to work on this sector and for guiding me every step of the way.

I would also like to acknowledge the Library and Support Staff of CCI for their unconditional help and cooperation during the entire duration of my internship.

My friends, colleagues and co-Interns deserve a mention for providing me with the most conducive environment to work all along.
LIST OF ABBREVIATIONS

CAGR: Compound Annual Average Growth Rate
CASE: Commission of Additional sources of Energy
CCI: Competition Commission of India
CEA: Central Electricity Authority
CERC: Central Electricity Regulatory Commission
CFA: Central Financial Assistance
DNES: Department of Non-conventional Energy Sources
EA: Electricity Act
EU: European Union
FIT: Feed-in-Tariff
FOR: Forum of Regulators
GDP: Gross Domestic Product
GoI: Government of India
GSI: Geological Survey of India
IREDA: Indian Renewable Energy Development Agency
MNRE: Ministry of New and Renewable Energy
MT: Million Tonnes
MW: Megawatt
MWh: Megawatt hour
NAPCC: National Action Plan for Climate Change
NEP: National Electricity Policy
NGRI: National Geophysical Research Institute
NRSE: New and Renewable sources of Energy
OA: Open Access
ONGC: Oil & Natural Gas Corporation
OTEC: Ocean Thermal Energy Conversion
RE: Renewable Energy
REC: Renewable Energy Certificate
RES: Renewable Energy Sources
RPO: Renewable Purchase Obligation
RPS: Renewable Purchase Standards
SEB: State Electricity Board
SERC: State Electricity Regulatory Commission
SLDC: State Load Dispatch Centres
SNA: State Nodal Agency
SPV: Solar Photovoltaic
TWh: Terawatt hours
UPS: Uninterrupted Power Supply
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EXECUTIVE SUMMARY

Energy is an indispensable part of our living. The standard of living of people across countries is gauged by many factors, one of which is the energy consumption. Access to various energy resources is the cause behind the growing disparity from country to country. The sources are not proportionally distributed among countries leading, thereby, to some nations being exceptionally rich in resources and some nations deficient in it. The resource rich nation can make use of resources in the best efficient way leading to better services to its people and hence improves the standard of living.

The report starts with the introduction of energy and its different sources and the need felt to switch to renewable energy resources. Coal, nuclear energy, natural gas, petroleum, diesel and hydroelectric are some of the traditional sources of energy used worldwide for the generation of electricity. The advantages and benefits of using these sources have turned out to be tremendous. But benefits of using them bring with it some disadvantages which cannot be over looked.

The green houses gases such as carbon dioxide ($CO_2$), Sulphur dioxide ($SO_2$), Nitrous oxide ($N_2O$) etc. produced in the process are not only harmful for the people vis-à-vis health hazards but it also deteriorates the environment vis-à-vis global warming. Nevertheless, the world’s energy consumption from these sources has always shown an upward trend year after year which is a matter of grave concern.

With the new wave of environmentalism running, the emphasis on fossil fuels as the source of energy has shifted to unconventional sources of energy which are clean and renewable. The need to look for alternate sources of energy was felt long back by nations when drastic climatic changes started to pose a potential threat to the existence of life in future on earth. The world population is expected to increase from 6 billion to 11 billion in this century and the life expectancy has increased 2 times in the last two centuries and the energy requirement has increased 35 times in the same period. Energy Security, sustainability and environmental concerns are the major factors behind shifting to renewable sources of energy.

India’s substantial and sustained economic growth over the years is placing enormous demand on its energy resources. Inspite of the substantial increase in installed electricity capacity in India, demand has outstripped supply. Thus, there is an emerging energy supply-demand imbalance. With constraints faced in resource availability and in delivery

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1. An Introduction to Energy Resources, B. Viswanathan; accessed on 4th Jan 2012
5. Annual Reports, WHO; accessed on 4th Jan 2012
mechanisms, traditional means of energy supply are falling short. Renewable energy can make a substantial contribution in this regard.\textsuperscript{6}

The Department of Non-Conventional Energy Sources (DNES) was created in the Ministry of Energy and entrusted with the charge of promoting non-conventional energy resources. In 1992, DNES was upgraded and it started functioning as a separate Ministry of Non-Conventional Energy Sources (MNES) which was subsequently renamed as Ministry of New and Renewable Energy (MNRE) in 2006\textsuperscript{7}. This is the only such Ministry in the world. MNRE is the nodal Ministry of the Government of India at the Federal level for all matters relating to new and renewable energy.

This report attempts to analyse the different promotional strategies adopted within a regulatory framework in India. The Electricity Act, 2003, was the first comprehensive framework that spurred the development of renewable power in the country by unfolding a developing regulatory structure composed of preferential tariffs, renewable purchase obligation, leading over to facilitating renewable energy certificates (RECs). The Government has been supporting renewable energy development through an attractive mix of fiscal and financial incentives. These include capital/interest subsidy, accelerated depreciation, nil/concessional excise and customs duties, and Generation Based incentives or feed-in-tariff. The growth of renewable energy in India has been led by private sectors majorly. Indian Renewable Energy Development Agency (IREDA) and other public sector agencies are also actively funding renewable energy projects.\textsuperscript{8} A proposed and already operational mechanism of REC is discussed in detail and competition issues are analysed thereafter.

If we talk about numbers and figures, then about 3,700 MW are currently powered by renewable energy sources (3.5 percent of total installed capacity). This is projected to be 10,000 MW from renewable energy by 2012. The key drivers for renewable energy are the following\textsuperscript{9}:

- The demand-supply gap, especially as population increases
- A large untapped potential
- Concern for the environment
- The need to strengthen India’s energy security
- Pressure on high-emission industry sectors from their shareholders
- A viable solution for rural electrification

Coal, gas and oil have witnessed considerable price volatility in recent years. Development of renewable energy sources, which are indigenous and distributed and have low marginal

\textsuperscript{6}www.energycrisis.com, accessed on 4\textsuperscript{th} Jan 2012
\textsuperscript{7}Ministry of New and Renewable Energy, Annual Report, 2010-11
\textsuperscript{8}www.moef.nic.in, Divisions: Renewable energy, accessed on 4\textsuperscript{th} Jan 2012
\textsuperscript{9}Ministry of New and Renewable Energy, Annual Report, 2010-11; accessed on 4\textsuperscript{th} Jan 2012
costs of generation, can increase energy security by diversifying supply, reducing import
dependence, and mitigating fuel price volatility.\textsuperscript{10}

Although we have a set of policies, missions and programmes, we do not yet have a
developed renewable energy law as in the case of European Union (EU) and USA. The
multiplicity of laws, regulations, and agencies governing the renewable energy sector makes
integrated intervention difficult and undermines investor confidence. No single law governs
the development of the renewable energy sector in India.\textsuperscript{11}

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.\textsuperscript{12} Barriers can be grouped into three categories: financial viability, support
infrastructure, and regulatory approval.\textsuperscript{13} These factors make the use of renewable
resources for electricity generation less competent in comparison to conventional sources
of energy. Though it is at a very nascent stage, the competition issues are the same as those
prevailing in the energy sector as a whole relating to vertical integration and possible
threats to competition, open access and issues in switching suppliers in deregulated markets
and many more. But their entry into the electricity market requires already integrated
utilities to unbundle. In simpler terms, competitive electricity markets will ease the entry of
renewable energy sources.

Lastly, Conclusion is drawn about the state of renewable energy potential in India and
possible competition issues that can emerge. Recommendations are given thereafter.

This report hopes to bring about the awareness of the upcoming renewable sector in India
and the competition issues that can be averted through a better and simple design of
policies.

\textsuperscript{10} National Renewable Energy Laboratory, \url{www.nrel.gov}, accessed on 4\textsuperscript{th} Jan 2012
\textsuperscript{11} \url{http://relaw.wisein.org/}, Need for Renewable Energy Law in India, accessed on 4\textsuperscript{th} Jan 2012
\textsuperscript{12} \url{http://www.martinot.info/Beck_Martinot_AP.pdf}, Barriers to Entry in Renewable Energy, accessed on 4\textsuperscript{th} Jan 2012
\textsuperscript{13} Unleashing Renewable Energy Potential in India, ADB and World Bank; Author: Gevorg Sargsyan & Mikul Bhatia, 2010;
accessed on 4\textsuperscript{th} Jan 2012
1. **INTRODUCTION**

Since time immemorial, people have been using conventional sources of energy for various purposes which ultimately cater to their energy needs and requirements. Little do they realise that the use of such resources not only limits the stock available for future generation but also cause serious environmental threats to the world in general.\(^\text{14}\) The cheap availability of these resources keeps their demand at an all time high. If this trend continues in future, we might have to face serious energy shortages because once gone, these resources cannot be renewed and otherwise would take millions of years to form again. The energy shortage would spiral up the fuel costs in future and the very characteristic of fossil fuels (Cheap, reasonable) would be violated.\(^\text{15}\)

This calls for some modification in the energy mix inviting the use of renewable resources to fulfil energy needs. Countries across the world are exploring this segment and trying to achieve maximum possible usage of these resources in the energy mix thereby contributing less to the green house gas emissions.\(^\text{16}\)

Today, India boasts perhaps the only Ministry of Non Conventional Energy Sources in the world. The Ministry manages one of the world's largest renewable energy programmes covering the whole spectrum of renewable energy technologies for a variety of grid and off-grid applications. The country has the largest decentralized solar energy programme, the second largest biogas and improved cook stoves programme, and the fifth largest wind power programme in the world. A substantial manufacturing base has been created in a variety of new and renewable sources of energy (NRSE)\(^\text{17}\), placing India not only in a position to export technology but also to offer technical expertise to other countries. These sources have begun to emerge as an attractive option sometimes the only one, to provide light and power to areas too remote for grid electrification. Promotion of renewable energy sources is an integral component of the country’s strategy for sustainable development.

The inclusion of renewable energy sources in the energy mix of a country, however, seriously distorts the pricing mechanism leading thereby to inefficient outcomes. This is because renewable resources are not cost competitive vis-à-vis conventional fossil fuels and are thus given preferential treatment in terms of subsidies and are kept outside the gambit of market boundaries. However, the costs are declining gradually due to the ongoing innovations and new technologies and very soon they will be brought under the umbrella of market and their prices would be determined by market forces and mechanisms and not by Central or State Government.\(^\text{18}\)

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16 Renewable Energy: Economic and Environmental issues, Author: D. Pimentel, 2006; accessed on 4\(^\text{th}\) Jan 2012
17 Renewable Energy in India-Business Opportunities; accessed on 4\(^\text{th}\) Jan 2012
Before we get into the nitty gritties of competition and how it can be brought in the renewable energy sector, we see and analyse the potential of renewable sources of energy in India and the legal framework wherein it operates.
2. ENERGY AND ITS IMPORTANCE

2.1 Introduction

Energy is a crucial ingredient for economic development. As both agricultural and industrial activities increase, the demand for energy similarly increases. In the developing world provision of a greater access to energy has been suggested by some that will help grow their economies and improve the lives of the poor. As a result progress is being done to provide energy to as much percentage of the population as possible by individuals, firms and governments incentivized from inside and outside the countries and motivated by financial or humanistic interests, valuing it as a human right or a combination of these and others.  

While business and financial economists pay significant attention to the impact of oil and other energy prices on economic activity, the mainstream theory of economic growth pays little or no attention to the role of energy or other natural resources in promoting or enabling economic growth. An exception of course was the extensive discussions concerning the “productivity slowdown” following the 1970s oil crises.

Like labour and capital, energy is also an essential factor of production (Stern, 1997). All production involves the transformation or movement of matter in some way and all such transformations require energy. Energy should be given its due status in the production process as one of the vital factors affecting production and not just a mere intermediary input to the production process. Studies have come up with one crucial relation between energy and growth: When energy is scarce it imposes a strong constraint on the growth of the economy; however, when energy is abundant, its effect on economic growth is much reduced. Therefore, an abundant energy base is a prerequisite for a steady growth of an economy and thereby, maintaining the momentum of Gross Domestic Product (GDP). Moreover, price of energy (for e.g. Diesel, petroleum) affects the economy enormously via oil price shocks. This is because oil is a necessary component in almost all productions and the price of which affects the price index as a whole, thereby, leading to a change in inflation rates and affecting macroeconomic aggregates like unemployment, output etc.

Electricity is one of the most used forms of energy. The arrival of electrical energy has transformed lives. Homes are clean and well lit. Cooking, washing and ironing are simplified. There is a much-reduced risk of fire. There are previously undreamt-off opportunities for learning, communicating and for home entertainment. The uptake of a wide range of electrical appliances is a clear indication of the benefits electrification brings.

19 Importance of Energy, www.indienergy.com, accessed on 4\textsuperscript{th} Jan 2012
20 Oil scarcity, Growth, and global imbalances, 2011, International Monetary Fund, Chapter 3; accessed on 4\textsuperscript{th} Jan 2012
21 Energy and Economic Growth (April 2003), David I. Stern; accessed on 4\textsuperscript{th} Jan 2012
22 Aggregate output and factors affecting it, Macroeconomics, Blanchard 2007
Extension cords taking electricity to the unelectrified are yet another sign that its benefits are desired.  

Electrification seems fully sustainable on the social and ecological levels. The health hazards presented by solid and liquid fuels are increasingly being quantified, and identified with significant lost years of life. At the lowest level electrification is clearly economically sustainable also, as it permits the household to receive the basic minimum energy services cheaper than any alternative. At higher levels, however, the sustainability must be questioned.  

However, it is increasingly clear that significant capital expenditure in both generation and distribution are essential and urgent if electrification is to deliver on its promise in a truly sustainable way. Electrification has clearly impacted on poverty, if only because it provides an alternative to solid and liquid fuels that costs less than those fuels and has far less external costs. For these reasons, it is starting to play a significant role in social upliftment. Because electrification has transformed many people’s lives and impacted positively on poverty, it is playing a significant role in social upliftment, and that it is essential to extend electricity to as many homes as possible as quickly as possible, while addressing the identifiable problems in the delivery system that prevent full uptake from occurring rapidly.  

Rural electrification is the process of bringing electrical power to rural and remote areas. Electricity is used not only for lighting and household purposes, but it also allows for mechanization of many farming operations, such as threshing, milking, and hoisting grain for storage; in areas facing labour shortages, this allows for greater productivity at reduced cost. Electricity can be generated from different forms of energy. These forms of energy can be conventional or non-conventional. Usually traditional forms of energy are used. These are coal, petroleum, diesel, natural gas etc. These sources are used because of their abundant and cheap availability. Locally generated renewable energy is an alternative technology, particularly compared to electrification with diesel generators. In some countries (particularly Bangladesh and India) hundreds of thousands of Solar Home Systems have been installed in the last years. The deployment of these systems is coupled with microfinance schemes, such as Grameen Shakti. Most of these systems provide electricity for lighting and some small appliances (radio, TV). Mini-grids (central generation and village wide distribution network) can be a more potent alternative to energy home systems since they can provide capacity for the productive use of electricity (small businesses). Hybrid  

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mini-grids (renewables combined with diesel generators) are a widely acknowledged technology for rural electrification in developing countries.  

There are different energy sources available. Let us now look at the different energy resources in detail:

### 2.2 Non-renewable Resources

They are natural resource which cannot be produced, grown, generated, or used on a scale which can sustain its consumption rate, once depleted there is no more available for future needs. Also considered non-renewable are resources that are consumed much faster than nature can create them. Fossil fuels (such as coal, petroleum, and natural gas), types of nuclear power (uranium) and certain aquifers are examples.

India is well-endowed with both exhaustible and renewable energy resources. Coal, oil, and natural gas are the three primary commercial energy sources. India’s energy policy, till the end of the 1980s, was mainly based on availability of indigenous resources. Coal was by far the largest source of energy. India is, however, poorly endowed with oil assets and has to depend on crude imports to meet a major share of its needs (around 70 percent). India’s primary energy mix has been changing over a period of time.

Despite increasing dependency on commercial fuels, a sizeable quantum of energy requirements (40% of total energy requirements), especially in the rural household sector, is met by non-commercial and traditional energy sources, which includes fuel wood, crop residue, biomass and animal waste, including human and draught animal power. The usage of such sources of energy is estimated at around 155 mtoe per annum. However, other forms of commercial energy of a much higher quality and efficiency are steadily replacing the traditional energy resources being consumed in the rural sector.

Coal is the most important & abundant fossil fuel in India and accounts for 55% of India’s energy need. India’s industrial heritage was built upon indigenous coal, largely mined in the eastern and the central regions of the country. Thirty per cent of commercial energy requirements are met by petroleum products, nearly 7.5 per cent by natural gas and 3.5 per cent by primary electricity.

Resource augmentation and growth in energy supply has not kept pace with increasing demand and, therefore, India continues to face serious energy shortages. This has led to increased reliance on imports to meet the energy demand.

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26 Electricity Generation, [www.wikipedia.org](http://www.wikipedia.org), accessed on 5th Jan 2012
27 Fossil fuels, [www.wikipedia.org](http://www.wikipedia.org); accessed on 5th Jan 2012
28 Energy Mix, [www.wikipedia.org](http://www.wikipedia.org); accessed on 5th Jan 2012
2.2.1 Coal

India now ranks third amongst the coal producing countries in the world. Being the most abundant fossil fuel in India till date, it continues to be one of the most important sources for meeting the domestic energy needs and accounts for 55% of the country’s total energy supplies. The development of core infrastructure sectors like power, steel, and cement are dependent on coal.

Coal has been recognized as the most important source of energy for electricity generation in India. About 75% of the coal in India is consumed in the power sector. In addition, other industries like steel, cement, fertilizers, chemicals, paper and thousands of medium and small-scale industries are also dependent on coal for their process and energy requirements. In the transport sector, though direct consumption of coal by the Railways is almost negligible on account of phasing out of steam locomotives, the energy requirement for electric traction is still dependent on coal converted into electric power.

With hard coal reserves around 246 billion tonnes, of which 92 billion tonnes are proven, Indian coal offers a unique ecofriendly fuel source to domestic energy market for the next century and beyond. Hard coal deposit spread over 27 major coalfields, are mainly confined to eastern and south central parts of the country. The lignite reserves stand at a level around 36 billion tonnes, of which 90% occur in the southern State of Tamil Nadu.

Through sustained programme of investment and greater thrust on application of modern technologies, it has been possible to raise the production of coal from a level of about 70 million tonnes at the time of nationalization of coal mines in early 1970's to 492.95 million tonnes (All India – including Meghalaya) in 2008-09. Coal India limited and its subsidiaries are the major producers of coal. 403.73 million Tonnes of coal was produced by Coal India Ltd. and its subsidiaries during 2008-09 as against the production of 379.459 million tonnes in the year 2007-08 showing a growth of 6.4%.

Despite this increase in production, the existing demand exceeds the supply. India faces coal shortage of 24 MT. This shortage is likely to be met through imports mainly by steel, power, and cement sector. India exports insignificant quantity of coal to the neighbouring countries.  

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29 Annual Reports, 2009-10, Ministry of Coal; accessed on 5th Jan 2012

30 Traditional buyers of Indian coal are Bangladesh, Bhutan, and Nepal
2.2.2 Oil and Natural Gas

The latest estimates indicate that India has around 0.4% of the world’s proven reserves of crude oil. Oil and Natural Gas Corporation Limited (ONGC) and Oil India Limited, the two National Oil Companies (NOCs) as well as private and joint venture companies are engaged in the exploration and production (E&P) of oil and natural gas in the country. Crude oil production by the NOCs during 2009-10 is found to be around 29.334 MMT (81.6% of total crude oil production). In addition, private and JV companies produced about 6.62 MMT of crude oil in 2009-10. Thus, total crude oil production in 2009-10 is about 35.954 MMT, which is 7.3% higher than the previous year.

Gas production during the year 2009-10 is found to be around 50.237 BCM by ONGC, OIL and private/JV companies, which is 53% higher than the previous year. The contribution of private/JV companies in natural gas production is about 25.43 BCM (50.6% of total natural gas production) in 2009-10. 31

India’s consumption of natural gas has risen faster than any other fuel in the recent years. Natural gas demand has been growing at the rate of about 6.5% during the last 10 years. Industries such as power generation, fertilizer, and petrochemical production are shifting towards natural gas. India’s natural gas consumption has been met entirely through domestic production in the past. However, in the last 4-5 years, there has been a huge unmet demand of natural gas in India, mainly required for the core sectors of the economy. To bridge this gap, apart from encouraging domestic production, the import of LNG (liquefied natural gas) is being considered as one of the possible solutions for India’s expected gas shortages.

2.3 Empirical Evidence of Energy Shortage

The empirical evidence32 of India’s GDP growth, its energy consumption backs our theoretical conclusions and implications. India’s economy has been growing fast and must continue doing so to ensure inclusive growth. At a likely GDP growth rate of 7.5 per cent a year, real per capita GDP is expected to reach USD 2,700 by 2030, a five-fold increase over the 2005 level. This growth will be accompanied by increased urbanisation, with well over half a billion people living in India’s cities two decades from now. Economic growth will drive up demand in all sectors. Demand for power is likely to increase more than five-fold, from 700 terawatt hours (TWh) in 2005 to 3,870 TWh13 by 2030. Demand for building stock and infrastructure is expected to grow at the same rate, increasing annual demand for cement to 860 million tonnes and for steel to around 300 million tonnes by 2030. The vehicle fleet is likely to grow seven-fold to about 380 million vehicles, including two-wheelers.

31 Annual Report, 2009-10, Ministry of Petroleum and Natural Gas; accessed on 5th Jan 2012
32 Environmental and Energy sustainability; Mckinsey and Company Report 2005
With this growth, India’s total energy demand is likely to reach around 1.8 btoe a year in 2030 even after assuming efficiency improvements that could occur in the normal course. This would make India the third largest energy consumer in the world, after the United States and China. Meeting this demand would mean that India’s share of world energy consumption would nearly double, and thus India would have to find and secure energy resources much faster than other countries. That itself is going to be a challenge for India.

This demand growth will greatly increase energy requirements. India’s coal demand by 2030 is likely to be 60 per cent higher than the projected domestic production of about 1.5 billion tonnes per annum by the same year. This shortfall would likely have to be met with equivalent coal imports. Further, given India’s limited oil reserves, more than 10 times India’s domestic supply of oil may have to be imported. Such a high level of energy imports would have implications for India’s energy security. There would also be the challenge of expanding coal mining in India more than three times to reach approximately 1.5 billion tonnes of coal production per annum. Growth in energy consumption and the resulting increase in fossil-fuel supply would increase India’s GHG emissions. In the reference case, by 2030, India’s emissions could reach between 5.0 billion and 6.5 billion tonnes CO2e depending on GDP growth (6 to 9 per cent) and the implementation of initiatives that are planned or likely in the course of business. For our analysis, we have assumed annual emissions of 5.7 billion tonnes CO2e by 2030 at a GDP growth rate of 7.5 per cent a year between 2005 and 2030.

2.4 Emergence of Renewable Energy

The scenario of dominant energy sources in world as a whole is not different from that of India’s. The world’s energy supply is largely based on fossil fuels. It is estimated that by 2030, 80% of primary energy mix will be dominated by fossil fuels, where in oil will remain the dominant fuel and demand for coal will rise more than that of any other fuel in absolute terms. In such a scenario, the realisation that these sources of energy will not last forever and are also contributing to environmental problems is what has made renewables a lucrative and sustainable option. This has also led the governments around the globe, along with industries, thinking seriously about alternative sources of energy, the need for which was further affirmed by the 1973 oil embargo and oil price shock of 2008, coupled with the ever increasing oil prices.

Recent studies underscore that current global trends in energy supply and consumption are patently unsustainable – environmentally, economically and socially. It also went on to add that the situation can be changed if the supply of reliable and affordable energy is

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33 World Energy Outlook 2008; accessed on 5th Jan 2012
secured and a rapid transformation is made to a low-carbon, efficient and environmentally benign system of energy supply.

Countries all over the world fully recognise the need to promote wide spread adoption of renewable energy into their country’s energy sources, with the intention of promoting sustained economic growth, social development and environmental stewardship. It is also presumed that with increasing scope, scale, research and development, the cost of renewable energy technologies will come down; making them affordable and able to make a major contribution to electricity generation, heating, cooling and transport. Estimates highlight that renewable energy could contribute at least half of all the electric power in each of the large economies by 2050; even in countries where electricity demand is significantly high. What’s more, renewable energy not only has the capacity to provide millions of people with access to electricity; renewable energy equipment manufacturing and installation is highly labour intensive, thus contributing not only to improved living conditions, but also leading to reduced poverty. Renewables Global Status Report (2009 update) by REN21 also reiterates that the renewable energy sector offers an essential path for growth that can stimulate economic recovery and job creation without the burden of increasing carbon emissions.

Keeping up with the trend, Indian government focus is also on exploitation and development of various forms of energy and making energy available at affordable rates. The country’s energy supply comes from different sources: coal, hydropower, oil and gas and various forms of non-conventional energy. Government of India has recently brought out an Integrated Energy Policy linked with sustainable development that covers all sources of energy and addresses all aspects of energy use and supply including energy security, access and availability, affordability and pricing, as well as efficiency and environmental concerns. This policy also underlines the importance of renewables in India’s energy sector. The Policy states that solar power in particular could play an important role in helping country attain energy independence in the long run. With an increasingly favourable regulatory and policy environment, along with a growing number of enterprising entrepreneurs and project developers; India is ranked the third most attractive country to invest in renewable energy after USA and Germany.

The average per capita consumption of energy in India is around 500 W, which is much lower than that of developed countries like USA, Europe, Australia, Japan etc. However, this figure is expected to rise sharply due to high economic growth and rapid industrialization. The consumption of electricity is growing on the worldwide basis. Energy is a necessity and sustainable renewable energy is a vital link in industrialization and development of India.

35 Ernst and Young Survey, 2011
transition from conventional energy systems to those based on renewable resources is necessary to meet the ever-increasing demand for energy and to address environmental concerns.

2.5 Renewable resources

They are imperishable and we can have unlimited amounts without distressing over their exhaustion. They have the ability of being replaced by natural and biological processes. There are several types of renewable resources. The abundant availability of renewable resources in India keeps it at an advantageous position vis-à-vis other countries and it can use the resources for its own betterment and can also cater to the energy security concerns at the same time. Government of India is performing quite well in initiating programmes and implementing projects in this regard.

The availability, installed capacity and achievement of the programmes in promoting the use of renewable resources, is what follows now.

2.5.1 Wind Energy

It has been the flag bearer for the Indian Renewable energy industry for quite some time now. Investments in RE in India have increased from a meagre USD 94.58 million in 2001 to USD 3.7 billion in 2008 and about USD 5 billion by 2010 at a phenomenal compound annual growth rate (CAGR) of 56\%\textsuperscript{37}. A significant part of these investments (USD 3.2 billion) were in wind energy. The increase in investment was driven largely by a sharp rise in asset finance, and this in turn was mainly due to the continuing spectacular growth of Indian wind capacity. Wind asset finance has been contributing an average 60\% of total RE investment in India in the past 3 years. Amongst various RE sources, wind energy has emerged as a viable, cost-effective and commercial option for grid connected power generation.

The development of wind power in India began in the 1990s, and has progressed steadily in the last few years. The short gestation periods for installing wind turbines, and the increasing reliability and performance of wind energy machines have made wind power a favoured choice for capacity addition in India. Currently, India has the fifth largest installed capacity of 14158 MW till the end of March 2011. Stating from about 1350 MW in 2001, this figure has been achieved at a CAGR of 26\% for the period 2001-11. Wind mills are established mainly in Tamil Nadu, Gujarat, Maharashtra, Madhya Pradesh, Kerala, Karnataka and Rajasthan. It is expected that, addition in installation capacity will reach 2000 MW this year.

The Ministry of New and Renewable Energy (MNRE) plays an important role in introducing suitable fiscal and promotional incentives at the central and state levels to encourage

\textsuperscript{37} Annual Report 2010-11, Ministry of New and Renewable Energy; accessed on 5\textsuperscript{th} Jan 2012
private investors and developers to take up commercial projects. Indian policies have been really encouraging in this sector. The custom and excise duties are such that import of components is more favourable than import of complete machine, thereby, intensifying local business. India also has a national certification programme for testing and certifying wind turbines, under MNRE, again intended to boost local manufacturing. With tax and generation based incentives, there has been a flurry of announcements from the Indian corporates on their mega plans for large capacity wind farms.

Though this segment has shown tremendous progress, its contribution to India’s electricity demand is currently negligible. Currently, wind power accounts for about 8% of India’s total installed power capacity but it generates only about 2% of the country’s power. This shows that India’s wind energy endeavours need to increase by leaps and bounds in order to have a real contribution towards power generation.

2.5.2 Biofuels

It primarily includes biodiesel and bio-ethanol, have been recognised the world over as the most suitable substitutes for petro-based fuels. In India, biofuels assume special importance, particularly from energy security point of view, as the domestic supply of crude oil meets less than 30% of the demand. Several initiatives have been taken to supplement petro-based fuels with biofuels.\(^{38}\)

The availability of biomass in India is estimated at about 540 million tons per year covering residues from agriculture, forestry, and plantations. Principal agricultural residues include rice husk, rice straw, bagasse, sugar cane tops and leaves, trash, groundnut shells, cotton stalks, mustard stalks, etc. It has been estimated that about 70- 75% of these wastes are used as fodder, as fuel for domestic cooking and for other economic purposes leaving behind 120- 150 million tons of usable agricultural residues per year which could be made available for power generation. By using these surplus agricultural residues, more than 16,000 MW of grid quality power can be generated with presently available technologies. In addition, the potential of bagasse cogeneration is estimated at 5000 MWe, if all the 500 sugar mills in India switch over to modern techniques of co-generation. Thus, India is considered to have a biomass power potential of about 21,000 MW.\(^{39}\)

To tap this potential, MNRE has been implementing biomass energy/ co-generation program for the last 10 years. The program aims at optimum utilization of biomass materials for power generation or for replacement of conventional fuels through adoption of efficient and state-of-the-art conversion technologies. The technologies being promoted include combustion/ gasification/ cogeneration, using gas/ steam turbines, dual fuel engines/ gas engines, or a combination thereof, either for generation of power alone, or for cogeneration

\(^{38}\) MNRE is primarily involved in the development of National Policy on bio-fuels besides Research, Development and Demonstration on transport and stationary applications using bio-fuels, strengthening the existing institutional mechanism and overall coordination regarding biofuels

\(^{39}\) Annual Report 2010-11, MNRE; accessed on 5\(^{th}\) Jan 2012
of more than one energy form, for captive and/ or grid connected applications. The Program has two main components- a) Biomass Power/ Co-generation & b) Biomass gasification.

Biofuels are generated from animal waste and dung called biomass. A capacity addition of 400 MW has been achieved in Bihar, Chhattisgarh, Haryana, Karnataka, Maharashtra, Rajasthan, Tamil Nadu and Uttarakhand against a target of 450 MW, making the cumulative achievement to about 2560 MW which comprises of 998 MW of biomass power projects and 1562 MW of bagasse cogeneration projects. TNEB and Govt. of Tamil Nadu have taken up project for setting up high efficiency cogeneration power plants along with concurrent sugar factory modernisation project on BOOT basis at 12 cooperative and public sector sugar factories. The cumulative installed capacity and exportable surplus respectively works out at 183 MW and 120 MW. So it can be seen that projects initiated by MNRE have shown encouraging results.

### 2.5.3 Solar Energy

The exploitation of Solar Energy has been one of the major programs. Solar energy, which is manifested in the form of heat and light, is harnessed through solar thermal and solar photovoltaic (SPV) routes for applications like cooking, water heating, drying farm produce, water pumping, home and street lighting, power generation for meeting decentralized requirements in villages, schools, hospitals, etc. In spite of the limitations of being a dilute source and intermittent in nature, solar energy has the potential for meeting and supplementing various energy requirements.

India, being a tropical country, is blessed with plenty of sunshine. The average daily solar radiation varies between 4 to 7 kWh per square meter for different parts of India. There are on an average 250 to 300 clear sunny days a year. Thus, it receives about 5,000 trillion kWh of solar energy in a year.\(^4\) It is environment friendly and is freely available locally.

Though the energy density is low and the availability is not continuous, it has now become possible to harness this abundantly available energy very reliably for many purposes by converting it to usable heat or through direct generation of electricity. The conversion systems are modular in nature and can be appropriately used for decentralised applications. As a result of sustained research and development, several technologies have already been commercialised while some technologies are still under development.

The main objectives of the solar thermal program are to develop and promote the use of these technologies in order to meet the heat energy requirements in domestic, institutional and industrial sectors in India and also to generate electricity in an environment friendly manner. For harnessing the enormous potential of solar energy, MNRE is implementing a variety of programs in India. One such programme is **Jawaharlal Nehru National Solar Mission**. Its mission is to establish India as a global leader in solar energy, by creating policy

conditions for its rapid diffusion across the country quickly and achieve a scale, large enough to drive down costs to levels required to achieve grid capacity by 2022.\textsuperscript{41}

The development and deployment of PV technologies for more than two decades, a strong research infrastructure and a good manufacturing base for production of single and polycrystalline silicon solar cells/modules has been established in India, which ranks fifth in the world among the PV module manufacturing countries.

Although the cost of the technology is high, it has been gradually decreasing. Today, PV technology has become cost competitive to other technologies based on conventional energy for meeting power requirements of small load in remote areas. There is a need to bring down the cost of PV modules further so that PV technology becomes commercially viable.

The solar grid power program has two components - the thermal conversion technology and the photovoltaic technology. The Solar Photovoltaic technology converts sunlight into electricity without any pollution. The solar photovoltaic (SPV) program has resulted in significant technological developments for various applications.

34 grid-interactive SPV power projects with an installed capacity of 2.8 MW have been installed and 6 more projects with an aggregate capacity of 400 KW are under installation. MNRE has supported demonstration projects involving grid interactive SPV power plants. Under this program, Central Financial Assistance (CFA) in the form of grants-in-aid and subsidies is being provided to beneficiaries - State Nodal Agencies (SNAs) and SEBs for resource assessment, feasibility studies, research and development and to design, install and operate Solar Photovoltaic Power Plants in grid interactive mode.

2.5.4 Ocean Energy

The vast potential of energy of the seas and oceans, which cover about 3/4th of our planet, can make a significant contribution to meet our energy requirements. The various forms of energy from the seas and oceans which are receiving attention at present are Tidal Power, Ocean Thermal Energy Conversion (OTEC), Waves and Ocean Currents. The realization of power from oceans is limited due to large technological gaps and limited resources. At the present level of technological advancement only tides can be harnessed for power generation. In India, the Gulf of Kutchh and Gulf of Cambay in Gujarat and the delta of the Ganga in Sunder bans in West Bengal are potential sites for generating tidal power. The technology required for harnessing tidal power has been demonstrated in other countries. The main barrier in its introduction in India so far is that the technology is not commercially viable.

\textsuperscript{41} Detailed mission and achievement given in Annual Report 2010-11, MNRE; accessed on 5th Jan 2012
OTEC has a potential installed capacity of 180,000 MW in India and that of wave energy along the 6000 Km is 40000 MW.

MNRE, however, has been supporting the deployment of tidal power generation in India and in this context has sponsored the preparation of a feasibility report by the West Bengal Renewable Energy Development Agency (WBREDA) to set up a 3.6 MW capacity tidal power plant at Durgaduani Creek in the Sunderbans area of West Bengal.  

2.5.5 Geothermal Energy

Geothermal energy, which is derived from the high temperature geothermal fluids, can be utilized for power generation and thermal applications like greenhouse cultivation, space heating and cooking. Geothermal energy has been commercially exploited by as many as 20 countries to generate approximately 9000 MW of electricity. However, for further utilization of geothermal energy, adequate infrastructure needs to be created and training needs to be undertaken.

Over the years various agencies like the Geological Survey of India (GSI), Oil & Natural Gas Corporation (ONGC), National Geophysical Research Institute (NGRI), and Central Electricity Authority (CEA) have conducted studies to assess the geothermal potential in India. Valuable data has been generated through these studies for the exploitation of geothermal potential at some fields in India. As a result of systematic geothermal exploration down to depths of up to 400 meters, preliminary data has been generated for nearly 340 hot springs in India. The use of geothermal energy has earlier been demonstrated in India for small-scale power generation and thermal applications. Assessing the suitability of sites through magneto-telluric investigations and other studies are also planned.

2.5.6 Hydrogen & Fuel Cells

Hydrogen, high in energy content, is receiving world-wide attention as a clean and efficient energy carrier with a potential to replace liquid fossil fuels. When burnt, hydrogen produces water as a by-product and is, therefore, environmentally benign. At present, hydrogen is available as a by-product from several chemical processes, plants or industries.

Fuel cells electrochemically produce direct current (DC) electricity through reaction between hydrogen and oxygen. Emerging fuel cell and hydrogen energy technologies are suited for stationary and portable power generation as well as for transportation purposes. Hydrogen can be used either directly in IC engines or through fuel cells. Fuel cells can be potentially used in domestic, industrial, transport and agricultural sectors and also in remote areas for

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42 Ocean Energy, [www.eai.in/ref/ae/oce/oce.htm](http://www.eai.in/ref/ae/oce/oce.htm); accessed on 7th Jan 2012
44 Hydrogen can be produced through several routes such as biological conversion of various organic effluents like distillery starch, sugar processing etc. It is produced by electrolysis of water using electricity and by thermal decomposition of water through solar energy or nuclear power. Hydrogen can also be produced through gasification of coal and by steam reformation of natural gas, naphtha etc.
reliable power supply. Fuel cell power systems can be used as uninterruptible power supply (UPS) systems, replacing batteries and diesel generators. Low operating temperature (up to 100°C) fuel cells are better suited for transport and small power generation applications. Medium and high temperature (up to 1000°C) fuel cells are preferred for power generation/combined heat and power applications.

In view of the growing importance being attached to the development of fuel cells and hydrogen, a National Hydrogen Energy Board was set up in October 2003. The Board provides guidance for the preparation and implementation of the National Hydrogen Energy Road Map, covering all aspects of hydrogen energy starting from production, storage, delivery, applications, codes & standards, public awareness and capacity building.

2.6 Importance of Renewable Energy

The positive attributes of generating electricity from renewable energy sources are widely accepted, although some of these technologies may not be currently competitive commercially with conventional fuels. Renewable energy technologies can help solve energy issues related to electricity generation, namely, environmental concern, energy security, rural electrification and applications in niche markets where conventional electricity supply is not feasible. In case of India, all the above mentioned issues are important, however, the most critical issue is that of energy shortages. Almost all the states in India are facing energy shortages in the range of 3% to 21% with national average energy shortage of about 10%. A graph reflecting the energy shortage is given below:\n
![Energy Deficit Graph](image)

Source: Publication 2009, Central Electricity Authority

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45 Source: Publication 2009, Central Electricity Authority, [www.cea.nic.in](http://www.cea.nic.in), accessed on 9th Jan 2012
Renewable energy sources can supplement the present power generation and at the same time address the environmental and energy security issues. Renewable energy technologies have a good potential in India and considerable progress has been achieved.

The table below shows the potential for major renewable energy technologies for power generation and the installed capacity.\(^{46}\)

<table>
<thead>
<tr>
<th>Resource</th>
<th>Estimated Potential (MW)</th>
<th>Upto 9(^{th}) Plan</th>
<th>During 10(^{th}) Plan</th>
<th>Targets for 11(^{th}) Plan</th>
<th>During 11(^{th}) Plan upto 31.01.2011</th>
<th>Total capacity as on 31.01.2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind power</td>
<td>48,500</td>
<td>1,667</td>
<td>5,427</td>
<td>9,000</td>
<td>6,090</td>
<td>13,184</td>
</tr>
<tr>
<td>Small Hydro-power</td>
<td>15,000</td>
<td>1,438</td>
<td>538</td>
<td>1,400</td>
<td>977</td>
<td>2,953</td>
</tr>
<tr>
<td>Bio power(^{a})</td>
<td>23,700</td>
<td>390</td>
<td>795</td>
<td>1,780</td>
<td>1,488</td>
<td>2,673</td>
</tr>
<tr>
<td>Solar power</td>
<td>20-30 MW/ sq.km</td>
<td>2</td>
<td>1</td>
<td>50</td>
<td>29</td>
<td>32</td>
</tr>
<tr>
<td>Total</td>
<td>3497</td>
<td>6,761</td>
<td>12,230</td>
<td>8,584</td>
<td>18,842</td>
<td></td>
</tr>
</tbody>
</table>

The breakup of installed power capacity of all sources of energy is given in the following pie chart:\(^{47}\)

Source: Annual Report, 2010-11, Ministry of New and Renewable Energy

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\(^{46}\) Source: Annual Report, 2010-2011, Ministry of New and Renewable Energy

\(^{47}\) Ibid
3. REGULATORY FRAMEWORK OF RENEWABLE ENERGY RESOURCES

3.1 Introduction

The dwindling investment scenario is one of the prime reasons behind the need for enactment of policies to support renewable energy projects. The barriers to investment in renewable energy sector bring down its competitiveness relative to the conventional sources. Taking into account the cost factor, the investors find it costly and risky to enter into renewable energy projects. The higher initial capital costs imply that installed capacity per unit of initial investment is less than that in conventional sources. Also, because of the intermittent character of renewable resources, the value of the power is not fully actualised when it is fed into electric power grids. Apart from the initial higher investment, transaction costs on resource assessment, developing project proposals, assembling financial packages, negotiating power purchase contracts are also higher than when using conventional sources. Also the environmental costs (negative externalities) of using conventional fossil fuels are often not taken into consideration while making output decisions thereby making the use of conventional sources appear more advantageous.  

The renewable energy technologies are being promoted through various policies and programmes of the Ministry of Non Conventional Energy Sources (MNES) and the above mentioned achievements are result of such promotional policies. However, it has been observed that in the overall power generation scenario, the utilization of renewable energy for electricity generation has remained marginal. The present installed capacity of renewable energy based electricity systems is about 8100 MW whereas the total installed capacity in India is about 1,26,000MW. 

Some of the other limitations and barriers that have been faced for promoting renewable energy based electricity generation are (a) pricing of power generated from the renewable energy sources, (b) intermittent nature of electricity from wind and small hydropower, (c) barriers such as restrictions on siting, access to grid and (d) market barriers such as the lack of access to credit. Out of these issues the pricing of power generated from renewable energy sources remains the most critical issue and various policies have been implemented to overcome this issue in India. These policies are generally related to the stage of development of the technology e.g. capital subsidies in the early stages of development.

In India, MNES, in 1993 prepared policy guidelines for promotion of power generation from renewable energy sources which included provisions such as accelerated depreciation, concessions regarding the banking, wheeling and third party sale, among others. Further, the Electricity Act 2003 (EA 03) that was notified by the Ministry of Power in June 2003

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48 Annual Report, 2010-11, Ministry of New and Renewable energy
49 Ibid
50 Ibid
51 Ibid
along with the National Electricity Policy recognized the role of renewable energy technologies and stand-alone systems. The EA 03 has accorded significant responsibilities to the State Electricity Regulatory Commissions (SERCs) that are now key players in setting tariffs for renewable energy based electricity generation and have also been mandated to set quotas for renewable energy as a percentage of total consumption of electricity in the area of the distribution licensee. The National Tariff Policy that was notified by the Ministry of Power in January 2006, in continuation with the EA 03 and the National Electricity Policy also emphasizes the importance of setting renewable energy quotas and preferential tariffs for renewable energy procurement by the respective SERCs.\textsuperscript{52}

In India, the utilization of renewable energy technologies for electricity generation has a long history. The wind demonstration projects set up in early 80’s e.g. in Tamil Nadu, Gujarat, and Maharashtra are example of this. This phase was followed by development of policy measures, including financing and institutional measures to support the renewable energy technologies. The Ministry of Non-Conventional Energy Sources (MNES), in 1993 prepared policy guidelines for promotion of power generation from renewable energy sources. Some of the salient features of this policy guideline are - buy back price of Rs. 2.25 per kWh with 5% annual escalation, with 1993 as base year, concessions regarding the banking, wheeling and third party sale and fiscal incentives like allowing 100% accelerated depreciation for renewable energy projects were also given. The MNES guidelines were valid for a period of 10 years.\textsuperscript{53}

Power being a concurrent subject between the central and the state governments in India; different states adopted the MNES guidelines to varying degree. Further, there have been modifications in the state level policies with on one hand, some states giving additional benefits to renewable while on the other hand, some states have even diluted the benefits that were proposed in the MNES guidelines.

With an objective of enhancing the operations of the power sector entities in the country as well as creating a conducive environment for investments, Ministry of Power, has taken a number of initiatives in the past. These initiatives have been characterized on the basis of major legislative changes, policy measures and administrative actions and have been highlighted as follows:\textsuperscript{54}

\textsuperscript{52} Annual Report, 2010-11, Ministry of New and Renewable energy
\textsuperscript{53} Mahesh C Viprasas, Case Study: Development of regulatory framework for renewable power in India; accessed on 10\textsuperscript{th} Jan 2012
\textsuperscript{54} Ibid
**Major Legislative Initiatives**

Legislative framework in the past:

Prior to the EA 03, the power sector in India was governed by three important legislations viz. The Indian Electricity Act, 1910; the Electricity (Supply) Act, 1948 and the Electricity Regulatory Commission (ERC) Act, 1998. Prior to the enactment of the ERC Act, 1998, the regulatory function at the central level was performed by the Central Electricity Authority (CEA) / GoI and at the state level was performed by the SEBs / state government. The authority of the CEA was exercised through the process of grant of techno-economic clearance and the stipulation of various norms. GoI was responsible for the tariff setting of central generating stations. At the state level, the state governments and the SEBs were responsible for the regulatory function of the sector.  

The key features of the ERC Act, which is relevant in the context of pricing of renewable energy based power generation, are as follows:

The ERC Act, 1998
- Provision for setting up of Central Electricity Regulatory Commission (CERC) / State Electricity Regulatory Commission (SERC) with powers to determine tariffs;
- Constitution of SERC optional for states; and
- Distancing of government from tariff setting process.
- Rationale for change in legislative framework

The key reasons for devising a new legislation governing power sector were:
- Requirement for harmonizing and rationalizing provisions in the existing laws to
- Create a competitive environment which would result in enhancing quality and reliability of supply to consumers;
- Distance regulatory responsibilities of the government.
- Obviate the need for individual states to enact their own reform laws;
- Introduce newer concepts like power trading, open access, Appellate Tribunal etc.;
- Providing special provisions for rural areas.

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55 Mahesh C Vipradas, Case Study: Development of regulatory framework for renewable power in India; accessed on 10th Jan 2012
3.2 *Electricity Act 2003*\(^{56}\)

In order to formulate a comprehensive legislation imparting renewed thrust to coordinated development of the power sector in the country, the Electricity Act, 2003 (EA 03) has been enacted. The EA 03 provides a comprehensive yet flexible legislative framework for power development and envisions a sector characterized by a competitive market in power where the regulators and the power utilities play increasingly significant role.

The important objectives of the EA 03 are as follows:

i) To consolidate the laws relating to generation, transmission, distribution, trading and use of electricity and generally for taking measures conducive to development of the entire electricity industry;

ii) Promoting competition in the industry;

iii) Protecting the interest of consumers and supply of electricity to all areas;

iv) Rationalization of electricity tariff;

v) Ensuring transparent policies regarding subsidies;

vi) Promotion of efficient and environmentally benign policies;

vii) Constitution of CEA, Regulatory Commissions and establishment of an Appellate Tribunal; and

viii) For other related matter

The EA 03 also had its impact on the **renewable power sector and recognized the role of renewable energy technologies in the National Electricity Policy and in stand-alone systems.**

There is quite a mention about renewable resources in the Electricity Act 2003 and National Electricity Policy 2005 at various places under different sections. A glance at those particular sections will enhance our understanding about the legislative framework in which the electricity sector operates.

**ELECTRICITY ACT 2003\(^{57}\)**

**Section 3 (1)**

“The Central Government shall from time to time, prepare the National Electricity Policy and tariff policy, in consultation with the State Governments and the Authority for development of the power system based on optimal utilization of resources such as coal, natural gas, nuclear substances or materials, hydro and renewable sources of energy.”\(^{58}\)

**Section 4**

“The Central Government shall, after consultation with State Governments, prepare and notify a national policy, permitting stand alone systems (including those based on renewable sources of energy and other non-conventional sources of energy) for rural areas.”

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\(^{56}\) Electricity Act, 2003, Government of India

\(^{57}\) Electricity Act 2003, Government of India; accessed on 10\(^{th}\) Jan 2012

\(^{58}\) Ibid
The state electricity regulatory commissions (SERCs) are now crucial players in the context of state level policies for renewable.59

Section 61 (h)
"The Appropriate Commission shall, subject to the provisions of this Act, specify the terms and conditions for the determination of tariff, and in doing so, shall be guided by the promotion of co-generation and generation of electricity from renewable sources of energy."60

Further the EA 03 has made it mandatory for SERCs –
Section 86 (1) (e)
"to promote co-generation and generation of electricity through renewable sources of energy by providing suitable measures for connectivity with the grid and sale of electricity to any persons, and also specify, for purchase of electricity from such sources, a percentage of the total consumption of electricity in the area of a distribution licensee."61

Policy measures and Initiatives

3.3 NATIONAL ELECTRICITY POLICY 200562

In pursuance of the provisions of the Act, the Government of India has notified the National Electricity Policy.63 National Electricity Policy also stresses the need for the promotion of Non-Conventional Energy Sources.

The extract from NEP 2005 which relates to Non-conventional resources is given below:

"5.12 Cogeneration and Non-Conventional Energy Sources

5.12.1 Non-conventional sources of energy being the most environment friendly there is an urgent need to promote generation of electricity based on such sources of energy. For this purpose, efforts need to be made to reduce the capital cost of projects based on nonconventional and renewable sources of energy. Cost of energy can also be reduced by promoting competition within such projects. At the same time, adequate promotional measures would also have to be taken for development of technologies and a sustained growth of these sources.64

5.12.2 The Electricity Act 2003 provides that co-generation and generation of electricity from non-conventional sources would be promoted by the SERCs by providing suitable measures for connectivity with grid and sale of electricity to any person and also by specifying, for purchase of electricity from such sources, a percentage of the total consumption of

59 Electricity Act, 2003, GoI, accessed on 10th Jan 2012
60 Ibid
61 Ibid
63 vide MOP notification No. 23/40/2004-R&R (Vol-II) dated 12.2.2005
64 Supra Note 62
electricity in the area of a distribution licensee. Such percentage for purchase of power from nonconventional sources should be made applicable for the tariffs to be determined by the SERCs at the earliest. Progressively the share of electricity from non-conventional sources would need to be increased as prescribed by State Electricity Regulatory Commissions. Such purchase by distribution companies shall be through competitive bidding process. Considering the fact that it will take some time before non-conventional technologies compete, in terms of cost, with conventional sources, the Commission may determine an appropriate differential in prices to promote these technologies.\(^{65}\)

5.12.3 Industries in which both process heat and electricity are needed are well suited for cogeneration of electricity. A significant potential for cogeneration exists in the country, particularly in the sugar industry. SERCs may promote arrangements between the co-generator and the concerned distribution licensee for purchase of surplus power from such plants. Cogeneration system also needs to be encouraged in the overall interest of energy efficiency and also grid stability.\(^{66}\)

3.4 NATIONAL TARIFF POLICY\(^{67}\)

In compliance with Section 3 of the EA 03, the Central Government notified the Tariff Policy\(^{68}\) in continuation with the National Electricity Policy. Some of the important provisions with regard to nonconventional energy generation are highlighted below –

**Section 6.4\(^{69}\)**

(1) Pursuant to provisions of section 86(1)(e) of the Act, the Appropriate Commission shall fix a minimum percentage for purchase of energy from non-conventional sources taking into account availability of such resources in the region and its impact on retail tariffs. Such percentage for purchase of energy should be made applicable for the tariffs to be determined by the SERCs latest by April 1, 2006. It will take some time before non-conventional technologies can compete with conventional sources in terms of cost of electricity. Therefore, procurement by distribution companies shall be done at preferential tariffs determined by the Appropriate Commission.

(2) Such procurement by Distribution Licensees for future requirements shall be done, as far as possible, through competitive bidding process under Section 63 of the Act within suppliers offering energy from same type of non-conventional sources. In the long-term, these technologies would need to compete with other sources in terms of full costs.

(3) The Central Commission should lay down guidelines within three months for pricing non-firm power, especially from non–conventional sources, to be followed in cases where such procurement is not through competitive bidding.

Implementation of Section 86 (1) (e) of the EA 03 and Section 6.4 (1) of the National Tariff Policy are underway and different SERCs are in the process of issuing tariff orders for renewable energy based electricity generation and specifying quota/share for power from renewable energy.

\(^{65}\) Supra Note 62

\(^{66}\) Ibid


\(^{68}\) vide MOP notification No.23/2/2005-R&R (Vol. III) dated January 6, 2006

\(^{69}\) Supra Note 67
3.5 A need was felt to draft an **Integrated Energy Policy**\(^{70}\) linked primarily with sustainable development goals of the country. The Prime Minister and the Deputy Chairman, Planning Commission, Government of India, took the decision for an effective and comprehensive energy policy as an urgent imperative in the year 2004. The draft of integrated energy policy was circulated in December 2005 and the final policy was notified in August 2006. The broad vision behind the energy policy is to reliably meet the demand for energy services of all sectors including the lifeline energy needs of vulnerable households, in all parts of the country, with safe and convenient energy at the least cost in a technically efficient, economically viable and environmentally sustainable manner.

The integrated energy policy has outlined some ambitious tenets. These are summarized below.

- Renewable energy may need special policies to encourage them. This should be done for a well-defined period or up to a well-defined limit and should be done in a way that encourages outcomes and not just outlays.\(^{71}\)
  - Phase out capital subsidies, which only encourage investment without ensuing outcome, by the end of the 10th Plan linked to creation of renewable grid power capacity
  - Power regulators must seek alternative incentive structures that encourage utilities to integrate wind, small hydro, cogeneration, etc., into their systems. All incentives must be linked to energy generated as opposed to capacity created.
  - Respective power regulators should mandate feed-in laws for renewable energy, where appropriate, as provided under the Electricity Act and as are mandated in many countries.

The following specific policies to promote various renewable have been recommended in the policy:\(^{72}\)

- **Mini Hydro:** A detailed survey should be carried out to identify potential sites. Identified sites should be auctioned. For plants which are not connected to grid bid for lowest tariff with a pre-specified premium in the form of Tradable Tax Rebate Certificates (TTRC) should be invited. For village level plants, the entrepreneurs should be encouraged to supply power to meet other requirements such as agro processing and milling. If the plant can feed into a grid, the grid should be required to accept power at the going time of day tariff, and the plant site should be auctioned off for minimum premium in the form of TTRC linked to output. The responsibility for investments for connecting to the grid should be fixed in advance before the bidding.

- **Wind Power:** For wind power, site selection is freer than hydro-power and wind plants can be set-up on private land. Thus there may be need to auction only sites on public property. The same two types of auctions may be followed as described above for hydro-power plants.

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\(^{70}\) An expert committee was constituted on 12\(^{th}\) August 2004 under the leadership of Dr. Kirit Parekh, to prepare an integrated energy policy linked with sustainable development that covers all sources of energy and addresses all aspects including energy security, access and availability, affordability and pricing, efficiency and environment

\(^{71}\) Supra Note 53

\(^{72}\) Ibid
• **Fuel-wood Plantation:** Cooperatives should be encouraged and facilitated to grow tree plantations in villages. Cooperatives which are open to all members of the community and which are non-discriminatory should be given government land on long-term lease. Women should be encouraged to set-up and manage such plantations so that the time they now spend in gathering fuel can be spent productively in a way that empowers them. They should also be provided finance. If organized and managed properly, such plantations are economic and successful. Field based NGOs could also be involved in this activity. To encourage large-scale plantations, contract farming should be facilitated.

• **Electricity from Wood Gasification:** This can provide electricity based on gasification of wood and can be very useful especially in remote villages. The same set of policies, indicated for micro hydel and wind power plants should be followed here.

**Bio Gas Plants:** The real potential of bio gas is in community level plants. To encourage private or community entrepreneurs to set these up, they need to be provided land and finance. Also to have the willing participation of all the cattle owners in the community requires an appropriate operating strategy. The essential policy required is provision of land and finance.  

Growth of renewable energy sector with changing policies can be seen in the figure below:

![Graph showing growth of renewable energy sector with changing policies](source: PwC analysis for World Bank)

The above figure shows that the growth of renewable energy sources especially wind has been phenomenal and responding well to the policies taken up by the government at different stages.

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73 Supra Note 53

74 Source: Unleashing the Renewable Energy Potential in India, PwC analysis for World Bank
4. COMPARISON WITH CONVENTIONAL SOURCES OF ENERGY AND PROMOTION OF RENEWABLE ENERGY

Electricity supply industry has undergone a process of reform in a number of developed as well as developing countries. Market reforms are intended to improve competition in the power sector along with setting up of independent regulatory institutions. In a competitive market framework, electricity from renewable energy sources faces the challenge on account of cost, reliability as well as system integration. While a significant share of electricity supply continues to be dependent on conventional sources both fossil and non-fossil, the support for renewable sources has increased due on account of environmental and sustainability arguments. Development of renewable energy is often supported by financial subsidy, fiscal incentives and mandating its use. The Kyoto protocol has brought a new lease of life for investment in renewable energy in developing countries by improving its viability and encouraging research to enhance their cost competitiveness.

Indian power sector has witnessed reforms since the sector was first opened for private investment in the early 90s. The policy framework for investment in renewable energy sources for electricity generation has been supported with a number of fiscal incentives, and preferential procurement and pricing. This has largely been a voluntary approach guided by guidelines of the Ministry of Non-conventional Energy Sources. The Electricity Act 2003 (the Act) has enabled competition in the Indian power sector in bulk as well as retail electricity supply. The Act also mandates promotion of co-generation and renewable energy sources. In the follow-up action, various State Electricity Regulatory Commissions (SERCs) have specified a renewable portfolio standard as well as tariff for procurement of power from such sources. Renewable portfolio standard with cost based feed-in-tariffs disregard economic efficiency.

The Electricity Act 2003 and the National Electricity Policy (NEP) provide for competitive procurement of power by the electricity distribution companies, however, the regulatory developments following the Electricity Act 2003 continues to shield inefficiencies by promoting cost plus and assured off take policies. While renewable energy would continue to demand public support due to cost and technological disadvantages, the scope for cost reduction and operational efficiency cannot be neglected.

When two entities are on a level playing field, competition is inevitable. Both the entities would like to have a larger share of consumer base to cater to for their own potential benefits. Competition issues arise when one indulges in unfair trade practices wanting to capture the entire market illegally and unfairly. Or when the two entities merge and form a

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76 The Kyoto Protocol was adopted in Kyoto, Japan, on 11 December 1997 and entered into force on 16 February 2005. It is an international agreement linked to the United Nations Framework Convention on Climate Change
77 Supra Note 75
monopoly preventing the entry of firms in the industry or when the circumstances are such that the execution is unfair. The basic point remains that, the companies are on an equal footing and hence the competition emerges between them.

In case of power from renewable and conventional energy sources, the two entities cannot be said to have competition between them. This is because of the disadvantageous position the renewable energy sector is at on account of the higher costs in generation. The inability of internalisation of external benefits into the cost analysis makes the generation of electricity from renewable sources a costly affair. This prevents renewable energy sources to compete with conventional sources in generating electricity.

Although the cost of generating electricity from renewable energy sources is more than that of fossil fuels/conventional sources, the long term benefits might just be higher for renewables. A so-called ‘level playing field’ demands that allowances are made for various factors, some of which add and others subtract value to renewables. Essentially, the benefits of a new renewable source of energy for an electricity network may be specified as:

Value due to fuel saving + Value due to reduction in external costs + embedded generation benefits/disbenefits + Value of capacity credit – Costs associated with variability\(^78\), where

# Fuel saving value is value of each kWh of fuel saved.
# External costs are costs attributable to an activity that are not borne by the party involved in that activity, for e.g., threats of global warming due to CO\(_2\) emissions.
# Embedded generation benefits/disbenefits acknowledge that many renewable energy sources are small-scale and so connect into low-voltage distribution networks. This means that losses in the electricity network may be reduced and, possibly, transmission and distribution network reinforcements delayed or deferred. The calculation of these benefits is a complex issue and varies both regionally and locally.
# Value of capacity credit and extra balancing costs are due to the renewable energy source variability.

Economists around the world are now recognising the substantial costs of pollution to the society, costs to which the electricity industry is a major contributor. The task facing energy policy makers is how best to capture the external costs and benefits when in most countries external costs are not reflected in the market price of the end product. If this was done realistically, fossil fuel technology and nuclear prices would rise, making renewable energy more competitive. Deregulation of the power markets can either aid or hamper the quest for proper recognition of external costs. Crucial to the process is the willingness of governments to mandate that all energy options should compete on an equal footing.\(^79\) This

\(^{78}\) "Renewable Energy in Power Systems", Author: Leon Freris and David Infield, 2008

\(^{79}\) Ibid
spurs utilities to take the full costs of electricity supply into account. Such levelling of markets will also force the hidden subsidies to conventional technologies into the open. Unbundling is a primary aim of privatization or deregulation. What is needed are fair and workable procedures to achieve what is referred to as the internalization of external costs.

External costs are basically:\(^{80}\)

- Hidden costs borne by governments: it includes cost of regulatory bodies and pollution inspectorates and the cost of energy industry subsidies and research and development programmes.
- Costs of the damage caused due to health and the environment by emissions other than CO\(_2\)
- The costs of global warming attributable to CO\(_2\) emissions.

The external costs are not internalised when determining the market price of electricity and the flip-side of this is that renewable energy generation is not properly credited for avoiding these external costs.

**It is recognised that renewable energy would find it difficult to compete on level terms due to the issues of variability, cost and external costs.**

In a highly free competitive environment, the trade of renewable energy generation is different from conventional generation in the electricity market. The relatively small size of renewable energy generation units indicates that such generators tend to have less leverage in a competitive market. In order to make a reasonable profit, electricity suppliers have relatively large customer bases and may demand thousands of MW. Renewable energy generators may only produce tens of MW. Many of the power exchanges, for example, do not accept bids or offers of less than 1 MW and even if a renewable energy generator is able to trade in 1MW blocks, this market is likely to be relatively illiquid, i.e., trading blocks of this size are not easily sold in the market. These drawbacks will tend to restrict the value of the renewably generated electricity.\(^{81}\)

Growth of renewable energy in India has been supported through a host of fiscal incentives. These include 80 % (earlier 100 %) accelerated depreciation for tax purposes in the first year of the installation of projects, nil excise duty on manufacture of most of the finished products for utilization, low import tariffs for capital equipment. Apart from this a five-year tax holiday is provided for power generation projects using renewable energy sources.\(^{82}\) As per the guidelines of the MNES, the state utilities encouraged renewable energy by offering

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\(^{80}\) "Renewable Energy in Power Systems", Author: Leon Freris and David Infield, 2008

\(^{81}\) Ibid

\(^{82}\) Supra Note 46
remunerative price for power purchase and providing facilities for facility for banking and wheeling of electricity including for sale to third party.

Before we explain the inefficiencies of various regulations, let us first see what the prevailing regulations around the world mean and how do they work in the prevailing legal framework.

Renewable sources of energy are at a disadvantageous position when it comes to cost competitiveness vis-à-vis conventional sources. This is because the conventional sources have been in use since centuries ago and their generation, transmission and distribution is well established. Also, their use is further augmented because of the incentives and subsidies (direct or indirect) given for their exploration. In addition, the negative externalities are not reflected in the prices. This prevents the use of renewable resources and more and more reliance is placed on cheap, subsidised conventional sources of energy for electricity generation. To promote the use of renewable resources, the environmentalists around the world advocate for the similar incentives be given to their use so that the use of renewable sources of energy is encouraged, given the current cost disadvantage that they are at.

This implies that the electricity generation from renewable energy sources is associated with financial incentives and regulatory mandates which depend on the political decisions.

There are various promotional strategies adopted by countries to encourage the use of renewable resources. They can be clubbed under four broad ways:

1. **Regulatory price-driven strategies**: No quantity goals are set. The emphasis is on providing generators with financial support in terms of subsidy per kW of capacity installed or payment per kWh of energy produced. This can be done in two ways. One way is investment-focused strategies where financial support is provided through investment subsidies, soft loans, or tax credits per unit of generating capacity installed. The other is generation-based strategies where financial support is offered as a fixed payment or as a premium per unit of energy generated. Under a fixed payment scheme such as Feed-in-tariff (FIT), generators receive a fixed amount per kWh generated regardless of the costs of generation or price while under a premium scheme a fixed amount is added to the electricity price. A mechanism based on such a scheme which gives environmental bonus for the use of renewable energy sources and penalises conventional energy for their externality costs could establish a level playing field allowing fair competition between renewable energy sources and conventional power sources. As the cost of production decreases and goes below (electricity + fixed payment) with increasing production and better technology, investment in renewable energy sources makes it a worthwhile investment.

2. **Regulatory quantity-driven strategies**: Under this scheme, a desired quota is set to encourage the market penetration of renewable energy sources. This can be done

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83 Competitive Electricity Markets, Author: Fereidoon P. Sioshansi, pg 421
84 Competitive Electricity Markets, by Fereidoon P. Sioshansi, pg 424-425
85 Ibid
through tendering or bidding schemes which call for tenders to acquire specific amounts of capacity or generation from specified types of renewable energy sources. The winners get a contract for a specified period of time and receive a guaranteed tariff. Other way in which this strategy can be operationalized is through tradable certificate schemes such as renewable portfolio standards (RPS). It obligates one or more parties involved in the electricity supply chain such as generators, wholesalers, distribution companies or retailers to acquire a certain percentage of electricity from renewable energy sources in their energy mix. Parties trade certificates to demonstrate compliance. Certificates can be obtained either from their own renewable electricity generation or by purchasing renewable electricity and associated certificates from other generators or by purchasing certificates without purchasing the actual power from a generator or broker.\textsuperscript{86}

3. **Voluntary approaches**: they are based on the willingness of consumers to pay a premium for green energy. This can be done through investment based schemes where individuals voluntarily contribute to renewable energy by providing up-front capital. Also, there are generation based schemes where consumers pay a volumetric premium for renewable electricity deliveries.\textsuperscript{87}

4. **Indirect strategies**: This includes environmental taxes, regulatory and institutional assistance such as preferential permitting and siting, easy connection to the grid and operational concessions that make it easy to feed renewable energy sources’ generated power into the system. This is important because most renewable energy sources’ generation tends to be intermittent and unpredictable.\textsuperscript{88}

How well do these strategies perform depends from country to country. Policy which has generated good results in one country has performed miserably in the other. So no hard and fast rule can be applied as to which policy to use. There is no way to identify one such policy/scheme which will guarantee success in including renewable energy sources in the energy mix in a large proportion. From the experience of different nations in this segment, we see that policy effectiveness of different policies has been quite different in one country from the other. The intensity of impact of schemes is not constant among countries/nations.\textsuperscript{89}

There is no doubt that there are tremendous risks involved in the generation of electricity from renewable energy sources. The investment needed for the purpose is huge as compared to conventional sources of energy and the returns are not one-on-one actualised because of the intermittent nature of renewable resources. To promote investments in such an area, a highly conducive environment especially with regard to finance is required and also a considerable amount of support in terms of risk alleviation is needed.\textsuperscript{90} FIT schemes and tendering instruments may work well in combination to promote both mature and less

\textsuperscript{86} Competitive Electricity Markets, by Fereidoon P. Sioshansi, pg 424-425
\textsuperscript{87} Ibid
\textsuperscript{88} Ibid
\textsuperscript{89} Renewable Energy Promotion, Stefan Nowak, files.repic.ch/files/REPIC_SESEC_III.pdf, accessed on 14\textsuperscript{th} Jan 2012
\textsuperscript{90} Competition in Electricity Markets, author: Fereidoon P. Soishansi, pg 427
mature technologies. The risks to purchasers and generators are largely alleviated in such schemes due to the long-term contracts ensured by governments. In the quota-based tradable green certificates system, multiple risks for the investors may emerge resulting in strong preference for long-term arrangements. The strong bilateral interdependence between developers and obligated purchasers may lead to long-term contracts and to be only marginal in determining the certificate price. For small and medium sized suppliers with uncertain demand, there remains a tension between the risk associated with the uncertainty of future loads and the certificate obligation as well as the efficiency of managing the risks by long term contracting.

A long term and stable policy environment for potential investors with favourable economic support schemes are the key criteria for the success of developing renewable markets. The cost reduction of the renewable technologies is another important criterion for evaluating the efficiency of policy instruments in relation to technological learning. Lack of a sustained long-term policy commitment reduces the incentive for cost reductions. However, subsidy variations need to be designed well with care because they may be used by retailers to increase their own profits to the disadvantage of consumers in a sellers’ market.

The promotion of renewable energy as a substitute for fossil fuels in many countries is often achieved outside of the market mechanism because the willingness of consumers to pay for the quality differential is not sufficient to compensate for the higher cost of many renewable options, at least at current prices. After a certain level of market penetration has been achieved, this of course distorts the market process if one section of the market lives behind a protective fence and the other has to adjust to whatever happens behind that fence. This is particularly true if renewable production is stochastic as in the case of wind. Conventional producers have to adjust their output and portfolio to the dynamics of the renewable generators without adequate compensation, whereas the production of renewables is often kept free of market risks.

Use of renewables is encouraged to fulfil two goals; substitution of scarce fossil resources and reduction of greenhouse gas emissions. The signals given to the market by the political instruments for promoting renewables should be consistent with these goals and the investment incentives or disincentives for conventional generation should be consistent with the necessary backup function of the conventional generation section. This can only be achieved if reserve power needed for stabilizing renewable generation is integrated into the scheme of promotion.

The economic and financial implications of support schemes for renewables are reaching levels that are much higher than any efficiency gains that can be reached through competition in the core of the electricity market. The economic relevance of competition is reduced unless schemes of promotion are made to fit much better into the competitive market.

91 Chapter 12 by Haas et al, Competitive Electricity Markets, 2008
92 Author: Fereidoon P. Sioshansi, “Competition in Electricity Markets”, 2008; pg
5. **EMERGENCE OF REC MECHANISM IN INDIA**

5.1 Introduction

Renewable Energy Certificate (REC) mechanism is a market-based instrument to promote renewable energy and facilitate renewable energy purchase obligations amongst various stakeholders. REC trade has recently been put in place and the trading started in March 2011. Since then, there has been a significant growth in trade volumes and the remunerative prices for renewable energy generators invite investors to put money in this growing sector. Before we explain this mechanism, we, first, look into the factors that led to this.

Non-uniformity of endowment of renewable resources among different states of India leads to some states in being resource rich and others being deficient in resources. There is currently no inter-state mechanism of trading for renewable energy sources’ generates electricity. The high cost of renewable energy generation discourages developers of resource rich states to produce more than that obligated by SERC. This leads to some states having set the renewable purchase obligation (RPO) at a very low level because of the deficiency of renewable resources in those states. However, non-availability of mechanism for inter-state sale and purchase of renewable energy is not the only impediment in the path of achievement of higher targets. Many other issues such as increased cost of generation, lack of compliance mechanism, etc would have to be resolved. However, it is believed that lack of coordination among States while setting RPO targets and non-uniformity in procedures and norms for determination of tariffs for various renewable energy technologies are the two most important barriers.

The RPO targets vary significantly across the States. At one end of the spectrum, Delhi has target of just 0.5% for renewable energy purchase, while at other end, Himachal Pradesh has target of 20% for distribution utility in the State. This disparity in targets is a reflection of the varying renewable energy potential in different states. Similar disparity is noted in achievement of the targets or actual injection of renewable energy in the State. While States like Tamil Nadu and Karnataka have achieved target of 10% for renewable energy, many other states are not able to meet target of even 1-2% for purchase of renewable energy. Since nothing could be done about the potential of renewable energy in different states, a well designed mechanism for inter-state trading was needed to allow all the states set a higher RPO target, thus achieving an overall higher national target.

Given the current legal framework, setting the RPOs for states by centre is not a feasible option. Therefore, consensus among the SERCs is the only feasible option to achieve the national target. It is necessary to develop appropriate regulatory and institutional mechanism to ensure that States determine RPO targets in consultations with each other.

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93 Development of Conceptual Framework for REC Mechanism for India, ABPS Infra Advisory Pvt. Ltd., 2009
94 RPO and tariff Orders, CERC, accessed on 15 Jan 2012
Under Section 86(1) (e) of the EA2003, the SERCs are empowered to specify the percentage of electricity to be procured by the obligated entities from the renewable sources of energy. Most SERCs have put significant emphasis on this provision and have issued Orders/Regulations specifying such percentages. It can be easily noted from the table that obligation under Section 86(1) (e) varies significantly from the State to State.  

<table>
<thead>
<tr>
<th>States</th>
<th>Date of the RPS order</th>
<th>Minimum percentage of renewable power in following years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andhra Pradesh</td>
<td>September 27, 2005 extended up to July 31, 2006</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5%</td>
</tr>
<tr>
<td>Chhattisgarh</td>
<td>Regulation dt. July 14, 2009</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5%</td>
</tr>
<tr>
<td>Delhi</td>
<td>Feb 23, 2008</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>NDPL</td>
</tr>
<tr>
<td></td>
<td>Feb 23, 2008</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>BYPL</td>
</tr>
<tr>
<td></td>
<td>Feb 23, 2008</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>BRPL</td>
</tr>
<tr>
<td></td>
<td>Jan 7-Mar-08</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>NDMC</td>
</tr>
<tr>
<td>Gujarart</td>
<td>Notification Oct 29, 2005</td>
<td></td>
</tr>
<tr>
<td>Haryana</td>
<td>January 31, 2007</td>
<td></td>
</tr>
<tr>
<td>Karnataka</td>
<td>January 23, 2008 (Amendment of regulation 2004)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wind</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SHP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Others</td>
</tr>
<tr>
<td>Kerala</td>
<td>Regulation June 24, 2006</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SHP-2%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wind-2%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Others-1%</td>
</tr>
<tr>
<td>Madhya Pradesh</td>
<td>Regulation June 2008</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wind</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Biomass</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cogeneration and others</td>
</tr>
<tr>
<td>Maharashtra</td>
<td>August 16, 2006</td>
<td></td>
</tr>
<tr>
<td>Punjab</td>
<td>December 13, 2007</td>
<td></td>
</tr>
<tr>
<td>Rajasthan</td>
<td>Proposed Order- March 31, 2006</td>
<td></td>
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<tr>
<td></td>
<td>Final RPS order Sept. 29, 2006</td>
<td></td>
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<tr>
<td></td>
<td>RPS order for OA and CPP - March 7, 2007</td>
<td></td>
</tr>
<tr>
<td>Tamil Nadu</td>
<td>May 15, 2006</td>
<td></td>
</tr>
<tr>
<td>Uttar Pradesh</td>
<td>UERC (Tariff for Electricity from RE)</td>
<td></td>
</tr>
<tr>
<td>West Bengal</td>
<td>Notification dated March 25, 2008</td>
<td></td>
</tr>
</tbody>
</table>

Source: Conceptual and Regulatory Framework of REC in India, ABPS Infra Pvt. Ltd., 2009

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95 Source: Annual Reports, CERC website, accessed on 12th Jan 2012
96 Source: Annual Reports, CERC website, accessed on 12th Jan 2012
In case of RPO obligations, percentage is not the only thing which varies significantly. Other parameters such as applicability to OA/ Captive consumers, period of obligation and compliance procedures are few other areas where significant difference of opinion among various SERCs exists.

The regulatory framework requires the Appropriate Commission to determine the Preferential Tariffs for procurement of renewable energy power by the distribution licensees under RPO regime. It is envisaged that the Commission will determine tariff separately for each type of technology adopted for harnessing any of the renewable energy sources.\(^97\) For instance, it is expected that separate tariffs will be determined for solar thermal and solar PV applications. Following table summarises the tariffs determined for various RE based generation sources across various States. The table also provides vital information about the average power purchase costs in these States.\(^98\)

<table>
<thead>
<tr>
<th>State</th>
<th>Wind (Rs./kWh)</th>
<th>Small Hydro</th>
<th>Biomass</th>
<th>Bagasse</th>
<th>Solar * PV</th>
<th>Solar Thermal *</th>
<th>Avg. Power Purchase Cost (Rs./kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andhra Pradesh</td>
<td>3.37</td>
<td>2.6</td>
<td>2.88</td>
<td>2.75</td>
<td>7</td>
<td>7</td>
<td>1.83</td>
</tr>
<tr>
<td>Gujarat</td>
<td>3.37</td>
<td>-</td>
<td>3.1</td>
<td>3</td>
<td>3.4+12</td>
<td>3.4+10</td>
<td>2.46</td>
</tr>
<tr>
<td>Karnataka</td>
<td>3.4</td>
<td>2.8</td>
<td>2.85</td>
<td>2.8</td>
<td>3.4+12</td>
<td>3.4+10</td>
<td>3.22</td>
</tr>
<tr>
<td>Kerala</td>
<td>3.14</td>
<td>2.44</td>
<td>-</td>
<td>2.8</td>
<td>3.18+12</td>
<td>-</td>
<td>1.74</td>
</tr>
<tr>
<td>Madhya Pradesh</td>
<td>3.97</td>
<td>-</td>
<td>3.4</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1.97</td>
</tr>
<tr>
<td>Maharashtra</td>
<td>3.5</td>
<td>3</td>
<td>3.04</td>
<td>3.05</td>
<td>3 +12</td>
<td>3 +10</td>
<td>2.58</td>
</tr>
<tr>
<td>Rajasthan</td>
<td>3.65</td>
<td>-</td>
<td>4.48</td>
<td>-</td>
<td>15.7</td>
<td>-</td>
<td>2.61</td>
</tr>
<tr>
<td>Tamil Nadu</td>
<td>2.9</td>
<td>-</td>
<td>3.15</td>
<td>3.15</td>
<td>3.15</td>
<td>3.15</td>
<td>1.78</td>
</tr>
<tr>
<td>West Bengal</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>2.6</td>
<td>11</td>
<td>11</td>
<td>2.04</td>
</tr>
<tr>
<td>WBSEB</td>
<td></td>
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<tr>
<td>CESC</td>
<td></td>
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<td></td>
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<tr>
<td>Durgapur</td>
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<td></td>
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<tr>
<td>DPSC</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Haryana</td>
<td>4.08</td>
<td>3.67</td>
<td>4</td>
<td>3.74</td>
<td>15.96</td>
<td>-</td>
<td>2.68</td>
</tr>
</tbody>
</table>

Source: Tariff Orders, CERC

It is apparent from the above table that in all the States the tariff applicable to any renewable energy technology is higher than the average power purchase cost in that particular States. The high tariff of renewable energy based power in comparison to the average power purchase cost has been one of the key barriers in large scale deployment of renewable energy power. The distribution licensees have been reluctant to contract renewable energy power beyond their RPO target.

\(^97\) Refer to chapter 4 of the Report

\(^98\) Tariff orders, CERC, accessed on 15\(^{th}\) Jan 2012
5.2 Limitations of the RPO Regime

The significant limitations of existing RPO regulation are given below:

1. Absence of Legal and Regulatory Framework to Facilitate Purchase of RE from Outside the State
2. No RPO for Open access (OA) and Captive consumers
3. Weaker Enforcement Methodology

5.3 Need for the Revamp of RPO Regime

In the recent past, several developments have taken place, which emphasize the need of development of Renewable Energy Certificate Mechanism. These developments are:

5.3.1 National Action Plan for Climate Change

It suggested that national renewable standard be set at 5% from 2009-10 onwards and must increase by 1% every year for 10 years. It also recommended REC to become operational and procurement of renewable energy electricity should be through competitive bidding. Also, Renewable Energy power over and above the applicable renewable standards must compete on equal basis with that from conventional sources.

5.3.2 FOR Working Group Recommendations

Forum of Regulators (FOR) established under Section 166 of the Electricity Act is an association of Chairpersons of all electricity regulators. Chairperson of the Central Electricity Regulatory Commission is ex-officio Chairperson of the FOR. The primary responsibility of the FOR is to harmonize the regulatory policies in the country. It suggested need for inter-state exchange of renewable power.

5.4 REC Mechanism

Because of the inefficiencies and lack of defined enforcements in RPO regulation, the need to revamp this strategy was evident. The objectives of the new plan would take care of all the inefficiencies in the existing regulatory framework. These are given as follows:

1. Effective implementation of RPO Regulations
2. Increased Flexibility to Participants
3. Overcome geographical constraints

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99 World institute of sustainable energy (WISE), http://relaw.wisein.org/, accessed on 15th Jan 2012
100 NAPCC, pmindia.nic.in/Climate%20Change.doc, accessed on 23rd Jan 2012
4. Reduce transaction costs for RE transactions
5. Enforcement or penalty mechanism
6. Create competition between different RE technologies
7. Development of all encompassing incentive mechanism
8. Reduce risks for local distribution company

RECs have been used extensively as a successful market based policy instrument to promote renewable energy in many countries, such as Australia, Japan, US, Netherlands, Denmark and UK. However, these schemes vary in detail and need to be customized for local legislations and market situations. Further federal structure of governance as found in India and electricity being part of the concurrent list are unique challenges faced by this scheme. Also, involvement of various stakeholders such as State Electricity Regulatory Commissions, State Utilities, RE developers, etc. in the development and implementation of REC Mechanism is essential.

**Overview of REC Mechanism**

Internationally, purchase of REC is deemed as purchase of power generated from RE sources. It is acknowledged that renewable energy generation entails production of certain environmental attributes apart from electricity generation per se. Thus, RE generator can sell two different products on account of renewable energy generation. These products are the electricity and the environmental attributes associated in the form of RE Certificate. It is proposed to adopt the same philosophy for REC mechanism in India. The following figure presents the concept of REC mechanism and also represents the revenue model for the RE generator in the context of REC mechanism.

Source: Conceptual and Regulatory Framework of REC Mechanism in India, ABPS Infra Advisory Pvt. Ltd., 2009

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103 Case studies, Competitive Electricity Markets, by Fereidoon P. Sioshansi, 2008
104 Development of Conceptual Framework for REC for India, ABPS Infra Advisory Pvt. Ltd., 2009, pg 8
105 Development of Conceptual framework for REC for India, ABPS Infra Advisory Pvt. Ltd., 2009, pg 9
In the mechanism, one REC is issued to the RE generator for one MWh electrical energy fed into the grid which they can trade further on a national trading platform and help other states not so endowed with renewable resources fulfil their Renewable Purchase Obligation (RPO). The purchase of RECs will be deemed as a purchase of power generated from renewable sources and accordingly will be allowed for compliance the RPO target. Thus, REC mechanism will address the issues of scarcity of RE sources in some of the States which currently have negligible RPO targets in view of the limited RE potential in the State.

The operational framework for India as presented below has been customized to comply with existing legal and regulatory framework.

The following represents a flow diagram for various processes involved in the REC mechanism. The numbers indicate the chronological sequence of seven identified key processes\textsuperscript{106}

\textsuperscript{106} Development of Conceptual framework for REC Mechanism for India, pg 76, ABPS Infra Advisory Pvt. Ltd., 2009

\textsuperscript{107} Ibid

The framework entails appointment of an agency at national level to facilitate the registration of eligible RE generators, issuance of RECs and maintenance of record of procurement of RECs by Obligated Entities.
Institutional Framework for the Proposed REC Mechanism

The following figure below presents the institutional framework of REC mechanism in India.

For successful working of REC mechanism, regulatory oversight through Forum of Regulators (FOR), various State Electricity Regulatory Commissions (SERCs) and Central Electricity Regulatory Commission (CERC) play the pivotal role.

Renewable Energy Certificate Mechanism provides few additional options to RE generators to structure their electricity sale to maximize their profit. Structuring the sale of electricity can play an important role in maximizing the benefits of a particular project. A Renewable Energy Generator can have multiple options to manage electricity sale. Each option has its own advantages and limitations. The options can be listed out as:

1. **Sale to DISCOM at Preferential Tariff**: Power Purchase Agreements (PPA) with DISCOM is a very basic option which can assure guaranteed ROI over a longer duration. This can be a benchmark to evaluate other options against.

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108 Source: Development of Conceptual framework for REC for India, pg 65, ABPS Infra Advisory Pvt. Ltd.
2. **Sale to DISCOM at Average Power Purchase Cost:** Sale to DISCOM at Average Power Purchase Cost can assure a guaranteed return with an additional income from GBI, but the tariff is low when compared to the preferential tariff. This drop in tariff can be compensated by additional revenue from RECs.

3. **Third Party Sale/ Open Access:** Detailed analysis is required while going for Third Party Sale or Open Access as this may involve higher risks and other applicable charges as well. The charges may include Transmission Loss, Transmission Charges, and wheeling Charges. Cross Subsidy charges may also be eligible and will have a considerable effect on the price if implemented. The advantage with Third party Sale/ Open access is that the tariff may be comparatively higher and the generator is allowed to avail RECs as well.

4. **Captive/ Group Captive Consumption:** Most of the states allows RE generators to consume electricity generated as a captive consumption by paying nominal wheeling and banking charges (in case of wind/small hydro). As per CERC regulation, when RE generation is used for captive consumption and promotional benefits are availed (promotional wheeling and banking), RE generator becomes ineligible to participate in REC mechanism.

A Trade off has to be made by the generator in selecting the option that can provide maximum benefits of the project. Selecting an option just to avail RECs cannot provide maximum benefits for a project, but a strategic combination of one of the above options along with RECs can maximize the revenue for a project. With REC mechanism and its complex rules in place, detailed analysis and strategic planning is required by the generator before structuring the sale of electricity for any new or upcoming project.¹¹⁰

For any RE generator to be eligible to trade for RECs on power exchange, the following figure gives out the rules of participation:

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6. **SCOPE OF COMPETITION AND RELATED ISSUES**

For renewable energy to enter the electricity sector, there has to be competition in the electricity market because high level of concentration and existence of vertically integrated utilities (generation units-transmission units-distribution units) will make it difficult for new firms to enter the market and especially when the costs of generation is relatively higher than that generated from conventional sources of energy.\(^\text{111}\) But these barriers pose challenges for the easy entry of renewable resources in electricity generation. The promotional strategies thus come to use here. But completion issues are involved there too.

For e.g. in RPO: The States based on their endowment of renewable resources are mandated to produce electricity from a certain proportion of renewable resources. Each state has a different RPO (Renewable Purchase Obligation) that they have to abide by. The generating station can sell the power at a pre-specified tariff which is called feed-in-tariff. Feed-in-tariffs are seen to be higher than average power purchase cost and hence the distribution licensee (obligated entity) does not have an incentive to procure renewable electricity more than what they are bound to. These tariffs are different for different renewable energy depending upon the cost of technology and geographical area (endowment of resources). This creates competition issues among the companies involved in generation of different states. For example, a company in Tamil Nadu (resource rich) has a higher RPO to fulfil than a company in Delhi.\(^\text{112}\) This is unfair for companies in Tamil Nadu because of the following reasons:

1. They have to abide by a higher RPO
2. The tariffs are presumably higher in Delhi because of not-so-advanced technology for harnessing renewable energy leading to higher costs of generation.

Since feed-in-tariffs are cost based, it invariably benefits the resource-deficit states because the return is higher even though they have to comply to lower RPOs. This also discourages innovation in technology (which leads to low costs) because then (cost + fixed premium) falls with lower cost of advanced technology. This creates anti-competitive environment as there will be no incentive to go for better technology and lower costs of generating electricity.

This causes a major hindrance to the flow of investment in this sector. Because of this, companies in resource rich states would not find any incentive to enter into electricity contracts or involve themselves in the bidding process.

If, however, REC mechanism is followed and the pricing of RECs is done on power exchange with a floor and ceiling level of prices as stipulated by CERC then it offers a choice to the RE


\(^{112}\) Interaction with TERI Scholars on the subject
generator to either go for FIT scheme or REC scheme. Some states would find REC more lucrative than FIT scheme because of higher floor and ceiling prices given by CERC. In other States, FIT scheme would be more profitable. The inelasticity of demand and supply of RECs lends volatility in REC mechanism and so a floor and ceiling price is decided by CERC. A higher level for both prices would benefit Generators in REC scheme. Tariffs are the most appropriate instruments to ensure efficient choices by producers in choice of technology and appropriate renewable energy source. A higher floor price for REC would not provide incentive for cost reductions and improvement in technology. The prescribed levels of floor and ceiling price provide a room for windfall gain for investors in RES in some states. If the floor price is higher than FIT, then it would increase the compliance cost of obligated entities in the REC scheme and that would burden the consumers.

Other than costs, it is the non-variability of electricity supply that impedes investments in this sector. The intermittent nature of renewables leads to less actualisation per unit of investment as compared to conventional sources.

If electricity were to trade in a completely competitive environment where there is no regulation by governments and markets are deregulated, the variability factor of renewable energy sources would not let the sector grow.

The variability or lack of controllability for most renewable energy generation units is an important issue in a market that sets ex ante prices and has a balancing market. Wind power generation is variable, relying on changes in the wind, which can be forecast to a degree but with diminishing accuracy the further ahead one looks. Hydro generation, without storage, is dependent on river flow rate, which in turn relies on rainfall. Reservoir storage will help to mitigate fluctuations, but a prolonged drought will cause generation output to cease. Biomass generation, though controllable, is dependent on the biomass feedstock, which may be seasonally dependent. Photovoltaic power can be reasonably predictable in a warm climate with little cloud, but the movement of clouds can cause significant fluctuations in output. Wave power generation is reliant on wind to create waves. Changes in the energy in waves tend to be smoother than changes in wind energy as the waves tend to integrate the energy that the wind imparts. Tidal power relies on the relative phases of the moon and sun and as such is very changeable on a daily basis but is reasonably predictable. Changes in wind speed/direction and pressure can modify the expected tidal range. This implies all renewable energy sources have issues relating to variability to varying degrees and on different timescales. The ability to forecast changes also varies from one renewable energy generation source to another. If an intermittent

113_economics, Regulation, and Implementation Strategy for Renewable Energy Certificates in India: Anoop Singh
114_economics, Regulation, and Implementation Strategy for Renewable Energy Certificates in India: Anoop Singh
115_supra Note 78
renewable energy generator contracts bilaterally for a given amount of energy with another party, e.g. a supplier, any difference between what the generator is contracted to supply and what the generator actually supplies will be cashed-out at prices emerging from a balancing market. These prices are generally unfavourable compared with average bilateral prices. In this type of market, renewable generators that cannot accurately predict their output are disadvantaged.\textsuperscript{116}

**Since the supply of electricity coming from renewable sources is variable and not fixed, complete dependence on such sources for electricity might not be a good idea. This is another factor leading to renewable energy being non-competitive with other sources of energy in a deregulated framework (modern electricity market)**

If, however, the renewable generator were trading in a market with ex post pricing, it would not be exposed to unfavourable imbalance prices. This procedure spreads the cost of balancing on the entire system on all participants. The ex post prices are less volatile than balancing market prices, as all power must be traded through it, so the price penalty to intermittent renewable generator is less.

These challenges are insurmountable because of the very nature of renewable resources so renewable energy generators will have a hard time dealing with these constraints in a deregulated market system. Deregulation in Indian Electricity Markets is proposed in the Electricity Act 2003 but complete deregulation is impossible. Liberalisation is a choice variable and its extent in the electricity system is restricted. We can have policies favouring liberalisation in the liberalisation and regulation power mix but not complete deregulation. Liberalisation of power markets will bring with it the efficiency gains in generation but with regulation one can expect stability in the retail prices.\textsuperscript{117}

Like in electricity generated from conventional sources of energy, unbundling of vertically integrated firms and open access provision applies to renewably generated electricity as well. Any violation of this would lead to violation of Section 3 and 4 of the Competition Act. It relates to anti-competitive agreements and abuse of dominance demonstrated by firms, one of which is in generation and the other one in transmission of electricity. They have preferential treatment with each other (for mutual security) and prevent the entry of new firms because of the dominance they create in the market. This discourages new firms from entering the market and competition is reduced and hence the working of market to produce efficient outcomes is stalled.

One such case is presented before Competition Commission of India (CCI). It is related to biofuels generation by firms and archaic government policy favouring oil companies such that the producers of biofuels electricity are affected adversely. It is still yet to be investigated if anti-competitive policies are being followed by government and oil

\textsuperscript{116} Supra Note 78  
\textsuperscript{117} FOREWORD, Competitive Electricity Markets, Fereiodoon P. Sioshansi, 2008
companies to prevent the growth of biofuels renewable energy electricity. The newspaper article\textsuperscript{118}, dated 28\textsuperscript{th} December 2011 in The Economic Times said that the Ministry of Petroleum allowed biofuels producers to supply biofuels as a transport fuel only to oil companies and also set the price too low for them which was not viable for more investment. Sections 3, 4 and 26 of the Competition Act allow the regulator to probe further, including government enterprises and ministries. The case is still under investigation and the verdict is yet to come.

This implies that there could be more cases as such where the governments or private firms have vested interests and indulge in anti-competitive trade practices, thereby, reducing the scope of competition and efficiency in the market. The commission should look for possible anti-competitive agreements between generators and suppliers and encourage more competition in this sector. This will invite investment and help the sector grow.

Another case\textsuperscript{119} relating to the switching of supplier of electricity by consumer in Maharashtra came before CCI and was solved earlier this December, 2012. The request for change of supplier was not accepted by the new supplier as the former supplier had exclusive jurisdiction in that particular area. This was termed ‘anti-competitive’ by the informant. The DG’s report comes to the conclusion regarding violation of the Act in terms of unfair and discriminatory practices with regard to

1. Condition in purchase or sale of goods or services
2. Price in purchase of goods or services
3. Abuse of dominance by indulging in practices or practices resulting in denial of market access.

This case was actually the violation of Section 4 of the Competition Act. A lesson can be learnt from this case and see that no such practices are adopted in case of renewable energy electricity as well.

Another case\textsuperscript{120} involving Coal India Limited in which Explosives Manufacturers Association of India (EMAI) wrote a complaint to CCI that CIL was procuring 20-22 per cent of its requirement from IOCL-BP without inviting bids, which is killing competition in the market. However, after investigations and subsequent hearing of both parties, the Competition Commission of India (CCI) decided that even when Coal India has decided to source part of explosives from IOC-IBP to ensure continued supplies without disruptions, overall competition in the market.

\textsuperscript{118} Economic Times article, dated December 28, 2011
\textsuperscript{120} Economic Times article, August 21 2011
Mahagenco (Maharashtra State Power Generation Co) has filed before the Competition Commission of India (CCI) claiming that subsidiaries of state-run Coal India (CIL) are abusing its dominant position by supplying it with low-grade coal at inflated prices. The Matter is yet to be looked into by CCI.

The above three cases related to coal industry can be looked from the renewable energy sector perspective as vertical integration can take place in this sector with or without affecting the competition in the market. These cases provide a reflection of how competition issues can emerge in renewable energy sector as well since the nature of sector is the same.

\[\text{\footnotesize\textsuperscript{121}}\] Newspaper article, Wednesday, 18\textsuperscript{th} January 2012, Legally India.
**7. CONCLUSION AND RECOMMENDATIONS**

Energy is the lifeline of any economy. It is not given its due importance in economic growth models to keep away from complexity of issues and concepts involved. It, however, holds a very significant part in determining the growth of economy. Energy shortage can overhaul an economy’s growth process while its abundance can help economy grow by leaps and bounds. Too much of it will not contribute towards growth and development but little of it will hamper the growth process and restricts an economy’s growth. Therefore, an economy’s growth is dependent on appropriate amount of energy available for fulfilling its various needs. By and large, this requirement is met by conventional sources of energy which are available in abundance and hence can be accessed very cheaply. Coal, petroleum and natural gas are some very common fossil fuels used worldwide with great intensity. Due to the intensive use of fossil fuels (which take millions of years to form), the world is already facing acute shortage of energy resources from which electricity can be harnessed. Also, the use of fossil fuels emit harmful green house gases in the air which are threatening the environment with the dangers of global warming, the signs of which are already visible to us in the form of floods, melting of glaciers, increased water level. If this trend is continued at the current speed, the earth will soon be submerged in water. This calls for identifying alternative sources of energy which not only provide energy security in the face of acute shortage but also cater to sustainability and environmental arguments. Sources of energy that come under this category are renewable resources. With an abundance of renewable resources in countries around, this source can be exploited to its extremes without fearing about its depletion.

However, the cost of electricity generation from renewable energy sources has a competitive disadvantage relative to that from conventional sources of energy. The intermittent nature of renewable energy sources and less actualisation of power than what is fed into the grids make renewable energy a relatively costly endeavour by electricity developers. Also, there is no mechanism to internalise the external costs and benefits of using renewable resources leading to overall high costs. This prevents investments in this sector because the returns are low in comparison to amount invested. But it is expected that with increasing innovation and advanced technology, the costs of generation would come down and it will become a profitable area for investment. But innovation can happen only if we have enough investments coming in. To promote and encourage the use of renewable energy sources, the developers have to be subsidised for the initial start up. Once that is done and they penetrate into the market of energy sources and reach maturity, we can have a set of renewable resources which are no longer “alternative” sources of energy but a part of mainstream energy resources. The promotional strategies such as FIT, RPO and REC can help to bring about a change in the perceptions regarding renewable resources.
A detailed analysis of Renewable Energy Certificate (REC) mechanism is given in the report in which a suitable and significant level of penetration of renewable energy sources in the total energy mix can be achieved. This requires a change in the prevailing regulatory and legal framework and setting up of inter-state trading platform for green certificates. In India, this approach is adopted keeping in view the large scale disparity of renewable resources among states. The uneven distribution of these resources can be overcome by setting up of trading platform for renewable energy certificates where states with abundant resources can trade green certificates (issued per unit of MWh of power) to resource deficient states and thereafter it can be used to fulfil their RPS obligations. Here, apart from producing the electric component, a renewable environment friendly component is also generated. The electric component can compete directly with that coming from conventional sources and sold at average power purchase cost. The environment component is the extra revenue that electricity generators can get from trading it on national platform.

If this mechanism is followed, we can hope for a much enhanced involvement of renewable energy sources in generating electricity. This mechanism has requires determination of floor and ceiling prices by CERC because of the volatility in REC market. It can lead to inefficiency and excessive burden on consumers if the prices are not fixed properly. In this approach, the ceiling and the floor price for RECs should be set at the respective minimum levels observed across the states. This would encourage efficiency and remove room for windfall gains for certain technologies in a few states. Also those states which cannot fulfil their obligation even with RECs must pay a buy out price (ceiling price) as penalty. Moreover, banking facility should be made available so that more RECs can be bought when there is a good supply of RECs on power exchange and can be used later for future compliance (when the supply is deficient) because the supply of RECs, like RES, is inelastic and highly variable. This also implies that the validity period of RECs should be extended from 365 days to at least two years.

Currently, the renewable energy mechanism imparts distortion in the market because they work behind a protective fence and the changes in generation directly impact the amount to be generated from conventional sources. So generation of conventional sources depend on the signals given by policies and mandates requiring a particular percentage of electricity coming from renewable sources. Once these signals are compatible with the environmental goals and sustainability targets, we can achieve self sufficiency in energy security. Also, once the level of penetration required of the renewable energy sources is achieved, the protective fence can be done away with and be allowed to compete with conventional sources on a national platform like a power exchange. A separate treatment of renewable sources’ generators is needed and this can go on till they are in infancy stage. The current Electricity Act 2003 does not mention anything concrete for renewable energy resources electricity. Since it requires special treatment especially during the early phases of its development, it deserves a different chapter in the Electricity Act 2003.
One major impediment to the flow of investment in renewable energy sector is the multiplicity of laws, regulations, and agencies governing the renewable energy sector which makes integrated intervention difficult and undermines investor confidence. No single law governs the development of the renewable energy sector in India. In the absence of unified national legislation, multiple laws and policies govern development, often creating delays and conflicts. A single agency or institution often becomes a bottleneck, creating problems for the entire project development cycle. The institutions, empowered under different laws and often lack coordination, include the Ministry of Power, the MNRE, the CERC and SERCs, state governments, state nodal agencies, and regional electricity corporations. The Ministry of Power is responsible for national electricity policy and national tariff policy, both of which play a key role in promoting procurement of renewable energy–based power. The MNRE has a direct mandate for renewable energy in all policy and programmatic aspects. The SERCs, which have the most direct impact on feed-in tariffs, RPOs, and open-access charges, are loosely bound by the directives and guidelines of the CERC. All central agencies have a state counterpart, which has the final say on how renewable energy projects are developed. Progress on the ground depends mainly on state-level policies on feed-in tariffs and RPOs, evacuation, clearances, open access, and facilitation from state nodal agencies. More often than not, one or more of these elements becomes a bottleneck in developing renewable energy projects. Therefore, an integrated and coordinated approach for financial incentives is urgently needed. Also an agency on a national level can be formed which could help SERCs of different states to coordinate with each other as far as setting up of RPOs is concerned.

A key issue for the industry has been the lack of uniformity in feed-in tariffs across states. There is an urgent need for adequate capital cost benchmarks, periodic indexing of input prices and harmonization of investment assumptions used to arrive at acceptable returns for renewable energy investors. Non-uniform tariff rates leads to incentive issues, thereby, curtailing the flow of investments for better technology.

Competition Enabling provisions of different policies have actually shown promising results. Competition issues like the violation of Section 3 and 4 of Competition Act 2002 have been seen in “biofuels case”, “MERC case” and “CIL case” and dealt with accordingly by CCI.\(^{122}\)

A lot is required to be done in this sector for a continuous flow of investments. The policies are to be refined a lot more for dealing with this important sector which, if not in the short run, will definitely pay back more than the amount of money invested into it in terms of energy security, sustainability and environment protection.

\(^{122}\) Refer to chapter 6 of this Report
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