

*Draft material for the Mid Term Appraisal
of the Eleventh Plan*

Emissions Intensity of GDP

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Concern with climate change has led to an understandable global concern with the accumulation of CO₂ emissions in the atmosphere as a result of human activity over the centuries. A comprehensive solution to this problem requires limiting the total volume of emissions globally. This in turn requires coordinated action by all nations and especially the industrialized countries which historically are responsible for the overwhelming bulk of accumulated emissions to date. The ongoing negotiations under the UNFCCC are aimed at evolving a satisfactory solution to this problem keeping in mind the universally accepted principle of common but differentiated responsibility and respective ability.

Even as we pursue a satisfactory global solution through multilateral negotiations, we have responded nationally by doing what we can on our own. It is with this end in view that the government launched a National Action Plan for Climate Change which outlines the nationally determined actions we will take to mitigate our own emissions. The implications of these actions can be assessed by considering what they imply for the emissions intensity of GDP, i.e., CO₂ emissions in kg per \$ of GDP.

India's emissions intensity of GDP¹ was 1.785 kg per \$ in 1990. Over the fifteen year period from 1990 to 2005, India's emissions intensity declined by 17.6%, from 1.785 in 1990 to 1.471 in 2005. China's emission intensity also declined in this period from 5.579 to 2.960. The decline in China was faster than in India, but that is primarily because China began from a much higher level. In 2005, China's emissions intensity was more than twice that of India. An inter-country comparison of emissions intensity is given in Appendix A.

During the 15 year period 1990 to 2005, India's economy grew at an annual average rate of 6.1% and emissions intensity declined by 17.6%. The implicit elasticity of emissions with respect to GDP in this period was 0.83. Using this elasticity, and projecting forward for the next 15 years, but assuming a faster GDP growth of 8% per year, **we can expect a further decline in the emissions intensity to 1.216, i.e., a reduction of 17.3% by 2020 from the 2005 base.**

It is worth noting that India's elasticity of emissions was higher than 0.83 in the period 1990-2000, and was only 0.59 in the period 2000-2005, due to improvements in technology, energy mix and energy efficiency in the latter period. Using the elasticity of emissions for the shorter period 2000-2005 i.e., 0.59 to project forward the emissions intensity of GDP would fall by 37% by 2020 from the base of 2005.

A separate analysis done recently by the Planning Commission, Ministry of Environment & Forests and the Bureau of Energy Efficiency suggests that India could expect a decline in emissions intensity of 24% by 2020 from the 2005 base.

It may be noted that China has announced its intention to reduce its emissions intensity by 43 % by 2020 from the 2005 base. If this is achieved, it would reduce China's emissions intensity from 2.960 in 2005 to 1.687. While China's proposed proportional reduction is impressive, China's emissions intensity in 2020 would still be higher than India's level in 2005, and as much as 39% higher than India's target for 2020, even if we only target a decline of 17.3%.

The above projections are based on simple elasticity calculations which assume that we can rely on the same factors that operated in the past to produce the observed elasticity. An alternative approach is to project emissions intensity by using an economy-wide model in which the growth of energy demand is endogenous, taking account of a number of interactions which determine the energy mix, the level of investment, the growth rate and the consequent emissions level.

Percentage reduction in
Emissions intensity

NCAER CGE Model	39%
TERI MoEF Model	31%
IRADE Model	33%
McKinsey	26%

The potential reduction levels projected by the models are much higher than the simple elasticity based projections from past experience because they assume conscious policy action in a number of areas such as a faster shift to hydro and nuclear power and other action to improve energy efficiency. These include mandatory fuel efficiency standards, mandatory energy conservation-compliant building codes, mandated minimum contribution of renewables (excluding hydel) to our energy mix, mandated minimum contribution of clean coal to our domestic coal-based power generation, greater use of methane reducing technology in agriculture, increasing the value of carbon stocks stored in India's forests, and reduction in the overall energy intensity of the economy.

All the above initiatives are derived from existing policy documents, including the Eleventh Five Year Plan, the National Action Plan on Climate Change and the Integrated Energy Policy which was approved by the Cabinet in 2008. All these actions are part of our policy agenda and while some of them may appear difficult, they are not impossible to implement. Indeed, they are necessary to ensure energy security in terms of limiting our dependence on imported energy.

In view of the above, it is reasonable to plan on the basis of a feasible reduction in emissions intensity of GDP of at least 20% and possibly even 25% by 2020 on a 2005 base. With firmer policy action and technological change making the shift to energy efficiency both easier and quantitatively more significant, the outcome could be even better.

Emission Intensity of different Countries - Appendix-A

Year	Canada CO2 /GDP kg/\$	China CO2 /GDP kg/\$	India CO2 /GDP kg/\$	Republic of Korea CO2 /GDP kg/\$	Russian Federation CO2 /GDP kg/\$	United States CO2 /GDP kg/\$
1990	0.738	5.579	1.785	0.823		0.838
1991	0.740	5.368	1.926	0.834		0.832
1992	0.757	4.956	1.928	0.858	4.068	0.823
1993	0.740	4.577	1.909	0.882	4.310	0.826
1994	0.729	4.310	1.892	0.925	4.359	0.805
1995	0.727	4.122	1.876	0.924	4.492	0.785
1996	0.739	3.960	1.845	0.923	4.582	0.784
1997	0.734	3.537	1.820	0.940	4.197	0.765
1998	0.710	3.318	1.766	0.880	4.381	0.739
1999	0.685	2.957	1.714	0.881	4.234	0.714
2000	0.678	2.748	1.684	0.874	3.932	0.711
2001	0.657	2.603	1.730	0.845	3.776	0.707
2002	0.653	2.538	1.672	0.817	3.566	0.693
2003	0.667	2.624	1.594	0.789	3.377	0.685
2004	0.644	3.055	1.546	0.777	3.156	0.669
2005	0.624	2.960	1.471	0.726	2.996	0.652

Emissions intensity is taken as kg of CO2 per dollar of GDP. Emissions data is taken from IEA.
 GDP is taken at constant 1990 prices converted to US\$ at 1990 exchange rates from UN Stats database.
 Source : IRADe Analysis