

COUNTDOWN TO COPENHAGEN**STANFORD PROGRAM ON ENERGY AND SUSTAINABLE DEVELOPMENT PRESENTS ...****Promoting Clean Development
Competing Market Mechanisms Post-2012****VARUN RAI**

According to climate scientists, averting the worst consequences of climate change requires that the increase in global temperature should be limited to 2°C (or 3.6°F). To achieve that objective, global emissions of green house gases (GHGs)—the main human cause of global warming—must be reduced to 50 percent of 1990 levels by 2050.

The key to successful climate change abatement at those scales lies in leveraging the collective actions of developed and developing countries. Cumulatively, developed countries have been responsible for most human emissions of GHGs. That picture will be quite different in the future as emissions from the developing world take over the top mantle. Given this dynamic, there is a general agreement internationally that developed countries will lead emissions reductions efforts and that developing countries will follow with “nationally appropriate mitigation actions.” Turning that agreement into environmentally beneficial action requires close international coordination between the developed and developing countries in allocating the responsibility for the necessary reductions and following up with credible actions. However, the instruments employed so far to promote the necessary collective action have proved to be insufficient, unscalable, and questionable in terms of environmental benefit and economic efficiency.

Currently, the most important and visible link between developed and developing countries’ efforts on climate change is the Clean Development Mechanism (CDM). The CDM uses market mechanisms—the “car-

bon markets”—to direct funding from developed countries to those projects in developing countries that lead to reductions in emissions of warming gases. In reality, the experience with the CDM has been mixed at best since its inception in 2006. While the CDM has successfully channeled funding to many worthy projects that reduce emissions of warming gasses, it has also spawned myriad projects with little environmental benefits. Overall, the CDM has led to a significant overpayment by developed countries for largely dubious emissions reductions in developing countries.

As the world enters a new phase of large-scale climate change abatement efforts, it is imperative to motivate and persuade developing countries to take action on climate change, while providing the additional funds where necessary. It is increasingly clear that the CDM is not an effective instrument for engaging developing countries in climate change efforts. When climate change negotiators from around the world get together in Copenhagen in December 2009, one of the key discussion items will be the future of the Clean Development Mechanism (CDM). Those negotiations will aim to design a new framework that retains CDM’s positive traits while addressing CDM’s fundamental limitations. Research at the Program on Energy and Sustainable Development (PESD) at Stanford University and other institutions across the globe show the need to reduce reliance on CDM-like mechanisms that promote perverse incentives while introducing new mechanisms that incentivize long-term changes in the emissions trajectories of the developing countries. PESD researchers have proposed a new framework, called the Climate Accession Deals (CADs), for incentivizing developing countries to take environmentally beneficial actions. The fundamental idea of the CAD framework is to find synergies between climate change benefits and the core interests—economic growth and energy security—of developing countries. Working to exploit those synergies, CADs include bi- or multi-lateral deals between developed and developing countries for effective action to mitigate climate change.

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A Chinese man and his son ride past a cement plant in Baokang. The cooperation of China and other developing countries is essential to mitigating climate change, but developed countries must offer meaningful incentives to reduce emissions.

CDM as an Emissions Offset Mechanism

Within the Kyoto Protocol—the existing international climate change regime that is set to take a new shape after 2012—developed countries can emit more than their GHG emissions caps if they can offset those extra emissions by achieving emissions reductions in developing countries. CDM is such an offset mechanism and is the only mechanism in the Kyoto Protocol involving developing countries. Admissible emissions reductions in the developing countries are granted Certified Emissions Reductions (CERs) by the CDM Executive Board, a United Nations body. Once granted, CERs achieve status as a legal tender, quite similar to the legal guarantee enjoyed by international currencies; this has prompted the phrase, “A CER is a CER.” If developed countries emit more than their caps allow, they can meet their obligations through the purchase of CERs in international carbon markets. Just as the price of a commodity depends on the balance of supply and demand, the price of CERs depends on their supply from developing countries and their demand by developed countries. Likewise, just as the least-cost producer of a commodity is the most profitable, the least-cost supplier of a CER has the highest incentive to supply the CERs. Thus, in theory, the CDM incentivizes the least-cost GHG reductions in developing countries.

Not all climate-friendly projects in developing coun-

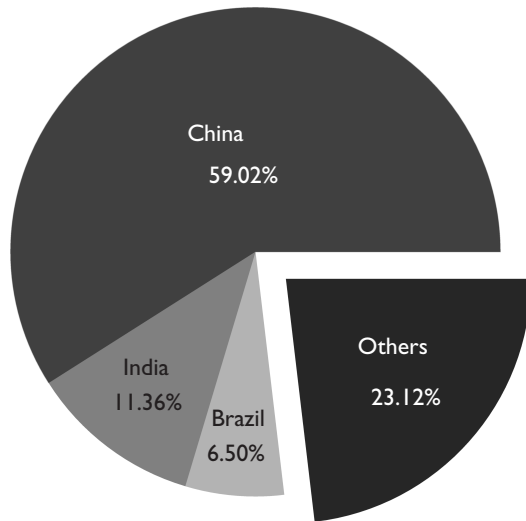
tries qualify for CDM funding. Indeed, projects that are commercially profitable without CDM funding do not qualify for such funding; these projects will occur anyway. For example, new equipment that boosts the efficiency of the manufacturing process at an existing facility may lead to high enough cost savings to justify the installation of the equipment. In this case, even though the improved efficiency is environmentally beneficial, CDM funding will not be available, because an a priori economic incentive exists. In other words, the CDM intends to grant CERs only for projects that represent emissions reductions that would not have happened without the sale value of the CERs. Such reductions are called additional reductions. In contrast, reductions inherent in the normal developmental course of countries’ baseline emissions are “anyway” reductions. Developed countries emit more GHGs domestically by an amount equal to the volume of CERs traded through the CDM. Thus, if projects in developing countries that do not in fact represent additional reductions nonetheless generate CERs, then the end effect will be more emissions than allowed by the caps. Thus, ensuring the additionality requirement is fundamental to the use of the CDM in an environmentally responsible way.

Perverse Incentives and Transaction Costs

While the logic behind the CDM is great in theory,

Certified Emissions Reductions

Distribution of Expected Annual CERs from Registered projects by Country



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UN Framework Convention for Climate Change, 2009

the CDM's incentive structure is fundamentally problematic. Because all CERs are legally valid and therefore equal, there is little incentive for buyers, who are only interested in purchasing CERs at the lowest prices, to ensure that CERs come from genuinely additional reductions projects. Thus, the quality of the CERs is largely irrelevant in the existing CDM framework. The CDM quality problem is even worse on the supply side. For the suppliers of CERs, withholding information about project costs and baseline emissions can only increase the chances of being awarded the CERs. Thus, CDM rewards and incentivizes the ability to portray "anyway" reductions as additional reductions.

The perverse incentive is most glaring in the case of HFC-23, a very potent warming gas produced as waste during the manufacturing of another gas, HCFC-22. Because HFC-23 is over 10,000 times more potent than CO₂ in greenhouse-warming potential, projects capturing HFC-23 generate large volumes of CERs: every tonne of HFC-23 is roughly equivalent to 10,000 tonnes of CO₂ and hence generates about 10,000 CERs. Because the sale value of the CERs from HFC-23 capture projects dwarfs the market value of HCFC-22, the core product of these businesses, there is a great incentive to overproduce HFC-23. Not surprisingly, so far CERs from HFC-23 capture projects account for nearly a third of total granted CERs. In another case, nearly all of China's new gas-fired power plants are applying for CERs, even though China's local pollution problems and burdened coal supply chain provide great incentives to build those gas plants anyway. Furthermore, the issue of perverse incentives applies not

only at the project level but also at the country level. In order to receive CDM money, countries might delay adopting policies to improve industrial efficiencies, as higher emissions baselines creates opportunities to reap larger CDM funding. Due to these perverse incentives inherent in the CDM, many analysts have seriously questioned CDM's environmental integrity.

Scalability is the other key deficiency of the CDM. Proponents of CDM hoped that market-based incentives would enable CDMs to capture the benefits of a large number of small projects, but huge transaction costs associated with CDM projects have dampened those hopes even at the moderate scales of the CDM market today. CDM projects have to be approved and registered with the CDM Executive Board before they are granted CERs. For each project, however small, the registration process involves a series of protocols and interactions between the project developers and a number of administrative and oversight bodies. These transaction costs of the CDM registration process are significant, and reaching a large number of smaller projects implies the need for additional institutional machinery if the system is not to be bottlenecked, further adding to the transaction costs of the CDM. As Copenhagen negotiators consider more aggressive mitigation for the post-2012 period, when the first commitment period of the Kyoto Protocol ends, the offset mechanisms need to be scalable. The institutional complexity of CDM makes it an unlikely candidate to deliver on that requirement.

To be sure, there are several ways to tweak the CDM process and improve both its efficiency and integrity, but those band-aid improvements will only be marginal. The fundamental limitations of the CDM process, namely perverse incentives and huge transaction costs, will always loom large, thus restricting CDM's utility as a viable post-2012 offset mechanism. Recognizing this, the designers of the post-2012 climate change regime should seek fundamentally different alternatives to the CDM when they meet in Copenhagen this December. Based on research at Stanford University's PESD, below I outline an alternative framework that could serve that purpose.

Addressing the Additionality Problem

The additionality problem of the CDM can be resolved if developing countries are incentivized to reveal their energy-policy priorities and preferences. Transparent, clearly stated, and internationally accepted national energy policies permit a sound estimation of baseline emissions trajectories, which is at the core of the additionality problem. While climate change mitigation efforts of developing countries are critical to the climate change equation, the core interests of economic growth and energy security of those countries eclipse their climate change mitigation action. Our research shows that a sound approach for incentivizing developing countries into environmentally

beneficial action is to look for overlaps between their core interests and environmental benefits.

To do just that, David Victor of the University of California, San Diego has suggested a framework called Climate Accession Deals (CADs). The CADs framework provides the right incentives to elicit necessary information on emissions baselines by exploiting overlaps between developing countries' core interests and environmental benefits. This framework begins with the observation that there are several large "sectors" that align well with the deeper interests of developing countries, but that also provide significant leverage on GHG emissions reductions. Bi- or multi-lateral climate deals between developed and developing countries centered on those sectors could offer developing countries technological and financial support in return for credible climate change action on items agreed upon in the negotiations. As the benefits will be tied to the outcomes, there will be strong incentive to follow up on the promised action.

Each CAD must begin with the initiative of a developing country government. This is necessary for two primary reasons. First, only the government can make credible long-term promises on behalf of its country. Second, only the government can assemble the necessary information about baseline policies, country plans, and the network of domestic actors to put together a viable CAD. As the CADs will be formed around specific sectors, the developing country proposing the CAD must engage the domestic private sector and government ministries operating in that sector. This will be a departure from the CDM, in which the climate change discussions within

developing countries are dominated by environmental and foreign-affairs ministries.

The sectors covered under CADs could be one large project (i.e. an international gas pipeline), a collection of projects (i.e. all coal power plants in a country), or all emissions within a large geographical area, like a city. Several sectors amenable to CAD exist in nearly all developing countries, and there will be no cap on the number of deals a developing country can host. This way, a large part of the energy system in the developing world can be carved out under sectors that are amenable to CADs. In CADs, developing countries' governments will make proposals around those sectors. CAD proposals will include what the developing host country can and will do on its own, such as national policies and institutional support, and where it will need support from developed countries, like in areas of technology and know-how. Negotiations with a developed country, or a group of them, will finalize the deal. CERs may be granted to the host developing country if the performance of the sector exceeds the negotiated baseline. The volume of CERs granted will equal the degree of over-performance. In the CADs framework the incentives for developing countries to reveal information will be twofold. First, countries that become part of the CADs framework will get general benefits in the form of access to carbon markets in developed countries, long-term broad-based technology and R&D support, etcetera. This is similar to the membership benefits of trade-accession arrangements in the World Trade Organization (WTO). Second, each CAD will entail specific benefits for the particular sector covered by the deal. The specific benefits

Climate Accession Deals (CADs) in BRIC Countries

Country	Deal	Description	Carbon Dioxide Savings
Brazil	Improved Monitoring of Hydro Power	Engagement of foreign and Brazilian scientists to document GHGs from dams.	~20 MtCO ₂ * annually by 2025
Russia	Reducing Natural Gas Flaring and Leaks in Russia	Third party agreements to reduce flaring, improve infrastructure.	~150 MtCO ₂ annually by 2012
India	Boosting Efficiency of Coal Plants	Improving efficiency by 30% to perhaps 40% over two decades for India's 77GW coal-based power generation as well as new plants built between now and 2030.	400 MtCO ₂ annually by 2030
	US-India Nuclear Power Deal	Partnership to provide technology and materials to aid in nuclear power production.	~150 MtCO ₂ annually by 2025
China	Improved Grid Efficiency	Improved technology that saves money (in addition to GHGs), but require additional licensing and imported equipment.	234 MtCO ₂ annually by 2025
	Securing China's Natural Gas Supply	Natural gas to replace 50 GW coal power	~213 MtCO ₂ annually by 2020

* MtCO₂: million tonnes of CO₂

Stanford Program on Energy and Sustainable Development; 2009

may include technology transfer and support, capacity building, and funding where necessary. Thus, in the CADs framework outside support and funding provides the catalyst for the country to do what it wanted to do anyway. Aligning incentives in this way ensures that the country follows through on the deal in earnest.

The success of CADs in addressing the additionality problem of the CDM certainly depends on the ability to negotiate an appropriate baseline that is as close to the actual baseline as possible. (Recall that a transparent and internationally-accepted baseline-emissions trajectory is the key to the additionality problem.) If the negotiated baseline is lax, then CADs will be no better than CDM at ensuring the additionality of the emissions reductions. But those concerns are much weaker in the CADs framework by design: strong alignment of host country interests and the general and specific benefits offered by CADs will incentivize the developing countries to more readily reveal critical information about their energy systems and planning, thus allowing for a transparent determination

place will continue to allow innovation and investments in low-carbon technologies to emerge bottom-up, at the project level. This remarkable virtue of project-based CDM is unparalleled in any other instrument. The CADs framework brings out this good feature of CDM by carving out large portions of developing-world energy systems as CADs, thus leaving the CDM to focus on truly additional projects. That will also ease out the institutional bottlenecks in the CDM, but the high transaction cost issue will remain.

CADs in Action: The Case of India

David Victor and I have adapted and applied the CADs framework in the context of India. We found several large opportunities in India that are ideal for CADs. Among other CADs opportunities in India, power-sector reforms and efficiency of coal-fired power plants are ripe candidates for CADs. India has struggled to provide reliable electricity supply to its population. Hundreds of millions in India still have no electricity, and those with

“The fundamental idea of the framework is to find synergies between climate change benefits and the core interests—economic growth and energy security—of developing countries.”

of internationally-accepted baseline emissions. Even in CADs, however, parties on both sides have similar perverse incentives as in CDM. For example, if the developed and developing country parties to a CAD settle on a generous baseline, then a large number of CERs could be generated, which will benefit both parties. To minimize that outcome, every CAD deal must be approved by an international body, which could be modeled on the lines of WTO, IEA, OECD, and the IMF. Additional upfront international scrutiny before finalizing a CAD, especially by other developed countries also in need of CERs, will keep CADs honest and minimize additionality concerns of the CADs. Finally, each CAD will cover a large “sector,” often with the opportunity of addressing several hundreds of million metric tons of CO₂ per year (Mt CO₂/yr). This is much more effective than the system under the Kyoto Protocol, which has caused worldwide emission reductions of, at most, a couple hundred Mt CO₂/yr. Globally, a limited number of CADs could cover large parts of the developing world GHG emissions. Thus, even though CADs need a complex array of interests and institutions to be brought together, the CADs implementation process will be more effective overall.

A climate change regime based on CADs as the main mechanism for engaging developing countries will still have space for CDM. Leaving project-based CDM in

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 is unaccounted for, i.e., there is no revenue generation for about a third of the supplied electricity. 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 percent to 20 percent of the net supply in just five years. Our calculations indicate that power-sector reforms similar to Delhi, if replicated across India, could lower India’s CO₂ emissions between 200 and 250 Mt CO₂ per year by 2017. This is equivalent to nearly 50 percent of India’s total power-sector emissions in 2007 (520 Mt of CO₂) and about 6 percent of Europe’s total emissions in 2006. 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, as we have shown that the high losses in India’s electricity system owing to widespread electric-

ity theft results in emissions much higher than those of developed countries. As part of a CAD involving India's power-sector reforms, 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.

India's coal-based power generation fleet is also a very conducive candidate for CADs. As in the past, cheap and abundant coal remains India's fuel of choice for continued economic growth. But price distortions, poor technology, freight problems, and environmental clearance in coal production have accentuated the cracks in India's coal supply chain. Consequently, India's coal imports have risen significantly in the last few years, and India will likely import large quantities of coal in the next decade. 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 percent efficiency, India's first supercritical coal unit with an efficiency of about 40 percent 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 CADs framework, India could propose a 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 percent to perhaps 40 percent 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 will be part of the CAD negotiations. 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 per year 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 percent 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 CO₂ per year below the business-as-usual emissions. CAD negotiations must decide what part of those emissions reductions form part of the appropriate baseline of India and what part can be credited as

CERs. Further, the program could also emphasize the early deployment of ultra-supercritical plants—the 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 offers a tremendous win-win opportunity for India's developmental goals and for helping the creation of a transparent global climate change regime.

Conclusion

No serious solution to the climate problem is possible without developing countries. So far the efforts to reduce GHG emissions, largely through the CDM, have not been serious. Despite the CDM's theoretical potential to leverage market mechanisms to incentivize investments in low-carbon technologies in the developing world, its real impact on emissions reductions has been limited. The core problem with the CDM—the additionality problem—is the difficulty in disentangling investment decisions that lead to genuine emissions reductions from investments that are inherent in the normal developmental pathway of the developing world. Increasing evidence shows that perverse incentives to game the CDM system have led to costly investments by the developed world in projects of questionable environmental integrity.

For effectively engaging developing countries the post-2012 climate change regime needs a new strategy that is fundamentally different from the CDM. David Victor of UCSD and other researchers at Stanford University's PESD have suggested a new strategy—called Climate Accession Deals or CADs—to address the additionality problem of the CDM. By focusing on large opportunities that are deeply aligned with the core interests of developing countries and that also provide huge leverage on GHG emissions, CADs incentivize developing countries to reveal information about national policies and motives. Essentially, CADs draw developing nations to the negotiations table by providing incentives that help those nations address their key energy and developmental issues. Each CAD involves international negotiations to finalize what the developing country will do on its own and what the donor country or countries will provide. Upfront international dialogue and scrutiny of every CAD will ensure that national priorities are clearly reflected in the estimates of emissions trajectories of the developing world. That is, CADs largely eliminates the additionality problem of CDM through a priori international agreement on appropriate emissions baselines. Any reductions beyond the negotiated baselines will count as legally acceptable reductions in international and domestic carbon markets. Finally, because large parts of the energy systems in the developing world can be covered under the CADs framework, the CDM institutional machinery can be focused on truly additional projects and technologies. ■