# Climate Change Mitigation Measures in India

INTERNATIONAL BRIEF 2 SEPTEMBER 2008

## EMISSIONS AND ENERGY OVERVIEW

India is the world's fourth largest economy and fifth largest greenhouse gas (GHG) emitter, accounting for about 5% of global emissions. India's emissions increased 65% between 1990 and 2005 and are projected to grow another 70% by 2020.[1] By other measures, India's emissions are low compared to those of other major economies. India accounts for only 2% of cumulative energy-related emissions since 1850. On a per capita basis, India's emissions are 70% below the world average and 93% below those of the United States.

India remains home to the world's largest number of poor people, with nearly 35% living on less than a dollar a day. Its economy is growing rapidly, however, with GDP rising about 8% a year over the past five years. As the economy has grown, emissions intensity (GHGs per unit of GDP) has declined significantly. India's GHG intensity is currently 20% lower than the world average (and 15% and 40% lower than the United States' and China's, respectively). Factors contributing to the decline in energy intensity include improved energy efficiency, increased use of renewable and nuclear power, expanded public transport, and energy pricing reform.[2]

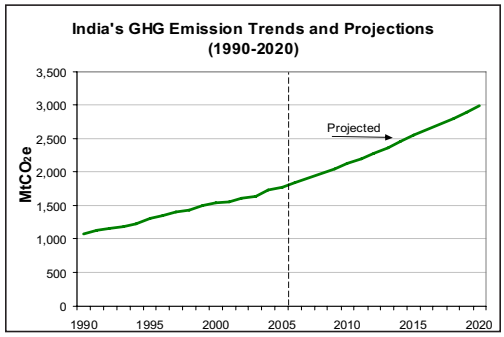
With rapid economic growth, rising income, and greater availability of goods and services, energy demand rose 68% between 1990 and 2005, about 3.5% annually.[3] The government projects energy demand growth of 5.2% a year for the next 25 years, driven by annual GDP growth rates of 8-10%.

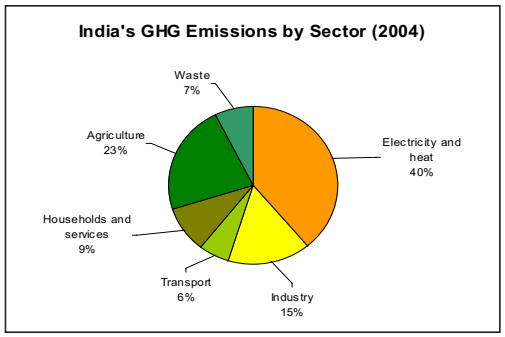
Coal accounts for 39% of total primary energy demand, followed by biomass and waste (29%), oil (25%) and natural gas (5%). The high proportion of biomass and waste reflects the fact that some 500 million people have no access to electricity or other modern energy services. Coal is projected to remain the primary energy source, with demand growing nearly three-fold by 2030.[4]

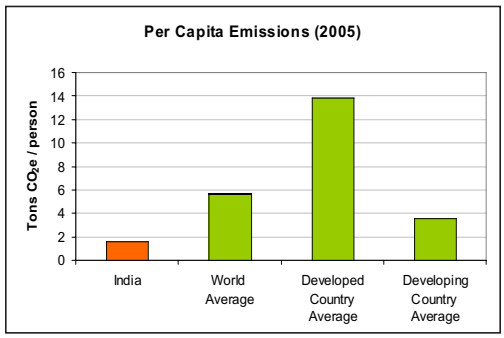
## INTERNATIONAL PARTICIPATION

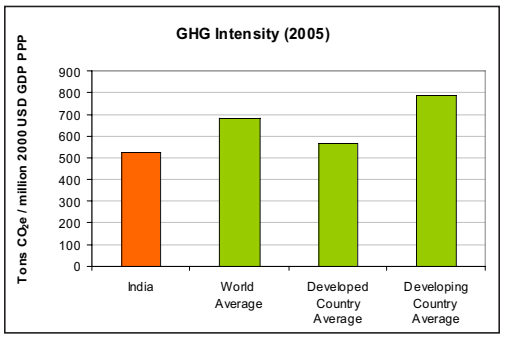
India is a party to both the UN Framework Convention on Climate Change and the Kyoto Protocol. As a non-Annex I (developing) country, India has no binding emission limits under the Protocol. However, India is an active participant in the Clean Development Mechanism (CDM) established by the Protocol. (The CDM grants marketable emission credits for verified reductions in developing countries. Developed countries buying these credits can apply them toward their Kyoto targets.)

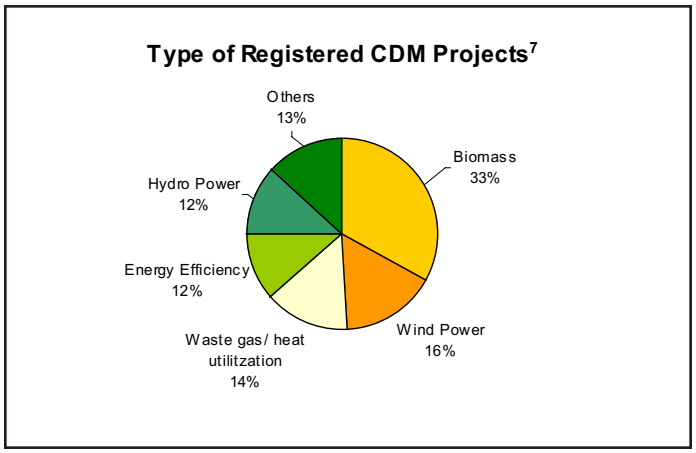
India has more than 345 registered CDM projects, more than any other country, and about a third of all projects globally.[5] (In terms of the overall volume of CDM reductions, China ranks first with 51% followed by India at 14%.)[6] The largest project categories are biomass and wind power. Most projects in India are undertaken on a unilateral basis—developed independently by local stakeholders without the direct involvement of Annex I countries.






## POLICIES CONTRIBUTING TO CLIMATE MITIGATION

As in many other countries, India has a number of policies that, while not driven by climate concerns, contribute to climate mitigation by reducing or avoiding GHG emissions. (Specific estimates of the emission impacts of the policies described below are in most cases not available. However, a recent analysis by The Energy and Resources Institute (TERI) concluded that in the absence of a number of energy policies that are currently being implemented, $CO_2$ emissions would be nearly 20% higher compared to business as usual scenarios in both 2021 and 2031.[8])

Many of these policies are contained in the Five Year Plans developed by the Planning Commission to guide economic policy in India (the 11th Five Year Plan covers 2007-2012).[9] Other policies are found in the Integrated Energy Policy approved by the Planning Commission in 2006 with the broad objective of meeting energy demand "at the least cost in a technically efficient, economically viable and environmentally sustainable manner."

In June 2008, Prime Minister Singh released India's first National Action Plan on Climate Change outlining existing and future policies and programs addressing climate mitigation and adaptation. The plan identifies eight core "national missions" running through 2017 and directs ministries to submit detailed implementation plans to the Prime Minister's Council on Climate Change by December 2008.[10]

### Energy

Renewable Energy - Currently, modern renewable energy constitutes 4% of the total installed capacity of the power generating sector. Between 2002 and 2007, 6800 mewgawatts (MW) of renewable power capacity was added, about 3000 MW more than the 10th Five Year Plan target. The 11th Five Year Plan sets a target of increasing the installed capacity to 23,500 MW by 2012, or more than 10% of total installed capacity, with wind comprising 72% and biomass and hydro power about 14% each.

The Electricity Act (2003) encourages the development of renewable energy by mandating that State Electricity Regulatory Commissions (SERCs) allow connectivity and sale of electricity to any interested person and permit off-grid systems for rural areas. The National Tariff Policy (2006) stipulates that SERCs must purchase a minimum percentage of power from renewable sources, with the specific shares to be determined by each SERC individually. The states of Himachal Pradesh and Tamil Nadu have the highest quotas—20% by 2010 and 10% by 2009, respectively.

Under the Rural Electrification Policy (2006) electrification of all villages must be completed by 2012. Of the 80,000 villages that have no access to electricity, 18,000 villages are in remote areas that must be electrified through use of renewable energy. Currently, about 3000 villages have been electrified, primarily through solar systems.[11]

- Wind Power - Wind power comprises over 65% of renewable capacity, ranking India fourth in terms of wind power generation worldwide.[12] The Ministry of New and Renewable Energy estimates the overall potential for wind power at 45,000 MW, with only about 6270 MW currently developed.

  In recent years, the policy framework has been strengthened to reduce upfront costs to investors. Long-term low-interest loans are being provided by the Indian Renewable Energy Development Agency. Cumulative loan approvals amounted to $1.9 billion at the end of 2006. The central government allows 80% accelerated depreciation for the first year; concessions on import duties, sales tax and excise duties; and a 10-year income tax exemption for profits from wind generation. Subsidies also are provided for demonstration projects in states where commercial activity has not begun.

- Solar Power - Solar thermal projects receive financial assistance in the form of capital subsidies, sales incentives, and reimbursement of fees. To encourage foreign investment in solar photovoltaic technology, the government allows an automatic approval procedure for up to 74% of foreign direct investment in joint venture projects.[13] Up to 100% foreign direct investment is permitted if approved by the Foreign Investment Promotion Board. Various subsidies and loans are also available for manufacturers and users of solar power. Raw materials and photovoltaic components are exempt from excise duties and benefit from concessional import duties. In New Delhi, the use of solar water heating systems in certain categories of buildings has been made mandatory.[14] In 2006, a rebate scheme was introduced in the domestic sector to encourage the use of these systems. The government recently

introduced a demonstration program to support large grid-interactive solar projects. The program sets a feed-in tariff of 12 rupees (about 25 cents) per kilowatt-hour (kWh) for solar photovoltaic power and Rs.10/kWh (~22c/kWh) for solar thermal power generation through 2009 for qualifying projects.

- Other Renewables - Biomass projects for power generation receive fiscal incentives including subsidies, income tax holidays, excise duty and sales tax exemptions, and accelerated depreciation. Currently, the CDM also attracts developers to build biomass projects.

  Hydropower contributes 33,642 MW (or 26%) of electricity generated in India. The 11th Five Year Plan calls for an additional capacity of 15,585 MW by 2012 and the Accelerated Hydro Development Plan targets 50,000 MW of new capacity by 2025-26. Small hydropower projects (up to 25 MW) are eligible for incentives such as concessional customs duties and income tax exemptions for 10 years.

Coal - Currently, coal accounts for 55% of electricity generation. According to the new national climate action plan, about 7% of the installed coal capacity is in inefficient plants that will be retired by 2012, and an additional 10,000 MW will be retired or reconditioned by 2017. Three R&D plants based on Integrated Gasification Combined Cycle technology have been established, and the government is encouraging the adoption of supercritical coal combustion technologies. The 10th Five Year Plan calls for research and development of advanced combustion technologies for the Indian power sector.[15]

The very high ash content of Indian coal reduces the efficiency of coal-fired power generation, increasing the amount of coal transported to power plants, and resulting in excess emissions from both transportation and combustion. Since 2001, the use of washed coal has been mandated at all power plants more than 1000 kilometers from the mining source, or in urban, sensitive and critically polluted areas.

The 10th Five Year Plan projects Coal Bed Methane (CBM) providing up to 19,260 MW of power generation. The CBM Policy 1997 incentivizes investors to develop CBM commercially by providing liberal fiscal terms.

Nuclear Power - Nuclear power presently accounts for 3% of total power generation.[16] The Integrated Energy Policy sets a goal of increasing installed nuclear capacity from about 3900 MW to 20 gigawatts (GW), a five-fold increase, by 2020. To meet these targets, the 11th Five Year Plan targets an additional 3160 MW in capacity and the 12th Five Year Plan will further increase capacity by 11,000 MW, with the National Thermal Power Corporation providing an additional 2000 MW.

## Energy Efficiency and Conservation

The Energy Conservation Act (2001) established a national Bureau of Energy Efficiency (BEE) with the objective of improving energy efficiency in various sectors. BEE has developed energy efficiency labels for refrigerators and other appliances, conducted mandatory energy audits of large energy-consuming industries, developed demand-side management programs, and established benchmarks for industrial energy use.

BEE is in the process of developing a CDM project called the "Bachat Lamp Yojana," which will replace all incandescent bulbs in the residential sector with compact fluorescent lamps. The price differential will be recovered by the sale of carbon credits. It is estimated that this will reduce 24 million tons of $CO_2$ annually.

In 2007, the Energy Conservation Building Code was introduced, initially on a voluntary basis, to establish energy performance requirements for commercial buildings with loads of 500 kW and above.

The National Tariff Policy (2006) implemented a higher tariff base for consumers with a large demand (for example, in excess of 1 MW). States like Assam and Orissa have also come up with state-level tariff policies to complement the central government efforts.

## Transportation

Vehicles - The National Auto Fuel Policy (2003) mandated that all new four-wheeled vehicles in eleven cities meet Bharat Stage III emission norms for conventional air pollutants, (similar to Euro III emission norms), and comply with Euro IV standards by 2010.

The largest urban fleet of compressed natural gas (CNG) vehicles was introduced in New Delhi and Mumbai to reduce pollution and increase energy security. In New Delhi alone, 106,000 vehicles, including all buses, taxis and three-wheelers, were converted from gasoline or diesel to CNG. Vehicles in cities like Vadodara, Surat, Ankleshwar and the state of Maharashtra also have been converted. This combined effort resulted in the conversion of 375,000 vehicles by March 2007, with three-wheelers forming the largest share (64%).

Mass Transit - The Delhi Metro subway system began construction in 1998 and will cover the entire metropolitan region by 2021. Currently, only Phase I has been completed, with daily ridership projected to reach 2.6 million by 2011. The Bangalore Metro Phase I is expected to be operational by 2011 and projected to provide transportation for one million passengers per day.

The National Urban Transport Policy (2006) and the National Urban Renewal Mission provide funding for development of mass transit strategies for cities. Currently bus rapid transit systems are functional in the city of Indore and are being tested in Delhi.

## Biofuels

The Ministry of Petroleum and Natural Gas is implementing a mandatory program for the introduction of ethanol-blended gasoline (5% gasohol) nationwide by April 2008. However, due to fluctuations in the supply of ethanol, the program is currently running behind schedule. The Biodiesel Price Policy (2005) fixed the initial purchase price of biodiesel at Rs.25/liter (~60c/liter). The government is formulating a national policy on biofuels to introduce financial incentives, develop R&D for production and commercialization of ethanol and jatropha, and establish a national biofuel development board.

## Forestry

In 2005, the forest and tree cover in India was 24%.[17] The 11th Five Year Plan proposes an increase in the forest and tree cover of 1% a year through 2012. In 2007, the Prime Minister announced the Green India program to reforest 6 million hectares of degraded forest lands.

## References


[1] Data from IEA, 2007. "$CO_2$ Emissions from Fossil Fuel Combustion 1971-2005"; IEA, 2007. "World Energy Outlook 2007: China and India Insights" and USEPA, 2006. "Global Anthropogenic Non-$CO_2$ Greenhouse Gas Emissions: 1990-2020". All emissions figures are for total greenhouse gas emissions as estimated by the International Energy Agency ($CO_2$ from fossil fuels), the US EPA (other greenhouse gases) and the World Energy Outlook (projections), except for GHG emissions by sector which rely on these same sources but are estimated by Ecofys, 2006 in this report: http://www.ecofys.com/com/publications/documents/Ecofys_Factors_underpinning_future_actionOct2006.pdf. Charts on page 1 use 2005 data.

[2] Government of India, 2008. "National Action Plan on Climate Change". Prime Minister's Council on Climate Change

[3] The compounded annual growth rate for the world in the same time period was 1.3%. Data from IEA, 2007. "World Energy Outlook 2007: China and India Insights". International Energy Agency

[4] Planning Commission, 2006. "Integrated Energy Policy Report of the Expert Committee". Government of India

[5] Data as of 14th July 2008. Data from Capacity Development for the CDM, available at http://www.cd4cdm.org

[6] Data as of 14th July 2008. Data from UNFCCC CDM Statistics, available http://cdm.unfccc.int/Statistics/Registration/AmountOfReductRegisteredProjPieChart.html

[7] IGES, 2008. "CDM Country Fact Sheet: India". Institute of Global Environmental Strategies

[8] Unpublished analysis prepared for Ministry of Environment and Forests, 2005

[9] Economic policy in India is implemented through five-year plans which are developed, executed and monitored by the Planning Commission. The five-year plans are focused on strong GDP growth rate, though recently other targets for economic performance, for instance education and health services, have been included. The most recent 10th Five Year Plan (2002-2007) aimed at a GDP growth rate of 8%. The 11th Five Year Plan (2007-2012) is currently being developed and the working group papers are available. The fact sheet uses both the 10th Five Year Plan and the 11th Five Year Plan working group papers as reference.

[10] Government of India, 2008. "National Action Plan on Climate Change". Prime Minister's Council on Climate Change

[11] Ministry of New and Renewable Energy, 2007. "Annual Report 2006-07". Government of India

[12] Ministry of New and Renewable Energy, 2007. "Annual Report 2006-07". Government of India

[13] Solar PV Technology Programs apply to Solar Street Lighting Systems, Solar Lanterns, Solar Home Lighting Systems/Solar Home Systems, Stand-alone PV Power Plants, Solar PV Water Pumping systems and other applications of PV Technology including new applications.

[14] This category includes industries, hospitals and nursing homes, government buildings, educational institutions and corporate and residential buildings, having an area of 500 sq m. and above.

[15] Government of India, 2008. "National Action Plan on Climate Change". Prime Minister's Council on Climate Change

[16] As of 31st December 2006. Ministry of Power, 2007. "Report of the Working Group on Power for Eleventh Plan (2007-2012)" Volume II. Government of India

[17] Ministry of Environment and Forests, 2005. "Forest Survey of India". Government of India



This fact sheet has been prepared in collaboration with The Energy and Resources Institute (TERI) in New Delhi, India.



Pew Center on Global Climate Change
2101 Wilson Boulevard
Suite 550
Arlington, VA 22201 USA
Phone: +1-703-516-4146

www.pewclimate.org

The Energy and Resources Institute (TERI)
Darbari Seth Block, IHC Complex
Lodhi Road
New Delhi 110003 INDIA
Phone: +91-11-24682144

www.teriin.org