

India

1. Description of National Energy Policy

The key laws and policy statements relevant to the Indian energy sector are shown in the following table.

Table 1. Relevant Decrees, Regulations, Policies, and laws Affecting the Indian Energy Sector

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

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

The Integrated Energy Policy sets a goal of a 25% reduction in India's energy intensity from current levels. The major areas where energy efficiency 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 to a larger extent. 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, provision of clean transport systems goes a long way in reducing oil consumption and decreasing the country's dependency on oil imports.

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

India has the following renewable energy promotion policies in place:

- Capital subsidies, grants, or rebates
- Investment excise or other tax credits
- Sales tax, energy tax, or VAT reduction
- Public investment, loans, or financing
- Public competitive bidding

The following renewable energy promotion policies are in place but only in some states/provinces and there is no national policy:

- Feed-in tariffs (six states)
- Renewable portfolio standard
- In 2006, a new national tariff policy was announced that aims to promote renewable power generation. The policy includes quotas, preferential tariffs, and guidelines for pricing 'non-firm' power.

2. National Programs/Policies and Targets for Renewable Energy

The Renewable Energy Plan 2012 calls for achieving a 10% share for renewable energy in incremental power capacity by adding about 10,000 MW of new renewable energy based generation. Other major Renewable Energy (RE) initiatives in addition to the grid connected RE goal include deployment of 1 million household solar water heating systems, electrification by renewable mini-grids for 24,000 unelectrified villages, deployment of 5 million solar lanterns and 2 million solar home lighting systems, and setting up of an additional 3 million small biogas plants.

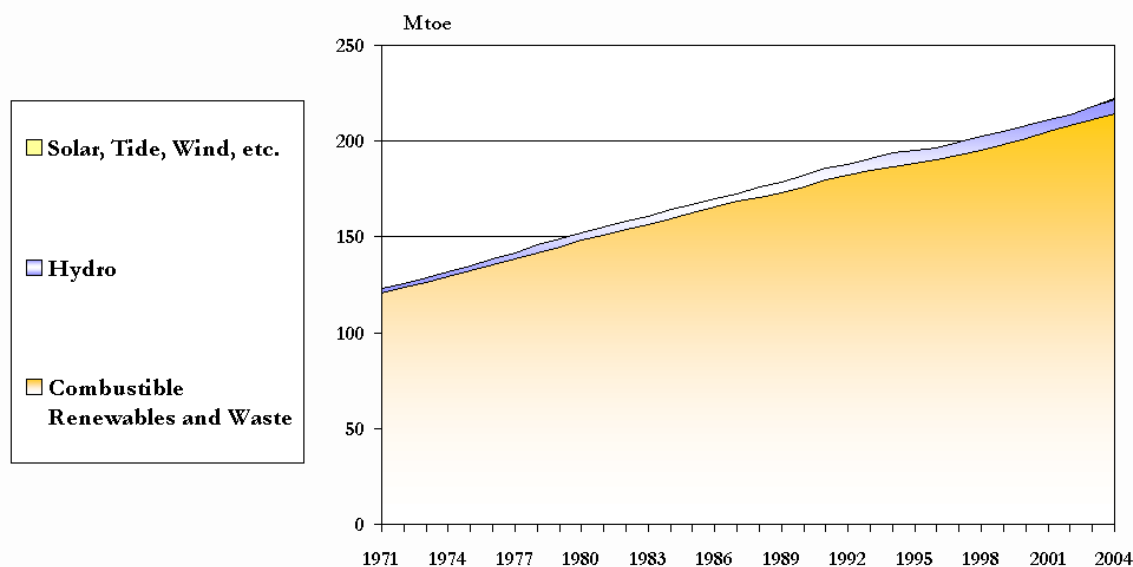
Additionally, the Government aims to supply 18,000 remote villages with electricity and meet 10 % of its country's power supply through renewable energy by the year 2012. This is in addition to other targets already set by the government such as; establishing 1 million biogas plants, 1 million solar photovoltaic systems for lighting, 8,000 SPV pumps for irrigation, 10,000 SPV generators, stand-alone SPV power plants, solar water heating systems, solar air heating systems, solar cookers including large steam cooking systems, 360 energy demonstration parks and establishing more solar retail outlets and solar passive buildings.

The Electricity Act 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 2005 (NEP) provides each State regulator with

authority to create a Renewable Energy Portfolio Standard for the transmission and distribution companies serving their jurisdictions.

Figure 1. Total Primary Energy Supply from Renewables

India - Total Primary Energy Supply from Renewables (Mtoe)



Source: IEA Energy Statistics - Copyright: © OECD/IEA 2006

Access to detailed data for almost all fuels for both OECD countries and over 100 other countries is available through the IEA website at: <http://www.iea.org/statistics>

India has proposed long-term targets for 2032 in several categories;

- 15 % of power capacity
- 10 % of oil consumption substituted by biofuels, synthetic fuels, and hydrogen;
- 100 % use of solar hot water in all possible applications. Additionally, proposing full coverage of users like hotels and hospitals by 2022.

Short term targets by 2012 include full use of cogeneration in the sugar and other biomass-based industries.

India is a member of the Asia Pacific Partnership on Clean Development and Climate (AP6). This is a partnership between six Asia-Pacific countries including the United States, Australia, China, India, Japan, and South Korea. The purpose of this partnership is to promote the transfer of technology and aid each other in meeting nationally-designed strategies to improve energy security, reduce pollution, and address climate change.

Progress/Barriers

Several steps have been taken by India to urge the progress of renewables. First, renewable portfolio standard policies have been enacted in six states. Secondly, India's Renewable Energy Development Agency (IREDA) uses public funds to provide financing for renewable energy projects.

Solar: The number of solar home systems added in 2005 was at 20,000 for India

Biomass/biofuels: In 2005 the Bio-Diesel Purchase Policy was adopted by the Government of India. It states that oil-marketing companies in the public sector should buy bio-diesel of prescribed BIS specification from registered authorized suppliers. The price for the bio-diesel is to be uniform and will be reviewed every six months. This has led to much research and discussion in the private sector oil companies. Many are looking at different mixes of bio-diesel and sharing results with the auto industry. Also in 2005 India produced 300 million liters of ethanol using sugarcane. In fact, sugar producers are hoping to build 20 new ethanol plants. Not to mention, a biomass resource atlas of India is under preparation and thirty seven commercial grid-connected biomass-based power projects creating a total capacity of 180 MW have been commissioned, and 39 projects of 240 MW capacity are under implementation. Biogas remains a priority in India, with about 3.8 million household-scale biogas plants now reported installed and 66,000 new plants were expected to be installed from early April 2005 to April 2006. India also has achieved 70 MW of small-scale biomass gasification systems for rural (off-grid) power generation.

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.

Small hydro: One hundred and ninety one projects with a total capacity of 551.9 MW are under implementation. During April 2002-March 2003, small hydro power plants with a total capacity of 80.39 MW were built.

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 the project construction.

Wind: India places fifth in the world of wind production with a generation capacity of 1870 MW. Thirty project sites have been developed under the Demonstration Programme, resulting in a capacity of 65 MW. The target capacity for wind power in 2009 is about 1,500 MW, expected to be achieved through commercial developers.

See table below for Overview of India's progress in renewable energy:

Table 2: Progress in Renewable Energy

RE Source	Unit	Installed Capacity	Position in the World
Wind Power	MW	1870	5 th
Small Hydro (up to 25 MW)	MW	1519	4 th
Biomass Power	MW	484	4 th
Biomass Gasifiers	MW	53	1 st
Solar PV	MW	3	--
Waste-to-Energy	MW	26	
TOTAL	MW	3,955	

Source: Planning Commission, 2006

According to a recent report entitled “From Ideas to Action: Clean Energy Solutions for Asia to Address Climate Change” (USAID, 2006) there are several possible reasons for the gap in developed renewable energy projects and energy efficiency projects. The reasons stated are as follows;

- “Renewable Energy has a Dedicated Ministry with a Union Minister assigned, whereas BEE is a department within MoP”
- “The renewable energy private sector is very active in promoting its agenda, especially the Wind Energy Association”
- “Renewable Energy is seen as a tangible asset, whereas the “negawatts” from energy efficiency investments are less iconic.”

There is considerable confusion at the State level regarding implementation of the Electricity Act requirement for a renewable energy 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 renewable energy, 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.

3. National Programs/Policies and Targets for Energy Efficiency

The specific policies targeted towards energy efficiency improvements as recommended in the *Integrated Energy Policy* are:

- Merge the Petroleum Conservation Research Association (PCRA) with 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 Central Government.

- The expanded BEE should be responsible for accelerating efficiency improvements in energy using appliances, equipment and vehicles through schemes such as “golden carrot” incentives¹ target.
- Implementation of energy efficiency standards and labeling of energy-using equipment, including financial penalties if equipments fail to meet minimum energy performance standards
- Benchmarks should be established for energy consumption in energy intensive sectors
- Increased gross efficiency in power generation, including improvements of 10 percent in existing generation and 5-10 percent in new plants;
- Promote urban mass transport, energy efficient vehicles and freight movement by railways

The National Building Code of India (NBC) is a national instrument providing guidelines for regulating the building construction activities across the country and serves as a Model Code by all agencies involved in building. The Code mainly 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 for each of the six climatic zones of India. This provides minimum requirements for the energy-efficient design and construction of commercial buildings by addressing energy-efficiency aspects of buildings, including air conditioning, lighting, electric power and distribution, and service water heating and pumping. Compliance with the Energy Conservation Building Code (ECBC) will initially be voluntary, but starting in 2009 building plans will not be approved by local authorities unless the building plans comply with the ECBC. The code will make it mandatory that buildings do not use energy more than 140 kilowatt/hour per square meter annually.

Accelerated Power Development and Reform Programme (APDRP) of the Ministry of Power, Government of India 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, reducing outage & interruption and increasing consumer satisfaction.

The Ultra Mega Projects were announced by the Ministry of Power in early 2006. In the first phase, two projects at pit-head sites and three projects at coastal locations have been identified for development of Ultra Mega Power Project. Each project would have a capacity of more than 4,000 MW with scope for further expansion. Power Finance Corporation (PFC) is the nodal agency, while five companies for each power plant have been set up as its subsidiaries. These companies are working independently to get all the necessary approvals, after which these would be transferred to potential investors. These projects would be awarded to developers on Build, Own, and Operate (BOO) basis. The

¹ A Golden Carrot scheme provides substantial monetary rewards to firms which develop and commercialize high-efficiency equipment or appliances

size of these projects being large, they will meet the power needs of a number of States through transmission of power on regional and national basis.

India attended the compact fluorescent light bulb (CFL) workshop, sponsored by USAID, in October of 2007 for all ASEAN countries. The purpose of the workshop was to discuss how to avoid shoddy CFLs as right now there are no common agreements between ASEAN countries on testing or standards. This creates problems for manufacturers who have to comply with different standards leading to increases in product cost and the possible loss of gains from efficiency of the CFLs. According to the report from this workshop, India has 40% substandard quality for CFLs. India plans to increase its annual CFL output. If India's projected estimates holds true, the number of CFL units produced a year in India will rise from 70 million in 2005 to 172 million in 2009. This would be a six-fold increase from 2002's production level.

4. National Programs/Policies and Targets for other Clean Energy Technologies

Nuclear: India expects to have 20,000 MWe of nuclear capacity on line by 2020. It aims to supply 25% of electricity from nuclear power by 2050.

India is outside of the Nuclear non-Proliferation Treaty. As such, it is largely excluded from trade in nuclear plant or materials, which has hampered its development of civil nuclear energy. India's relative isolation in international trade and lack of indigenous uranium, has led India to uniquely develop a nuclear fuel cycle in exploiting its reserves of thorium.

The Nuclear Power Corporation of India Ltd (NPCIL) is responsible for design, construction, commissioning and operation of thermal nuclear power plants. It has 15 small and two mid-sized nuclear power reactors in commercial operation and six under construction, including two large ones and a fast breeder reactor and more planned.

Table 3. India's Operating Nuclear Power Reactors:

reactor	type	MWe net, each	commercial operation	Safeguards status
Tarapur 1 & 2	BWR	150	1969	item-specific
Kaiga 1 & 2	PHWR	202	1999-2000	
Kaiga 3	PHWR	202	2007	
Kakrapar 1 & 2	PHWR	202	1993-95	by 2012 under new agreement
Kalpakkam 1 & 2 (MAPS)	PHWR	202	1984-86	
Narora 1 & 2	PHWR	202	1991-92	by 2014 under new agreement
Rawatbhata 1	PHWR	90	1973	item-specific

Rawatbhata 2	PHWR	187	1981	item-specific
Rawatbhata 3 & 4	PHWR	202	1999-2000	by 2010 under new agreement
Tarapur 3 & 4	PHWR	490	2006, 05	
Total (17)		3779 MWe		

Kalpakkam also known as Madras/ MAPS
Rawatbhata also known as Rajasthan/ RAPS/ RAPP
Kakrapar = KAPS, Narora = NAPS

Natural gas: Natural gas currently is a minor fuel in the overall energy mix of India. However, is rapidly expanding infrastructure to serve demand. According to the International Energy Outlook 2007, India increased its spot and short-term natural gas purchases in 2006, reportedly paying more than \$9 per million Btu for one cargo. Natural gas shortages in India have reportedly left natural-gas-fired electric power plants and fertilizer plants underutilized in the past few years. As international natural gas prices gain acceptance in India, domestic natural gas supply is expected to catch up and expand with growing demand.

The Ministry of Petroleum and Natural Gas (MoPNG) has been undertaking several initiatives to tap gaseous fuels other than natural gas. Proven CBM (Coal Bed Methane) is estimated to double India's proven gas reserves. The government has formulated a CBM policy to attract technology and investment for E&P (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 (MoPNG 2005).

In-situ coal gasification can 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 CO₂ (carbon dioxide). Recoverable energy from one of the blocks (Mehsana-Ahmedabad) alone, with coal reserves of 63 billion tonnes in the form of gas, could be equivalent to 15 000 BCM (billion cubic metres) of natural gas. Public sector oil and gas companies are collaborating with leading international organizations in this area. (MoPNG 2005).

Clean Coal: According to the report "From Ideas to Action: Clean Energy Solutions for Asia to Address Climate Change" (USAID 2006), most existing coal-fired plants in India are "inefficient and polluting when compared to the best-available technology." As such, India has made several plans for CCT:

- Ongoing and near-term plans: coal beneficiation and improved heat recovery, R & M for improvement in power plant performance, FBC; super-critical power plant boilers, IGCC (demo-unit), Enhanced energy recovery from coal: CBM, CMM, etc. (pilot scale)
- 5 – 10 years: IGCC, PFBC, Ultra-supercritical power plants, Enhanced energy recovery from coal: CBM, UCG (commercial scale), coal

liquefaction (commercial scale), zero emission technologies (ZETs) (pilot scale), carbon sequestration pilot scale.

- More than 10 years: zero emission technologies (commercialization), carbon sequestration (commercial scale), IGFC, Hydrogen fuels from coal.

Most Indian coal is not cleaned; studies show that even screening of the rocks that are often included in the coal would improve the economics of coal transport. Coal India recently started washing all coal in new coal mines. Additionally, the Government of India, through the Ministry of Environment and Forest now requires that coal that is to be shipped more than 1,200 km be washed. Therefore, it is predicted that coal washing will reach 55 million tons in 2007 and rise to 263 million tons by 2012.

The first supercritical pulverized coal plant is under construction in India and more are planned. Additionally, the Government of India has specified supercritical PC for five ultra-mega power plants (4,000 MW each).

Bharat Heavy Electricals has developed a pilot plant of coal-based IGCC of 6.2 megawatts electrical at its research and development center. Design of 125 MW IGCC demonstration plants is being pursued with this technology, but no final approval has been received.

References

“Confidence in Quality: Eliminating Shoddy CFL Products Within ASEAN Countries”. USAID Asia (2007)

USAID. “Clean Energy Priorities for Asia: A Regional Imperative”. USAID RDMA. (2006).

USAID. “Clean Energy Priorities for Asia: A Regional Imperative”. Annex 2_India. USAID RDMA. (2006).

Ministry of Non-conventional Energy Sources (MNES). 2004. Renewable Energy in India: Business Opportunities. Available from <http://mnes.nic.in/business%20oppertunity/pgtwp.htm>

Renewable Energy Policy Network. Update (REN 21) 2006. Renewables Global Status Report. 2006. Publication on-line. Available from http://www.ren21.net/globalstatusreport/download/RE_GSR_2006_Update.pdf

Regional Strategy Report (2007).

Uranium Information Center. (UIC) 2007. Nuclear Power in India, Briefing Paper 45. Available from <http://www.uic.com.au/nip45.htm>