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ANNEX 2

INDIA COUNTRY REPORT

FROM IDEAS TO ACTION: CLEAN ENERGY SOLUTIONS FOR ASIA TO ADDRESS CLIMATE CHANGE

June 2007

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FOR ASIA TO ADDRESS CLIMATE CHANGE

CONTENTS

LIST OF ABBREVIATIONS

ADB	Asian Development Bank
ALGAS	Asia Least Cost Greenhouse Gas Abatement Strategy Study
BEE	Bureau of Energy Efficiency
BIS	Bureau of Indian Standards
CBM	Coal Bed Methane
CDM	Clean Development Mechanism
CERs	Certified Emission Reductions
CNG	Compressed Natural Gas
CPCB	Central Pollution Control Board
DGH	Directorate General of Hydrocarbons
DMRTS	Delhi Mass Rapid Transport System
DNA	Designated National Authority
ECBC	Energy Conservation Building Code
EE	Energy Efficiency
ESCOs	Energy Service Companies
FBR	Fast Breeder Reactor
GEF	Global Environment Facility
GHG	Greenhouse Gas
IAP	Indoor Air Pollution
IBRD	International Bank for Reconstruction and Development
IFC	International Finance Corporation
IGCC	Internal Gasification Combined Cycle
IREDA	Indian Renewable Energy Development Agency
ITC	Indian Tobacco Company
JBIC	Japan Bank for International Cooperation
LPG	Liquefied Petroleum Gas
MNRE	Ministry of New and Renewable Energy
MoEF	Ministry of Environment and Forests
MoP	Ministry of Power
MoPNG	Ministry of Petroleum and Natural Gas
MSW	Municipal Solid Wastes
Mt	Million Cubic Tons
MW	Megawatt
NAAQS	National Ambient Air Quality Standards
NATCOM	National Communication
NBC	National Building Code
NELP	New Exploration Licensing Policy
NEP	National Electricity Policy
NTPC	National Thermal Power Corporation
NUTP	National Urban Transport Policy
ODA	Official Development Assistance
OECD	Organization for Economic Cooperation and Development
OEMs	Original Equipment Manufacturers
PCRA	Petroleum Conservation Research Association
PFC	Power Finance Corporation
PHWR	Pressurized Heavy Water Reactor
R&D	Research and Development

RE	Renewable Energy
REPS	Renewable Energy Portfolio Standard
RSPM	Respirable Suspended Particulate Matter
SERC	State Electricity Regulatory Commission
SME	Small and Medium-sized Enterprise
PV	Photovoltaic
SRC	State Regulatory Commission
TERI	Energy Resource Institute
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
VERs	Voluntary Emission Reductions
WHO	World Health Organization

1. INDIA'S CLEAN ENERGY CHALLENGE

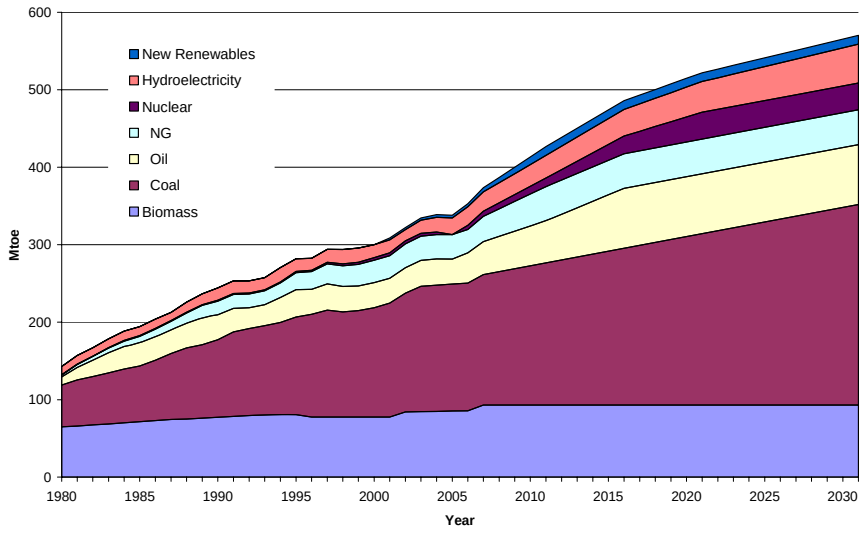
1.1. TRENDS IN ENERGY RESOURCES

The role of energy in India's economy has become globally relevant in recent years due to the country's high economic growth and rising concerns about the environmental impacts of energy use. Primary energy demand grew at the rate of 6 per cent a year between 1981 and 2001 (Planning Commission, 2002), and India now ranks fifth in the world in terms of primary energy consumption. It accounted for about 3.5 per cent of the world's commercial energy demand in 2003.

Although there has been a gradually increasing dependency on commercial fuels, a sizeable amount of the national energy requirement, especially in the rural household sector, continues to be met by non-commercial energy sources. These include fuel wood, crop residue, and animal waste, as well as human and draught animal power. Future economic growth will lead to a rapid increase in demand for commercial energy higher levels of urbanization, and adoption of modern lifestyles.

Projections indicate that coal will remain the dominant source of energy supply followed by oil. In 2030, it is expected that coal will contribute around 51 percent to the total primary energy supply, while the share of oil will be around 15 percent (Figure 1).

FIGURE 1:TOTAL PRIMARY ENERGY SUPPLY BY SOURCE[1]



Various Sources.

With energy demand increasing more rapidly than supply, coal continues to remain the dominant fuel in the commercial energy mix, followed by oil. The major challenge to India's energy sector has largely been finding enough supply to keep pace with rising demand Despite efforts to enhance domestic energy production and diversify fuel mix, India still faces energy and peak shortages of around 8 percent and 12 percent respectively, while a large section of the rural population continues to lack access to clean and efficient energy fuels to meet their daily requirements. As with many developing economies starting from a low per-capita energy consumption point, India's consumption of 439 kgoe per capita is far below the world average of 1,688 kgoe per capita (Planning Commission, 2006). One of the key

1. Past time series data on biomass consumption is not available

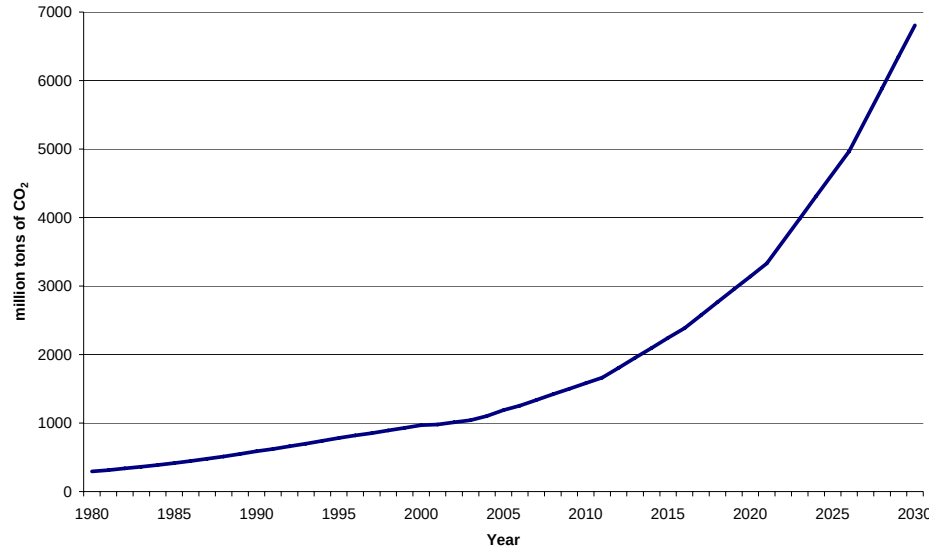
challenges facing the country is, therefore, to provide adequate and clean energy to fuel the rising aspirations of a billion plus population in a sustainable manner.

1.2. IMPACTS OF ENERGY USE

India's energy import dependency has increased over the years because the rise in domestic supply has not kept pace with increasing energy demand. Imports accounted for 30 percent of the country's total primary energy supply in 2004-05, up from 17.85 percent in 1991. During 2004-05, imports constituted 72 percent of the country's total oil consumption. In recent years, India has also become more dependent on imports of coal and gas. This increasing import dependency imposes a high financial burden on the country and makes the economy more prone to oil supply shocks emanating from external factors. These trends raise increasing concern about India's energy security.

India is the sixth largest greenhouse gas (GHG) emitter in the world, and the fastest-growing one after China. The 1994 inventory of GHGs for India provides an estimate of emissions by sources and removals by sinks of CO_2, methane, and nitrous oxide. In 1994, 1,228,540 gigagrams (Gg) of CO_2 equivalent GHGs were emitted from India. CO_2 emissions were the largest at 793,490 Gg, or 65 per cent of the total national CO_2 equivalent emissions (see also Figure 2). The shares of CH_4 and N_2O were 31 per cent (18,082 Gg) and 4 per cent (178 Gg) respectively (MoEF, 2004). Respirable suspended particulate matter (RSPM) levels exceeded national ambient air quality standards in eight major cities, primarily due to poor road conditions and lack of maintenance (Figure 3).

FIGURE 2: CO_2 EMISSIONS FROM FUEL COMBUSTION IN INDIA

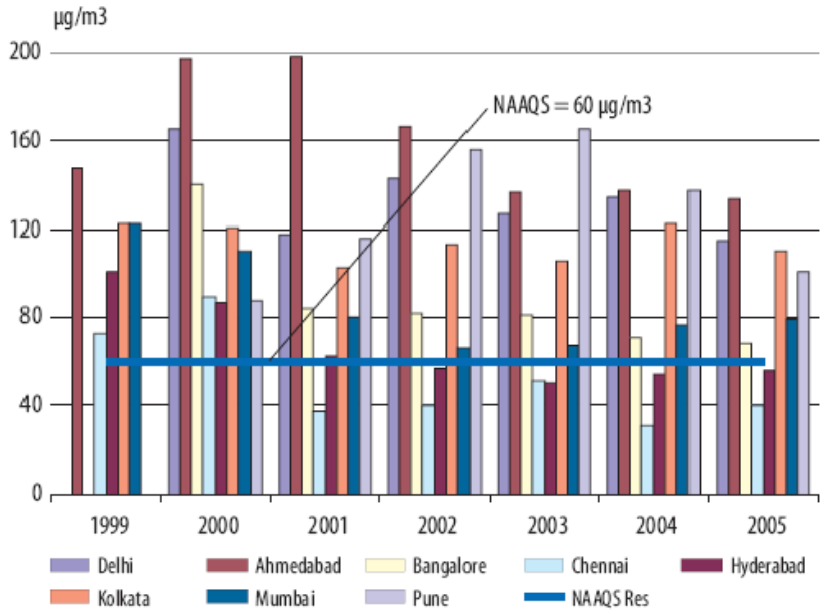


Source: MoEF, 2004.

Urban air pollution results from the combustion of fossil fuels used in transportation, power generation and industry while indoor air pollution (IAP) results from unprocessed biomass use. Several studies have reported the adverse health impacts of IAP. The WHO has reported that IAP doubles the risk of pneumonia and other acute lower respiratory tract infections among children below five years, and triples the risk of chronic obstructive pulmonary diseases among women. Some studies have linked exposure to IAP to asthma, cataracts, tuberculosis, adverse pregnancy outcomes, and interstitial lung diseases (Smith, 2000). According to the reported burden of disease estimate, IAP is the third most important risk factor (next to poor water quality, sanitation, and malnutrition) for ill health and is

responsible for 17 percent of all deaths among children under five in India (Smith, Mehta, and Feuz, 2004).

FIGURE 3: ANNUAL RSPM LEVELS IN RESIDENTIAL AND OTHER AREAS OF EIGHT MAJOR CITIES IN INDIA



CPCB = Central Pollution Control Board; NAAQS Res = national ambient air quality standard for residential areas; RSPM = respirable suspended particulate matter; and ug/m^3 = mi crogram per cubic meter

Source: CPCB, 2006.

2. CLEAN ENERGY REGULATORY FRAMEWORK

2.1. KEY LAWS, DECREES, AND POLICIES

The key laws and policy statements relevant to clean energy development are shown in Table 1.

TABLE 1: SUMMARY OF ENERGY RELATED LAWS AND POLICY DECREES

Year	Title	Main Thrust
2006	**Rural Electrification Policy**	Establishes a national goal for universal access, assigns responsibilities for implementation, and creates new financing arrangements
2006	**National Urban Transport Policy**	Encourages integrated land use and transportation planning in cities
2006	**National Tariff Policy**	Provides guidance on establishing power purchase tariffs by State Electricity Regulatory Commissions
2005	**National Electricity Policy**	Provides guidelines for accelerated development of the power sector
2003	**Electricity Act**	Legislates a comprehensive reform and liberalization process for the power sector
2001	**Energy Conservation Act**	Provides the legal framework and institutional arrangements for embarking on a national energy efficiency drive
2001	**Accelerated Power Development and Reforms Program**	Establishes intervention strategies for distribution reforms in the power sector

Source: USAID ECO-Asia Clean Development and Climate Program, 2006.

2.1.1. Overarching Policy

The Planning Commission's Integrated Energy Policy notes that lowering the energy intensity of GDP growth through higher energy efficiency (EE) is critical to meeting India's energy challenge and ensuring its energy security.

The Integrated Energy Policy sets a goal of a 25 percent reduction in India's energy intensity from current levels. The major areas where EE can play a key role are mining, electricity generation, transmission and distribution, water pumping, industrial production processes, building design, construction, heating, ventilation, air conditioning, lighting, and household appliances.

Renewables can play an essential role in enabling the country to diversify its energy sources and harnessing domestic supply options. While the contribution of renewables is expected to be a small fraction of India's commercial energy mix from the long-term perspective, its distributed nature can provide numerous socio-economic benefits (Planning Commission, 2006). Similarly, providing clean transport systems goes a long way in reducing oil consumption and decreasing the country's dependency on oil imports.

In this regard, the centerpiece of the Government of India's Integrated Energy Policy is several policy measures and programs for promoting demand and supply-side EE measures, policy mechanisms for aggressively promoting renewable energy sources, and an emphasis on providing a clean transport system.

2.1.2. Energy Efficiency

The specific policies in the Integrated Energy Policy intended to improve EE are:

- Merge the Petroleum Conservation Research Association and the Bureau of Energy Efficiency (BEE) into an autonomous statutory body under the Energy Conservation Act, independent of other energy ministries and separately funded by the Government of India;
- Make the expanded BEE responsible for accelerating efficiency improvements in energy-using appliances, equipment and vehicles through schemes such as the "Golden Carrot" incentives[2];
- Implement EE standards and labeling of energy-using equipment, including financial penalties if equipments fail to meet minimum energy performance standards;
- Establish benchmarks for energy consumption in energy intensive sectors;
- Increase gross efficiency in power generation, including improvements of 10 percent in existing generation and 5-10 percent in new plants; and
- Promote urban mass transport, energy efficient vehicles, and freight movement by railways.

The National Building Code of India (NBC) provides guidelines for regulating building construction across the country and serves as a model code for all agencies involved in building. It contains administrative regulations, development control rules and general building requirements, fire safety requirements, stipulations regarding materials, structural design and construction (including safety), and building and plumbing services. Additionally, the BEE has prepared Energy Conservation Building Codes (ECBC) for each of the six climatic zones of India. The ECBC provide minimum requirements for EE design and construction of commercial buildings, including air conditioning, lighting, electric power and distribution, and service water heating and pumping. In the first phase, ECBC compliance is voluntary,

2. The Golden Carrot scheme provides substantial monetary rewards to firms that develop and commercialize high-efficiency equipment or appliances.

but from 2009 building plans will not be approved by local authorities unless they comply with the ECBC. The code will make it mandatory for buildings to not exceed 140 kilowatt/hour per square meter annually.

2.1.3. Renewable Energy

The Renewable Energy Plan 2012 calls for achieving a 10 percent share for renewable energy in incremental power capacity by adding about 10,000 MW of new renewable energy (RE) based generation. In addition to the grid-connected RE goal, other major RE initiatives include (1) installment of 1 million household solar water heating systems; (2) electrification by renewable mini-grids for 24,000 villages without electricity; (3) deployment of 5 million solar lanterns and 2 million solar home lighting systems; (4) and establishment of an additional 3 million small biogas plants.

The Electricity Act of 2003 has provided a major thrust to RE technologies via its mandate: "To promote cogeneration 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 specifying, for purchase of electricity from such sources, a percentage of the total consumption of electricity in the area of a distribution licensee." The National Electricity Policy of 2005 gives each State regulator authority to create a Renewable Energy Portfolio Standard for the transmission and distribution companies serving their jurisdictions.

2.1.4. Clean Transport

Recognizing the merits of biofuels, the Government of India has identified ethanol and bio-diesel as the key focus areas. Both are at the early stages of commercialization. In 2004, the government mandated 5 percent blending of petrol with ethanol, subject to certain conditions, following a Memorandum of Understanding between the Indian Sugar Mills Association and Indian Oil Corporation. An autonomous National Biodiesel Board is being created to promote, finance, and support organizations that are engaged in the field of oilseed cultivation and oil processing leading to bio-diesel production. In 2005, the Government of India adopted the Bio-Diesel Purchase Policy. The policy prescribes that oil-marketing companies in the public sector should purchase bio-diesel of prescribed Bureau of Indian Standards (BIS) specification from registered authorized suppliers at a uniform price to be reviewed every six months. Some public sector oil companies are already experimenting with various mixes of bio-diesel with diesel in state transport buses, and are in ongoing discussions with the automobile industry to share results.

The National Urban Transport Policy (NUTP) of the Ministry of Urban Development seeks to encourage integrated land use and transport planning in cities, and focuses on greater use of public transport and non-motorised modes by offering central financial assistance. The policy incorporates urban transportation as an important parameter at the urban planning stage.

The National Auto Fuel Policy of 2003 provides a roadmap for achieving various vehicular emission norms over a period of time and the corresponding requirements for upgrading fuel quality. While it does not recommend any particular fuel or technology for achieving the desired emission norms, it suggests that liquid fuels should remain the main auto fuels throughout the country and that the use of CNG/LPG be encouraged in cities affected by higher pollution levels so as to enable vehicle owners to have the choice of the fuel and technology combination.

The Auto Policy of 2002 spells out the direction of growth for the auto industry in India and addresses most of its concerns, including:

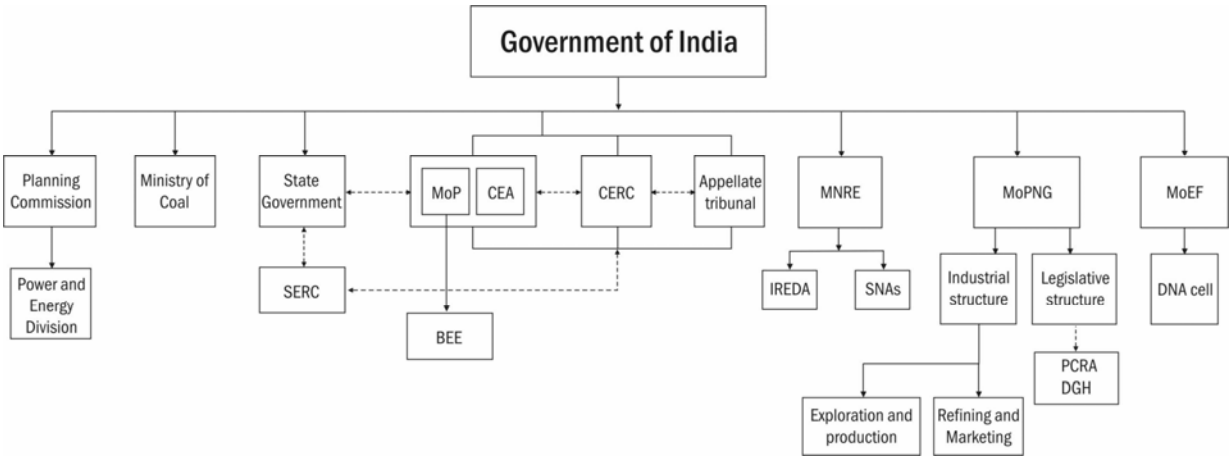
- Promotion of R&D in the automotive sector to ensure continuous technology upgrades and enhanced designing capacities to remain competitive;
- Providing an impetus to alternative fuel vehicles through appropriate long-term fiscal structure to facilitate their acceptance; and
- Emphasizing low emission fuel auto technologies and availability of appropriate auto fuels, and encouraging construction of safer bus/truck bodies (subjects unorganized sector to a 16 percent excise duty on body building activity just as in the case of OEMs).

3. INSTITUTIONAL ANALYSIS

3.1. ORGANIZATIONAL OVERVIEW

An overall organization chart of clean energy agencies in India is shown in Figure 4. Organizational responsibility for components of the energy sector is split among several ministries – Ministry of Coal, Ministry of Power, Ministry of Petroleum and Natural Gas, and Ministry of New and Renewable Energy. The Planning Commission holds integrative power at the national level, but individual State governments hold considerable power, especially regulatory power through State Electricity Regulatory Commissions (SERCs) (TERI, 2005). Table 2 summarizes key energy institutions in India.

FIGURE 4: KEY ORGANIZATIONS/BODIES RELATED WITH CLEAN ENERGY INITIATIVE IN INDIA



Source: TERI, 2005. Notes: CEA (Central Electricity Authority); CERC (Central Electricity Regulatory Commission); SNAs (State Nodal Agencies).

TABLE 2: KEY GOVERNMENT ENERGY INSTITUTIONS

Organization	Scope of Work
Ministry of Power	Overall responsibility for power sector planning and investment.
Bureau of Energy Efficiency	Statutory body established to reduce energy intensity in the Indian economy by spearheading the improvement of energy efficiency through various regulatory and promotional instruments.
Ministry of Coal	Overall responsibility for development and production of coal and lignite in India.

TABLE 2: KEY GOVERNMENT ENERGY INSTITUTIONS

Organization	Scope of Work
Ministry of Petroleum and Natural Gas	Responsible for upstream and downstream development and production of oil and gas. Operates the Petroleum Conservation Research Association (PCRA).
Ministry of New and Renewable Energy	Responsible for development, demonstration and investment in renewable energy-based technologies.
Indian Renewable Energy Development Agency	Promotion, development and extension of financial assistance for renewable energy, EE and conservation projects.
Bureau of Indian Standards	Operates a product certification program.

Source: USAID ECO-Asia Clean Development and Climate Program, 2006.

The **Ministry of Power (MoP)** is concerned with planning and policy formulation, processing of projects for investment decision, monitoring of power project implementation, training and manpower development, and the administration of legislation regarding thermal and hydro power generation, transmission and distribution. The Bureau of Energy Efficiency (BEE) is a statutory body under MoP, established under the Energy Conservation Act 2001. Its legislative mandate is quite broad, including coordination of EE and conservation policies, establishing procedures to monitor and verify EE results at the sector and macroeconomic levels, and leveraging Official Development Assistance and private sector support in implementation of its energy and conservation programs. It is also responsible for interpreting, planning and managing the energy conservation programs envisaged in the Energy Conservation Act of 2001. Particular areas that BEE has focused on include: EE in the industrial sector, demand side management in the power sector, standards and labeling for appliances and equipment, EE in buildings and establishments, professional certification and accreditation, manuals and codes for energy conservation, EE policy research, energy conservation awareness in schools, and delivery mechanisms for EE services.

The **Ministry of Coal** is responsible for development and exploitation of coal and lignite reserves in India. Its responsibilities include exploration, development, production, supply, distribution, and pricing of coking coal, non-coking coal, and lignite deposits, as well as administration of laws and policies governing the coal industry.

The **Ministry of Petroleum and Natural Gas (MoPNG)** is responsible for exploration and production of oil and natural gas, their refining, distribution and marketing, import, export, and conservation of petroleum products and liquefied natural gas. MoPNG formulated the New Exploration Licensing Policy (NELP) to accelerate and expand exploration of oil and gas in the country. So far, the Government of India has invited four rounds of bidding under NELP. MoPNG is also responsible for coal bed methane (CBM) development in cooperation with the Ministry of Coal. The Government has formulated a CBM policy and signed contracts with private companies. The Petroleum Conservation Research Association was set up as a registered society under MoPNG in 1978. Its mandate is to promote conservation of petroleum products in the major consuming sectors – transport, industry, households, and agriculture – through direct technical assistance, R&D, educational and training programs, and mass awareness campaigns.

The **Ministry of New and Renewable Energy (MNRE)** is involved in the development, demonstration and utilization of various renewable energy-based technologies, including solar thermal, solar photovoltaics, wind power, biomass combustion/co-generation, small hydro power, biogas, geothermal, waste-to-energy, and tidal power. Major MNRE activities include: (i) Project development

and financing of RE-based grid power; (ii) Urban solar hot water heaters; (iii) rural biogas projects; and (iv) Resource mapping.

The **Ministry of Environment and Forests (MoEF)** is the nodal agency for the planning, promotion, coordination and overseeing the implementation of environmental and forestry programs. It is the focal point for all climate change activities in India and the Global Environmental Facility (GEF). It is also the nodal agency for the United Nations Environment Programme (UNEP). Its principal activities are: conservation and survey of flora, fauna, forests and wildlife; prevention and control of pollution; afforestation and regeneration of degraded areas, and; protection of the environment. MoEF also houses the Designated National Authority (DNA) that approves all CDM projects in India.

The India Renewable Energy Development Agency (IREDA) is a public limited government company established in 1987 under the administrative control of MNRE.[3] IREDA's main objectives are: operating a revolving fund for development and deployment of new and renewable sources of energy; providing financial support to specific projects and programs for generating energy through new and renewable sources or conserving energy through EE; providing assistance in upgrading technologies for new and renewable energy; and developing new criteria, systems and concepts for financing projects based on new and renewable sources of energy and EE/conservation. Areas of EE interest for IREDA include SMEs and small industry, waste heat recovery in steel and other industries, and cogeneration.

The **Bureau of Indian Standards (BIS)** operates a product certification program. It has granted more than 30,000 licenses to manufacturers of various industrial sub-sectors, from agriculture to textiles to electronics. The certification allows the licensees to use the popular ISI mark, which has become synonymous with quality products for the Indian and neighboring markets over the past 50 years.

3.2. INSTITUTIONAL NEEDS ASSESSMENT

The single biggest institutional need in the Indian energy sector is to improve management of the power sector, especially governance of distribution entities. Nearly 40 percent of energy supplied into state transmission systems is lost, not billed, incorrectly billed, or the payment not collected. This is extremely poor by any standards, and puts the Indian power sector well below others in the region in terms of technical, financial or commercial performance. Since the State Regulatory Commissions (SRC), empowered by the Electricity Act of 2003, has been recently set up, it may benefit from capacity building and political and budgetary support. The agenda of loss-making state-owned enterprises, poor commercial performance, misplaced subsidies, and tariff distortions is daunting indeed. Moreover, there are other mandates related to undertaking renewable energy development, EE improvement, formulation and implementation of regulations on service quality and service obligations, and outreach efforts designed to enhance public participation and break the deadlock around tariff increases versus quality of supply improvements. Given these major challenge, enhanced governance is the key institutional need in the power sector (World Bank, 2006a).

The other major institutional need is greatly increased involvement of the private sector in all aspects of the energy sector. The massive investment requirements to scale-up production and transportation of coal, further explore and develop offshore oil and gas, add some 60,000 MW of new, cleaner power generation, and rehabilitate the power delivery network is estimated to require around US$600 billion over the next twenty-five years – much of which will have to come from the private sector. However, the energy sector in India is highly centralized and still dominated by state-owned enterprises.

3. MNRE was then called the Ministry of Non-Conventional Energy Sources (MNCES).

4. CURRENT STATUS AND POTENTIAL OF CLEAN ENERGY

4.1. OVERVIEW OF FUELS AND RESOURCES

4.1.1. Fossil Energy and Nuclear Power

Coal. Coal is a major energy source catering to India's growing energy needs. It meets about 60 percent of the country's commercial energy needs, and about 70 percent of the electricity produced in India comes from coal. While the adoption of efficient coal-based power generation technologies (internal gasification combined cycle and ultra-supercritical) would reduce the environmental impacts from coal combustion, clean coal utilization needs to be adopted across the entire coal cycle – through scientific mining practices followed by land reclamation, beneficiation of coal for ash reduction at source, transforming coal from its current form to cleaner energy forms via coal liquefaction, and coal gasification. Moreover, coal bed methane (CBM) may well be an important clean energy option for the country and needs to be examined judiciously as a key alternative to the country's sustainable energy pathway.[4]

Oil and Gas. Oil accounts for about one-third of India's commercial energy consumption, and its share has been growing gradually in recent years. Although India has significant domestic oil reserves, it is a net oil importer. The Government of India has initiated many steps to ensure oil security for the country. One such step was to intensify domestic exploration and development efforts to explore new fields and increase the reserve base of the country. The Hydrocarbon Vision 2025 laid down a phased program for reappraising 100 percent of sedimentary basins of the country by 2025 (Planning Commission, 1999). The Directorate General of Hydrocarbons (DGH) has conducted a number of studies to upgrade information on the unexplored or the less explored regions in the country. Overseas acquisition of equity oil is another major strategy adopted to enhance the oil security of the country. The Government of India aims to produce 20 Mt per annum of equity oil and gas abroad by 2010.

The DGH has divided India's topography into 26 sedimentary basins comprising 1.35 million km^2 of onshore area and 0.39 million km^2 of offshore area (up to 200 meter isobaths). Despite several developments in country's hydrocarbons sector, several areas that may have hydrocarbon reserves are yet to be explored. In 1997/98, the Government of India announced its New Exploration Licensing Policy (NELP) with the twin objectives of enhancing domestic production by attracting private capital and foreign technology for the Indian upstream sector, and mapping the sedimentary basins of the country as extensively as possible. Under this framework, total freedom has been given to market crude in the domestic market and a company can bid directly without the participation of ONGC or OIL, which was mandatory earlier.

4. The Ministry of Petroleum and Natural Gas has been undertaking several initiatives to tap gaseous fuels other than natural gas. Proven coal bed methane (CBM) is estimated to double India's proven gas reserves. The government has formulated a CBM policy to attract technology and investment for exploration and production of CBM from coal-producing areas. Already, 16 exploration blocks for CBM have been awarded to national oil companies and private companies, and exploration work in all these blocks is in progress. In-situ coal gasification can also release usable gas from in-extractable coal reserves below 600 metres depth and bring the energy to the surface without the accompanying ash while providing the potential for injecting back the captured CO_2. Recoverable energy from one of the blocks (Mehsana-Ahmedabad) alone, with coal reserves of 63 billion metric tons in the form of gas, could be equivalent to 15 000 billion cubic metres of natural gas. Public sector oil and gas companies are collaborating with leading international organizations in this area. (MoPNG, 2005).

Nuclear Power. Nuclear power has a key role to play in terms of providing a clean energy alternative. India has developed the capability to build and operate nuclear power plants that meet international standards of safety. The current installed capacity of nuclear power plants in India is 3,900 MW accounting for about 3 percent of the total installed capacity of the country. The Nuclear Power Corporation of India proposes to increase the installed capacity to 9,935 MW by 2011/12.

India has limited resource availability of uranium, about 70,000 metric tons, but has one of the largest supplies of thorium in the world, amounting to 360,000 metric tons. The future strategies focus on the optimal utilisation of available nuclear energy resources. The adoption of a three-stage development of nuclear power in India was envisaged by Dr. Homi Bhabha in 1944. The first stage of the country's nuclear program proposes to develop 10,000 MW based on pressurized heavy water reactors (PHWR) using indigenous natural uranium resources. The second stage is to be based on fast breeder reactor (FBR) technology using plutonium extracted by reprocessing of the spent fuel from the first stage. In the third stage, the country's vast thorium resources will be utilized for power generation.

4.1.2. Renewable Energy and Distributed Generation

India has the most developed and diversified renewable energy market in the region. The annual turnover of the RE industry in India is approximately US$500 million, with total RE investment of around US$3 billion. Furthermore, the 3,500 MW of RE generation capacity installed so far is just a fraction of the estimated total economic potential of 100,000 MW. Table 3 summarizes India's renewable energy accomplishments up to 30 September 2006,

TABLE 3: INDIA'S PROGRESS IN RENEWABLE ENERGY

RE Source	Unit	Cumulative Achievement
Wind power	MW	6,070
Small hydro (up to 25 MW)	MW	1,850
Biomass power	MW	542
Biomass gasifers	MW	76
Solar PV	MW	3
Waste-to-energy	MW	35

Source: Ministry of New and Renewable Energy.

The Government of India has set a goal of electrifying 18,000 remote villages and meeting 10 percent of the country's power supply through RE by 2012. These targets are in addition to those fixed for other RE devices or programs, including establishing 1 million biogas plants; 1 million solar PV systems for lighting; 8,000 solar PV pumps for irrigation; 10,000 solar PV generators, stand-alone solar PV power plants, solar water heating systems, solar air heating systems, and solar cookers, including large steam cooking systems; 360 energy demonstration parks, and; more solar retail outlets and solar passive buildings.

RE is competitive with many sources of conventional energy in India, thanks to a combination of fiscal policies and incentives, and resource portfolio regulations that create guaranteed markets for it. Among the fiscal policies in place are income tax holidays, accelerated depreciation, duty free import of renewable energy equipment, capital subsidies and concessionary financing from IREDA, requirements for energy purchases by distribution companies, and exemptions from electricity taxes and sales taxes. Table 4 shows the effect of these incentives and tax regimes on the capital costs and delivered costs of RE from various sources (MNRE, 2005).

TABLE 4: CURRENT ECONOMICS OF RENEWABLE POWER GENERATION

Type	Capital Cost (US$/kW)	Delivery Cost (US cents/kWh)
Small hydro	900-1300	5-6
Wind energy	950-1100	6-7
Biomass power	800-1000	5-6
Bagasse cogeneration	600-800	4.5-5.5
Biomass gasification	600-800	5-6
Solar PV	5000-6500	19-40

Source: MNRE, 2005.

4.1.3. Energy Efficiency

In the Indian context, the most important supply side efficiency prospects are high-efficiency, low-emission coal thermal electric power generation and electricity distribution loss reduction.[5] Given the current and future dominance of coal in India's energy sector there are large efficiency and environmental gains from using advanced technologies for coal-based power plants. The National Thermal Power Corporation (NTPC) is envisaging a 660 MW green field project employing super critical steam parameters. Feasibility studies for a commercial-scale demonstration plant based on IGCC are also underway. A USAID-funded feasibility study of an IGCC demonstration project in India estimated that a 200 MW demonstration plant could be constructed for US$2,000/kW. So far, no one has been willing to finance such an expensive demonstration. In the meantime, there are at least two super-critical coal-fired power plants being constructed by NTPC with lending from JBIC – a 2,000 MW North Karanpura super thermal power project in Bihar and a 420 MW project in Bakreshwar.

Industry is a major target of any EE effort, as accounts for 50 percent of the total commercial energy use in India. Six key industries – aluminum, cement, fertilizers, pulp and paper, petrochemicals and steel – account for about two-thirds of total industrial energy use. The energy intensity in these industries is higher than in developed countries, mainly due to obsolete and energy inefficient technologies in some of these sectors. The Energy Conservation Act singled out these consuming sectors for special attention, including promulgating specific energy consumption norms, conducting regular energy audits, implementing technically and economically viable improvement measures, and establishing energy management systems including certified energy managers.

The so-called "Three Country Report" on financing EE touched on the market-oriented EE activities in India. The report concluded that a strategic direction and improved alignment within the industry is needed to provide the support necessary to develop an investment pipeline. BEE and IREDA have important roles to play in enabling and spurring such investment. ESCOs in India have not made as much progress as those in neighboring countries (e.g., China and Thailand), at least so far. This is partially due to their small size and limited reach, and lack of credibility and relationships important players. Support to these companies, mostly SMEs but some subsidiaries of large companies, is needed, as is support to developing awareness of EE benefits among building owners and operators. These two groups, whose core business includes EE, could become important promoters of EE investments in India and thus contribute to increasing commercially based EE investments.

5. The Accelerated Power Development and Reform Program of the Ministry of Power lays down a six level intervention strategy for distribution reform to reduce aggregate technical and commercial losses, bring about commercial viability in the power sector, reduce outages and interruptions, and increase consumer satisfaction.

4.1.4. Clean Transport

Several measures have been taken to upgrade automobile technology, improve fuel quality, enhance pollution under control checking systems, and expand urban public transport systems. The gross emission standards for vehicles have been made progressively stringent and a roadmap has been developed to improve fuel quality. The Government of India has also set up the Expert Committee on Auto Fuel Policy, which has proposed several measures to reduce air pollution in selected cities. It also prescribes vehicular emission norms equivalent to those of developed countries.

The use of clean fuel options such as CNG, LPG, and biofuels in the transport sector provides opportunities for clean transport and needs to be stepped up. Although clean fuels like CNG and LPG have been introduced in some cities, efforts need to be made to quickly expand their network to other cities to combat the emissions resulting from the use of personalized vehicles, which is increasing across most of the large cities.

Some state governments – including Andhra Pradesh, Chattisgarh, Gujarat, and Tamil Nadu – are promoting bio-diesel production, including setting up state bio-diesel boards and implementing buy-back schemes with farmers. Private players have already come into the plantation phase of the biodiesel production chain in some states like Tamil Nadu. In Gujarat, private companies are already producing quality bio-diesel that meets the American Society for Testing and Materials (ASTM) 16750 standard.

4.2. COMPARISON OF ECONOMIC POTENTIAL AND COST EFFECTIVENESS

Detailed cost-benefit assessments were undertaken for India's energy sector mitigation options in the India country study conducted under the Asia Least Cost Greenhouse Gas Abatement Strategy (ALGAS, ADB, 1998) project (see Table 5).

TABLE 5: COST EFFECTIVENESS OF SOME RENEWABLE ENERGY OPTIONS IN INDIA

Technology	GHG emissions reduction	Investment cost	Cost-effectiveness (US$/ton CO_2)
Small hydro	1.3 kg/kWh	US$1,950/KW	88
Wind farms	1.3 kg/kWh	US$1,405 /KW	257
Biomass	1.6 kg/kWh	US$710 /KW	102
Solar thermal	1.3 kg/kWh	US$3,730 /KW	592
Solar PV	1.6 kg/kWh	US$5,952 /KWp	541

Source: ADB, 1998.

5. CARBON AND GREENHOUSE GAS ABATEMENT

5.1. STATUS OF ACTIVITIES IN THE CARBON MARKETS

India has been participating in the carbon market quite proactively and holds the distinction of having the most number of projects registered with the CDM Executive Board. The National CDM Authority in India approved around 500 projects as of February 2007. Based on the vibrant CDM activities in India, Point Carbon, a leading carbon market analyst, rated it as the No 1 destination for CDM projects in the year 2005. This recognition has its roots in the fact that India has been involved in the CDM from the

very beginning, much before the entry into force of the Kyoto Protocol, and has played a very proactive role in the field.

The growing Indian economy and its diverse sectors offer huge potential for emission reduction. Initial efforts in CDM project development were supported by bilateral and multi-lateral agencies. This helped develop a portfolio of CDM projects and skilled manpower across the country. This also helped boost the confidence of Indian industry substantially and the industry has now reached a stage where it has started participating in CDM on its own.

The entry into force of the Kyoto Protocol in February 2005 gave a boost to CDM activities in India. Out of the 489 projects registered with the CDM Executive Board as of January 2007, 155 belong to India and have the potential for 109 million certified emission reductions (CERs) by 2012. Wind and biomass energy are the main sectors in the CDM projects. EE in the iron and steel, cement, and petrochemical industries also constitute a major share.

Besides the CDM, the concept of voluntary carbon markets is also picking up in India, given the corporate social responsibility of the organisation in countries that have not taken legal commitments under the Kyoto Protocol like the US. Though the price of Voluntary Emission Reduction (VERs) is less than CERs, it offers potential for small projects that are unable to go through CDM given the high transaction cost and time involved in the process.

5.2. INSTITUTIONAL CAPACITY FOR MEASURING AND REPORTING GREENHOUSE GAS ABATEMENT

The Ministry of Environment and Forests (MoEF) submitted its initial National Communication (NATCOM) to the United Nations Framework Convention on Climate Change (UNFCCC) in April 2005. It presents an inventory of anthropogenic emissions of GHGs from various sources and their removal by sinks not controlled by the Montreal Protocol. As a UNDP project funded under the Global Environment Facility (GEF), NATCOM meets the commitment under UNFCCC (Articles 4 and 12). MoEF is the executing agency. Preparation of NATCOM in India involved 350 scientific personnel representing multidisciplinary institutes and organizations. This reflects the contribution of the NATCOM process in building the capacity of institutions in India for GHG inventorization and climate change impact studies.

The NATCOM process comprised comprehensive scientific and technical exercises for estimating GHG emissions from different sectors, reducing uncertainties in current estimations, developing sector and technology-specific emission coefficients pertinent to India, assessing the adverse impacts of climate change, and developing strategies for adapting to these impacts. NATCOM also provided the general description of steps taken or envisaged to implement the convention. The NATCOM process also initiated efforts to identify areas of targeted research on climate change according to India's sustainable development plans.

Before NATCOM, various research institutes had attempted to estimate and quantify the levels of GHG, either economy-wide or for particular sectors. The pioneering effort in this direction was the Asia Least-Cost Greenhouse Gas Abatement Strategy Study (ALGAS) carried out by TERI in the late 1990s. It identified GHG mitigation options across different sectors in India and estimated their abatement costs. The Indian Institute of Management (IIM) Ahmedabad has carried out some sectoral inventories. The National Strategy Study for CDM implementation in India carried out by TERI also presents an

assessment of short term (up to the year 2012) GHG mitigation potential across the power, industry, and transport sectors based upon the planned interventions till that time.

6. DONOR ACTIVITY IN CLEAN ENERGY

Table 6 lists major donors and their activities, which are briefly described below.

TABLE 6: SUMMARY OF MAJOR DONOR'S CLEAN DEVELOPMENT ACTIVITIES

	Demand Side EE	Supply Side EE	Renewable Energy	Clean Fossil Fuels	Clean Transport
IFC	✓				✓
ADB	✓	✓			✓
USAID	✓	✓	✓	✓	✓
World Bank	✓	✓	✓		✓
JBIC		✓		✓	

Source: USAID ECO-Asia Clean Development and Climate Program, 2006.

IFC. IFC South Asia has a US$1.6 billion lending portfolio covering India, Sri Lanka, the Maldives, Bhutan, and Nepal. India alone accounts for three-fourths of this portfolio. IFC's South Asia portfolio is split as follows:

- One-third in financial markets (ICICI, HDFC, Shrey International (equipment leasing))
- One-third in general manufacturing (medium and large enterprises)
- One-third in infrastructure and agribusiness (power transmission and water utilities)

IFC South Asia has pioneered development of a new product line – a lending portfolio focused on sub-national lending to municipalities for purposes of improving energy, water, and solid waste management by municipal corporations. This represents a new and risky area for IFC as there is no sovereign guarantee; IFC, therefore, is taking on municipal risk.

ADB. The Asian Development Bank is financing several clean energy-related projects in India, including the Kerala Sustainable Urban Development project, a US$250 million project that includes components addressing rehabilitation, improvement, and expansion of urban water supply, sewerage and sanitation, urban drainage, solid waste management, and urban roads and transportation services.

USAID. USAID India has sponsored India-US cooperation on energy development since the 1980s. Early efforts that focused on science and technology have evolved into a focus on three key areas: (i) building regulatory capacity at the State level in order to implement sector reform; (ii) asset-based reform and commercial capacity building focused on utilities, such as the DRUMM program, and; (iii) relating public policy (e.g., the Electricity Act of 2003 and the Energy Conservation Act of 2001) to business policy via practical ways to overcome classic market and institutional barriers.

Two market transformation strategies being pursued are centers of excellence for end-use efficiency and green buildings. Several green buildings activities are being supported or encouraged, including the Indian Tobacco Company building (200,000 sq ft), the Grundfos building in Chennai, the Green Buildings Business Council, and the Godrej CII Green Business Center in Hyderabad.

World Bank. The World Bank has a large project focused on improving EE in coal-fired power generation through rehabilitation (US$45 million GEF, US$157 million IBRD). The Second Renewable Energy Project is still underway, supporting both RE and EE. The Project provides a financial intermediation loan of US$200 million to IREDA, which will be lent to private companies to finance numerous small renewable energy projects. Sub-projects will be primarily for electricity generation, and will include biomass power generation, cogeneration at sugar refineries, small hydropower, windmill power, solar PV power, and solar thermal projects.

The World Bank is also supporting EE improvements in the urban sector. The third Tamil Nadu Urban Development Project for India aims at improving the delivery of urban services through enhancing the quality of urban infrastructure, and strengthening institutional and financial frameworks. Project components include: support for management, improvement and institutional changes, including provision of goods, technical assistance, workshops, and staff training to support the implementation and sustainability of urban policy reforms, organizational performance, and urban services delivery; and developing sustainable urban investments for water supply, solid waste management, drains, roads and sanitation facilities, including provisions for EE for street lighting, buildings, and water delivery and waste water disposal. A very large new programmatic CDM effort with US$75 million in GEF financing for India has just been launched (World Bank, 2006b).

JBIC. Japan Bank for International Cooperation projects include Phase 2 of the Delhi Mass Rapid Transport System (DMRTS), two new large supercritical coal power plants, and a pumped storage scheme. The DMRTS project aims to reduce traffic congestion and air pollution by constructing an urban rapid rail system.

7. BARRIERS AND NEEDS ASSESSMENT IN CLEAN ENERGY

A wide range of EE initiatives are underway in India, many of them quite creative and with great promise. The centerpiece of activity is the Energy Conservation Act of 2001 and its implementation by BEE together with its partners at the State level. To generate the best results in terms of actual EE gains, there is a need for strategic review at the national level, involving the central Government, to assess priorities for work on EE development in the coming years, and to focus sustained, multi-year attention on the implementation of the policy initiatives and market-oriented investment mechanisms that can provide the biggest contributions. Such an integrated and strategic review would also be useful for establishing national priorities for support under international clean energy and climate change initiatives. A review might begin at the macro level, assessing energy intensities and potential savings in different sectors, and the most viable investment areas that could yield the biggest and most immediate benefits. Only by establishing priorities for specific consuming sectors and then developing the proper combination of regulatory inducements, access to financing and market development will it be possible for efficiency programs to gain enough vigor for scaling-up.

Of interest from an institutional needs and clean energy program design perspective is the well-advanced state of project development in RE compared to EE. Plausible reasons for this investment gap include:

- RE has a dedicated ministry with a Union Minister assigned, whereas BEE is a department within MoP;

- The RE private sector is very active in promoting its agenda, especially the Wind Energy Association;
- A favorable regulatory regime at the State level, with portfolio standards established in the Electricity Act of 2003 being implemented in most states; and
- Renewable Energy is seen as a tangible asset, whereas the "negawatts" from EE investments are less iconic.

These considerations suggest that the institutional needs agenda for DSM and EE should address head-on the need to create a more level playing field for scaling-up EE investment:

- Building capacity to undertake integrated energy planning at the State level;
- Pursuing private-public infrastructure partnerships, especially at the municipal level;
- Funding EE technologies with broad appeal, e g., lighting;
- Building private and public sector EE technical capacity, perhaps via a network of end-use efficiency centers;[6] and
- Developing markets for commercial EE services companies (the EE equivalent of wind power developers).

RE development is dominated by a few very large players, such as Suzlon and Vestas, which are both manufacturers and developers. There is some concern about the sustainability and the fundamental economics of the RE investment boom, as some marginal projects may be speculative given the generous fiscal policies provided to renewable energy (e.g., accelerated depreciation, production tax credits, and guaranteed returns). The wind energy boom is especially worrisome, as India actually has a rather poor wind regime. The result is that the machines installed have poor capacity factors, eventually requiring taxpayers to make up the difference via a guaranteed return.

Small hydro potential is very large – 15,000 MW. However, its development has been stalled because some developers purchase rights to a site via State-administered auctions for speculative reasons rather than developing it. This not only drives up the project price but also delays project construction.

Biomass is also estimated to have a large potential of 16,000 MW (from agricultural residue for power). However, the threshold size for economical applications is 5-10 MW, which implies considerable costs in terms of gathering the input fuel. Moreover, there are existing rural markets and uses for this residue: traditional biomass use by households for cooking and recycling of the biomass in fields for planting.

There is considerable confusion at the State level regarding implementation of the Electricity Act requirement for a RE portfolio standard (REPS) to be put in place by each SERC. In some states the REPS is higher, in other states there are carve-outs for specific types of RE, and in most states there are price differentials in the power purchase tariffs that each distribution licensee must follow when meeting their REPS. All of this leads to confusion and sometimes litigation, as some distributors are balking at the power purchase tariff terms and price levels. Although state-to-state differentials in power policy and renewable energy potential are important, some standardization at least of setting the power purchase price would be helpful.

6. This approach has been proposed by USAID's energy office in Delhi and would comprise separate centers for lighting (Bangalore), motors (Gujarat), and appliances (Calcutta).

8. CONCLUSIONS

8.1. RECOMMENDATIONS FOR A CLEAN ENERGY STRATEGY

India's distinctive leadership in certain clean energy technologies, notably wind power, is overshadowed by the very poor performance of its power sector. The combination of a generation mix dominated by poor-performing coal thermal power plants together with an abysmal record of performance in distributing electricity results in very poor overall performance in terms of GHG emission per kWh sold.

On the other hand, India is a regional leader in terms of creating an enabling climate for rapid scaling-up of investment in clean energy sources such as RE. As of 2006, there were 9,000 MW of grid-connected renewable energy capacity in India – almost 7 percent of total installed capacity.

At present, the institutional structure that exists in the public sector undertakings in the energy sector has led to a monopolistic market structure that promotes inefficiencies inherent in the cases of majority public ownership of the enterprise. The private sector is expected to play an important role in the energy sector in a liberalized economy like India (Planning Commission, 2006).

From a macroeconomic viewpoint the key priorities for managing the Indian energy sector are briefly described below.

Enhancing demand-side end-use efficiency: The major areas where efficiency in energy use can make a substantial impact include: heavy industry, power generation, power distribution, pumping water, transport, buildings heating, ventilation and air conditioning, and lighting and household appliances. A study prepared for the Asian Development Bank (ADB, 2003) estimated an immediate market potential for energy saving of 54,500 GWh and peak saving of 9,240 MW just in electricity consumption alone. Large additional savings in primary energy and vehicle fuels are possible on the supply side through reduction in industrial consumption, and power generation.

Through the Bureau of Energy Efficiency, India already has in place a basic regulatory and institutional framework to encourage end-use efficiency improvements in buildings, industry, and appliances. Extensive capacity building is needed in all of its statutory functions and in extending its reach. BEE also needs to mobilize the state level regulatory commissions in creating a monitoring, data collection and enforcement scheme to ensure progress is being made towards the numerical targets of audits performed, improvements made, and investment mobilized. Also, real consideration should be given to an "EE portfolio standard" to mobilize pro-efficiency activities of distribution utilities.

Other practical EE measures that should be undertaken by BEE include developing outreach and awareness building to SMEs and co-investing in rehabilitation programs for energy-intensive industries that fall below energy intensity benchmarks.

Reducing AT&C Losses in Power Distribution: The biggest most pressing need is to thoroughly and comprehensively implement the reform agenda set out in the Electricity Act of 2003. Only when the Indian power sector is thoroughly liberalized, including privatization of state-owned generation, de-licensing of existing distribution franchises, and establishment of wholesale competition, will conditions begin to improve. However, regulators will have to take an active role in creating and enforcing a performance-improvement program for the remaining distribution utilities serving uncontested small customers. Otherwise, a price and performance gap will emerge between the larger customers that can shop around for power supply and smaller customers that are stuck with the franchised provider.

Clean(er) Power Generation: For the foreseeable future India would have to rely on high-ash, low-quality coal as its main domestic commercial energy source. Although gas-fired power generation is scaling-up in the short run, this energy source is limited, better suited to use as a feedstock, and subject to energy security concerns. Therefore, it is important to immediately undertake a program to clean up all aspects of India's coal fuel cycle for both heavy industry and power generation. A 10 percent improvement could make a big difference in GHG emissions. Cleaner, more energy-efficient technologies should also be sought for the other coal-consuming sectors of the Indian economy, notably cement and brick making.

Private Sector Participation in Energy Sector Development: India is far too reliant on the public sector for the massive investments that will be required in its energy sector over the next 10-20 years. India should actively undertake strategies to increase private sector participation, such as removing the single-buyer monopoly of Coal India and liberalizing how prices are set throughout the hydrocarbon sector.

Improve and Refine the Regulatory and Institutional Framework for Scaling-up Renewable Energy: Although renewable energy power generation is a genuine clean development success story, there are some problems that need to be addressed to make the industry sustainable and self-supporting. There is currently some retrenchment going on with respect to RE policy amongst the State regulators. States with strong RE policies include Andhra Pradesh, Tamil Nadu, Maharashtra, and Gujarat. A strong RE policy consists of: (i) preferential treatment; (ii) portfolio standards; and (iii) standardized PPA. However, care must be taken towards over-subsidizing renewable energy development relative to other energy sources at the expense of rate payers and taxpayers.

The disaggregate nature of implementing the Electricity Act's renewable energy portfolio standards has created considerable disparities and lack of analytic basis for the relative pricing of various forms of RE within and between different States (e.g., hydro gets a lower price than wind or biomass in one state, or the price is very different between two adjacent states). Because the price made available to RE project developers does not seem to be firmly grounded, transmission and distribution licensees are going to court to avoid entering into power tariffs for purchases of renewable energy. There is a need for standard methods of valuation of the relative environmental benefits accruing to different forms of RE, which could then be reflected in PPA price differentials

RE resources should also play a bigger role in providing decentralized power to remote areas, in line with the goal of providing modern energy access to all by 2012. Decentralized power generation, especially in remote locations where the grid cannot be extended, should necessarily be based on RE forms to provide these regions with access to clean and reliable energy.

Full Speed Ahead on Nuclear Power Development: Besides coal, nuclear power is India's only other large intermediate term energy supply source. India's nuclear power program should be scaled-up as soon as practicable to displace as much of the coal-fired power generation additions as possible. The Integrated Energy Plan estimates that up to 70 GW of new nuclear power capacity could be constructed over the next 25 years.

Don't Forget the Rural Poor: Most of the rural poor are still reliant on traditional fuels for their needs, primarily cooking. Access to modern energy of any kind, including electricity and LPG, in rural India is often unaffordable to those who need it most. Traditional fuels need to be replaced with affordable cleaner fuels, or at least used with modern cooking stoves that are more efficient and do not

produce harmful indoor pollution. Care should also be taken to ensure that large projects using traditional fuels for modern power generation do not create new problems for the rural poor. Also, RE-based modern energy solutions should be developed and delivered where possible, especially to remote populations.

8.2. RECOMMENDED INTERVENTIONS AND ACTIVITIES

This profile has touched on many of the recommended interventions, activities and strategies whose implementation is already on the priority list of the Government of India. Based on a literature review of the existing and proposed clean energy initiatives and discussions with various stakeholders, the following priority areas can be identified where a regional program could potentially strengthen implementation of India's national clean development agenda.

Virtual Project Preparation Facility: The scope for EE improvement in the energy sector is huge and growing as the region continues to develop rapidly. This project would attempt to support and extend the work already done on an Energy Efficiency Manual for City Managers by supporting a "virtual" project preparation facility whereby managers could access software tools on a website, put in their specific project data and energy costs, and a menu of efficiency improvement measure (including costs expressed in local terms) would be available – in essence allowing a pre-feasibility study to be done online. Seminars and outreach could also be done and a regional users group created.

Logistics and Procurement Support for Green Buildings Construction: India is a pioneer in the area of green buildings, having established the Indian Green Building Council (IGBC), developed a Leadership in Environmental and Energy Design (LEED) rating system to suit India, and sponsored an annual flagship event titled "Green Building Energy Congress", complete with awards for the best green building design. However, an irksome issue facing project developers is supply problems, especially of advanced materials and equipment specified in designs but difficult to acquire locally. Technical assistance from donors could sponsor a "Green Buildings" trade show and expo to help build up suppliers in the region and help develop a logistical network of equipment suppliers to complement the existing designers.

Regional Green Certificates Program: RE portfolio standards in place in a half dozen States have to be complied with via long-term procurement contracts under the 2005 Power Tariff policy. The continued expansion of the RE power sector would be benefited if more liquidity in the green energy market could be created, while at the same time providing more ways for distribution and transmission licensees to satisfy their portfolio requirements. The economies of scale are such that this could be usefully undertaken as a regional project. Technical assistance could help the process by providing specialized consultancies to work out an indicative regional green certificates program while also working with regulators, RE project developers, and licensees to make sure the program suited the needs of the Indian RE industry.

Policy Paper on Sustainability of Fiscal and Tax Policy Regimes Encouraging RE Project Development: There is some concern among some policy-makers and financial analysts that the Indian wind energy sector is either not sustainable under the current tax policy regime or is too expensive for taxpayers and ratepayers. This policy paper would take on the question of an optimal fiscal and tax policy regime to encourage renewable energy (and EE) in a least-cost fashion. The paper would be generic enough to be regional but would be responsive to the Indian situation, as India is farthest along in the conception and implementation of these policies.

Regional Project Preparation Facility for MSW-to-Energy Projects: MSW is an often overlooked renewable energy resource. It is also on its own one of the biggest problems facing the rapidly-urbanizing Asia region. Although MSW-to-energy is promising, and there have been successful projects developed, there is not yet a body of regional best practice in this area, let alone standard project designs. This activity would create a community of practice to look at the requirements of MSW to energy project development from technical, environmental, site, financial, and risk assessment points of view. The PPF could be virtual, but with annual meetings. Assistance from donors and government would be very likely, given the size and importance of the problem.

There are numerous additional ideas for regional cooperation. These include: (i) leveraging private investment in EE by mobilizing corporate social responsibility; (ii) harmonization of appliance standards, labeling, MEPS, and testing; (iii) a regional dialogue on principles and practice of efficiency regulation, including Energy Efficient Building Codes, mandatory audit requirements for large customers, and energy intensity benchmarking; (iv) a Regional Bus Rapid Transit consortium; (v) regional RE resource mapping; (vi) regional approaches to ESCO market development assistance, e.g., how to stimulate demand for ESCO services and projects so market development assistance such as potential studies, exhibitions, or a regional ESCO industry association might be useful; and (vii) a regional utility DSM alliance.

TABLE 7: SUGGESTED NATIONAL ACTIVITIES AND ANCHORS IN INDIA

Organization	Activity Description
IFC	• Clean Energy Manual for Municipalities, covering street lighting, building envelopes, water distribution, sanitary waste, and municipal solid waste • Project Preparation Facility for municipalities in cooperation with IFC/WB/ADB to create a pipeline of sub-national clean energy projects
USAID Mission	• Leverage private investment in EE by mobilizing corporate social responsibility. Examples: Green Buildings and Green Supply Chain Management • Addressing the SME sector via dialogue and outreach to the only two constituencies all SMEs have in common - their customers and their banker • Regional technology demonstrations – IGCC (unlikely), distributed clean generation, bus fuel conversion • Regional Virtual End-Use Efficiency Center of Excellence • Regional Green Buildings Initiative, including design competitions and annual awards • Green Buildings Materials: regional expo to bring A&E community in touch with efficiency buildings equipment and materials suppliers
Bureau of Energy Efficiency	• Assistance to preparation of bankable EE projects • Harmonization of appliance standards, labeling, MEPS, and testing • Regional dialogue on principles and practice of efficiency regulation • Regional development of Energy Efficient Building Codes • Technology transfer of high-efficiency buildings equipment and materials
ILFS, Ltd.	• Clean energy project preparation facility • Guidelines for public-private partnership in clean energy projects
Society of Indian Automobile Manufacturers	• Regional Bus Rapid Transit consortium • Regional demonstration of clean passenger vehicles, such as electric plug-in hybrids • Private sector-led mass transit
Ministry of New and Renewable Energy	• Regional study of MSW to energy schemes, with emphasis on special approaches suitable for low-calorific combustible waste streams • North-South technology sharing of emerging RE technologies, especially wind turbine technology developed for low-wind regimes such SE Asia • RE Resource mapping (Note: India not a signatory to the UNDP SWERA project)
IREDA Ltd.	• Study what it take to move from balance sheet financing to project-based financing, and how fiscal and regulatory policies can help • Regional study of industrial EE potential • ESCO model applied to municipalities –OR- mainstreaming energy and water efficiency into financial restructuring of municipalities
Confederation of Indian Industry	• Collaborative effort to chart clean energy trajectories for each country, piggy-backing on the OECD + MARKAL model

TABLE 7: SUGGESTED NATIONAL ACTIVITIES AND ANCHORS IN INDIA

Organization	Activity Description
	• Develop a regional template – bringing the ingredients together – for successful public-private energy center partnerships • Look at previous USAID clean energy programs across the region to identify common threads worth continuing • Clean energy "rock star" regional tour to heighten awareness of clean energy, especially among corporate executives • Regional association of private sector organizations committed to clean energy, with ITC as a leader • Regional approaches to encourage clean energy innovation in the SME sector
World Bank	• Regional development of strategies for scaling-up EE in the SME sector • Regional collaboration around clean energy development trajectories

Source: USAID ECO-Asia Clean Development and Climate Program, 2006.

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