Identifying Viable Options in Developing Countries for Climate Change Mitigation: The Case of India

By Varun Rai and David G. Victor*

One of the most contentious issues in diplomatic efforts to cut global emissions of warming gases is the effort expected of developing countries. The "Bali Roadmap," which set the agenda for the Copenhagen climate summit, envisioned that that developing countries must make efforts to control growth in their emissions.[1] Yet those countries have many other priorities, and schemes such as the Clean Development Mechanism (CDM) that help them pay the cost of warming policies have proved cumbersome and often ineffective. Yet pressure for some kind of action is growing, and the major developing countries—such as Brazil, China, India, Indonesia and South Africa—are all responding by offering various proposals that would lower growth in these emissions. In this paper we focus on India and we develop a general framework for assessing whether the policies offered are credible.

India has crafted a national action plan on climate change (NAPCC), which provides the roadmap for India's climate-change policy. Specifically, it lays out eight national missions as the way forward:[2] national missions for solar energy, energy efficiency, sustainable habitat (public transport; building codes), water, Himalayan ecosystem, Green India (aforestation), sustainable agriculture, and strategic knowledge for climate change. The NAPCC is a positive first step in India's efforts to combat global climate change. The NAPCC is comprehensive in ambition—the agenda it sets for the eight national missions is wide-ranging. These missions span actions that are cost-effective and ready for implementation to those that are difficult to see achieved in practice. But the real opportunity each of the mission areas provide as a viable and a valuable response varies. In the eyes of India's foreign-policy partners, it is hard to assess the real leverage that the NAPCC will have on the country's GHG emissions.

While these proposals have been welcomed by climate change diplomats, the more fundamental questions remain unanswered? Are such proposals credible, and what can the rest of the world—including the western countries most worried about global warming and willing to compensate developing countries for the cost of extra effort—do to encourage the policies at a greater scale? Here we lay out a framework that allows answers. We also highlight an array of Indian policy options that are not only materially relevant to climate change but are also feasible to attain.

Framework for India's Engagement: Interests, Capabilities, and Leverage

We suggest that the only serious and viable approach for India's engagement in global efforts to tame global warming is one that aligns with India's own core interests. Those interests are complex, but at their core are the goals of economic development and energy security.

All domestic and international strategies involving India must realize these core interests (shown on the horizontal axis in Figure 1) as boundary constraints on what India is willing to offer as part of its contribution to climate change. The vertical axis in Figure 1 shows the potential for CO_2 reductions. At the bottom of the chart (Boxes III and IV) are options with small or negative CO_2 reductions (i.e., large emissions)—these options offer no leverage in international climate-change negotiations. At the bottom left of the chart (Box III) are options that do not interest India—they are irrelevant to the discussion in this paper. The options at the bottom right (Box IV), where India's interests are high, may be irrelevant; or they may be potentially harmful for climate change (for example, coal-to-liquids projects pursued under the umbrella of energy security). At the left side of the chart (Boxes I and III) are options that fail the condition that they be seen in India's interest. The interesting box is the upper right (Box II)—also known in global-warming policy parlance as "co-benefits."

Thus India's search for a strategy must begin with Box II. But not all options in Box II are equal. Some options exist in theory but will be difficult to implement; those options will be viewed as much less credible (and thus less effective as part of India's strategy to engage with the world). As other countries look at India's choices, there is much discussion about effectiveness, efficiency, and equity of climate-change policies,[3] but real progress in forging successful alliances for concrete action is often crippled by doubts about what parts of the strategy can be successfully implemented in the Indian context.[4] Irrespective of what India promises, only those promises will be valuable bargaining chips where the central government (the negotiator) *is seen* by outsiders to have real influence.

Figure 2 unpacks Box II and explores two major dimensions to the credibility

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See footnotes at end of text.

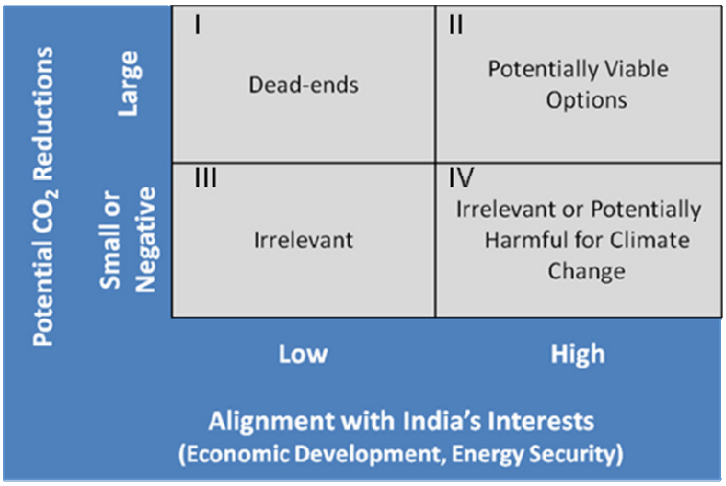

Figure 1: Framework for evaluating the viability of India's energy options as a credible response to climate change. The potentially viable options are in the upper right corner (Box II). The structure of Box II is further unpacked in Figure 2.

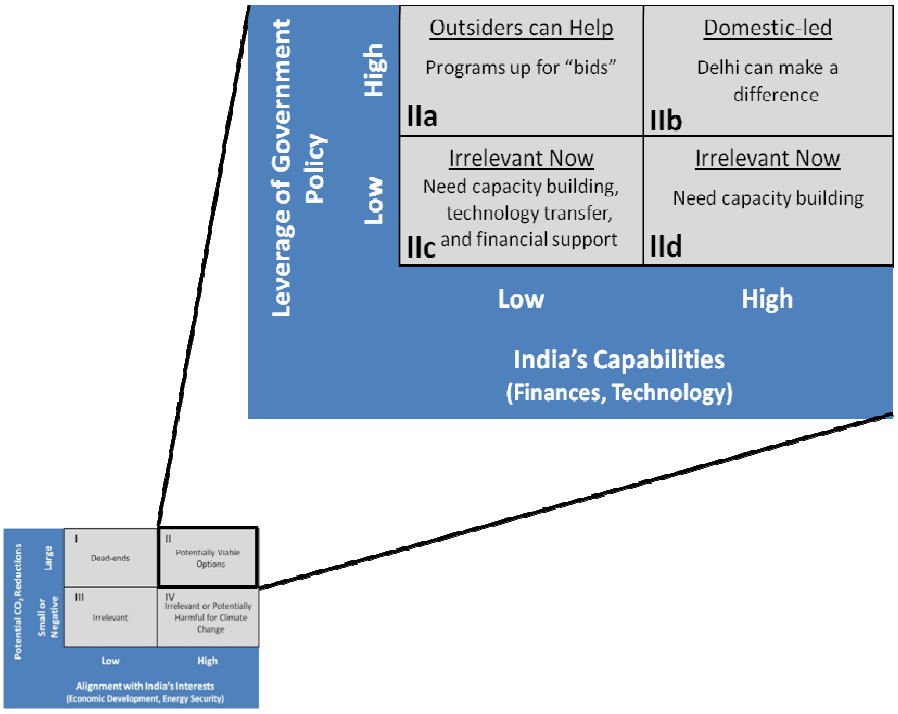

Figure 2: Exploring Box II of Figure 1 in more depth: Leverage inside and outside India

of the options that India can choose. On the vertical axis is the government of India's (GoI) ability to administer policy. Across many areas of policy, GoI is unable to have much influence over what really happens in India—those areas of policy include topics for which competence is given to India's states through its federal system as well as areas where the central government does not have the administrative capacity to have much impact on outcomes. The options at the bottom of Figure 2, though they become viable options over time as the leverage of GoI's policy increases, are irrelevant now. The viable options for India's engagement, then, are those where the ability of GoI to make promises that it can actually deliver is high. Those are shown in Boxes IIa and IIb. Of those options, one more level of unpacking is needed. For some issues the government, state firms and the private sector have all the capability needed. For example, with technology already available to Indian firms it would be possible and cost-effective to make fuller use of natural gas or to shift to more efficient technology for new coal plants. These options are shown on the upper right side (Box IIb). For other options, outsiders may need to help—by providing technology or finance to make viable options that are not otherwise available (Box IIa).

This framework, then, transforms the debate about what India can and should do to mitigate emissions. India, working alone, can make credible offers to the international community in Box IIb. And the international community, working with India, can make options in Box IIa viable.

Making Boxes IIa and IIb Real: Some Concrete Suggestions for Action

Contrary to the view maintained that costs of mitigation will be very high for India (thus violating India's growth plans) we argue that there are several options available in India for large-scale CO_2-emissions reductions that satisfy the viability conditions discussed above. Among other opportunities in India, power-sector reforms and efficiency of coal-fired power plants are ripe candidates for immediate action. These are discussed below.

Power-Sector Reforms

India has struggled to provide reliable electricity supply to its population. Hundreds of millions in India still have no electricity, and those with electricity have unreliable access, usually only for a few hours per day. A major issue is the widespread theft of electricity by end-users. Every year about a third of the net electricity produced in India goes unaccounted—that is, the power is generated by there is no revenue generated. A large fraction of that is theft, along with poor technical management of the power supply system. Although India has initiated programs to improve the electricity situation, the progress

has been slow and limited to very few areas. For example, in Delhi, the use of advanced technology in power delivery and metering, as well as commercial incentives to power distributors has brought down the losses in the low-voltage electricity distribution from nearly 50% to 20% of the net supply in just five years.[5] A completely unintended, nevertheless quite relevant to the climate change discussion, consequence of the Delhi reforms have been a significant reduction in growth rate of electricity demand, and hence, in CO_2 emissions. Rationalization of tariffs and stricter compliant mechanisms mean that the end users are now exposed to the true cost of power greater than ever. As electricity distributors have used innovative technologies to crack down on theft, electricity demand in Delhi has grown much slower in the last 5 years (i.e., post reforms) than in the pre-2003 state-of-affairs (Figure 3), despite a much stronger economic growth in Delhi post-2003.

Our calculations indicate that power-sector reforms similar to Delhi, if replicated across India could lower India's CO_2 emissions between 200 and 250 Mt CO_2/yr by 2017. This is equivalent to nearly 50% of India's total power-sector emissions in 2007 (520 Mt of CO_2)[6] and about 6% of Europe's total emissions in 2006.[7] Clearly, power-sector reforms will have a significant developmental impact in India by improving the access and reliability of the electricity system. From a climate-change perspective, an Indian electricity system with system losses at par with the developed world allows for an accurate accounting of baseline emissions from India's power sector. Outsiders could help by co-funding efficiency improvement programs on a large scale across India. India could also be engaged early on in international efforts on advanced local-grid management systems that could enable further technical efficiency gains in India, under its "electricity for all by 2012" program.

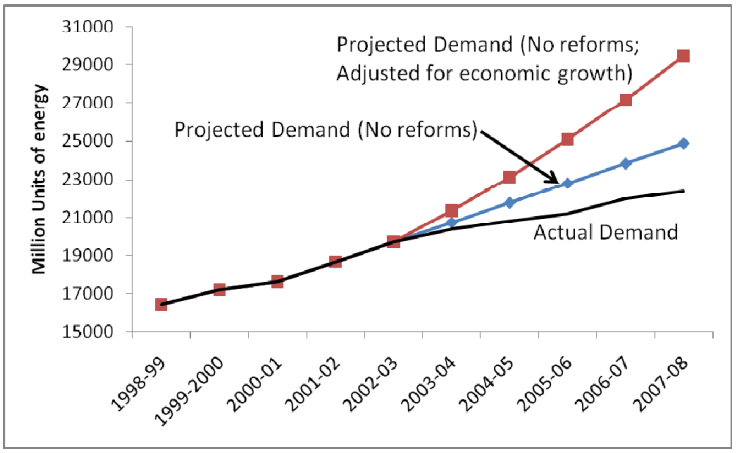

Figure 3: Impact of power-sector reforms on electricity demand in Delhi.

Efficiency of Coal-based Power Generation: The Indian Coal-Efficiency Program

India's coal-based power generation fleet is also a very conducive candidate for policies that align India's national interest with the global interest of reducing the growth in CO_2 pollution. As in the past, cheap and abundant coal remains India's fuel of choice for expanding its energy supply to fuel continued economic growth. But commercial inefficiencies (price distortions) and infrastructure bottlenecks (poor technology, freight problems, environmental clearance) in coal production have accentuated the cracks in India's coal supply chain.[8] Consequently, India's coal imports have risen significantly in the last few years, and India will likely import large quantities of coal by 2030 (Figure 4).[9] India recognizes its precarious coal situation, and there is a strong interest in India for using coal more efficiently. Search for those improvements must start in India's coal-based power generation, which accounts for over two-thirds of India's coal consumption. India has initiated programs to induct more efficient, supercritical coal units, but technology has been a major roadblock. While the best coal plants in the world now approach 50% efficiency, India's first supercritical coal unit with an efficiency of about 40% will start operations only later this year. Although supercritical coal plants have been in use in the developed world since the 1960s, India is just starting its coal-efficiency efforts, and is years away from developing the technology cost-effectively at home. In the context of the framework presented above, India could propose an India coal-efficiency program to deploy coal-fired power plants with advanced supercritical units. The specific goal of the program could be to lift India's average coal-combustion efficiency from 30% to perhaps 40% over two decades. Developed countries will be a critical part of such a program both to support India with the necessary technology and with financial help where necessary. The specifics of the technology and financial support package can be part of a bi- or multi-national international deal. The benefits of such a program for coal demand and installed power-generation capacity—issues close to India's core interests—are staggering: compared with the business-as-usual scenario, in the proposed program coal demand will be lower by about 250 Mt/yr and the required installed capacity will be lower by about 90 GW by 2030. (For comparison, India currently consumes about 500 Mt of coal per year, 10% of which is imported; and India's total installed power-generation capacity is about 170 GW.) Looking to 2030, such a program could reduce India's emissions by about 400 Mt CO_2/yr below the business-as-usual emissions. Further, the program could also emphasize the early deployment of ultra-supercritical plants—the

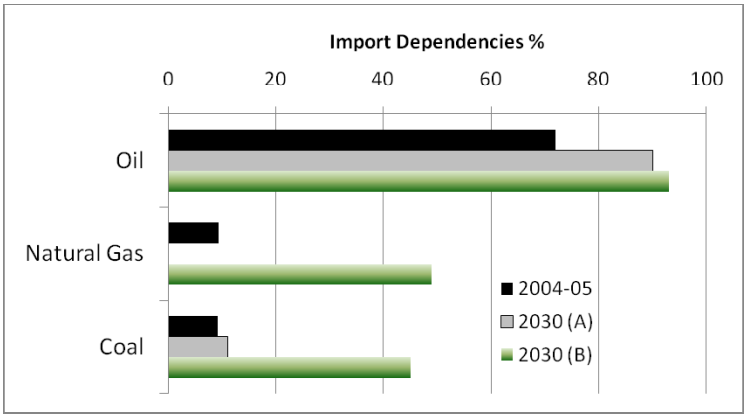

Figure 4: Import Dependencies. Scenario A: Minimum requirement, maximum domestic production. Scenario B: Maximum requirement, minimum domestic production. Source: Integrated Energy Policy, Government of India, April 2006.

most efficient commercially available coal plants—to create learning and expertise with this technology, which will build the platform for further emissions reductions in future. Achieving these higher efficiencies, especially for new plants, then, offer a tremendous win-win opportunity for India's developmental goals and for helping the creation of a transparent global climate-change regime.

Beyond Boxes IIa and IIb: Building Capability and Credibility

When planning international engagement strategies the key questions always hinge on credibility and enforcement—problems that are much more readily solved when the contributions of each country are broadly seen in that country's self interest. India's decision about what is in its interest depends on and varies with India's technological and administrative capabilities. India and outsiders can, together, shift that equation so that, in time, options that are "irrelevant now" (Figure 2) are transformed into viable options (Box IIa and IIb, Figure 2). That matters because it creates a greater potential for leverage on the climate problem and because it makes more of that leverage directly in India's interest. A couple of possibilities are outlined below.

Advanced Technologies and R&D

Cutting-edge technologies like carbon capture and storage, fuel cells, solar photovoltaic (PV), which are also very expensive, will not make a significant difference in developing countries from a climate-change viewpoint in the next two to three decades. India must facilitate demonstration projects at home and participate in international research efforts. But that should be part of a long-term innovation strategy (supported with domestic institutional continuity), and not a medium-term strategy as a viable response by India. New technologies will lead the warfront against climate change. EU, Japan, and U.S. recognize this well, and have been most aggressive in incentivizing inventions in green technologies since 1991. Historically too, just a handful of countries have led most of world's R&D efforts: only ten countries spend more than 90% of global R&D expenditure (Figure 5).[10] Success in technological inventions requires more than mere spending. It requires a robust national system of innovation with a long-term vision that closely integrates and coordinates basic R&D expenditure (mostly by the government) with commercial R&D through favorable policies to pull these technologies in the marketplace. In India, except matters related to national-defense (aerospace, military, nuclear energy), such vision and coordination has been lacking and the system of innovation has not kept pace with global advancements in science and technology. Indian policymakers recognize this lacuna, and there is increasing emphasis to resurrect technological innovation in India. But even if India fires all R&D cylinders and gets its act together in the next few years, the benefits will not be felt for years to come. Yet, a successful R&D program will be enabling for India to spearhead its own technology-based mitigation response in future.

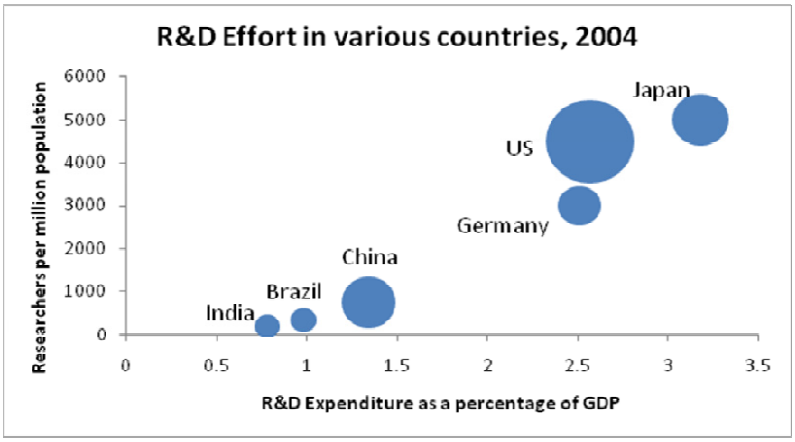

Figure 5: 2004 R&D expenditure of India and some other major countries. Source: EIA, World Bank.

Creating a National Information Administration for Energy

Besides research in energy technologies, economic modeling and forecasting are also important in the planning and negotiation process. So far energy-related data in India are quite dispersed, incoherent,

and often contradictory. This not only hinders serious research on energy economics in India, but also hurts transparency (and hence credibility) of India's planning process in the climate-change arena. Accordingly, we urge the creation of a National Information Administration for Energy (NIAE) that would serve as the central repository of all energy-related data in India.

Conclusion

We have argued that in the Indian context the costs of engagement at the margins are not as high as many think and that the apparent dichotomy between economic growth versus de-carbonization of energy sources is not nearly as serious. Of a number of seemingly interesting options for significant emissions reductions, only those offer real leverage in the climate-change arena that align with India's core interests (economic development and energy security) while also aligning with what the Indian government can implement given its administrative, political, and technological resources. Successful design of such policies will help boost India's credibility and make still deeper cooperation possible in the future. This, we have suggested, is the framework through which all available options should be evaluated.

An important issue not discussed in this paper is the institutional aspect of how these self-interested "offers" (boxes IIa and IIb) could be crafted into international commitments/deals. In our view, key developing countries could make offers of what they would do on their own (IIb) and what they would like to have help for (IIa) and then negotiations would craft deals of those two elements plus outside support. As IIa would be contingent on that support, the program would be largely self-enforcing. A good model is WTO.[11]

Footnotes

[1] Bali Action Plan, Decision -/CP.13, UNFCCC, 2007. Particularly see item 1b, p.1: "Enhanced national/international action on mitigation of climate change", http://unfccc.int/files/meetings/cop_13/application/pdf/cp_bali_action.pdf

[2] National Action Plan on Climate Change (NAPCC), Government of India, June 2008. Available at http://pmindia.nic.in/Pg01-52.pdf

[3] (i) Climate Change Mitigation and Sustainable Development, Background Paper, TERI, New Delhi, India (ii) Adger, W. N. et al., "Successful Adaptation to Climate Change across Scales", Global Environmental Change, Vol. 15, 2005.

[4] Victor, D. G., "Climate Accession Deals: New Strategies for Taming Growth of Greenhouse Gases in Developing Countries",PESD Working Paper #82, Stanford University, January 2009.

[5] Source: Central Electricity Authority (CEA), India and Delhi Electricity Regulatory Commission (DERC), http://derc.gov.in

[6] CO_2 Baseline Database, v4. Central Electricity Authority (CEA), Government of India, September 2008.

[7] World Energy Outlook 2008, IEA.

[8] Carl, J. C., Rai, V, and Victor, D. G., "Energy and India's Foreign Policy", PESD Working Paper #75, Stanford University, May 2008.

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

[10] Dooley, J. J. and Runci, P.J., "Adopting a Long View to Energy R&D and Global Climate Change", Prepared for U.S. Department of Energy, February 1999.

[11] Victor, D. G., "Global Warming Policy After Kyoto: Rethinking Engagement with Developing Countries", PESD Working Paper #82, Stanford University, January 2009.