



Encouraging clean energy investment in developing economy like India

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ABSTRACT

The prices of oil, natural gas, uranium and coal are increasing at a high rate. It gives importance for all countries to focus on development of alternative energy resources. For developing countries, these price increases can have disastrous economic consequences; for many countries already overwhelmed by poverty this means a choice between fuel and food, health care, education and other essentials. Renewable energy resources need priority because: 1) the rapid climate change; 2) the severe health and environmental consequences from fossil fuel burning being experienced in every major developing country city; and 3) the high cost, environmental damages and security threats of nuclear power.

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Introduction

The prices of oil, natural gas, uranium and coal are increasing at a high rate. It gives importance for all countries to focus on development of alternative energy resources. For developing countries, these price increases can have disastrous economic consequences; for many countries already overwhelmed by poverty this means a choice between fuel and food, health care, education and other essentials. Renewable energy resources need priority because: 1) the rapid climate change; 2) the severe health and environmental consequences from fossil fuel burning being experienced in every major developing country city; and 3) the high cost, environmental damages and security threats of nuclear power.

The lack of a reliable supply of power from the electricity grid and the availability of free and inexpensive fuels, such as wood and kerosene, are key influences on this market. In this report, we focus on two areas in this growing, high-potential market: clean energy electricity systems and clean energy cooking and light products. The need for a revolution in clean energy is driven not just by environmental consequences of energy use, but also by the need for energy security.

Literature review

Bloomberg New Energy Finance (BNEF), There's a revolution going on India: a clean social innovation one! India's solar energy is transforming the country into a clean tech powerhouse with its world-beating green energy growth increase of 52% to \$10.3bn in 2011.

Shikhar Ghosh and Rama Nanda described in their study that a number of structural challenges related to investment in clean energy sector that are particularly acute for startups involved in the *production* of clean energy.

International Energy Agency has published in its Clean Energy Progress Report that Growth in clean energy has been strong, but needs to expand and accelerate. Clean energy technologies are making clear progress globally, but fossil fuels continue to outpace them. More aggressive clean energy policies are required, including the removal of fossil fuel subsidies and implementation of transparent, predictable and adaptive incentives for cleaner, more efficient energy options.

The International Journal of Renewable Energy Research (IJRER) seeks to promote and circulate knowledge of the various topics and technologies of renewable (green) energy resources. The journal aims to present the important results of work in the fields of renewable energy research, development, application or design.

The Energy Efficiency and Renewable Energy branch of the US Department of Energy Office heads the research, development, and deployment efforts in renewable sources of energy. It develops energy efficiency technologies to provide reliable and affordable supply of energy using the solar, biomass and wind. Due to their efforts, tremendous progress has been made in bringing renewable energy technologies to the marketplace. While the efforts of DOE have started giving results but a lot more has to be done to meet current energy challenges.

(Source:

<http://usinfo.state.gov/journals/ites/0504/ijee/garman.htm>)

Research Methodology

The research paper is an attempt of exploratory research, based on the secondary data sourced from e-journals, magazines, articles, websites and media reports.

Meaning of Clean Energy

There are two major sources of energy being used in today's world, Renewable and Non-renewable sources. The non-renewable sources are the sources which can not be renewed after a period of time and becomes exhausted e.g., coal, fossil fuels, natural gas, etc. Such sources release harmful gases to the environment thereby polluting the atmosphere. The alternative to such sources is the renewable source of energy (clean energy sources). These sources are clean or say, non-polluting or it reduces the effect of harmful gases to a considerable amount. Such sources can never be exhausted and hence called non-conventional sources of energy. Renewable sources include solar energy, bio-mass, wind, etc.

"Clean energy" refers to products and services that produce energy from renewable resources and emit fewer greenhouse gas emissions than does energy from conventional fuel sources.

According to Obama, clean energy investment is an “investment that will strengthen our security, protect our planet and create countless new jobs for our people.” If clean energy is defined as renewable energy, then this goal could prove to be superior. But if clean energy is a mix of clean coal, nuclear, renewable energy and natural gas, then this goal is undoubtedly attainable.

Obama announces \$2 billion investment in solar PV manufacturing and “the first large-scale solar plant in the U.S. to actually store the energy it generates for later use – even at night.”

Objective

The main objective is to inform investors about the market potential of the clean energy industry, by looking at its opportunities, challenges, and potential paths to growth. The purpose is to present an overall picture of these growing clean energy sectors, rather than to provide investment advice on individual companies.

Renewable/Clean Energy Technologies

There are a number of renewable energy technologies that can be used to end the dependence on fossil fuels and stop the contributions to global warming and pollution. Some of these new technologies are more effective and better to use than others.

1. Energy From Waste technology allows municipal solid waste to be used as a clean and renewable source of energy. This technology can resolve two separate issues with one process - municipal solid waste management and energy generation at the same time. Municipal solid waste is disposed of, and does not contribute to pollution or damage to the earth like traditional land filling methods. The garbage is used as a source of energy, supplying the energy needs of the population.

2. Renewable Solar Power systems use photovoltaic technology, panels, and cells to convert sunlight into electricity and heat. Solar energy presents great development opportunities in developing countries, particularly since most of them are in the Sun Belt. Solar thermal energy is particularly suited to the large demand for heat and hot water in the domestic, agricultural, industrial and commercial sectors of the economy. It is applied successfully for water heating, industrial process heating, drying, refrigeration and air conditioning, cooking, water desalination and purification (through use of solar ponds), pumping and power generation.

3. Wind Energy Systems utilize wind turbines to capture the power of the wind. This energy is then converted into electricity. Wind energy for electricity production today is a mature, competitive and virtually pollution-free technology widely used in many areas of the world. Wind also still is used to some extent for pumping water.

4. Geothermal Energy is provided by the heat inside the earth. This technology can be very effective if located in places where geothermal activity is high. Geothermal power is a relatively pollution-free energy resource derived from naturally occurring reservoirs of hot water or steam that occur below the earth's surface and is tapped to drive a turbine to create electricity. It is an established and economic energy source used in many parts of the world. Its use is expanding in Indonesia, the Philippines, Mexico, Kenya and Central America

5. Hydro Energy is derived from the rivers or the ocean tides.

6. Ocean Thermal Energy Conversion is another form of ocean power that uses the temperature of the water to create electricity.

7. Finally, last but not the least, Biomass Energy uses biomass algae which is converted into different forms of energy. This can be the production of various biofuels, part of waste to energy programs, and any other form of energy generation where biomass is used to create electricity, heat, or fuel. Utilization of biomass is a very attractive energy resource, particularly for developing countries since biomass uses local feedstocks and labor. Crop wastes, cellulosic biomass and crops raised to provide energy feedstocks on otherwise barren lands are good energy sources for industry, electricity production and home heating and cooking if used in efficient modern stoves or gasified.

Main Benefits of Clean Energy Investments:

- Investing before the technology takes off, so you are situated to get in on the ground floor and see a bigger increase in your investment value.
- Lower initial investment cost
- Potential for higher returns, because fossil fuel reserves will not last long
- Investment in the clean energy technology will help to stop pollution and environmental damage

Clean Energy Investment Status in India

There are some important aspects related to present status of Clean Energy in India.

□ Global rank 8th for investments made in clean energy technologies

□ Global 3rd best investment destination in renewable energy sector

□ Jawahar Lal Nehru National Solar Mission (JNNSM) aims to generate 1 GW of grid connected solar power by 2013, 5 GW by 2017 and 20 GW by 2022. The mission also envisages 500 MW of grid-tied CSP by 2013 and 10 GW by 2022

□ Indian clean energy sector is a US \$20bn opportunity annually

□ The installed capacity for wind energy has grown at a CAGR of 19% to reach 14 GW in FY 11

□ 7 of the top 10 global wind turbine manufacturers have manufacturing facilities in India

□ The total potential of small hydro power and biomass energy is estimated at 15GW and 18 GW respectively

□ Cleantech sector has the potential to generate 10 mn jobs in India by 2025 (<http://renewableenergyindiaexpo.com/>)

According to ECONOMIC TIMES.COM Mar 29, 2011, India entered top 10 Clean Energy Investment list for first time. India continued its rise as a top destination for clean energy investment, according to new research released by The Pew Charitable Trusts. In 2010, India attracted \$4 billion in private investments, ranking 10th among the G-20 countries. It also ranked 10th for five-year growth rates for renewable energy capacity and seventh worldwide in the amount of installed capacity. With a target of deploying 20 gigawatts of solar generating capacity by 2020, the country is poised to further grow its share of this sector of the economy.

Clean energy investments in India reached \$10.3bn in 2011, some 52% higher than the \$6.8bn invested in 2010. This was the highest growth figure of any significant economy in the world. There is plenty of room for further expansion - in 2011, India accounted for 4% of global investment in clean energy. Venture capital and private equity investment also made a strong comeback with \$425m invested in 2011, more than four times the 2010 figure. Wind and solar project developers such as Mytrah Energy India and Kiran Energy Solar Power succeeded in doing deals. The only major type of investment that fell in

2011 was equity-raising via the public markets. Only \$201m was raised compared to a record \$735m in 2010 when the Indian stock market was at its all-time high.

(<http://www.bnef.com/PressReleases/view/186>)

Clean Energy Investment Projects and Policies in India

"India is the fifth largest consumer of energy in the world, and it is projected to surpass Japan and Russia to become the world's third biggest energy consumer by 2030. At the same time, the country is facing an acute energy scarcity which is hampering its industrial growth and economic progress. (<http://www.eai.in/ref/services/consulting.html>)

With growing concerns on global warming, climate change and threat of fossil resource scarcity, India is increasingly looking towards renewable energy to power itself. A fundamental shift is already happening in many parts of the country in the context of renewable energy and clean technology.

There various Policies of Clean Energy in India for eg.

Solor Energy Policies

Jawaharlal Nehru National Solar Mission (JNNSM)

The National Solar Mission was framed to promote the use of solar energy for power generation and other application; also promoting the integration of other renewable energy technologies like biomass and wind with solar energy options. The Solar Energy can be tapped via two routes solar thermal and solar photovoltaic. Thus the framework is targeted to achieve Solar energy utilization via these routes:

Tax Incentives, Subsidies and Incentives under JNNSM

Various tax exemptions, capital subsidies and incentives are available for several components and sub-components of solar energy value chain. JNNSM promotes the assembly of solar modules after import of cells which is free from import taxes. Other benefits like Generation based incentives (GBI), 80% accelerated depreciation income tax benefits on renewable energy products including solar. Several products like Solar lanterns, street lights, blinkers and traffic signals are to be manufactured under specifications laid down by MNRE to avail capital subsidy benefits.

National Rural Electrification Policy 2006

Rural Electrification is high time need for india where still 45 million households are un-electrified.

Rajiv Gandhi Gramin Vidyutikaran Yojana (RGGVY)

This scheme is being implemented by Rural Electrification Corporation for permitting stand alone systems, rural electrification, bulk power purchase & management of local distribution (through franchisee model). Under this scheme, projects could be financed with 90% capital subsidy. For households below poverty line, 100% capital subsidy would be provided as per norms of Kutir Jyoti Programme.

Remote Village Electrification Programme

This project covers all those villages that are not under RGGVY scheme. The decision for choosing particular technology for power generation in such remote areas is taken by state implementation agency after examination of technical feasibility and resource availability. The projects are eligible for central financial assistance and developers can propose projects under the format specified in the policy document. Out of 8722 villages sanctioned under this scheme, 6446 have been completed and 1705 villages under progress. And out of 2533 hamlets sanctioned, 1587 have been completed.

Renewable Energy Supply for Rural Areas

This scheme was framed with the objective of developing and demonstrating commercially viable models for de-

centralized energy supply in rural areas from renewable sources. The implementation partners for the programme are: Ministry of New and Renewable Energy (MNRE), National Thermal Power Corporation Limited (NTPC Limited) and Kirloskar Oil Engines Limited. The partners are to frame out the business, governance and revenue models for target areas. The project is under demonstration mode for 30 target villages in Chhattisgarh.

Renewable Energy for Urban, Industrial and Commercial Applications

The programmes implemented under this scheme are working for developing: Solar energy systems and devices (including solar thermal and solar photovoltaic systems); Energy recovery from urban, industrial and commercial wastes; and Bioenergy and cogeneration in industry.

- Under MNRE's the Energy Efficient Solar/Green Buildings Programme, GRIHA rating system is being promoted for a target of supporting 4 million sq.meter built up area during 11th Plan. So far, 117 projects with 4.98 million sq.meter built up area with 81 projects from Government Departments with 3.22 million sq. meter built up area have been registered for GRIHA certification. An independent registered society 'Association for Development and Research in Sustainable Habitats' (ADaRSH) for promotion and implementation of GRIHA rating system has been set up in the country.

- Under "Development of Solar Cities Programme" the Ministry had proposed to support 60 cities/towns for Development as "Solar/ Green Cities" during the 11th Plan period with the aim to promote the use of renewable energy in urban areas. At least one and a maximum of five cities in a State is being supported. Systems that can be installed are: Solar street lights, Solar traffic signals, Solar blinkers, Solar power packs/inverters, Solar illuminating hoardings/ Bill boards and other systems of community use as felt necessary by Implementing Agencies.

- Under the Akshay Urja programme, shops are being established in each district to make renewable energy products easily available to people and provide after sales and repair services. Financial support in terms of soft loans from designated banks and a maximum of 2.40 lakh as recurring grant/incentive for first two years of operation from the Ministry is available for establishing such shops. Service Charge is also provided to SNAs. A total of 294 shops in 31 States / UTs, (including 113 Aditya Solar Shops) have been established under the scheme. (<http://www.eai.in/ref/ae/sol/policies.html>)

Solar Energy Business Opportunities

Indian solar energy market- with multiple opportunities along its value chain- has opened its doors worldwide to many players. The transformation of sand to power has proved out to be a highly proactive field for market and technology innovation. The areas of investment opportunities in Solar Energy are shown below :



Description	CERC Regulation
Capital cost	Rs.15 Crore/MW, linked to indexation formula
Commercial operational life (including evacuation systems)	25 years
Return on Equity	19% for first 10 years and 24% from 11th year pre-tax
Debt Equity Ratio	70:30
Interest on loan	Average SBI long term PLR plus 150 basis points
Depreciation	7% per annum
Interest on Working Capital	Average SBI short term PLR plus 100 basis points
Operational and Maintenance cost	Rs. 6.50 lakh/MW
Escalation	5.72% per annum
Capacity Utilization Factor	for wind power density 200-250: 20%for wind power density 250-300: 23%for wind power density 300-400: 27%for wind power density above 400: 30%
Sharing of CDM Benefits	First year: 100% to the project developerSecond year: 10% beneficiaries,to be increased at 10% per annum upto 50%.Thereafter to be shared on equal basis
Taxes and Duties	Tariff determined should be exclusive of taxes and duties levied by government provided allowed as pass through on actual basis

Source : http://www.cercind.gov.in/2010/ORDER/February2010/53-2010_Suo-Motu_RE_Tariff_Order_FY2010-11.pdf

NSM Phase	Utility Grid Power	Off Grid Solar	Solar Collector (sq. meters)	REMARKS
2010-13	1000-2000	200	7 million	Focus on capturing the low-hanging options in solar thermal and on promoting off-grid systems to serve populations without the access to commercial energy and modest capacity addition in grid based systems
2013-17	4000-10000	1000	15 million	Capacity will be aggressively ramped up to create conditions for up scaled and competitive solar energy penetration in the country after taking into account the experience of the initial years
2017-22	20000	2000	20 million	To create favorable conditions for solar manufacturing capability, particularly solar thermal for indigenous production and market leadership.

Category	Cost	Central Financial Assistance
Gear type Water Pumping Windmill	Rs. 80,000	Maximum 50% of Ex-works cost in general places Maximum 90% of Ex-works for un-electrified islands
Auroville type Windmills	Rs.1,50,000	
Wind Solar Hybrid Systems	Rs. 2,50,000/kW	Rs. 1,50,000/kW for Government, Public, Charitable, R&D, Academic and other non profit making organizations
		Rs. 1,00,000/kW for other beneficiaries not covered above

Item	Description
Accelerated Depreciation	IREDA says 100 % depreciation in the first year can be claimed(some conditions must be fulfilled) MNRE says 80% depreciation in the first year can be claimed (some conditions must be fulfilled)
Income Tax Holiday	Ten years tax holidays.
Customs and Excise Duty	Concessional customs and excise duty exemption for machinery and components for initial setting up of projects.
General Sales Tax	Exemption is available in certain States

Source: <http://www.mnre.gov.in/>

Financing Schemes	Interest rate (%)	Maximum repayment period (Years)	Maximum Moratorium (Years)	Minimum Promoters Contribution (%)	Term loan from IREDA	Remark
a) Ethanol production through Biomass/ Sugar juice/ Molasses	12.75	8	2	30	Upto 70% of project cost	IREDA loan is available only for plants of oil extraction & trans-esterification process.
b) Bio-Diesel Production	12.75	8	2	30	Upto 70% of project cost	IREDA loan is available only for plants of oil extraction & trans-esterification process.

Source: IREDALtd

Note: No duty exemption & subsidy are available at present.

Wind energy policies***Cerc tariff orders for procurement of power from wind energy generators***

Central Electricity Regulatory Commission in its order dated 16/09/2009 introduced its regulations and tariff orders for procuring wind power into the grid; for control period from 16/09/2009 to 31/03/2012. The tariff structure consisting of fixed cost components: Return on Equity, Interest on loan Capital, Depreciation, Interest on Working Capital and Operation & Maintenance Expenses.

Biomass to fuels**Bio fuels**

The national biofuel policy of India adopted in December 2009 aims at facilitating development of indigenous biomass feedstock for production of biofuels.

Conclusion

The conclusion obtained from the above topic is that we should increase the use of renewable sources of energy and decrease the use of non renewable resources. Existing renewable resources are well established and proven. Available renewable energy resources are helping in the production of the other forms of energy which makes our energy system more strong and economical. Likewise the production of solar energy, the available wind energy, and its usage is more clean, safe and efficient. They are commercially available and are being utilized. The new upcoming technologies in renewable resources are very promising but a lot more research and infrastructure is required before it can be adapted.

A wide variety of legislative and voluntary programs have been undertaken and the legal and financial mechanisms for doing so also are many and varied. It is possible to meet the

world's energy, development and environmental needs. This achievement can even be done on a basis of long term profitability. But achieving these goals will take determined action and political will among all the governments and international institutions of the world. For developing countries, achieving these goals will require an increased commitment to eliminating the barriers to adoption of sustainable energy measures and creating a climate and legislation to encourage private investment in them.

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