INTERNATIONAL DEVELOPING COUNTRY ANALYSIS AND DIALOGUE

INDIA FACT SHEET

Analysis of GHG Emissions for Major Sectors in India: Opportunities and Strategies for Mitigation

Integrated Research and Action for Development (IRADe)

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Center for Clean Air Policy

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Introduction

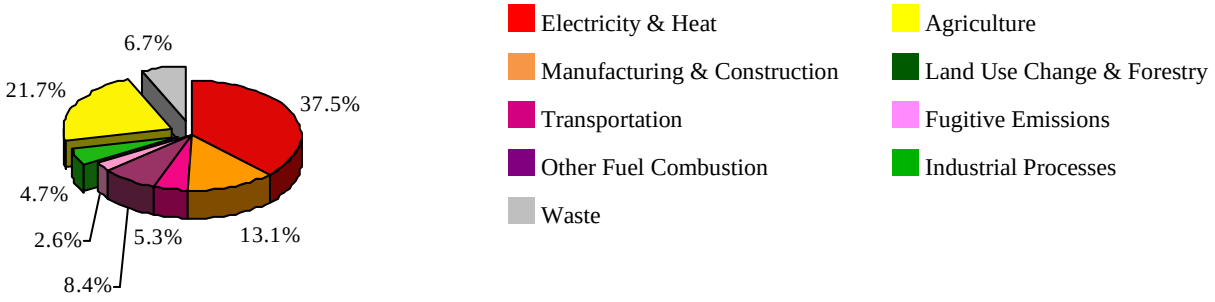
The Center for Clean Air Policy (CCAP), in cooperation with policymakers and researchers in Brazil, China and India, has completed the analysis of mitigation and policy options in all three countries in the context of Phase II of the *Assisting Developing Country Climate Negotiators through Analysis and Dialogue* project.

In Phase I of this project, CCAP and its research partners conducted in-depth analyses of the electricity, iron and steel, cement, transportation, forestry and other sectors. This involved estimating business-as-usual (BAU) emissions for each sector through 2030, evaluating the emissions reduction potential and implementation costs of a variety of mitigation options, and developing recommendations for the realization of important mitigation opportunities. During Phase II of the project, some of the most promising of the Phase I options for GHG mitigation were selected for further evaluation, and a detailed analysis was conducted on issues associated with the implementation of each option. The most suitable mitigation options were selected keeping economic viability, environmental benefits, technical feasibility and infrastructure requirements in mind. The Phase II analysis included identification of barriers to deploying each of these mitigation options (financial, technical, administrative, legal, etc.), elaboration of policies to overcome these barriers, identification of key actors that would be involved, estimation of potential emission reduction where appropriate, and the potential role of international assistance where feasible.

Brief statistics on energy intensive industries in India

- Electricity generation - India ranks fifth in the world in terms of installed capacity and accounts for about 4% of the world's total annual electricity generation. Coal contributes to 66% to the electricity generation and will continue to dominate India's electricity generation capacity mix.
- Electricity Demand - India's per capita electric consumption is approximately 650 kWh per person; well below the world average of 2,500 kWh. If India continues with sustained economic growth, achieving 8-10% of GDP growth per annum through 2030, electric supply alone will need to grow 500% to 700% to meet future electric demand.
- Iron & Steel - India is fifth largest producer of steel accounting for 4% of global production. Per capita steel consumption in India is only 40 kg and in rural area average per capita steel consumption is only 2 kg – compared to global average of 150 kg (Note: exports are less than 10% of production).
- Cement - India has a per capita consumption of only 125 kg compared to China, South Korea and Thailand, with a per capita consumption of 800 kg, 960 kg and 450 kg respectively (Note: exports are less than 5% of production).

India's Emission Profile[1] *(by sector in 2005)*



[1] Emissions data are taken from the World Resources Institute's Climate Analysis Indicators Tool (CAIT) Version 6.0.

Summary of Phase I results [(a)]

Sector wide emissions in 2020	Pre-2000 Policy Scenario / Reference ($MMTCO_2$) [(b)]	Recent Policy Scenario (Unilateral) [(c)]	Advanced Options Scenario [(d)]
Electricity	952	-12%	19%
Cement	334	-1%	3%
Iron & Steel	317	5%	10%
Pulp & Paper	12	-8%	25%
Transport	644	15%	28%
Residential	76	-5%	-5%
Commercial	18	0%	0%
Total	**2,353**	**0%**	**17%**

Notes: **(a)** Positive % figures denote emission reductions below reference scenario
(b) "Pre-2000 Policy" scenario considered only policies and programs adopted prior to 2000. For the analysis of mitigation options this scenario was used as the reference scenario.
(c) "Recent Policy" scenario (also called "unilateral actions") which considered the impact with implementation of all policies announced before 2006.
(d) "Advanced Options" scenarios Where appropriate, an analysis was conducted up to four variations of the Advanced Options scenario, based on the potential cost effectiveness (measured in $/metric ton CO2e reduced) of the mitigation measures analyzed. The described Advanced Options scenario considered all feasible (in the team's judgment) mitigation options.

Thus from the Phase I study we deduced that (1) India had taken unilateral policies that will reduce emissions growth significantly in transport (Integrated Transport Policy 2002 & Vision 2020 Transport) and iron & steel (National Steel Policy 2005) sectors while policies in the electricity sector (National Electricity Policy) which focus on increasing supply and per capita usage of electricity would lead to an increase in emissions and (2) with implementation of advanced mitigation options India could reduce emissions by 17% in 2020 compared to the reference scenario; the greatest potential being in transport and electricity sectors (in absolute terms). This analysis does not take into account India's recently announced renewable energy policies and the National Action Plan on Climate Chance (NAPCC) which includes energy efficiency and solar as two prominent mitigation missions.

Summary of Ph II results (time-line)

Sector	Performance of GHG Emission Reduction Policies across Time periods		
	Short Term	Medium Term	Long Term
Electric Supply	C	B	A
Electric Demand	A	A	B
Transportation	A	B	A
Cement	C	A	B
Iron and Steel	C	B	A
(A Best Suited) (B Moderately Suited) (C Least Suited)			

Highlights from results of Ph II study *(excerpts from table below)*

- Electricity Generation - Further development of the IGCC-CCS technology is considered a promising implementation policy taking into consideration all relevant parameters in India, including barriers to implementation, R&D with promotion of international cooperation etc. The most significant barrier is the implementation cost. For instance, the capital costs for IGCC are 1,900-2,000 US$/kW for demonstration projects in India. Other significant barriers include further information and research on geological storage potential. In addition to the need for expanding on the knowledge of available geological and other storage options, it has been identified that the technology is not yet mature and there is not sufficient evidence from current applications. One of the challenges has been in establishing sufficient technological development gateways for local applications that allow technologies to be adapted and used in local applications. A critical mass of such technology development gateways and centres should also be developed and several recommendations within the paper examine how these can be supported.
- Electricity Demand – Increased use of energy efficient appliances and equipment and energy efficient buildings are two of the most promising instruments for reducing the energy intensity in India. This could be supported by policy options tax incentives for manufacturers of efficient products, statutory labeling standards for equipment and incentives for builders of greener buildings. Barriers to adoption of these policies include financial constraints at the government level and lack of consumer awareness.
- Transportation – Introduction of biodiesel in fuel-mix and increased penetration of electric vehicles (EVs) are seen as the two most promising options in the transportation sector. Phasing out subsidies for gasoline, introducing blending standards and establishing financial incentives are possible policy options. Barriers include lack of the required infrastructure, conflict of interest between regulatory and implementing agencies, lack of incentives to domestic financiers and insufficient incentives for the Government to take voluntary action. Regarding EVs, India has many big-medium size cities which are seeing explosive growth in vehicular traffic and usage. Most of the urban travel distances in medium size cities are short and can easily be covered by EVs. More so, the number of para transit and non-motorized vehicles is expected to grow. Hence, EVs are not only viable but can prove useful in creating a cleaner transportation mix in these urban areas. Further technological improvements and higher penetration in both EV technology and infrastructure will improve viability.
- Iron & Steel - The mitigation options considered for India focuses on the use of more energy efficient production technologies and the use of appropriate control processes for iron and steel. In order to overcome the high cost of new technologies (identified as a key barrier) several policies could be put in place including: R&D focusing on improving the quality of steel, training to facilitate resolution of pending technical issues, developing adequate financing mechanisms such as domestic cap-and-trade mechanisms etc.
- Cement – Production of blended cement with higher ratio of additives and waste heat recovery are two promising mitigation actions that have been identified. Some barriers to adoption of these options are lack of trained personnel for modern equipment, non-availability of indigenous technology, huge investment costs and negative consumer perception about blended cement. Recommended policy options to address these barriers are capital subsidies for plant and infrastructure modification, excise and tax concessions for related equipment and increase in consumer awareness.

Summary Table for Ph II study

Sector	*Mitigation options*	*Mitigation Potential*	*Major Barriers*	*Recommended Policy options*
Electricity supply	IGCC-CCS	Conversion of 10% of coal-based power to IGCC plants in 2007 could lead to 4 Mt CO_2e reductions; inclusion of CCS technologies is expected to lead to higher reductions.	• High upfront costs • Lack of domestic capabilities • Lack of information	• Domestic pilot programs • International assistance programs • Capacity building • Fund and technology transfer • Subsidies or tax breaks • R&D
Electricity demand	Energy demand savings from products and equipment	Tax benefits to energy service companies could avoid capacity addition of 9,240 MW	• Insufficient infrastructure for testing of appliances • Reluctance to reduce taxes because of the impact on state revenues	• Products and equipment standards and labeling • Tax and duty exemptions for efficient products and equipment
	Energy efficiency in the Indian buildings sector	Long term (8 yrs) mitigation potential of 457 Mt CO2e /yr	• Huge informal construction sector • Lack of trained personnel	• Building energy codes • Tax incentives • Above-code building labeling
Transport	Expansion of biodiesel use		• Lack of coordination amongst ministries • Insufficient infrastructure • Lack of financial incentives	• Collaborated decision making framework among major players • Collaboration with the Integrated Wasteland Development Programme • Collaboration with other public and private companies • Quality control of fuel blending • Labeling for the feedstock plantation sites • Phasing out of subsidy on gasoline and diesel • Establishing financing mechanisms for plantation and extraction
	Integration of electric vehicles in urban transport	Depends upon vehicle efficiency and electricity generation source	• Insufficient infrastructure • Lack of laboratory facilities for testing EVs • Insufficient funds for urban planning • Lack of designated sites	• Soft loans • Mandatory type approval and conformity of production • Consortium of major players • End-to-end service • Research and development • Exclusive route for electric vehicles • Fuel-switching
Iron and Steel	Energy efficient production and appropriate control processes		• High costs of innovative technologies • Lack of quality raw materials • Stringent IPRs	• Strategy to achieve the objectives of the National Steel Policy • Relation to current policies, processes and trends underway in the country • Research and development focusing on improving the quality of steel • Training to facilitate resolution of pending technical issues

Sector	*Mitigation options*	*Mitigation Potential*	*Major Barriers*	*Recommended Policy options*
				• Developing adequate financing mechanisms
Cement	Production of blended cement with higher ratio of additives/cement		• Market uncertainty due to negative customer perceptions • High investment costs for the transportation, storage and handling of fly ash	• Concessions on excise duties, sales tax exemptions and capital subsidies • R&D • Training programmes for technical staff • Education and public awareness programmes • Promotion of PPC and PSC usage in large construction projects, • Modification of existing construction codes
	Switch to less carbon intensive fuel in kiln		• Modification of existing systems • Huge investment cost for alternative fuel handling • Lack of trained personnel	• Extension programs to facilitate the general use of new (Biomass/less carbon intensive) energy technologies • R&D in new energy technologies • Incentives to local entrepreneurs for the production of biomass energy conversion systems • Training of skilled personnel • Engineering infrastructure for the local production of components and spare parts for biomass and other less carbon intensive fuels.
	Waste heat recovery and utilization		• Non-availability of indigenous technology • Lack of operating experience • Large capital requirements	• Setting up pilot projects on the use of algae as fuel • Capital subsidies and tax exemptions • Guidelines for the treatment, storage & disposal of waste • Development of quality standards
	Energy efficiency & management practices		• Reluctance to invest in efficiency • Lack of incentives or disincentives	• Top management commitment • Energy management cell • Targets and budgets • Fiscal policies (e.g. tax rebates, subsidies) • Benchmarking & Energy audits • Harnessing carbon market opportunities • Good house keeping practices • Regulation and/or standards • Fiscal policies (e.g. taxes, tax rebates, subsidies) • Information dissemination and demonstration and • Research and development

Since 1985, CCAP has been a recognized world leader in climate and air quality policy and is the only independent, non-profit think-tank working exclusively on those issues at the local, national and international levels. Headquartered in Washington, D.C. CCAP helps policymakers around the world to develop, promote and implement innovative, market-based solutions to major climate, air quality and energy problems that balance both environmental and economic interests. For information about CCAP please visit www.ccap.org.

Center for Clean Air Policy

750 First Street, NE • Suite 940

Washington, DC 20002

Tel: 202.408.9260 • Fax: 202.408.8896