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FAST TRACK BRIEF

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The IEG report "Climate Change and the World Bank Group: The Challenge of Low Carbon Development," was discussed by CODE on September 22, 2010

Climate Change and the World Bank Group: The Challenge of Low Carbon Development

- **Over 2003-08 the World Bank Group (WBG) scaled up annual investments in renewable energy and energy efficiency from $200 million to $2 billion. In 2008 it adopted the Strategic Framework on Development and Climate Change (SFDCC), which triggered a further expansion of climate-related activity. This evaluation seeks lessons from the pre-2008 portfolio for increasing the World Bank Group's impact on development and climate change mitigation.**
- **Project types vary widely in impacts. Energy efficiency stands out as offering high economic and carbon returns and can contribute to increased electricity access. As one example, the distribution of compact fluorescent lamps appears to offer economic returns dwarfing those of most WBG projects, together with significant carbon reductions. Wind power offers more modest returns on both dimensions, while off-grid solar photovoltaic power has delivered large welfare gains to a niche market, but with relatively small co-benefits in greenhouse gas reduction. Protected areas that permit sustainable forest use have on average significantly reduced tropical deforestation, and indigenous areas have been even more effective.**
- **The Bank's Carbon Finance Unit has played an important demonstration role in helping to open a new field of environmental finance, and has contributed to the diffusion of some technologies. But much of its support for energy technologies has gone to projects where its catalytic impact was small, and it has not yet mainstreamed carbon finance in the Bank.**
- **The WBG should continue to provide support for adoption of climate-friendly development policies and to support the transfer and adaptation to local conditions of existing technologies, policies, and financial practices. The WBG has been successful in this kind of technology transfer—but only when demonstration and diffusion mechanisms were well thought out. With more rapid and systematic feedback on results, the WBG can identify a high-return portfolio of development solutions that can be scaled up, as climate finance expands.**

Evaluation Framework

This evaluation reviews a broad range of WBG activity in the adoption and diffusion of emissions-reducing technologies and practices. It addresses three main concerns. What actions will deliver the greatest overlap between GHG mitigation and local development? Where and how does the WBG have the highest leverage in promoting those actions? And how best can the WBG use feedback from ongoing experience to improve performance?

Because the range of activities is great, because most have not yet been subject to a final evaluation, and because most do not generate consistent and accessible data on impacts, the evaluation is selective, yet covers the bulk of evaluable WBG experience. Within each of the main GHG-emitting sectors—energy, transport, and forestry—it examines specific issues that capture a large part of the relevant WBG portfolio (such as support for energy efficiency via financial intermediaries), illuminate sectorwide issues (such as the role of finance for grid-connected renewables), or pioneer novel approaches (such as payment for ecosystem services). It also addresses three special issues: technology transfer, the WBG's carbon funds, and the role of the WBG in coal power. The evaluation looks at how the WBG has diagnosed barriers to technology adoption, on the effectiveness of prescribed interventions, and on the likely economic and mitigation impacts.

The previous volume of this evaluation looked at WBG support for key areas of policy reform. This volume focuses on two other areas of intervention: development, transfer, and demonstration of technical and financial innovations; and finance and implementation.

Findings

WBG-supported interventions vary widely in nature and effectiveness. The evaluation first looks at sectoral findings and then at cross-cutting lessons and recommendations.

Congruence of Mitigation and Development

There is ample scope for projects that promote local development goals while also mitigating GHGs. Energy efficiency (EE), more than other investments, offers a combination of high economic returns and GHG benefits. Other projects may individually have high carbon returns (forestry) or economic returns (solar home photovoltaic systems). To optimize carbon and economic gains, it may often be necessary to construct portfolios of projects, rather than pursue multiple goals with a single instrument.

Renewable Energy

Grid-connected RE reduces CO2 emissions, offers the additional domestic advantages of local air pollution reduction and energy security, and could potentially stimulate industrial development. But investors may not take account of the national or global benefits. Lenders may shy away from capital-intensive investments in less-proven technologies. Utilities may not know how to deal with intermittent energy sources.

Technical assistance can help overcome these barriers. The World Bank helped Sri Lanka to institute standardized small power purchase agreements that facilitated access to the grid. Analytic work, capacity-building and demonstration have contributed to Mexican and Chinese adoption of favorable RE payment schemes, which in turn have stimulated over 20 gigawatts of installed wind capacity in China and hundreds of megawatts under construction in Mexico.

Provision of long-duration loans (as in IFC lending and World Bank on-lending projects) has a much bigger impact on project bankability than purchase of carbon credits, at current carbon prices. As countries increasingly rely on paying price premiums for RE, World Bank and MIGA guarantees against breach of contract and other political risks could be catalytic.

The WBG's direct lending for RE is dominated by hydropower, the only grid RE technology for which there is a substantial evaluable record at the WBG. Among evaluated hydropower plants, 76 percent had outcomes rated as moderately satisfactory or better, with better ratings in recently initiated projects. Unsuccessful projects are often those where preparation or implementation of resettlement plans has been ineffective. About two-thirds of hydropower investment volume now goes to run-of-river hydro, which has less potential for local social and environmental damage but which is more vulnerable to climate change.

Direct WBG investments in wind power have been modest. Wind power on average offers significantly lower economic and carbon returns than hydropower due to high capital costs and often-low capacity utilization. Manufacturing cost reductions at the global level, together with better siting and maintenance, are crucial to increasing the competitiveness of wind and other new RE technologies.

The largest single area of off-grid RE investment has been in solar photovoltaics, mostly for home use. Since 1992, the WBG has contributed $790 million to solar home system (SHS) components in 34 countries, almost all using GEF-funded subsidies support. World Bank efforts have been more successful than those of IFC, using quality-contingent producer subsidies and relying on microfinance for consumers. These projects can have economic rates of return of 30 to 90 percent but have little impact on GHG reductions because off-grid households use little energy. At current prices SHS have been successful in a narrow niche market: the off-grid household that is either relatively well-off by rural standards or can access good microfinance services.

Energy Efficiency

Phase I of this evaluation assessed the most important barrier-removing policies: energy price reform and promotion of energy efficiency policies such as building and appliance standards. It noted that the Bank had pursued price reforms in energy but had relatively few, and modestly funded, projects dealing with EE. Since then there has been increased attention to policy-efficiency linkages, including Bank-IFC support for a recently adopted Russian energy efficiency law, support for a G20 study of energy subsidies and a recently approved Vietnam Power Sector development policy operation.

Owners of factories and buildings often fail to borrow for apparently highly profitable EE opportunities. The WBG's diagnosis: borrowers lack information, while lenders lack experience and comfort with EE project finance. The largest WBG response has been to support financial intermediaries—banks, special-purpose funds, and energy service companies—with guarantees and technical assistance. These programs have appropriately been directed to China and Eastern Europe, where energy inefficiency has been high. Parallel programs have been implemented by the World Bank and IFC, both supported by the Global Environment Facility (GEF), and without much communication between them. Yet, contrary to expectations, loan guarantees have turned out not to be a temporary, market-transforming measure that could be discontinued once the banks gained familiarity with EE lending. Inadequate lending for EE often reflects wider credit market failures, including onerous requirements for collateral. Guarantees have usefully triggered EE lending to credit-strapped small and medium enterprises. Because borrowers achieved high rates of return, guarantee programs could achieve higher impact through tighter targeting on less creditworthy companies.

World Bank-supported projects have been successful in introducing energy service companies (ESCOs) to China, with high returns, significant GHG impacts, and spontaneous replication. However, further replication and scale-up must address the ESCOs' own credit problems and recognize that energy performance contracting, the standard paradigm for ESCOs, may require major adaptations in many developing countries.

IFC also lends directly to industry for EE. A program of screening its clients for EE opportunities supports mostly small loans with low GHG impacts.

Three areas of existing activity stand out as having high impact and high potential for scale up: first, proactive IFC support for EE in the atypical but important cases of large, carbon-intensive factories that face credit or information barriers; second, increased support for transmission and distribution loss reduction, which offers economic rates of return of 16 to 60+ percent and lifetime carbon returns of 7 to 15 kilograms per dollar. Third, substitution of compact fluorescent lamps (CFLs) for incandescent lamps offers estimated direct economic returns (in saved energy) of 50 to 1800 percent, together with deferred construction of power plants and emissions reductions of 27 to 134 kilograms of carbon dioxide (CO_2) per dollar, but rigorous evaluation is lacking. These returns would be further magnified if initial projects catalyzed spontaneous diffusion of CFLs.

Forestry

Forest loss, especially in the tropics, generates a quarter of developing countries' emissions. The local and global values of standing forests often greatly exceed the gains from destroying those forests. Tapping this value could therefore offer large economic and GHG gains. The Forest Carbon Partnership Facility has been set up as a pilot to explore options to monetize the value of standing forests. However, the mechanisms to use the funds to conserve forests are still being planned. World Bank experience provides some models for scaling up.

Payment for Environmental Services (PES) programs constitute one such model. World Bank-supported programs in Costa Rica and Mexico have demonstrated the logistics of paying for services and have helped to globally popularize the PES approach. However, a substantial proportion of payments have gone to areas that are not at high risk for deforestation, diluting carbon and environmental benefits and prompting attention to improved targeting.

The most prominent line of action associated with forest conservation is support for protected areas. These now cover more than a quarter of the tropical forest estate, an area equivalent to Argentina and Bolivia combined, much of it supported by World Bank projects. A global analysis shows that these are on average effective in reducing deforestation. Areas that allow sustainable use are more effective than strictly protected areas, and indigenous areas are most effective of all. They also offer precious biodiversity benefits. These findings support the feasibility of the Reduced Emissions from Deforestation and Degradation (REDD) initiative in combining sustainable development and forest conservation.

Urban Transit

Growing transport demand clogs limited roadway space in the developing world, resulting in severe congestion, air pollution and GHG emissions. The single largest WBG response has been to support the deployment of Bus Rapid Transit systems, which cost much less than tramways or subways. Key barriers have been the lack of intermunicipality coordination, and opposition by displaced minibus drivers. However, systems have been successfully initiated in Bogota and Mexico City, and are being expanded there and replicated elsewhere.

The immediate economic benefits in Mexico City provide an estimated 81 percent economic return and a GHG return of 10 kilograms per dollar. Larger, sustainable long run gains will require demand-side management of traffic and rational land use planning.

Coal Power

Coal is a cheap source of power for a power-hungry world; but coal is a major source of GHG emissions. How does the WBG maximize development returns for clients with no GHG reduction obligations, while protecting other clients threatened by GHG emissions regardless of their source? SFDCC criteria restrict WBG support to instances where coal is the least cost after environmental externalities have been considered and there is optimal use of energy efficiency and where no concessional funds are available to finance low carbon alternatives.

IEG examined five pre-SFDCC coal power projects to determine whether WBG involvement had contributed to greater efficiency and whether lower-carbon alternatives had been considered.

None of the investment cases would have met the SFDCC criteria, either because they were not least-cost for generation after accounting for local air pollution burdens, or because they did not fully explore efficiency alternatives. The complexity of the issues, however, is illustrated by IFC's support for a supercritical coal plant in India. On one hand, it will be one of the largest point sources of CO2 on the planet, adding to the atmosphere's pre-existing burden as GHG concentrations climb towards dangerous levels. On the other, it may nevertheless have reduced emissions by about 10 percent compared to a scenario without IFC involvement, and indirectly accelerated the diffusion of this higher-efficiency technology in a country that will continue to rely on coal for decades to meet urgent power needs. However, more than a quarter of India's power is lost in transmission and distribution. Nationwide, reduction in distribution losses and other efficiency measures can offer higher returns in power availability, local environmental improvement, and GHG reductions than new construction.

The WBG's highest leverage for promoting low-carbon growth is at the level of the power system. The World Bank's technical assistance to Kosovo points to a way of resolving the tensions surrounding coal. A study assessed options for power system expansion using a systemwide power model that accounted for local health damages of pollution. It showed if CO2 abatement was valued at €10 per ton, it would be optimal to force the retirement of small, inefficient coal plants but also to construct a large efficient one. (The impact of higher carbon prices was not explored.) Models like this, if extended to include energy efficiency as an alternative to expanded generation, can serve as a basis of discussion for identifying technical and financial options for pursuing low-carbon growth at a national level.

Carbon Finance

As an *institutional innovation*, the World Bank's Carbon Finance Unit (CFU) has played an important demonstration role in helping to open an entirely new field of environmental finance, popularizing the idea of carbon markets and contributing to the institutional infrastructure of the market.

The CFU's exit strategy called for it to relinquish its role as carbon offset buyer as the private market began to flourish. But while the Bank indeed moved into higher-risk, pilot areas of the carbon market (the Forest Carbon Partnership Facility and the Carbon Partnership Facility), it continued to build up its lower-risk Kyoto-oriented business after that market was already thriving. It also failed to mainstream carbon finance within the Bank.

As a *vehicle for catalytic finance and technology transfer*, the CFU's record is mixed. It has contributed to the diffusion of some technologies, such as landfill gas, and supported first-of-kind technology investments in some countries. BioCF and the Community Development Carbon Fund have supported novel small scale, rural, and forestry projects – and learned in the process that this is difficult to do. On the other hand, much of the CFU's support for energy technologies has gone to projects where its financial leverage, and hence catalytic impact, was relatively small. In addition, two-thirds of carbon fund purchase commitments have been for projects that destroy HFC-23, a highly potent, industrially-generated GHG. The projects tapped a Chinese low-cost GHG abatement opportunity and gave participating companies high profits, 65 percent of which were then taxed for development purposes. Although this was an allowable use of the carbon market, an alternative would have been to use international funding to pay only for the low marginal costs of destroying the gas, deploying carbon funds with higher leverage elsewhere.

Technology Transfer

Technology transfer is one of the pillars of the Bali Action Plan (under the UN Framework Convention on Climate) and of the SFDCC. The WBG has contributed to transfer of existing clean technologies through projects that pilot, debug, demonstrate, and diffuse innovations in engineering and finance. These have been successful when the logic of demonstration and diffusion has been well thought out.

The Renewable Energy Development Project (China), for instance, used a combination of quality-contingent subsidies, research and development grants, and technical assistance to foster the growth of a competitive solar photovoltaic industry. The Energy Conservation Project supported China's first ESCOs, with strong emphasis on knowledge sharing and diffusion. The Regional Silvopastoral Project in Latin America piloted different approaches to integrating trees with pasture, rigorously documented that some techniques were highly profitable even without reckoning carbon and biodiversity benefits, and was able to convince the Colombian government to scale up the project. In all these cases GEF support was essential to mitigate up-front risk and to pay for global benefits of knowledge created.

Conversely, technology transfer has foundered in the absence of a solid logical framework linking interventions to technological diffusion, especially in the case of advanced technologies. Early efforts to support concentrated solar power (CSP), for instance, incorrectly assumed that a few scattered projects would spur cost reductions at the global level. (A new CSP initiative under the Clean Technology Fund is more appropriately scaled.) Projects incorrectly assumed that private beneficiaries of technology (such as recipients of technology licenses in the China Efficient Boilers Project) would share proprietary technology with competitors. Several IFC investments, pursuing multiple but conflicting objectives, tackled an insurmountable combination of inexperienced entrepreneurs, unfamiliar technology, and an uninterested target market. Finally, both the CSP and Efficient Boiler projects underestimated the difficulty of procurement when technology suppliers are few and costs are poorly known—an inherent feature of newer technologies.

Learning and Incentives

Rapid feedback and learning is essential for adapting technology to new sites, for deciding which technologies to scale up, and for ensuring that they are working as planned. As noted, technology demonstration projects work best when it is clear what is being demonstrated, how, and to whom. While recent demonstration projects have good plans for monitoring the direct results of demonstration, they do not yet track how effectively these results are reaching their intended audience.

As other IEG reports have noted, cost-benefit analysis has fallen out of fashion, impeding the WBG's ability to identify high-return investments. The estimates quoted here remain an unvalidated and possibly overoptimistic guide. The lack of good impact evaluations of forest projects, for instance, has deprived the REDD agenda of urgently needed guidance on how best to combine forest protection with economic development.

The publicly disclosed monitoring in carbon projects shows the gains from feedback. Landfill gas projects proliferated with the advent of the carbon market, but monitoring reports soon showed that these projects were systematically underperforming relative to design expectations. This feedback prompted the finding that the appraisal models were based on U.S. experience inapplicable to the waste streams of developing countries. The WBG helped to publicize this discovery. Newer projects have incorporated design and operational lessons. This kind of systematic feedback is missing from most projects, though IFC's monitoring system is beginning to cover it. It is especially needed for renewable energy projects, where economic and carbon impacts are proportional to capacity utilization. Many hydro and wind projects are underperforming for reasons that are not clear.

At the organizational level, the WBG has framed SFDCC goals in terms of dollars committed, rather than outcomes or impacts. This sets up poor incentives. For instance, energy efficiency projects are expensive in staff time and lead to relatively modest volumes of lending, yet can benefit clients more than cheaper-to-prepare, larger-volume generation projects.

Recommendations

The WBG should maximize its leverage in promoting low-carbon development. This will require a strategic approach to portfolio choice, instruments deployed, and technology policy. And it means scaling up what works and redesigning what does not, using learning to unlock value for its clients and for the world. Key aspects are as follows.

Act like a venture capitalist

In both the public and private spheres, the WBG can support the transfer, adaptation, piloting and demonstration of innovative technologies, policies, and financial practices—as it has, for instance, with ESCOs, bus rapid transit, solar home systems and agroforestry. These demonstrations carry risks but can offer high returns. What counts for clients, the WBG, and the world, however, is the return on the portfolio: in development, poverty reduction, and GHG mitigation.

A first challenge is to mitigate risks. This means using GEF or other concessional funds to support the earliest and riskiest ventures. Because of the potential for high returns, this could be a much higher-leverage use of climate finance than the purchase of carbon offsets from marginally-profitable RE projects. Risk is further mitigated by staging successively larger pilots and demonstrations, from test site to province to nation. With increasing experience and comfort, scale expands and risk declines. Changes are necessary, too, in internal WBG incentives to reward staff and managers for informative pilots and for producing results at the portfolio rather than project level.

A second challenge is to design projects effectively for learning and diffusion. Pilot or demonstration projects must have a clear logical framework showing how they will promote diffusion. The distinctive features of pilot, demonstration and technology transfer projects argue for additional support for preparation and supervision in funding and on-call expertise.

While there is a clear case and large scope for WBG involvement in technology transfer at the national level, the case is less clear for WBG involvement in new technology development at the global level. Candidate technologies would be those where WBG support could make an appreciable difference to the global market, helping to push down costs. Of special interest are technologies that are beneficial for poor people and are difficult to protect from copying (and therefore attract little private R&D)—for instance in agriculture and land use. The proposed new WBG effort to support concentrated solar power is a plausible area of support because a large proportion of the suitable resource is located in client countries, the technology is suitable for manufacture in

client countries, and the proposed effort is sufficiently large to globally push the industry down the cost curve.

The World Bank and IFC should:

- **Create incentives and mobilize resources to support effective pilot, demonstration and technology transfer projects that have a clear logic of demonstration and diffusion**. This will include: mobilizing GEF and other concessional funds to mitigate World Bank borrower risk; reshaping incentives for staff and managers; providing adequate resources for the design and supervision of complex projects; making available specialized expertise in technology transfer and procurement through a real or virtual technology unit.

Scale Up High-Impact Investments

Energy efficiency offers high economic and carbon returns. The WBG should:

- **Place greater emphasis on large-scale EE scale-up, as measured by energy saved and generating capacity avoided**. This includes support for efficient lighting and exploring the scope for accelerating the global phase-out of incandescent light bulbs. It includes continued and expanded support for reductions in transmission and distribution losses. And it includes proactive search by IFC for large-scale, catalytic investments in EE. There is scope to coordinate World Bank support for demand-side EE policies with IFC support for more efficient manufacturing and more efficient products.

The WBG should, wherever possible, help clients to find cleaner, domestically preferable alternatives to coal power. Moreover, the WBG faces strategic choices in staffing and programming between building up expertise in "sunrise" sectors of broad applicability and limited private sector competition (energy efficiency, land use management for carbon, energy systems planning) versus "sunset" sectors such as coal power. The WBG should:

- **Assist countries to find alternatives to coal power while retaining a rarely used option to support coal power**, strictly following existing guidelines (including optimal use of energy efficiency opportunities), and restricted to cases where there is a compelling argument for poverty or emissions reductions impacts that would not be achieved without WBG support.

The WBG cannot tackle this issue alone. Complementary financing for renewable energy and investments in technology R&D are needed from the developed world in order to provide better options for the WBG's clients.

Protected areas—especially those permitting sustainable use—reduce tropical deforestation, providing local environmental benefits as well as carbon emissions reductions. The WBG should:

- **Continue to explore, in the REDD context, ways to finance and promote forest conservation and sustainable use, including support for indigenous forest areas and maintenance of existing protected areas.**

In terms of its instruments:

- **MIGA's upcoming FY12-15 strategy should outline the role and scope for MIGA to provide political risk insurance to catalyze long-term financing for RE projects**, building on its expertise and existing portfolio of climate-friendly guarantee projects.
- **The World Bank should enhance the delivery of its guarantee products** by taking actions to improve policies and procedures, eliminate disincentives, increase flexibility and strengthen skills for the deployment of the products, and in parallel, assess the potential for greater use of partial risk guarantees to mobilize long-term financing for RE projects, particularly in the context of feed-in tariffs or other premiums to support investment in RE.
- **The Carbon Partnership Facility and other post-Kyoto carbon finance efforts should focus on demonstrating effective technical and financial approaches to boosting low-carbon investments**. Funds and facilities should have clear exit strategies.

Reorient incentives toward learning and impact

There is an urgent need to better understand the economic, social, and GHG impacts of a wide variety of scaleable interventions. How can REDD programs incorporate the lessons of protected areas, environmental services payments, and community forestry? What is the best way to encourage energy efficiency in the building sector?

Traditional evaluation cycles are too slow when tens of billions of dollars are envisioned being deployed annually for climate finance and where there is a danger of lock-in to high-carbon growth. At the same time, information costs are plummeting, remote sensing resources are multiplying, and cell phone access is nearly universal. By wiring up projects to return early information on impacts, global innovation can be accelerated and the WBG can optimize project supervision and new project design.

The WBG's extensive project portfolio and support for country strategies makes it a natural nexus for this global public good. It should:

- **Measure projects' economic and environmental impact during execution and afterwards, and aggregate this information for analysis.** For instance, RE projects should monitor capacity utilization and EE

projects energy savings. This may require the use of concessional funds to defray additional costs of monitoring by staff, clients, and project proponents.

- **Link these measures to a results framework that shifts the SFDCC toward a focus on outputs** such as power produced, power access, forest cover, transit share of urban trips, rather than money spent.

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