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This policy brief is part of the CSTEP research brief series. CSTEP policy briefs are succinct reviews of state of the art technologies and the options they provide to society.

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In the few days remaining before the UN Climate Change Conference in Copenhagen, there has been a flurry of discussions surrounding climate policy. The US has targeted a 17% reduction in CO₂ emissions by 2020 from 2005 levels, while China has offered to reduce its *carbon intensity* by 40% over the same period. Carbon intensity is equivalent to total CO₂ emissions per \$GDP. After considerable debate among policy makers, the Indian government has announced to cut its carbon intensity by 20-25% by 2020.

Currently both US and China emit more than 6,000 million tons of CO₂ per annum and India about 1200 million tons. With a projected economic growth rate of 6%-9%, and with no action taken, China's present emissions could grow to 13,000 to 17,000 million tons by 2020. However, with their new announcement, Chinese emissions would decline to about 8,000 - 12,000 million tons. Over the same period India's emissions would grow to 2,800 to 4,200 million tons for a 6%-9% GDP growth. This is still lower than the US and Chinese numbers!

Should India feel compelled to react to these announcements? We feel India

should engage and show flexibility in its conventional hard line position. India is in a good bargaining position since its CO₂ intensity and per capita emissions are low; at no point has India shown a dramatic carbon intensive growth. However, India should not feel pressured to compete with China. China's carbon intensity is already higher than India's since it has built hundreds of coal power plants in the last few years. India's position should be based on its current situation and its capacity to undertake emission cuts.

In addition, India's own interest requires it to pursue a less energy intensive growth trajectory that would help sustain its economic growth, ecology, energy security and public health. Moreover, risks of climate change are too high to be ignored. India's growth aspirations and climate mitigation are not mutually exclusive; there is considerable synergy.

What can India offer at Copenhagen? To arrive at a policy, let us take a look at the carbon to GDP intensity. It turns out (look below for the mathematical representation) that this is related to the carbon-to-energy intensity (kg CO₂ per kWh) and the energy-to-GDP intensity (kWh per \$).

$$\text{CO}_2 \text{ GDP Intensity} = \frac{\text{Total CO}_2}{\text{GDP}} = \frac{\text{Total CO}_2}{\text{Primary Energy}} \times \frac{\text{Primary Energy}}{\text{GDP}}$$

Energy GDP intensity (the second term on the right hand side) gives an indication of the technological maturity of an economy; with industrialization and innovation the production processes become more efficient and it takes lower energy to produce the same output. China is a case in point, where the intensity rapidly declined in 1980s. The Indian number is declining at a marginal rate.

Carbon-energy intensity (first term on the right side) illustrates the energy supply options for a country and the extent to which it is dependent on fossil fuels such as coal, oil and gas. This has been relatively flat for all the three countries, China, US and India, in the last decade, which is expected because the energy supply mix doesn't usually change rapidly. In case of France, it changed considerably when the country went for large scale nuclear power.

We propose that India should offer to cut its carbon intensity by 30% by 2030. This is based on the following reasons. As discussed above, energy GDP intensity is already declining at about 1% per annum and the trend is expected to continue for some more time. In fact, India's GDP is growing faster than the primary energy supply. This on its own would reduce the carbon intensity by about 15 – 20% by 2030.

In addition, the government has announced several new programs which could potentially alter the energy

mix and reduce the carbon-energy intensity. The country is now embarking on a major nuclear expansion and several Light Water Reactors are expected to come up in the coming two decades. India never attempted to develop solar technologies in a major way despite the country enjoying abundant sunshine. The recently announced National solar mission thus is a step in the right direction. The target of 20,000 MW of solar power by 2022 may appear ambitious, but the mission should be implemented with vigor. It could transform India into a global manufacturing hub for solar technologies. Energy efficiency improvement in industries such as steel and cement and demand side management measures can considerably reduce the emissions. Efficient mass transportation and limit on private transportation will not only alleviate traffic woes but would also curb urban pollution and reduce our dependence on fossil fuels. Similarly, electric power operates with over 30% transmission and distribution (T&D) loss. It is estimated that even 1% reduction in T&D loss would avoid the need of an additional 1000 MW coal power plant.

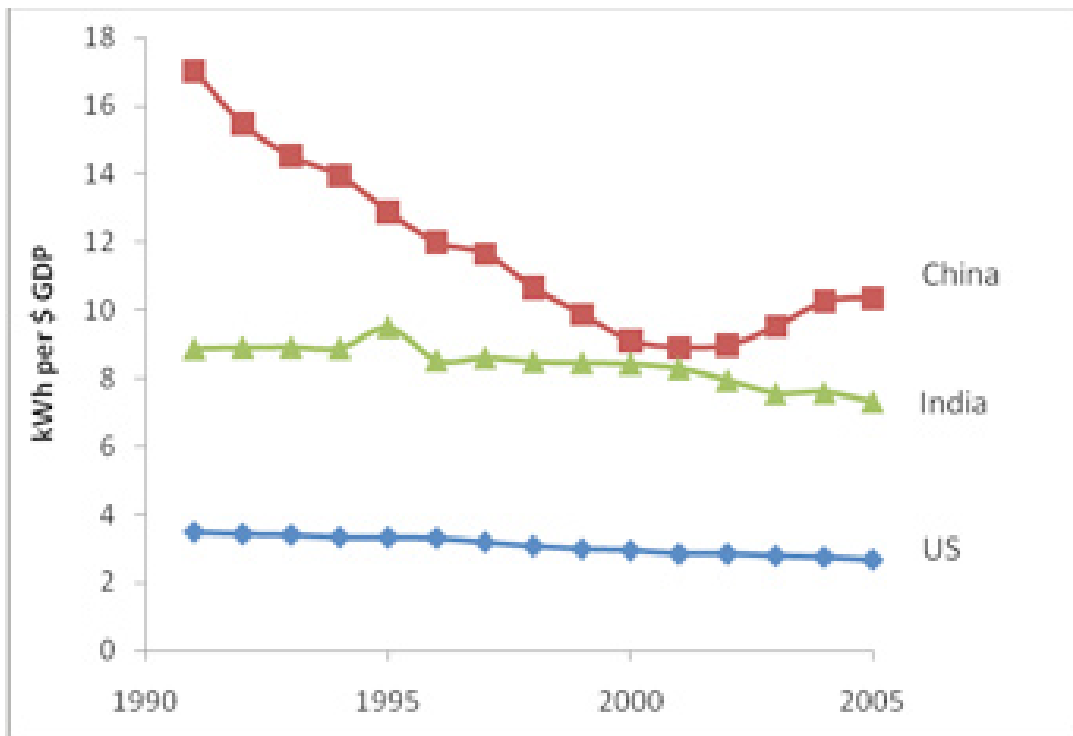


Figure 1: Energy intensity (Total primary energy consumption per \$ GDP, using market exchange rates, kWh per (2000) US \$)

The above measures could reduce India's carbon intensity by about 30% without imposing significant cost to the economy, but would require meticulous planning and implementation. This would translate into an actual reduction of 500-1000 million tons of CO₂ per annum. It would at least be a few years before the impact of the policy measures becomes visible. Therefore, the time frame required for 30% reduction should be 2030 and not 2020 as in China's announcement.

We believe that this provides India an opportunity to chart a new development trajectory for its own good and global welfare.