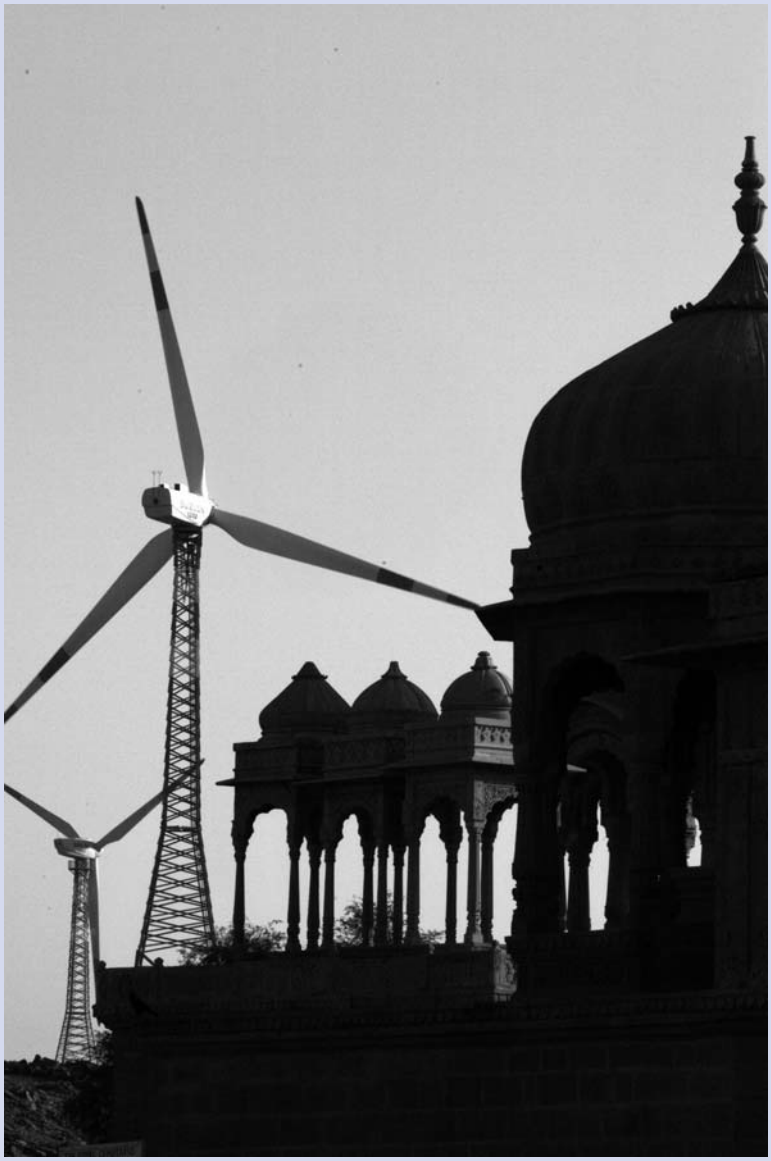
Chapter 7



Wind turbines contrast with the architecture of the 300-year-old buildings of Bada Bagh, Rajasthan, India. Photo ©Jacqueline M. Koch/Corbis, reproduced by permission.

Findings and Recommendations

Over the years, the World Bank's strategic documents have pointed to three approaches to the promotion of climate mitigation activities that are consistent with developing countries' "common but differentiated responsibilities."

One approach involves assembling global funds to compensate nations for the added expense of undertaking low-carbon development projects. A second, related approach is to support technology research, development, and diffusion. These approaches are covered here only tangentially and will be a topic for the next phase of the climate evaluation. (See box 7.1 for a discussion of the challenges related to technology adoption.) A third approach is to pursue win-win or no-regrets policies and investments that offer both attractive domestic benefits and global gains.

Strategy documents dating to 1993 emphasize energy efficiency and removal of energy subsidies as important win-win approaches. This evaluation has mainly looked at policies in these two areas, which the IEA and others stress as key approaches to emissions reductions over the next 20 to 50 years. The evaluation has also discussed the specific issue of gas flaring, which can be seen as an example of both a pricing and an efficiency problem. Finally, the report has examined the potential trade-offs among growth, energy access for the poor, and emissions.

Findings

Development spurs emissions.

A 1 percent increase in income induces—on average, and with exceptions—a 1 percent increase in emissions. To the extent that the World Bank Group is successful in supporting broad-based growth, it will put pressure on climate change. This is the fundamental challenge of development in a carbon-constrained world and underlines the need to find countervailing strategies, especially for middle-income countries.

But there is no significant trade-off between climate change mitigation and energy access for the poorest.

The poorest people and the poorest countries currently emit only tiny amounts of GHGs, so growth for them puts no real pressure on the world's carbon budget. Basic electricity access for the world's unconnected households, under the most unfavorable assumptions, would add only a third of a percent to global GHG emissions, and much less if renewable energy

and efficient light bulbs could be deployed. The welfare benefits of electricity access have been estimated in the range of $0.50 to $1 per kWh (IEG 2008e), while a stringent valuation of the corresponding carbon damages, in a worst-case scenario, is a few cents per kWh.

Policies can shape a low-carbon growth path.

The link between growth and emissions is strong but malleable. It is strong because income per capita and heating needs explain most of the 600-fold variation between countries in energy emissions per capita. It is malleable because there is still great potential for reductions. Although most countries follow a tight linkage of income to emissions, there is still a sevenfold variation between the most and the least emissions-intensive countries at a given income level.

Part of that variation is luck—including natural endowments of coal, gas, and hydropower—but it is also the product of policies that shape the use of those resources. So, in the relation between income per capita and emissions from power and heat generation, the share of electricity from hydropower accounts for half of the variation among countries not linked to income and heat needs.

Fuel pricing is a key policy affecting emissions.

This is especially clear for vehicle fuels, where high subsidizers—those whose diesel prices are less than half the world market rate—emit about twice as much per capita as other countries at similar income levels. Within the OECD, the countries that have maintained high fuel prices for decades (through taxation) have evolved more efficient transport systems. If all the member countries had maintained these levels, the OECD's emissions would be 36 percent lower (Sterner 2007).

Energy subsidies are large, burdensome, regressive, and damage the climate.

IEA (2006) estimates that energy subsidies outside the OECD cost a quarter-trillion dollars yearly. Subsidies also promote excessive GHG emissions. In many developing countries, these subsidies exceed the public expenditure on health, yet they are not well-targeted to the most vulnerable. Removal of these subsidies would bring domestic fiscal and economic dividends and could reduce global emissions by several percentage points.

The World Bank has been very active in supporting rationalization of energy pricing and increased collection.

The Bank has been a mainstay of power sector reform. While attribution is difficult, Bank-supported pricing reforms have often helped to boost tariffs and collection rates. Policy dialogue and analytic work have been associated with successful reforms. Success is noteworthy in many transition economies, which also recorded reductions in emissions per capita and emissions per dollar of GDP.

Country ownership of reforms is key. The prospect of EU accession has been a motivation for reform, and severe fiscal pressure has sometimes, but not always, facilitated reform. But tariff reform has been difficult where it threatens entrenched interests, such as agricultural users in India. Countries that are not under fiscal stress—such as those with ample oil revenues—are less likely to seek or accept World Bank advice on subsidy removal, especially with regard to implicit (off-budget) subsidies.

Although poorer groups often get a small share of energy subsidies, subsidy removal can threaten their welfare.

While some subsidies scarcely reach poor people, energy subsidies constitute 5 to 10 percent of household budgets of the lowest quintile in some countries. Removal of these subsidies can be painful to all, but especially dangerous for the poorest. Sharp increases in energy prices can be politically perilous, and are perceived as having sparked deadly riots and the fall of governments. The political feasibility of

price rises, therefore, can depend on the presence of mechanisms that protect both vulnerable and influential groups.

One way to facilitate energy price adjustments is to couple them with social protection measures funded from the savings from reduced subsidies.

In Ghana, the government removed school fees and boosted funding of clinics in poor areas as compensation for gasoline and kerosene price rises. In Indonesia, an unconditional cash transfer, targeted to the bottom two income quintiles, was put in place to complement a steep fuel price rise. In both cases, ex ante analysis showed that lower-income groups would be better off, on average. In Armenia, a social transfer payment, designed to offset an electricity price hike, initially reached only 55 percent of poor people, but coverage is thought to have improved. But such compensatory programs may not be sufficient to secure the acquiescence of wealthier interests who benefit from subsidies.

Another potentially important way to ease the adjustment to higher energy prices is to couple price hikes with efficiency measures, so that net outlays on energy increase less steeply than prices.

In principle, subsidy savings could fund such efficiency investments. This adjustment technique has been little used to date (though see the discussion of the China Heat Reform Project, below). While several Bank projects promote mass distribution of compact fluorescent light bulbs, these have not been linked to tariff reforms.

End-user energy efficiency has been relatively neglected.

Efforts on energy efficiency, especially on the demand side, have been modest compared with its potential and its stated priorities. While country strategies for 20 of the 33 top emitters contained general references to energy efficiency, only 10 had specific objectives. About 5 percent of energy lending by volume since 1990 has been for components specifically related to energy efficiency and district heating. (Efficiency gains may also accrue from improvements in transmission and distribution.) However, the limited evidence suggests that efficiency projects have had high rates of return compared with other energy sector projects, even without accounting for GHG benefits.

Policy engagement on efficiency has been even more limited.

Only 34 energy-efficiency projects supported by the World Bank during 1996–2007 included activities related to public policies, broadly construed. Among these, DSM projects have been limited in scope and sustainability because of a tendency to partner with utilities, which make money by selling electricity, and only in special cases by conserving it. Projects in standards and codes have succeeded in stimulating policy or regulatory change, but often devoted inadequate attention to institutions and implementation.

However, there have been some innovative efforts.

The China Heat Reform and Building Project is pursuing a difficult—but potentially very high pay-off—comprehensive policy and investment approach that promotes demand for and supply of efficiency. And there has been a spate of innovative projects in energy finance, including ESCOs, that seek to overcome credit market failures and transactions cost barriers. Although these contract-intensive institutions face challenges in weak institutional and legal environments, they appear to be expanding and will be assessed at greater length in Phase II of this evaluation. The availability of grant funds from GEF, ESMAP, and the Asia Sustainable and Alternative Energy Program has been critical in allowing staff to pursue innovative efficiency and renewables projects.

There are several reasons why energy-efficiency projects, and especially policy-oriented projects, appear to be underemphasized in Bank lending.

Internal Bank incentives work against these

projects because they are often small in scale and demanding of staff time and preparation funds. There is a general tendency (including among borrowers) to prefer investments in generation, which are highly visible and easily understood, to investments in efficiency, which are less visible, involve human behavior rather than electrical engineering, and whose efficacy is harder to measure. A neglect of rigorous monitoring and evaluation reinforces the negative view of efficiency. And investments often take place in the absence of an integrated resource plan (for power system expansion) that takes efficiency options into account. A paucity of Bank staff with expertise in efficiency (now being remedied) has both reflected and contributed to the neglect of the issue.

The Bank, through the GGFR, has fostered dialogue on gas flaring, but flaring activity has not yet been reduced.

Flaring of associated gas contributes more than 400 million tons of CO_2 to the atmosphere each year; if used for power, it would produce twice the amount consumed in Sub-Saharan Africa. Using flared gas is in many cases a clear win-win proposition. The Bank-hosted GGFR Partnership represents a modest but innovative effort to tackle this large problem. The GGFR has fostered dialogue on the issue among countries and oil companies, raised the issue's profile, and sponsored useful diagnostic analyses and data collection. The GGFR's global remote sensing survey of gas flaring provides objective and verifiable data in an area that is difficult to monitor and where some participants may have low incentives for accurate reporting. However, by 2006 there had not yet been any aggregate reduction in flaring among GGFR partners, although flaring per barrel of oil has decreased in most partner countries.

Carbon finance does not address the fundamental policy and institutional failures that cause gas flaring.

The GGFR has devoted attention to carbon finance as a means of flaring reduction, which is appropriate only where the economics of reduction are marginal. However, the GGFR's diagnostic work suggests that flaring often results from lose-lose policy-level natural gas pricing decisions rather than inherently marginal economics. Where this is so, the use of project-level carbon finance is a mere bandage for policy ailments that require a more fundamental cure.

Important information for the design and management of emissions-related policies is missing.

At the international level, there is no timely, comprehensive, and consistent monitoring of energy subsidies or prices. At the national level, there is a lack of basic data on key factors related to energy efficiency, such as technical losses in transmission and the extent and emissions of captive power plants. Lacking also are timely and accurate data on household, commercial, municipal, and industrial consumption and expenditures on energy. This makes it difficult to design and monitor the impact of price reform and efficiency policies. And monitoring and evaluation remain inadequate at the project level. For instance, only one of many compact fluorescent light distribution projects has built in a rigorous impact analysis.

The World Bank has a significant history of involvement with carbon accounting.

A pilot study on carbon shadow pricing was carried out 10 years ago, and carbon pricing is integral to the activities of the Bank's carbon funds. Carbon shadow pricing has been systematically incorporated in long-term planning of the expansion of Southeast Europe's power system. And the IFC has already adopted a Performance Standard that requires projects with significant GHG emissions to quantify them annually and to seek avenues for reducing them, including offsets. While there are important technical issues in footprinting and shadow pricing, these precedents suggest that they can be overcome and could be informative. However, quantifying the Bank's indirect and policy impacts on GHGs is more difficult, though these impacts may be larger than those of the direct, project-level effects.

Box 7.1: The Challenge of Catalyzing Technology Adoption

The next phase of the climate change evaluation will look in depth at the Bank Group's experience related to technology. The framework is presented here and may be helpful in exploring uses for the recently established Clean Technology Fund.

The public policy rationale for supporting renewable energy and energy efficiency revolves around barriers or market failures, including regulatory barriers, information and transactions costs, and spillover or demonstration effects that are not captured by innovators.

GEF climate projects and CDM projects are required to predicate their financial support for a project on a barrier-removal argument of this kind. IFC and IBRD/IDA support may do so implicitly. The next phase of the evaluation will examine a set of low-carbon technologies through this barrier-removal lens. Three evaluative questions stand out:

- Are the barriers as severe as they are represented to be? In the project context, could the project have been undertaken in the absence of concessional finance (known as the additionality test)?
- What are the spillover impacts of particular technology choices?
- What is the Bank's comparative advantage and how does that find expression in the strategic choices it makes among instruments and technologies?

On the ***additionality*** question, the experience of the CDM will be instructive, both for the Bank's expanded use of carbon finance (through the Carbon Prototype Fund) and for the deployment of the Clean Technology Fund. The CDM has built an elaborate apparatus to try to ensure additionality, project by project. Contentious from the start, the additionality tests are perceived as onerous red tape by some investors. At the same time, serious questions have been raised about whether these tests truly screen out projects that could have succeeded without carbon finance (Michaelowa and Purohit 2007; Schneider 2007; Wara 2008).

For instance, some observers cite a proliferation of CDM-financed hydropower plants in places where similar plants were already widespread. Analysis by the Bank's Carbon Finance Unit has shown that in many cases the sale of carbon offsets makes only a very small difference in the project's financial bottom line—a percentage point or less in the internal rate of return. For these projects, it is not plausible that carbon revenues alone were enough to push the project over the threshold from unprofitable to profitable. However, the carbon finance transaction may have provided some other catalytic benefits. For instance, the due diligence associated with carbon finance may have crowded-in investors and financiers.

These additionality concerns are not unique to CDM projects. They also apply to pricing policies (such as feed-in tariffs or renewable portfolio standards) that promote renewable energy. As the level of support increases, to what extent is there a supply response, and to what extent do incumbents simply receive higher profits? This is a fundamental question to ask with regard to choosing mechanisms, technologies, and locations to support.

With regard to ***spillover effects***, the technology projects with the most leverage are those that trigger spontaneous diffusion or replication. One well-known mechanism for spillovers is the learning curve. Technology costs decline with cumulative production volume, as has been well documented for solar photovoltaics and wind power. Taking advantage of these learning curves is inevitably an exercise in "picking winners," or at least short-listing them. Success is achieved when cumulative production of a particular technology is enough to push costs below the threshold of competitiveness.

Another mechanism is to reduce uncertainty among technology investors or users. For instance, the first wind or minihydro plant in a country or region may be viewed with skepticism. Risk-averse investors may demand a premium; lenders may simply be unwilling to lend. Successful demonstration of the technology in local circumstances could reduce the risk premium, making it easier for follow-on projects to get financing.

Finally, public policies can deter or enable investment. Subsidies to fossil fuels or red tape for small power producers are examples of deterrents. Building and appliance codes, in contrast, increase the salability of efficient building material and machinery.

A starting place for the discussion of the ***Bank's comparative advantage*** is to look at activities that are unattractive to the private sector, or the public sector in the developed world. Within that set, the Bank could focus on those that have the highest spillover effects.

These considerations suggest concentrating Clean Technology Fund and other new resources on technologies and activities that:

- Are not the subject of research and development in the developed world

(Box continues on the next page.)

Box 7.1: The Challenge of Catalyzing Technology Adoption (*continued*)

- Are easy to replicate and therefore difficult to protect by patent or other means
- Could be rapidly pushed down the learning curve
- Facilitate public sector activities that encourage investments in efficiency and renewables
- Cannot be financed through existing Bank instruments.

Examples include:

- Improved procedures for targeting social safety net payments to poor and vulnerable people, as a means to reduce energy subsidies
- Institutions, procedures, and technologies for ex ante assessment of energy consumption by buildings, and for implementing building code inspections
- Lower-cost technologies for delivering and installing (as opposed to manufacturing) efficiency measures and decentralized renewable power sources
- Low-cost technologies for DSM of traffic in high-density cities
- Detailed wind resource surveys for windpower site identification and investment decisions
- Geological surveys on the availability and integrity of carbon capture and storage sites
- Capacity building for regulators on integrated resource planning and on technology and regulatory issues for nuclear and carbon capture and storage technologies
- Land management techniques that reduce demand for energy-intensive fertilizer production
- Solar technologies of all kinds, given higher average insolation in developing regions.

Strategic consideration of these options will force some difficult choices. For instance, pursuing the learning curve route to technology commercialization requires focusing on a limited set of technologies and coordinating these investments across countries, while an emphasis on removing uncertainty as a barrier to investment would argue for a very diffuse set of investments across a wide range of countries.

Source: IEG.

Conclusion and Recommendations

The Bank is just one contributor toward the long-term goal of mitigating and adapting to climate change. The long-run solution to mitigation entails the invention and wide-scale deployment of zero-carbon technologies. Developing and deploying these technologies will require massive near-term increases in research and development expenditure in the developed countries, and trillions of dollars of investment—far beyond the Bank's direct financial resources—in developing countries.

Still, the Bank can aspire to play a catalytic role in this global transformation. Based on the analysis in this report, IEG makes the following recommendations.

Focus World Bank efforts more strategically on areas of its comparative advantage, which include supporting the provision of public goods and, at the country level, promoting policy and institutional reform.

The Bank has the potential to help its clients pursue nationally appropriate actions that meet pressing development objectives, while positioning them on a lower-emissions growth path. It can best do so by seeking maximum leverage in its actions. This entails a strategic focus on its comparative advantage in supporting policy reforms, public goods, and institutional innovations that transform markets. There is ample scope for clients to pursue win-win policies—but if these were easy, they would have been undertaken long ago. Reform will require a systems view: looking at the power system as a whole; looking at energy subsidies as just one, dysfunctional, part of a social protection system; and looking at the connections between water and power management. And it will require big investments in real-time monitoring and learning.

Systematically promote the removal of energy subsidies, easing social and political economy concerns by providing technical assistance and policy advice to help reforming client countries find effective solutions, and analytical work demonstrat-

ing the cost and distributional impact of removal of such subsidies and of building effective, broad-based safety nets.

The mid-2008 level of energy prices, while burdensome for many countries, nonetheless prompts a fresh look at policies on energy subsidies, energy efficiency, and renewable energy sources. The recent experience of these prices may open doors for policy and regulatory reform. The Bank can provide analytic support for countries to explore the potential for gains from reform, and financial and technical support for carrying out reforms if desired.

Energy price reform is never easy or painless. It can endanger poor people, arouse the opposition of groups used to low prices, and trigger inflation, thereby posing political risks. But failure to reform can be worse, diverting public funds from investments that fight poverty and fostering an inefficient economy that is increasingly exposed to energy shocks. And reform need not be undertaken overnight. The Bank can provide assistance in charting and financing adjustment paths that are politically, socially, and environmentally sustainable.

One way to do this is for the Bank to continue to develop and share knowledge on the use of cash-transfer systems or other social protection programs as potentially superior alternatives to fuel subsidies in assisting the poor. To assist countries in dismantling subsidies that benefit special interest groups, the Bank should foster cross-sectoral cooperation and greater use of political economic analysis. Timely monitoring and analysis of energy use and expenditure, at the household and firm levels, will be important in policy design, in securing public support, and in detecting and repairing holes in the safety net.

Emphasize policies that induce improvement in energy efficiency as a way of reducing the burden of transition to market-based energy prices.

Cost-reflective prices for energy boost the returns to efficiency, but policies may need to be put in place to allow households and firms to exploit efficiency opportunities. Conversely, the deployment of energy-efficient equipment such as compact fluorescent lights can be used as a device for cushioning the impact of price increases. The Bank should explore innovative ways to finance efficiency (and renewable energy) investments in the face of fuel price volatility.

This report calls for much greater emphasis on promotion of energy efficiency. But similar calls in the past have not evoked a strong response. If a real reorientation to energy efficiency and renewable energy is to occur, the Bank's internal incentive system needs to be reshaped. Instead of targeting dollar growth in lending for energy efficiency (which may distort effort away from the high-leverage, low-cost interventions), it needs to find indicators that more directly reflect energy savings and harness them to country strategies and project decisions. It also needs to patiently support longer, more staff-intensive analysis and technical assistance activities. Increased funding for preparation, policy dialogue, analysis, and technical assistance is required. Trust fund resources have been helpful for this in the past; the Clean Technology Fund may provide additional, near-term funds.

Promote a systems approach by providing incentives to address climate change issues through cross-sectoral approaches and teams at the country level, and structured interaction between the Energy and Environment Sector Boards.

To tackle problems of climate change mitigation and adaptation, the Bank and its clients need to think beyond the facility level, beyond subsectors, and beyond sectors. The value of a windmill depends on the load patterns of the grid to which it is connected. Removing electricity subsidies for farmers requires an understanding of agricultural policies and conditions. Promoting municipal electricity efficiency is closely bound up with reducing distribution losses in water systems. Traffic congestion and air pollution are a consequence of fuel subsidies. Urban forestry promotes mitigation by cooling cities and fosters adaptation by reducing flooding.

To be effective, the Bank needs to break down sectoral stovepipes and encourage cross-sector approaches and teams. This will require championship by country directors and vice presidents. The unfulfilled promise of mainstreaming sustainable development needs to be realized through structured interaction of the Energy and Environment Sector Boards. This could be initiated with ad hoc groups to address specific cross-sectoral challenges.

At the country level, the Bank should support capacity building for a systems approach—for instance, for power system regulators in the area of integrated resource planning. And it should think about using the Clean Technology Fund to support public systems that will catalyze widespread investments. For instance, capacity building for building inspectors and for the construction industry could transform that industry.

Invest more in improving metrics and monitoring for motivation and learning—at the global, country, and project levels.

Good information can motivate and guide action. Building on the Bank's current collaboration with the IEA or other partners on energy-efficiency indicators, the Bank should set up an Energy Scoreboard that will regularly compile up-to-date standardized information on energy prices, collection rates, subsidies, policies, and performance data at the national, subnational, and project levels. Indicators could be used by borrowers for benchmarking; in the design and implementation of country strategies, including sectoral and cross-sectoral policies; and in assessing Bank performance. The Bank could look for inspiration to India, which already publishes detailed data on power plant CO_2 emissions, state-level utility performance, and fuel subsidy levels, or to China, which is aggressively pursuing a goal of energy-efficiency improvement.

At the national level, the Bank should support integration of household and firm surveys with energy consumption and access information to lay the foundation for assessing impacts of price rises and mitigatory measures, as well as planning for improved access. The Bank could explore the use of advances in information technology (such as meters with automated, wireless reporting), together with statistical sampling, to undertake real-time monitoring of energy use and patterns. Affordable monitoring systems could pay big dividends in improved energy management at the sectoral and national levels.

More rigorous economic and environmental assessment is needed for energy investments and those which release or prevent carbon emissions. These assessments should draw on energy prices collected for the Energy Scoreboard and account for price volatility. In addition, they could undertake carbon accounting at the project level, computing switching values for high- and low-carbon alternatives. Investment projects should also be assessed, qualitatively, on a diffusion index, which would indicate the expected catalytic effect of the investment on subsequent similar projects. Where proprietary information is not involved, these assessments should be made public for information and comment. Public disclosure will provide incentives for accurate assessment and will also inform global technology and investment planning.

Ideally, investments should fund projects identified under an active integrated resource plan for system expansion. Such plans should allow for energy efficiency as a source of increased capacity and take account of the value of renewables in reducing pollution and exposure to external price shocks. The Bank should assist countries in preparing and implementing these plans. Countries may wish to compare expansion plans under different shadow prices for carbon.

It is desirable to complement project-based analysis with assessment of indirect and policy-related impacts, which could be much larger.

Monitoring and evaluation of energy efficiency interventions continues to need more attention. Large-scale distribution of compact fluorescent light bulbs is one example of an intervention that is well suited to impact analysis and where a timely analysis could be important in informing possibly massive scale-up activities.