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CDM MARKETS FOR RENEWABLE ENERGY PROJECTS

by

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RENEWABLE ENERGY TECHNOLOGY AND CLEAN DEVELOPMENT MECHANISM (CDM)

The Clean Development Mechanism project activities (CDM) are defined under the Kyoto Protocol as cost effective flexibility measure to mitigate climate change and to promote the transfer of climate friendly technologies. Clean Development Mechanism (CDM) is aimed to assist developing countries in achieving sustainable development, to contribute to the ultimate objective of the United Nations Framework Convention on Climate Change (UNFCCC) and to assist the Parties in achieving compliance with their emission limitations. Under the CDM, the countries co-operate in an emissions mitigation project in a developing country with the donor country acquiring the Certified Emission Reduction Units generated by the project while the host country benefits from the contribution of the project to sustainable economic development through investment in environmental sound technologies such as Renewable Energy Technologies (RETs).

CDM project under the Kyoto Protocol is a development Project, driven by market forces, which reduces greenhouse gases against a validated baseline. The project investor takes a risk based on the returns provided by certified emission reduction units, which correspond to the reduction of greenhouse gases achieved. The CDM also provides a trade opportunity for the developing countries to collaborate with industrialized country investors to develop new industries and technologies. This form of trade in credits under the CDM requires that project in developing countries must contribute to the sustainable development of the host country. The decision regarding which project do and which project do not contribute to the sustainable development of the host country is left to that host country itself, which must under the Protocol create a Designated National Authority to approve or reject project applications. The trade may also only be registered if the CDM project result in real and measurable reduction, must be validated and must ultimately be monitored and verified. The CDM offers an opportunity to promote sustainable development and to direct the flow of capital, expertise and technology into developing economics through the climate change. The Government of India had already constituted a Climate Change Advisory Group on Renewable Energy in order to take the advantages of the vast opportunities available to the Renewable Energy sector under the CDM project.

In India, a significant thrust has been given to the research, development, demonstration and actual implementation of a variety of RETs in different sectors. Renewable Energy, is seen as an effective option for meeting ever increasing energy demands as well as a mean to provide national energy security. The RETs depend on their level of technological maturity and the kind of market that they face, are broadly re-grouped in the following manner:

Technically mature RETs systems:

* **Grid connected electricity generating technologies:**

  (Wind, Small Hydro, Biomass, Solar PV & Co-generation)

* **Stand alone electricity generating technologies:**

  (Wind, Solar PV, Biomass based co-generation)

* **Stand alone thermal systems :**

  (Solar water heating systems, solar cookers, co-generation, biogas)

New and Emerging RET systems :

* **Grid connected electricity generating technologies :**

(Solar thermal, Geo-thermal, Tidal, Ocean Thermal Energy Conversion)

* **Stand alone electricity/thermal systems :**

(Solar pond, Geo-thermal, Hybrid systems, Fuel cells)

The Conference of Parties in Marrakesh in order to assist small projects to overcome transaction costs involved in executing a CDM project, asked the CDM Executive to develop simplified modalities and procedure for small scale Renewable Energy Project activities with a maximum capacity upto 15 MW.

Harnessing of Renewable Energy as a source for Power Generation has the redeeming feature of reducing the world wide phenomenon of environmental pollution effect besides conserving the dwindling reserves of fossil fuel, which meets about 80% of the fuel requirement. Renewable Energy not only augments energy generation but also helps in maintaining a pollution free environment.

Renewable Energy Sources are perennial, dependable and abundantly available. Their widespread availability makes power generation specially attractive for a large number of consumers. The estimated potential of various types of new and Renewable Sources of Energy and Technologies is given below :

S. No.	Sources / Technology	Potential
1.	Biomass Energy	19,500 MW
2.	Wind Energy	45,000 MW
3.	Solar Energy	20 MW/sq.km
4.	Small Hydro	15,000 MW
5.	Energy from Waste	1,700 MW

In India, Renewable energy sources are being tapped both for commercial and non-commercial purposes and over the years there has been a steady growth in Power Generation based on Renewable Electric Technologies. The Power Generation from Renewables witnessed a remarkable growth during the 8th Five Year Plan period from 1992-97. The 9th Five Year Plan i.e. 1997-2002 envisages a grid capacity addition of around 3000 MW from New and Renewable Sources of Energy (NRSE). It is understood that the Ministry of Non-Conventioal Energy Sources (MNES) is at present preparing a comprehensive perspective plan under which 10% of the total power generated by the year 2012 would be from the renewable sector.

The harnessing of renewable sources of energy in India constitute a small but rapidly growing industry and is dominated by small and medium sized enterprises. These companies are able to exploit not only the available talent but also adopt themselves rapidly to technological and market developments.

STATUS AND POTENTIAL OF RENEWABLE ENERGY :

1. BIOMASS ENERGY

Power generation based on biomass holds considerable promise in India. Being an agricultural country and the largest producer of sugarcane, India has abundant quantities of agricultural residues and bagasse. The manner in which Biomass is currently utilized for energy is, however, far from ideal as it results in polluting the environment particularly indoor air. Biomass fuels could provide a much more extensive use than at present in the field of power generation.

It is estimated that India produces about 350 million tonnes of Biomass every year, equivalent to 220 million tonnes of coal in terms of heat value. This quantum of available Biomass can generate 22000 MW of Power annually. A capacity of around 358 MW Biomass based Power Projects has so far been commissioned and about 400 MW capacity is under installation.

In the area of small-scale Biomass gasification, significant technology developments have made India a world leader in this field. Technology has been indigenously developed for producing Power from Biomass gasifiers upto 500 KW. Apart from local supply, these Biomass gasifiers are now being exported not only to developing countries but also to Europe and USA.

2. WIND ENERGY

In India, grid connected wind power generation has gained a high level of attention and acceptability as compared to other Renewable Technologies available in the country. Wind Energy installation in the country is around 1,507 MW as on December 31, 2001 and around

8.4 billion units of electricity have been fed to the State grids so far. Scientific surveys are being intensified to identify specific viable and potential wind sites. A recent study undertaken to reassess the wind potential in the country places it at about 45,000 MW.

India had undertaken one of the world's largest efforts for Wind Resource Assessment, a Programme which covers 25 States comprising about 900 stations. The study has indicated a gross wind potential of around 45,000 MW and the technical potential, currently estimated at 13,000 MW.

A notable feature of the Indian Wind Energy programme has been the interest evinced by private investors / developers in setting up of commercial wind power projects. A capacity of 1,444 MW of commercial wind power projects has so far been installed, mainly in Tamil Nadu, Maharashtra, Gujarat, Andhra Pradesh and Karnataka. State-of the art technology is now available in India for manufacturing Wind Turbines of capacity upto 1,000 KW. Presently about 12 manufacturers are engaged in the production of Wind Electric Generators. The annual production capacity of the domestic wind turbine industry is around 500 MW at present.

The future of wind energy in India is extremely bright and there is no doubt that in the renewable energy sector, wind power would play a predominant role in adding to the national grid clean and non-polluting energy to a substantial extent. The Ministry of Non-conventional Energy Sources has set up a Wind Turbine Test Station under the **"Centre for Wind Energy Technology (C-WET)"** to focus on standardization, testing and certification in order to improve the performance levels in the manufacturing, installation and operation of Wind Electric Generators in India. The Wind Turbine Test Station at Kayathar was dedicated to the Nation by the Hon'ble Prime Minister in July, 2000. The First Test Certificate for 500 kW Wind Turbine tested in the Wind Turbine Test Station at Kayathar was presented by the Hon'ble Union Minister of State (Independent Charge) for Non-conventional Energy Sources on August 13, 2001.

3. SOLAR ENERGY

Solar Energy represents the earth's most abundant energy resources. In our country the average global radiation is around 5 kWh per sq.mtr. per day with about 250-300 clear sunny days in a year in most areas in the country and the same can be judiciously exploited to meet the ever increasing energy requirements. Solar Energy can be used in diverse ways and are divided into two principal technologies for its utilization, viz., solar thermal and solar photovoltaic.

3.1 SOLAR THERMAL

It is estimated that in a year 5×10^{25} kWh/year of Solar Thermal Energy is received in India. The Solar radiation per Sq.meter per day received in most parts of India is about 4-7 kWh.

One of the areas of application of Solar Thermal is heating of Water for domestic, commercial and industrial purposes. Solar Water Heating systems and solar cookers have already been commercialized in India. The products are in many cases standardized by the Bureau of Indian Standards (BIS). Product innovation and cost reduction have been carried out in order to make solar thermal devices market oriented.

Solar water heating is one of the most widely used commercialized technologies amongst the renewable energy technologies. Tapping solar energy for heating purposes is one of the most efficient and well known applications of solar energy. Hot Water is needed for a number of applications at homes, in offices, institutions, hotels, hospitals, industrial units etc. Solar water heaters based on the thermo-syphon principle were in use before fossil fuels were commercially available in India. Solar Water Heating has become a commercially viable technology in India, with simple, box collector systems being manufactured, installed and serviced by indigenous manufacturers. Around 5,90,000 sq.mtrs. of solar collector area has been installed in the country for industrial and domestic use. Also 5,00,000 box type solar cookers are in use in different parts of the country.

3.2 SOLAR THERMAL POWER PLANTS

A Solar thermal power plant project of about 140 MW is proposed to be set up in Rajasthan as a demonstration project by the Government of India. The project consists of a 35 MW solar thermal power component based on parabolic trough collectors, and a

105 MW combined cycle component using gas turbines and naphtha as fuel. This will be the first project of its kind, and the largest such project in the world.

3.3 SOLAR PHOTOVOLTAICS

The utilization and expansion of Solar Photovoltaics as a source of electrical power is to be viewed not only in terms of power crisis being faced by the country due to gap between generation and demand but is also to be viewed in the context of the fast depletion of fossil fuel reserves.

Solar Photovoltaics have two distinct market segments in India. The first segment is the Government sector and the second segment in PV is commercial in nature being used mostly for meeting essential load requirements for data logging, telecommunications, transmissions and for various applications in Railways etc. Rural and tribal villages of India have an estimated potential requirement of 80 million Solar PV lanterns.

In the area of Solar Photovoltaic (SPV) India today is the second largest manufacturer in the world of SPV panels based on crystalline solar cells. Industrial production in this area has reached a level of 11 MW per year which is about 10% of the world's total PV production and 12 companies are engaged in the production of solar cells and modules. Another 70 companies are engaged in the design and supply of Solar Photovoltaic systems. So far, 9,20,000 SPV systems aggregating more than 82 MW have been produced in India. There are 9 firms engaged in the manufacture of solar cells and 21 in producing PV modules. A major drive has also been initiated by the Government of India to export Indian SPV products, systems, technologies and services. 28 MW capacity SPV products have been exported to various developed and developing countries.

Presently more than 6,00,000 solar lighting systems are in use. Also more than 4,200 SPV pumps are in use for agriculture and other related areas. In the grid connected mode around 1.8 MW capacity SPV power projects are in operation in the country.

4. SMALL HYDRO POWER PROJECTS

The total potential of Small Hydro Power Projects of sizes upto 25 MW has been assessed at 15,000 MW. Till December, 2001 about 400 projects of capacity upto 25 MW with an aggregate capacity of 1,423 MW have been commissioned. Another 170 projects of capacity upto 25 MW with an aggregate capacity of approx. 500 MW are under implementation. Various State Governments have shown their interest to establish Small Hydro Projects in their respective States. Already 13 States have announced their policies to encourage private sector investment in commercial Small Hydro Power Projects. The capacity addition from Small Hydro Power Projects in the next 10 years is expected to be around 2000 MW.

5. ENERGY FROM WASTE

The two main programmes on waste management undertaken by the Ministry of Non-conventional Energy Sources are i) National Programme on Energy Recovery from Urban, Municipal and Industrial Waste and ii) the UNDP/GEF assisted project on Development of high-rate biomenthanation process as a means of reducing greenhouse gases emission.

It is estimated that about 27 million tons of solid waste and 4,400 million cubic mtr. of liquid waste are generated by the urban and municipal sector in India every year in addition to the industrial waste and this can translate into about 1000 MW and 700 MW of power generation respectively from this sector.

CONCLUSION

The setting up of CDM Projects is still in its early stages, therefore guidelines for the incorporation of CDM projects in the mainstream of Renewable Energy Technologies are necessary. The guidelines should include the project guidelines to developers in baseline setting and monitoring, project validation and verification, evaluation of the complete project proposals, including a monitoring plan etc. Renewable Energy Technologies do however, offer tremendous opportunities for CDM projects provided there is additionality.

ABOUT THE AUTHOR

Born in London U.K. on 4th June 1958. Rakesh Bakshi, when very young itself, recognized the great potential that alternative sources of energy offered, and so committed all his strengths and resources towards

developing them. Renewables play a significant role, especially in the context of abating Global Warming and mitigating Climate Change. Rakesh Bakshi has successfully promoted and implemented advanced climate friendly technologies past the demonstration phase, more particularly by converting renewable sources of energy into heat and power.

Rakesh Bakshi is considered a pioneer in the field of Non-conventional energy sources in India, having contributed extensively to harnessing and promoting renewables for every day energy needs. In recognition of this immense contribution in the crucial area of alternate sources of energy, on the occasion of the Republic Day in 1991 the Government of India honoured Mr. Rakesh Bakshi with the Padma Shri, one of India's high civilian award. Rakesh Bakshi is a First-Class Graduate in Mechanical Engineering with Postgraduate qualifications in Computer Science and Foreign Trade.

In recognition of his significant contribution over many years towards the development of the wind energy industry, Mr. Rakesh Bakshi was recognized by the British Wind Energy Association as a **"Wind Energy Pioneer"** at the 17th Annual Conference of the British Wind Energy Association held at Warwick, England in July 1995. The **Order of Merit "Samajshri"** award was conferred on Mr. Rakesh Bakshi for Management by the Indian Council of Management Executives (ICME), Bombay in 1996. In recognisation of contribution towards industrial development of the country, the Institute of Economic Studies (IES) has conferred the **"Udyog Rattan Award"** to Mr. Rakesh Bakshi in February, 1997. In recognition of the outstanding services to the trade relations between Denmark and India, Mr. Rakesh Bakshi has been conferred the **"Diploma of the National Association for Danish Enterprise and His Royal Highness Prince Henrik's Medal of Honour"** in February, 1997. In recognition of his achievements and contribution in the field of Professional Management, Mr. Rakesh Bakshi has been admitted as a **Life Fellow** of the All India Management Association (AIMA) on 1st April, 1999. In recognition of his outstanding achievements in furthering the goals of the Climate Technology Initiative and dedication to fostering sustainable development and efforts to accelerate development and diffusion of Climate friendly Technologies especially into the developing world, Mr. Rakesh Bakshi has been bestowed with **"Climate Technology Leadership Award"** by Climate Technology Initiative (CTI) on 1st November, 1999 at the 5th Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC) held from 25th October, 1999 to 5th November, 1999 at Bonn, Germany. In recognition of the outstanding work in Renewable Energy Industry Promotion in India, Mr. Rakesh Bakshi has been bestowed with **"The 2000-Millennium Award"** by World Renewable Energy Network (WREN) on the occasion of the World Renewable Energy Congress-VI (WREC-2000) Renewable Energy for the 21st Century held from 1st to 7th July, 2000 at Brighton, United Kingdom. Mr. Rakesh Bakshi has been conferred with the **"Best Industrialist of 2000 Millennium Award"** by the Rural Education and Development Society, Vellore, Tamil Nadu on 28th September, 2000. Mr. Rakesh Bakshi is a **Former Member** of the **G8 Renewable Energy Task Force Advisory Group Membership.** Mr. Rakesh Bakshi is a member of the **Board of Governors of Winrock International India.** Mr. Rakesh Bakshi has been conferred with **"The Gold Medal 1999-2000 Award"** for **Management by the Indian Council of Management Executives (ICME), Mumbai** in February, 2001. Mr. Rakesh Bakshi has been nominated as **Non-official Member in the Governing Body of HIMURJA (Himachal Pradesh Energy Development Agency)** by the Governor, Himachal Pradesh on 24th February, 2001. Mr. Rakesh Bakshi has been elected as a **Fellow of The Institution of Engineers (India)** on 31st May, 2001. Mr. Rakesh Bakshi is a **Member** of the **Chairmen Committee of World Council for Renewable Energy (WCRE).** Mr. Rakesh Bakshi has on 12th November, 2001 been made a Member of the **High Powered Tourism Advisory Board** constituted by the Governor of Himachal Pradesh. Mr. Rakesh Bakshi has on 11th January, 2002 been made a **Member** of the **Climate Change Advisory Group on Renewable Energy constituted by the Ministry of Non-conventional Energy Sources, Government of India.**