Overcoming barriers to energy efficiency: new evidence from independent evaluation

Based on recent findings from the independent evaluation departments of the Asian Development Bank, the European Bank for Reconstruction and Development, the Global Environment Facility, and the World Bank Group, an ECG workshop on the subject in Manila in March 2011 and subsequent discussions. The note does not necessarily reflect ECG policy

Draft Briefing Note, version 8
November 20 2011

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About the Evaluation Cooperation Group

The Evaluation Cooperation Group is dedicated to harmonizing evaluation work among multilateral development banks. Its members are the evaluation departments of the African Development Bank, Asian Development Bank, European Bank for Reconstruction and Development, European Investment Bank, Inter-American Development Bank, International Fund for Agricultural Development, International Monetary Fund, the Islamic Development Bank and the World Bank Group. Observers are the evaluation departments of the Council of Europe Development Bank, the Organisation for Economic Cooperation and Development, and the United Nations.
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1. Energy efficiency is recognized as one of the main lines of action necessary to stabilize the concentration of greenhouse gases (GHGs) in the atmosphere and thus to limit climate change. In principle, energy efficiency is highly cost-effective and easily deployed through existing technologies. Yet actual investments in energy efficiency fall short of what is required. This note summarizes available evidence on barriers to energy efficiency and the interventions to surmount them from evaluations of the World Bank Group, Asian Development Bank, European Bank for Reconstruction and Development and the Global Environment Facility[i]. An assessment of the evidence suggests that

- Energy efficiency investments are highly cost-effective
- Fossil fuel subsidies discourage energy efficiency
- The financial sector can be persuaded to provide energy efficiency loans
- Genuine demonstration projects can transform markets
- Biases against energy efficiency projects can be overcome
- Better monitoring of local and global project impacts is needed

Energy efficiency investments are highly cost effective

2. Evidence from ECG members points to the high cost-effectiveness of energy efficiency measures in providing both local and global benefits. A common finding is that – in contrast to many renewable energy projects – cost-effectiveness is *not* a barrier to a wide range of energy efficiency projects, which typically offer much higher returns [ii]:

- A dollar of GEF funds catalyzed 2.2 tons of GHG reductions in energy efficiency projects, versus 0.38 tons in renewables projects.
- An analysis of World Bank Group projects found that most energy efficiency projects offered returns that greatly exceeded those of wind and hydropower projects. Wind projects had an economic rate of return of less than 10%, and hydropower had a median return of 13.3%. In contrast, projects that promoted efficient lighting – by substituting fluorescent lamps for incandescent bulbs – had returns over 100%, paying for themselves in months or even weeks. At the same time, these projects offered substantial GHG reductions.
- An analysis of EBRD investments in energy efficiency[iii] also found large local and global benefits. At the top of the list were projects that reduced the wasteful flaring (burning) of natural gas, capturing it instead for heat or power. Such a project pays for itself in roughly 6 weeks in energy savings, and in addition reduces GHG emissions by about .65 tons/euro[iv].

Fossil fuel subsidies discourage energy efficiency investments

3. Fossil fuel subsidies are fiscally burdensome, regressive, and climate-damaging. Fossil-fuel consumption subsidies have been enormous: they amounted to $558 billion in 2008 and $312 billion in 2009[v]. Producer subsidies are poorly measured but may be around $100 billion. For many countries, energy subsidies are larger than public spending on health. Though often justified as helping the poor, subsidies are not well targeted, with support going disproportionately to better-off groups. Because subsidies encourage fossil fuel consumption, total removal of subsidies would reduce global energy-related CO2 emissions by 6.9%[vi]. Subsidy removal thus offers fiscal, economic, and environmental gains.

4. Fossil fuel subsidies directly reduce the returns to energy efficiency investments, in some cases making them financially unattractive. For instance, in some countries, natural gas is flared, rather than used for power, because the

price of gas is set artificially low[vii]. At the economy-wide level, countries that heavily subsidize diesel fuel are nearly twice as energy-intensive as peers with the same income levels and heating needs[viii].

5. Because subsidies are such an inefficient way to protect poor people from high energy prices, there has been increased attention to devising ways to compensate poor people for price reform. The World Bank and other IFIs have also provided analytic support to countries in their efforts to reform energy pricing. Success has been most prominent where subsidies simply became unsustainable, or where there were powerful incentives to reduce them. This has been the case in some transition countries. In Romania, for instance, the combination of conditionality attached to EU accession, and a World Bank structural adjustment loan with support for social safety nets were factors enabling a doubling of the electricity tariff and an increase in collection rates from 49 percent to 99 percent[ix]. There is increasing interest in the use of unconditional cash transfers as a way to compensate poor people for hikes in fuel prices, as demonstrated by Indonesia. However, the long-run sustainability and impact of this approach remains to be demonstrated.

The financial sector can be persuaded to provide energy efficiency loans

6. Transition economies and China have a legacy of highly energy-inefficient industries and housing. Despite progress in reducing energy intensity, these countries still offer many profitable opportunities to retrofit old facilities with efficient modern equipment. The credit market is seen to be a barrier to these investments. The IFIs and GEF came up with two prescriptions to boost the financial sector's ability to provide loans to the private sector: technical assistance, and subsidized loan guarantees. They hoped that these would be *transformative*; that is, that *temporary* measures would result in a *permanent and far-reaching* change in credit markets. In particular, the GEF-supported subsidies were intended to be a temporary, confidence-building measure.

7. *Technical assistance*. The EBRD, IFC and World Bank have provided technical assistance to banks in Europe, Russia, and China, helping them to develop standardized methods for appraising efficiency loans. Banks interviewed by IEG confirmed that they benefited significantly from this assistance. Some banks were spurred to create in-house units dedicated to energy efficiency. An assessment of the CHUEE program in China found that technical assistance to energy service companies increased the probability of receiving finance by 27%[x]. EBRD's evaluation unit concluded that technical assistance associated with energy efficiency credit lines had been "highly instrumental in delivering the benefits of the funding."[xi]

8. Both the EBRD and the IFC have screened direct loans to clients, using energy audits. At the IFC, the Cleaner Production Lending Pilot ended up devoting much expensive staff or consultant time to small loans that yielded GHG savings of only a few thousand tons/year apiece. In contrast, IFC also supported efficiency investments at individual companies emitting over 10 million tons/ year –a much more cost-effective use of expertise[xii].

9. *GEF-subsidized guarantees.* IEG analysis found that these were helpful, but not transformative.[xiii] In China and in some transition countries, the problem was not that banks didn't comprehend that energy efficiency could save money. Rather, in these poorly developed credit markets, banks were reluctant to lend to small companies for *any* purpose unless the borrowers furnished daunting levels of collateral. In these circumstances, subsidized guarantees did indeed unlock GHG-reducing loans to small companies. Likewise, a GEF-seeded Revolving Capital Fund succeeded in eliciting larger-than-expected cofinancing for township and village enterprises. But IEG analysis found that the subsidies weren't critical for big companies in China, which already had access to capital.

Genuine demonstration projects will transform markets

10. One of the highest-leverage interventions available is the piloting and demonstration of a privately-attractive technology that has global co-benefits. Piloting can help debug technical problems or identify regulatory impediments. Demonstration can attract the attention of potential adopters and convince them of the technology's financial and technical feasibility. Once demonstrated, the technology can spread spontaneously, so a small external spark can kindle market-transforming impacts.

11. The IFIs – especially with GEF support – have implemented a large number of pilot and demonstration projects. A key evaluative finding is that these are much more likely to be successful if they are specifically designed with demonstration in mind, with clarity on *what* is being demonstrated, *how,* and *to whom.* The importance of this seemingly obvious but often neglected point is illustrated through a comparison of three GEF projects in China, a key market for energy efficiency.

12. The Energy Conservation Project sparked the diffusion of ESCOs (energy service companies, which combine lending with engineering) in China. Three demonstration companies piloted this novel concept for China, racking up an impressive 50% economic rate of return without even including the benefits of a claimed 18.6 million ton reduction in CO2. The three pilot companies were required to open their doors to would-be emulators and participate in training programs. Consequently, the industry grew to over 400 firms, multiplying the direct impacts of the investment. A random survey of 10 thousand firms found that 6.2% attributed efficiency gains to the information center's advice, with a claimed reduction of 71 million tons of CO2 catalyzed by a $10 million investment in the center.

13. The Energy Conservation and GHG Emission Reduction in Chinese Township and Village Enterprises (TVE) project was designed around a strategy of piloting, demonstration and scale-up. It tackled energy-intensive industries such as cement and coking. The direct CO2 reductions at the 8 demonstration sites were reckoned at 193,000 tons CO2/year, but reductions at the 111 planned replication sites were estimated at 1.3 million tons/year. In addition, there was widespread spontaneous replication thanks in part to information dissemination, training, and policy reforms[xiv].

14. In contrast, the Efficient Boiler Project was less successful. The project procured licenses to improved boiler technology and transferred them to eight Chinese manufacturers, hoping for spontaneous diffusion of the technology. But after five years, market penetration of the new designs was only 3.3%, not the anticipated 35%. This reflected in large part a lack of a mechanism to promote diffusion. There was an assumption that the recipients of the technology licenses would share this information with competitors. But this assumption was unfounded – the firms had no desire to help their competitors. [xv]

There are biases against donor-supported energy efficiency projects.

15. Energy-efficiency projects are often more challenging to design and implement than energy generation projects, both renewable and nonrenewable. Power generation is largely a well-defined engineering challenge; energy efficiency projects, on the other hand, often involve understanding the behavior of thousands of households and firms. Thus energy efficiency projects can be expensive to prepare and supervise, while often being small in dollar volume. Analysis of incentives, confirmed with staff interviews, suggests that this has historically made energy efficiency projects unattractive at the World Bank. From the viewpoint of donors and client governments, concerned with making a visible impact with limited budgets, such projects have a high ratio of preparation costs to total disbursements[xvi]. This is especially so for efficient lighting projects and for support for

energy efficiency policies. Yet, as illustrated above, these seemingly expensive projects may have much higher leverage, impact, and economic returns than larger, more charismatic projects.

16. For this reason, IEG has found that GEF grants and other concessional funds have been critically important for energy efficiency projects at the World Bank Group. This financing mitigates the risks perceived by host countries, and supports the extra expenses of preparing and supervising complex and often innovative projects. The Clean Technology Fund could play a similar role, and this may be reflected in a $714 million CTF-supported project that promotes efficient lighting and appliances in Mexico. And, attitudes may be changing, as signaled by a massive effort in Bangladesh to distribute compact fluorescent lights to households, potentially substituting for a more expensive and more polluting fossil fuel plant.

Monitoring of local and global project impacts is neither comprehensive nor consistent.

17. Improved and more consistent and rigorous monitoring and economic analysis of projects could help rebalance attention towards energy efficiency. IEG has found that cost-benefit and economic analysis of projects has fallen off across all sectors in the World Bank[xvii]. In addition, there is little *ex post* analysis of the impact of clean energy projects. Indeed, many of the cost-savings or GHG reduction estimates quoted in this note have had to rely on *ex ante* estimates for this reason. Better documentation of realized savings in energy and GHGs could be a powerful mechanism for promoting interest in energy efficiency by IFIs and governments.

18. Comprehensive accounting of all costs and benefits helps ensure that projects' true net benefits are understood , so that the most beneficial projects can be selected. Thus standard economic analysis of projects incorporates environmental externalities -- that is, benefits and costs that accrue outside the project, such as the damages caused by water pollution. But while greenhouse gas emissions constitute an environmental externality, they are not consistently included in project level analysis. The World Bank's Operational Policies, for instance, only require the incorporation of global externalities in project economic analysis when they are related to financing (such as GEF or carbon market funding).

19. The IFIs follow different procedures with respect to GHG accounting. EBRD undertakes portfolio-wide GHG accounting, with public reporting. Since 2006 it has reported that new lending has been in aggregate carbon-negative each year[xviii]. IFC has screened projects for GHG emission in connection with its Performance Standards, and recently began undertaking portfolio-wide GHG accounting. However, aggregate emissions are not disclosed. The Evaluation Department of ADB assessed the total GHG impact of the Bank's transport portfolio. The World Bank is undertaking limited GHG accounting on a pilot basis, with no disclosure thus far. While there is much room for methodological improvement and standardization, it is clear that GHG accounting is increasingly being incorporated into IFI practice. Consistent inclusion of the GHG in the economic analysis of projects could help level the playing field between energy efficiency and other kinds of projects.

20. Finally, it is worth stressing the need for rapid and sustained monitoring of innovations in energy efficiency and renewable energy. Each project, each policy reform potentially contributes valuable information on the relative impacts of different approaches. Currently there is little effort to verify *ex ante* estimates of benefits, to track the longer-run sustainability of investments and policies, or to track diffusion of innovations. Increased knowledge sharing will raise awareness towards the greatest opportunities.

[i] This note draws on the following evaluations:

Asian Development Bank Independent Evaluation Department – *GHG implications of ADB's energy sector operations* (2009)

European Bank for Reconstruction and Development Evaluation Department – *Sustainable Energy Initiative phase I, Strategic Review* (2011)

Global Environment Facility Evaluation Office (GEFEO) – *Fourth Overall Performance Study of the GEF* (2009) http://www.thegef.org/gef/OPS4

Independent Evaluation Group (IEG) of the World Bank Group – *Climate Change and the World Bank Group: Phase I: An Evaluation of World bank Win-win Energy Policy Reforms*(2009);

IEG *Climate Change and the World Bank Group Phase II: The Challenge of Low Carbon Development* (2010)

[ii] It should be noted that some efficiency projects face significant transactions costs and may not be cost effective when these are factored in. The extent of transactions costs and the degree to which they can be reduced remains an active area of discussion and experimentation.

[iii] EBRD Evaluation Department, Sustainable Energy Initiative Phase I Evaluation, June 2011, tables 9 and 11

[iv] Based on a ten year project life and an assumed value of $12/mmBTU for natural gas.

[v] http://www.worldenergyoutlook.org/subsidies.asp; IEA/OPEC/OECD/World Bank Joint Report, An Analysis of the Scope of Energy Subsidies and Suggestions for the G20 Initiative. 16 June 2010

[vi] IEA/OPEC/OECD/World Bank Joint Report, An Analysis of the Scope of Energy Subsidies and Suggestions for the G20 Initiative. 16 June 2010

[vii] IEG, Climate Change Phase I, pp 84-86.

[viii] IEG, Climate Change Phase I, p 18.

[ix] This paragraph based on IEG, Climate Change Phase I.

[x] IEG. 2010. Assessing the impact of IFC's China Utility-based Energy Efficiency Finance Program, p. 36.

[xi] EBRD Evaluation Unit, Sustainable Energy Initiative, Phase I, p. 27.

[xii] IEG, Climate Change Phase II, pp 38-40.

[xiii] IEG, Climate Change Phase II, pp 34-38.

[xiv] Paragraph based on GEFEO, 2009. The Catalytic Role of the GEF. OPS4 Technical Document no. 3. http://www.thegef.org/gef/node/2086

[xv] Energy Conservation and Efficient Boiler paragraphs based on IEG, Climate Change Phase II.

[xvi] IEG, Climate Change Phase II, pp. 43-44.

[xvii] IEG, Cost-Benefit Analysis in World Bank Projects (2010).

[xviii] EBRD. Sustainability Report 2010