



European Bank
for Reconstruction and Development



The Nexus Between Infrastructure and Environment

From the Evaluation Cooperation Group of the
International Financial Institutions

EVALUATION BRIEF

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International Financial Institutions

African Development Bank, Asian Development Bank, European Bank for
Reconstruction and Development, European Investment Bank, Inter-American
Development Bank, International Monetary Fund, and the World Bank Group

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Contents

v	Acknowledgments
vii	Executive Summary
1	Chapter 1 The Infrastructure-Environment Nexus and the Future of Development
3	Chapter 2 Infrastructure, Growth, and Poverty Reduction
5	Chapter 3 Environment and Development
11	Chapter 4 The Nexus at the Project Level
15	Chapter 5 Sectoral and National Policies
25	Chapter 6 Conclusions and Follow-Up
27	Bibliography

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Executive Summary

Infrastructure plays a crucial role in the drive for achieving development by providing energy, transportation, and water. There have been ups and downs in the degree of emphasis placed on infrastructure, but infrastructure has remained the largest component of the public investment programs in developing countries—two to six percent of gross domestic product (GDP). Nearly half of the international financial institutions' project lending to developing countries goes to infrastructure. Going forward, the Organisation for Economic Co-operation and Development (OECD) estimates that developing countries might have to invest over \$700 billion a year in infrastructure in the coming decade—rising to \$1 trillion a year by 2030—in order to sustain rapid growth rates.

Well-designed infrastructure can have positive impacts on the environment, which also is crucial for development. However, there is a dark side to infrastructural investments: they often lead to environmental degradation. Fossil fuel energy generation and transportation create emissions that contribute to acid rain locally and global warming. Hydropower and irrigation can lead to flooding, water pollution, and disruption of communities. Roads can lead to erosion, deforestation, and biodiversity loss. These environmental costs have been estimated to

reach four to eight percent of GDP for some developing countries, with most of the effects falling on the poor.

The Evaluation Coordination Group (ECG) recognizes the importance of this linkage, which we call the infrastructure-environment nexus. It represents a large and growing challenge for the countries and the international financial institutions (IFIs) in their development goals. Meeting the Millennium Development Goals depends on the provision of adequate infrastructure, such as providing clean water and sanitation, as well as on reducing adverse environmental impacts, such as reducing the impacts of air pollution on health and agricultural production (e.g., acid rain). The ECG commissioned this initial review of members' experiences to learn what can be done both to minimize the detrimental impacts of infrastructure on the environment and to enhance infrastructure's positive contribution to the environment beyond the role of existing safeguards.

The evidence points to the need for the nexus issues to be addressed both at the project level relating to selection, design, implementation, and supervision, as well as at the sectoral and national level relating to policies, regulations, and environmental capacity. Most attention to

environmental impacts is currently focused at the project level—whether safeguard criteria are met and efficiency improved “within the project fence.” This is important, and there are areas in this respect that need greater attention. Importantly, once projects are implemented, effective operation and maintenance of infrastructure is needed over the full life of the project to assure that environmental safeguard measures are implemented. Evaluations by the International Finance Corporation (IFC) and the European Bank for Reconstruction and Development (EBRD) demonstrate that projects which successfully take account of the environmental do as well financially and economically as projects which do not.

While project-level efforts across the Regions have produced significantly positive results, far more attention needs to be paid to sector-wide and national issues that have far-reaching impacts. There are more environmentally friendly alternative means of satisfying the needs, such as the energy conservation program run by Global Environment Facility (GEF) in Thailand, which reduced peak demand by a gigawatt with a benefit-to-cost ratio of 1.7. Alternate site selection in infrastructural investments could help, such as roads routed around unexploited forests with a buffer zone of protected areas built in, as possible in countries such as Brazil. Water conservation could reduce water usage to sustainable levels, for example, by reducing the Middle East and North Africa’s withdrawal of over 100 percent of renewable water.

The interface between projects on the one side and sectoral and national actions on the other remains a challenge. The first area for action concerns strategies and institutional approaches themselves. National governments need to establish national environmental strategies through Strategic Environmental Assessments or similar documents with implementation and follow-up. Strengthening national environmental management capacity will mitigate damage and promote a better environment. Experiences with the Bolivia-Brazil pipeline and Nam Theun 2 dam projects have shown how taking a more

integrated approach at a national and sectoral level can produce satisfactory environmental results while meeting project goals.

Second, national policies can provide incentives for increasing the efficiency of infrastructure projects. Sound pricing and market incentive policies help control excessive demand for infrastructure services, assure adequate maintenance, and encourage shifting to more conservation. Cutting water subsidies will reduce unnecessary depletion of water, and proper energy pricing and incentives will reduce demand and increase conservation. Incentives for new technologies can also make a difference: CO₂ emissions from coal-fired plants can be reduced by up to one-third with the latest technology.

Third, encouraging more private investment, with proper regulation and cooperation between the public and private sectors, can expand infrastructure availability effectively, as Morocco’s public-private coordination policies have demonstrated. Involving recipients in infrastructure projects will also help. For instance, the poor are willing to pay for clean water, if they understand the costs and benefits, as has been demonstrated in the Bolivia PROSABAR Project.

Finally, dealing effectively with governance and corruption issues is an especially important priority when it comes to infrastructure compared to other sectors. Improving governance and reducing corruption can significantly reduce the cost to society of infrastructure, improve its efficiency, and lead to better planning, design, implementation, and outcomes.

Overall, there is considerable scope to reduce the negative environmental impacts of infrastructure, to mitigate the impacts of others, and to actually enhance the environment in many cases. This requires moving beyond the conventional “do no harm” approach at the project level to a more proactive “do good” approach at both project and national levels. The evaluations reviewed demonstrate that this is an important possibility that can and should be exploited

much more extensively than is currently the case.

This review across regions provides implications for actions by the IFIs and the countries, by the evaluators, and by the ECG.

- The IFIs can work with countries to ensure that a more environmentally strategic approach is used in project selection, design, and management; that more incentives are provided to reduce environmental damage; and, better yet, that measures are taken to improve the environment through conservation and stewardship.
- Evaluators need to examine the infrastructure-environment linkages in their project, sector, and country assessments. A special effort needs to be made to cover the full operational life of projects in order to capture the full range of intended and unintended effects which often emerge over time.
- The ECG members can support work on the nexus issues by building and sharing fuller databases, by undertaking meta-analyses of infrastructure policies to learn how to help countries better address nexus issues, and by assuring more complete cost-benefit analyses are conducted to demonstrate the real costs of not adequately addressing the nexus.

Action on the nexus is a huge priority for the industrial countries as well, whose record on this score needs much improvement. Action by both industrial and developing countries will generate beneficial results for the whole world—including importantly for developing countries and especially the poor. The payoffs to all will be immense from building sound infrastructure while strengthening the environment. What is needed is a shift in priorities and emphasis to make that happen.

CHAPTER 1

The Infrastructure-Environment Nexus and the Future of Development

Infrastructures are at the very heart of economic and social development. The next decades are likely to see an accentuation of two facets of infrastructures. On the one hand, they will prove a vital tool in resolving some of the major challenges faced by societies—supporting economic growth, meeting basic needs, lifting millions of people out of poverty, facilitating mobility and social interaction. On the other, environmental pressures in the form of changing climatic conditions, congestion and so on are likely to increase, turning the spotlight firmly on the inherent tensions between the imperative for further infrastructure development and the quest for sustainability (*Infrastructure to 2030*, OECD, June 2006).

The recent report on climate change by the United Kingdom's Economic Service, commonly referred to as the Stern Review, highlighted the importance of environmental risks inherent in world economic growth and development.¹ This concern affects all countries and all populations, but the report points out that:

The most vulnerable—the poorest countries and populations—will suffer earliest and most, even though they have contributed least to the causes of climate change (Summary of Conclusions, p. 2).

Thus, as development agencies pursue their efforts to promote economic development in poor countries and improve the lives of their people, they are warned to be cognizant of the need to ensure that development is achieved in ways that minimize environmental damage or—better still—improve environmental quality. This is nowhere more evident than in the intersection

of environmental concerns with the need for developmentally important infrastructure—what we call the infrastructure-environment nexus.

Infrastructure is essential for growth, which is essential for poverty alleviation. Expanding infrastructure to meet expanding demands will absorb trillions of dollars of investment over the coming decades in the developing and transition economies. Many infrastructure investments deal effectively with their environmental impacts or directly promote environmental improvements, but many kinds of infrastructure also pose serious threats to the environment. If these threats are not addressed, many of the benefits of growth will be undermined, especially for the poor, who often suffer disproportionately from environmental damages. Infrastructure lasts for a long time, often 50 years or more, and greatly influences the direction of further development, so it is vital to take account of the full extent of its impacts. **The infrastructure-environment nexus addresses the challenge of meeting the demand for infrastructure services while maintaining or improving the quality of the environment.**

At its semi-annual meeting in Manila in the fall of 2005, the Evaluation Cooperation Group (ECG), representing the independent evaluation departments of the international financial institutions (IFIs), recognized the critical importance of this infrastructure-environment nexus. It commissioned this initial review of its members' experience to see what lessons can be learned to avoid the detrimental effects of infrastructure and contribute to environmental enhancement. To address this topic's scope and complexity, this paper sets out an analytic structure for assessing the nexus and uses evaluation results to illustrate that infrastructure outcomes are affected by

project design and implementation and by sector and national policies and practices. It offers guidance to the IFIs' management and staff on how they can better achieve their institutions' goals in infrastructure and environment. In particular, evaluating projects and programs in developing countries needs a more systematic approach. The ECG members should work together to strengthen the evaluation of infrastructure-environment nexus issues.

Questions Addressed

This paper addresses two crucial nexus questions related to IFI activities:

- At the project level, how effectively do project design and implementation incorporate environmental considerations?
- At the sectoral and national levels, do policy and regulatory regimes and investment portfolios effectively incorporate environmental considerations?

These questions are closely linked. The first deals with traditional “within-the-fence” efforts to ensure that projects meet environmental standards, often by applying environmental safeguard policies in project design. Safeguard policies may, for instance, ensure that thermal generators incorporate adequate controls for air pollution. However, there may be alternative projects or other actions that offer superior economic and environmental outcomes. For instance, hydropower rather than fossil fuel-

based power may be better when all factors are considered, or improvements in end-use efficiency could obviate the need for new generating capacity and thus save money while reducing air pollution. These considerations go beyond traditional project-focused safeguard policies. So the second, broader question is whether the right kinds of projects are being selected and whether there are policy alternatives (such as price reforms or market-based incentives) which are preferable to brick-and-mortar infrastructure investments. In many parts of the world, the broader question should also address regional coordination of infrastructure and environmental planning, such as African transport and energy networks or Mekong water management to assure that highways open landlocked countries to trade and that roads and dams do not excessively disrupt downstream water flows.

In addressing these two questions, we will evaluate outcomes, the relationship between IFI processes and outcomes, and the evaluation process itself. This paper focuses mostly on transport, energy, and water, which account for the bulk of infrastructure lending and tend to have more prominent biophysical environmental impacts and very significant socio-economic environmental consequences that need to be taken into account. We will begin by examining the role of infrastructure in growth and poverty reduction, and then consider the environmental impacts and how they can be addressed.²

Notes

1. United Kingdom Economic Service, 2006, Stern Review on the Economics of Climate Change.
2. The safeguard policies include both biophysical and socioeconomic factors. This paper concentrates on the biophysical, but takes into account the impact of infrastructure on poverty and the Millennium Development Goals.

CHAPTER 2

Infrastructure, Growth, and Poverty Reduction

Roads, electricity, clean water, and irrigation are integral parts of development and poverty reduction. Some infrastructure investments are directly linked to the Millennium Development Goals (MDGs). Provision of clean water, for instance, is an integral part of target 10 (in the environmental goal) and is critical to achieving target 5 (reduction of child mortality). The African Development Bank (AfDB) estimates that less than two-thirds of Africa's urban population has access to safe water and barely one half to sanitation—if all the systems work as designed. Access in rural areas is much lower.¹ Other linkages are likely to be strong but indirect—for instance, the role of rural roads in boosting farm incomes and improving access to schools and health facilities.

Good infrastructure is part of the enabling conditions for sustained economic growth which, in turn, is a prerequisite to reducing poverty. For instance, Fan and Chan-Kang (2004) report excellent returns to rural road investments in India.² They estimate a reduction in the poverty head-count of 10 people per 1 kilometer of road extension in low-potential rain-fed areas and economic rates of return in the hundreds or even thousands of percent. Similarly, for China, they estimate high economic returns to road investments, concluding that among infrastructure investments, roads had the greatest impact on reducing poverty. The International Energy Agency estimates that energy, as a factor of production, accounted for 13 percent of China's GDP growth over 1980–2001, 15 percent of India's, 30 percent of Mexico's, 50 percent of Korea's, and 77 percent of Brazil's.³

IFI Infrastructure Lending

Not surprisingly, then, IFI lending emphasizes infrastructure. IFI lending for infrastructure amounted to over \$40 billion in 2005. Over the

past 15 years, infrastructure lending has comprised about 50 percent of project lending and 40 percent of total lending. Within this roughly constant share, there has been a relative shift from power to transport (see Figure 2.1 and Figure 2.2). IFI lending constitutes less than the majority of infrastructure investments in developing countries, but its relatively high quality and profile help set standards that contribute to better overall infrastructure.⁴

Future Infrastructure Requirements

The Organisation for Economic Co-operation and Development (OECD) estimates that total global expenditures on infrastructure in energy, transportation, and water from 2000 to 2030 will need to be about \$57 trillion (in constant 2000 US\$) in order to achieve targeted economic growth rates.⁵ Nearly half of this expenditure will be in developing countries, which have the greatest needs for additional

Figure 2.1: IFI Infrastructure Lending

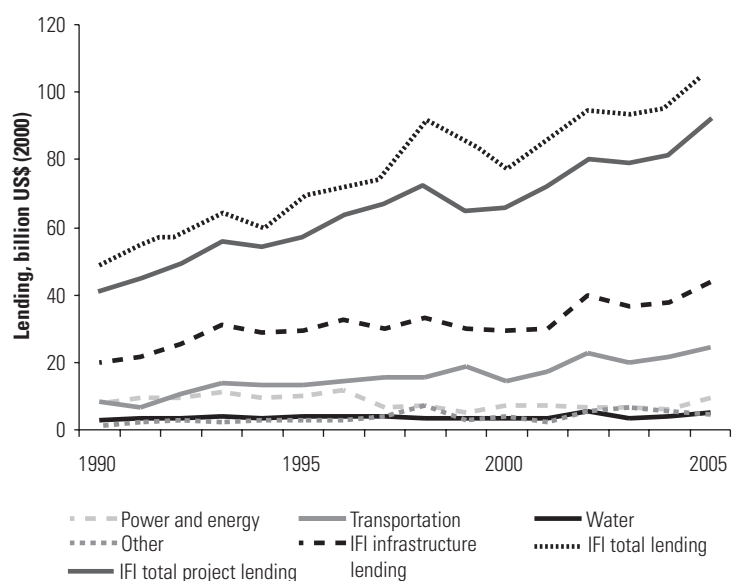
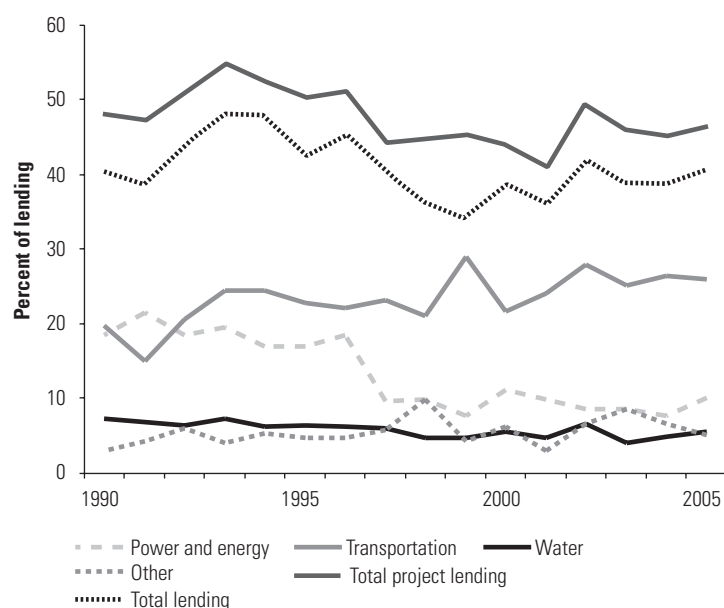


Figure 2.2: Infrastructure Share of IFI Lending

infrastructure (see Table 2.1). To support continued high growth, infrastructure investment will have to average over \$700 billion a year in this decade, rising to over \$1 trillion a year by the 2020s. The World Bank estimates that developing countries will need to invest about six percent of their gross domestic product (GDP) annually in infrastructure, rising to as high as nine percent for the lower-income countries.⁶ However, current investment levels in Africa and Latin America and the Caribbean are well below this target level, which has contributed to their relatively lower growth rates. Investment levels in Asia are generally high, exceeding seven percent of GDP for infrastructure in rapidly growing countries.⁷

Table 2.1: OECD Estimates of Infrastructure Investment Requirements

	2000–10		2011–20		2021–30		2000–30	
	Average annual	Total	Average annual	Total	Average annual	Total	Total	Percent of total
Total, developing countries	701	7,011	880	8,805	1,048	10,476	26,291	46
Energy	317	3,174	385	3,852	398	3,982	11,008	47
Transportation	83	826	92	919	108	1,075	2,820	31
Water	301	3,010	403	4,034	542	5,419	12,463	52

Source: Based on OECD, 2006, *Infrastructure to 2030: Telecom, Land Transport, Water and Electricity*, Paris: OECD.

Note: Investment figures are in constant 2000 US\$ billion.

Notes

1. African Development Bank, 2003 (July), *Evaluating Bank's Support for Capacity Strengthening of Urban Water Supply and Sanitation Entities in Regional Member Countries*.
2. Shenngen Fan and Connie Chan-Kang, 2004, "Returns to Investment in Less-Favored Areas in Developing Countries: A Synthesis of Evidence and Implications for Africa," *Food Policy* 29(4): 431–444.
3. International Energy Agency, 2004, *World Energy Outlook 2004*, Paris: OECD/IEA.
4. The World Bank's review of China has shown this to be the case. IEG (OED), 2004, *China: An Evaluation of World Bank Assistance*.

5. These estimates are derived from OECD, 2006, *Infrastructure to 2030: Telecom, Land Transport, Water and Electricity*, Paris: OECD, and represent estimates of what is needed to achieve desired growth rates. Based on past experience, actual spending often falls below what is needed to provide the appropriate level of infrastructure.
6. World Bank, 2005 (September), "Infrastructure and the World Bank: A Progress Report."
7. Asian Development Bank, Japan Bank for International Cooperation, and the World Bank, 2005, "Connecting East Asia: A Framework for Infrastructure."

CHAPTER 3

Environment and Development

Infrastructure services are vital for supporting economic growth and improving the quality of life by improving transport and communications, sanitation and home heating, access to education, health services, etc. However, providing these services can have environmental impacts that also have important implications for quality of life, including both biophysical and social aspects. The former affect geological and biological conditions such as land quality, water management, biodiversity, etc.; the latter affect health and other social conditions due to air and water quality, resettlement, etc. Well-designed infrastructure projects can produce positive environmental impacts, e.g., by reducing water pollution, or mitigate negative environmental impacts, e.g., through emissions controls. However, when environmental consequences are not taken into account, infrastructure projects can pose serious threats to the environment and resultant quality of life. Land degradation, flooding, water and air pollution, and acid rain that result from poorly designed projects seriously degrade living conditions, especially for the poor who lack the resources to compensate for the impacts. The nexus focuses attention precisely on this intersection between environment and infrastructure.

The construction and operation of infrastructure generally pose risks to local environment, which will result in environmental damage if not adequately mitigated or compensated. This is well documented in the case of **energy**, especially where power plants or industry burn coal. In China, acid rain and other biophysical effects of coal combustion have reduced crop yields by five percent to 30 percent for 70 percent of all crops.¹ In India, acid rain has acidified soils in a large part of the country and decreased crop

yield by up to 50 percent in the immediate environs of large power plants.² On the social side, particulates and smog from power plants and traffic are estimated to cause 427,000 excess deaths annually in China³ and 107,000 in India.⁴ Global damages from infrastructure-related fossil fuel emissions—such as climate change—are additional to these local damages. Emissions are inherent in fossil fuel energy (power and transport), and the challenges are to minimize emissions, promote alternate energy, and encourage conservation.

Rural road construction can also contribute to environmental damage, both directly and indirectly. The direct effects include erosion and sedimentation. Unpaved forest roads can be a major cause of erosion, gully, and stream sedimentation. The indirect effects can be much larger. Chomitz (2006), in an extensive literature review, confirms that roads are a major trigger for tropical deforestation.⁵ The challenges are to design and maintain roads well, route them to avoid negative impacts on forests, and enforce land use regulations.

In **transportation**, investment in urban mass transit systems may be more environment-friendly than building more extensive road systems that encourage automobile use, extended urban development, and the concomitant rise in demand for fuel.⁶ Thus, while infrastructure often requires mitigation measures to minimize environmental damage, in some cases it can directly reduce the need for mitigation and enhance environmental benefits.

Irrigation works can lead to overuse of water, land degradation, and downstream pollution (pesticides, herbicides, etc.). The Millennium

Ecosystem Assessment (MEA) claims that irrigation already consumes 20–30 percent of the planet’s available freshwater resources.⁷ Statistics reported in the World Development Indicators are less alarming at the global scale, but report that South Asia withdraws 52 percent of internal renewable freshwater resources (90 percent for agriculture), and the Middle East and North Africa withdraw 105 percent (89 percent for agriculture). A study conducted by the United Nations Environment Programme found that “half of the world’s irrigated land has been affected by water-logging, salinity, or alkalinity. Salinity seriously affects productivity on about 22 million hectares of land and has less severe impacts on another 55 million.”⁸ Irrigation and other water projects may also deplete water resources and lower water tables. The challenges include effectively managing watersheds while providing clean water and sanitation locally, and not disrupting water downstream.

In contrast, investment in **sanitation** represents an example of infrastructure specifically designed to improve the environment. A 2005 United Nations Task Force report on water and sanitation highlighted the health, poverty reduction, and environmental benefits of improved sanitation infrastructure and recommended steps to provide this infrastructure.⁹

The pressures on the urban environment and urban infrastructure are particularly acute in the world’s mega cities, many of which are in

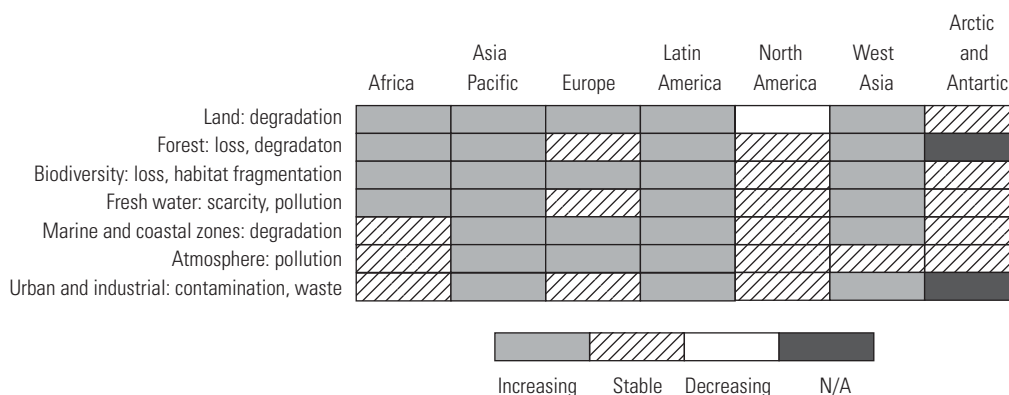
developing countries. Urban development that fails to plan for and provide basic public utilities contributes to both infrastructure and environmental problems, especially in poor countries. Insufficient roads prevent adequate access for fire fighting and solid waste collection. Lack of access to electricity and cleaner fuels can result in excessive use of coal and firewood for cooking and heating, leading to high levels of interior air pollution and negative health impacts. Water supplies and sanitation are typically insufficient.¹⁰

Estimates from the late 1990s (currently being updated) indicate that environmental degradation is increasing and that the damages are spread across all regions in a number of environmental categories (see Figure 3.1). This poses a growing threat to developing countries as the costs of such environmental damage are being increasingly felt and have the potential to undermine their potential for sustained growth.

Policies toward Positive Environmental Impacts of Infrastructure: Overview

Infrastructure is a double-edged sword, associated with income gains and also often with environmental costs. But those costs are, to a large extent, avoidable. There are several ways to reduce the costs and increase the environmental benefits of infrastructure projects, at both the project and national/sectoral levels. There are also regional and global challenges that have been identified through evaluations.

Figure 3.1: Environmental Damages Increasing in the Developing World



Source: United Nations Environmental Programme, 1997.

Project Level

Project **design** choices can reduce environmental impacts. Coal-fired power plants can use efficient technologies and incorporate scrubbers or other end-of-pipe pollution controls. Roads can be routed around sensitive environmental sites and incorporate drainage systems that reduce runoff and erosion. Watershed management can reduce flooding and water shortages while preserving access to good water supplies. Properly insulating and orienting buildings can reduce their heating and cooling demands. These design considerations are important because buildings, power plants, and other infrastructure have operational lives of 40–100 years.

Operations and maintenance are important determinants of economic and environmental outcomes at the project level. Maintenance is critical for end-of-pipe pollution control equipment. Because it is costly, facility operators may skimp on maintenance in the absence of incentives or controls. Similarly, road maintenance is crucial in order to avoid costly reconstruction and to reduce runoff and erosion, and urban sanitation and drainage systems will fail in the absence of maintenance.

National/Sectoral Level

At the national (sectoral and cross-sectoral) level, there are many more options for increasing the benefit-to-cost ratios of infrastructure investments. These options may not be apparent if environmental assessments are only undertaken at the project level. They require sectoral or national planning, which includes:

Shifting infrastructure toward more environmentally friendly technologies. For instance, the electric generation portfolio could move toward clean and renewable fuels and away from coal, or toward more efficient technologies, or toward conservation. While some of these changes may cost more up front, their reduced environmental impacts will produce more benefits over the longer run. Determining which shifts are most effective would employ more extensive cost-benefit analysis.

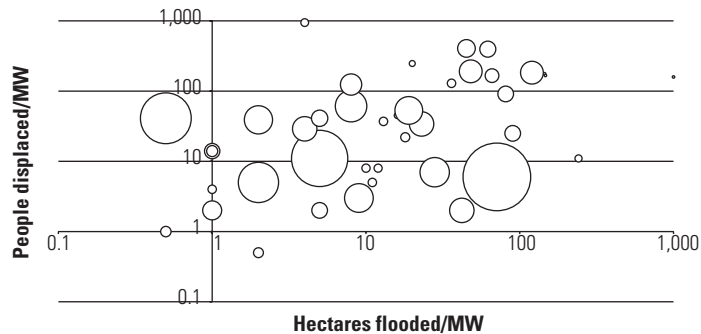
Substituting environmental capital for physical capital. In the water sector, the need for major investments in water purification can be reduced by introducing upstream stewardship methods for watershed management and reduction of polluted runoff (e.g., incentives for farmers and others to modify their practices).¹¹ Other examples include using wetlands and floodplains as buffers against flooding; using mangroves as buffers against storm surges and tsunamis; and reducing urban “heat island” effects through vegetative planting.

Infrastructure siting and spatial planning.

Infrastructure siting decisions can profoundly affect environmental impacts. For instance, the environmental and social impact of dams depends on the size and population of the basins that they flood. Figure 3.2, based on data from Ledec and Quintero (2003),¹² plots the relative impact of large dams along two dimensions: displaced people per megawatt (MW) and hectares flooded per MW (bubble size is proportional to the power plant’s generating capacity). The figure shows that some dams are 100–1,000 times more efficient (less damaging per MW) than others along these two dimensions. Similarly, road siting presents tradeoffs in induced deforestation versus stimulus for local development. Preferentially siting new roads and road upgrades in more densely populated, already degraded areas, and surrounding unavoidable forest roads with protected area corridors, can mitigate or possibly even reverse the potential growth-environment tradeoff associated with road construction.

Investing in efficiency. Increased efficiency of water and energy use can reduce the need for costly and environmentally damaging investments. Efficiency is typically low in irrigation: for instance, MEA (2005) reports only 40–50 percent of diverted water is used by crops. Water is often used for low-value crops rather than higher value industrial or domestic use. In water-scarce South Asia, for instance, average water productivity is \$0.20 per cubic meter in agriculture versus \$5.90 in industry.¹³ Likewise, there are many opportunities for increased efficiency of energy use.

Figure 3.2: Environmental and Social Impacts of Dams



Shifting from incandescent to compact fluorescent lights can realize substantial electricity savings and postpone the need for building more generation capacity.

Policy reforms. Sectoral policies can profoundly affect the demand for, supply of, and utilization of infrastructure. For instance:

- Reducing or eliminating agricultural price distortions that excessively favor water-consuming crops and that boost demand for irrigation with no net increased benefits, and setting water prices at levels that discourage excessive use of water for low value crops.
- Reducing or eliminating gasoline and diesel price subsidies to reduce demand for roadways, especially where prices do not fully reflect congestion and pollution costs.
- Reducing subsidies that favor coal-fired generators over less-polluting natural gas plants.

Such policy reforms have the potential to reduce environmental damages associated with the use of infrastructure.

Regional and Global Level

Many of the infrastructure challenges are common across regions. In all areas, there will be growing demand for power and transport. Demand for urban infrastructure (including water and urban transport) will surge as cities grow in Asia, Latin America, and Africa. Beyond dealing with common problems, a number of environmental challenges have to be addressed

by coordination and cooperation among neighboring countries. Watersheds often span one or more national borders. Energy sources, such as hydropower, can have impacts on countries along the river sources. Landlocked countries need access to the sea to participate in global trade. These regional issues affect nearly all developing countries. Despite many common features, there are also distinctive challenges in the major regions.

Africa: Infrastructure is inadequate and must be expanded in ways that promote growth and better integrate environmental factors. These countries have a relatively small infrastructure base and are investing only two to three percent of GDP in infrastructure.¹⁴ They should take advantage of the opportunities to adopt more advanced, integrated, and environmentally sound approaches to infrastructure. This will enable them to generate more effective growth and poverty alleviation, reduce threats to their environments, and provide greater capacity to deal with frequent natural disasters.¹⁵ Cross-boundary watershed management and prospective continental road and power networks are critical for Africa and will require international cooperation and environmental assessments.

Asia: These countries are investing about six percent of GDP in infrastructure, and their rapid expansion of urban infrastructure and energy demand will require greater efforts to enhance environmental protection and to remediate the serious losses resulting from past environmental degradation. Studies have estimated that environmental damage has cost China and India four to eight percent of GDP annually, and a significant portion of that comes from the impacts of infrastructure.¹⁶ Given the expected rapid expansion of infrastructure, especially related to energy production for power and transportation, these countries should give energy conservation an increased priority.¹⁷ While many Asian countries have adopted good environmental policies, implementation and enforcement remain a serious challenge. IFIs can play an important role in strengthening this process.

Eastern Europe: Further rehabilitation and management of infrastructure will accelerate the transition to modern economies, building on a reasonably successful program to date. These countries must meet the high standards set by the European Union (EU) environmental policies to better integrate into the European economy, which gives them a strong incentive to further improve infrastructure in relation to the environment. They have focused on improving both physical elements and management in their transition to more market-oriented processes, which has helped reduce emissions and pollution.¹⁸ As with Africa, regional planning of infrastructure and environmental management would contribute a great deal to their mutual well-being.

Latin America: Infrastructure investment needs to recover from recent lows of one to two percent of GDP to help accelerate growth, as levels of infrastructure are well below that of faster growing Asian countries.¹⁹ Nevertheless, the environment has often suffered from what infrastructure has been built, especially roads in the Amazon region and support for the exploitation of natural resources. There is a need to reduce the negative environmental impacts that have characterized much of the infrastructure development to date and to build a sound infrastructure that strengthens the environment in an integrated way to provide a basis for more sustainable development and poverty alleviation.

Global: Local infrastructure development has global implications. The manner in which energy and transport systems are constructed will have long-lasting implications for CO₂ emissions and thus for global warming and the recently recognized threat of ocean acidification. Beyond the direct impacts of infrastructure projects on the environment in their immediate areas or countries, global environmental impact issues should receive more attention. Currently most CO₂ emissions come from developed countries, but several fast-growing developing countries are rapidly increasing their energy consumption and

emissions, especially where they depend on coal for energy.²⁰ Promotion of energy efficiency and renewable fuels can help retard global warming while providing local benefits in reduced air pollution. Carbon reduction finance and trading programs could help to support more environmentally friendly infrastructure; carbon trading programs are in place in the World Bank Group (WBG), the Asian Development Bank (AsDB), the European Bank for Reconstruction and Development (EBRD), and the European Investment Bank (EIB).²¹

In addition, the effects of climate change on the prospects for sustainable development are serious. Many countries face major impediments to development from changing rainfall and water shortages, rising sea levels, and temperature fluctuations that will affect agricultural production, overall growth, and poverty-reduction prospects. The dual role of infrastructure in contributing to climate change while providing important services has not been adequately addressed in ways that would create opportunities to generate more positive effects in well-designed infrastructure projects. These potentially adverse impacts also need to be addressed in the infrastructure-environment nexus to make sure that infrastructure projects help protect against the impacts of climate change.

Summation

This brief review has illustrated the magnitude of future infrastructure demand and the potential environmental issues. Furthermore, it has established that there are ample opportunities to mitigate the potentially negative impacts of infrastructure on the environment. The following sections will examine whether IFI projects have been designed and executed properly within a well-structured environmental strategy, whether the IFIs adequately pursue opportunities for environmental strengthening, and to what extent they have been successful or fallen short of desired results. Both the project and national/sectoral levels will be considered.

Notes

1. Chameides et al., 1999, "Is Ozone Pollution Affecting Crop Yields in China?" *Geophys. Res. Lett.*, 26, 867-870 as cited in Zmarak Shalizi, 2006a, "Climate Change Implications for Energy Infrastructure in China and India (Clean Energy and Energy Efficiency)," ABCDE Conference.
2. Mitra and Sharma, 2002, "India Aerosol: Present Status," cited in Shalizi above.
3. World Bank data as cited in Shalizi above.
4. Cohen et al., 2004 "Mortality Impacts of Urban Air Pollution," cited in Shalizi above.
5. Kenneth M. Chomitz, 2006, *At Loggerheads? Agricultural Expansion, Poverty Reduction, and Environment in the Tropical Forests*.
6. World Bank, 1996, "Sustainable Transport: Priorities for Policy Reform"; and World Bank, 2006, "Safe, Clean and Affordable Transport for Growth: An Update of the World Bank's Sector Priorities for the Period 2007–2011."
7. Reid et al., 2005, *Ecosystems and Human Well-Being: Synthesis*, p. 747.
8. Morris et al., 2003, *Groundwater and Its Susceptibility to Degradation: A Global Assessment of the Problem and Options for Management*, p. 87.
9. United Nations Millennium Project, 2005, *Health, Dignity and Development: What Would It Take?*
10. African Development Bank, 2003 (July), *Evaluating Bank's Support for Capacity Strengthening of Urban Water Supply and Sanitation Entities in Regional Member Countries*, and World Bank, 2006, *World Development Indicators*.
11. Such approaches have proven successful in both developed and developing countries. John D. Shilling and Jennifer Osha, 2002, "Making Markets Pay for Stewardship"; and David Reed, 2006, *Escaping Poverty Grasps*.
12. George Ledec and Juan David Quintero, 2003, "Good Dams and Bad Dams: Environmental Criteria for Selection of Hydroelectric Projects."
13. World Bank, 2006, *World Development Indicators*.
14. See World Bank, 2005, *Infrastructure and the World Bank: A Progress Report*, for GDP shares in other regions.
15. African Development Bank, 2004, "African Development Bank Group's Policy on the Environment."
16. World Bank, 1997, *Clear Water, Blue Skies*; World Bank, 2005, *Environment Matters, Annual Review*; and Kirit S. Parikh, 2006, "India Energy Needs, Options and Environmental Sustainability."
17. Zmarak Shalizi, 2006, "Energy and Emissions: Local and Global Effects of the Rise of China and India," Chapter 5; GEF and World Bank, 2006, "Thailand Promotion of Electrical Energy Efficiency Project."
18. EBRD, 2005, "Power Sector Restructuring Loan, Summary of the Operation Performance Evaluation Review," and EBRD, 2005, "Water and Wastewater Company, Summary of the Operation Performance Evaluation Review."
19. "Slow: Government Obstacles Ahead," *The Economist*, June 17, 2006.
20. E.g., China and India; World Bank, 1997, *Clear Water, Blue Skies*; World Bank, 2005, *Environment Matters, Annual Review*; Zmarak Shalizi, 2006, "Climate Change Implications for Energy Infrastructure in China and India (Clean Energy and Energy Efficiency)"; and Kirit S. Parikh, 2006, "India Energy Needs, Options and Environmental Sustainability."
21. EIB, "Proposal from the Management Committee to the Board of Directors Concerning the EBRD-EIB Multilateral Carbon Credit Fund"; EIB, "EIB Carbon Funds Overview"; and EIB, "Proposal for Cost Recovery Basis, World Bank-EIB Carbon Fund for Europe (WB-EIB CFE)."

CHAPTER 4

The Nexus at the Project Level

At the project level, much of the concern on environment is captured through safeguard policies and environmental assessments. However, analysis of the evaluations suggests that this approach may be too narrow, and in any case is often more of a bureaucratic exercise than a serious attempt to enhance environmental values in infrastructure-related projects.

National and IFI Project-Level Safeguards

Safeguard policies outline the minimum requirements necessary on the part of the IFIs to identify, avoid, minimize, mitigate, and monitor the negative environmental impacts of projects.¹ Safeguards are increasingly coordinated through a common framework and harmonization process led by the Multilateral Financial Institutions Working Group on Environment, which also includes some bilateral donors, export credit agencies, and others.²

Project screening highlights areas of possible environmental impact and is used to categorize projects by the extent to which implementation will impact the environment—from significant impact to no impact at all. The WBG and AsDB categorize projects into Type A, Type B, Type C, and Type FI. Type A projects are those with significant potential to negatively impact the environment; Type B projects have less severe environmental impacts; and Type C projects are unlikely to adversely impact the environment. Type FI flags lending through financial intermediaries. Type A projects require full environmental assessments (EAs), and Type B projects require EAs of aspects which are expected to have an impact on the environment. Other IFIs use similar categories to determine environmental impacts.³

Most of the projects which have major environmental impacts are in infrastructure. Environmental assessments are designed to play a major role in defining the scope of these impacts, the management issues to be addressed, and the actions that need to be taken. They constitute a major part of the IFIs' environmental and social safeguard policies.

Safeguard policies play an important role at the project level in improving the quality of projects and reducing negative environmental impacts. However, compliance with safeguard policies is most often focused on environmental factors during project preparation and appraisal. They have increasingly become seen as a checklist that narrows the focus on environmental issues to those explicitly listed in the safeguards. The World Bank's Third Environmental Assessment Review (2002) found that EAs are often not used to help identify projects in terms of alternate sites or means of achieving the project's goals since they are incorporated into the project cycle beyond the point where such questions are most relevant.⁴ ECG evaluations have found that most of their infrastructure projects focus primarily on issues "within the fence" of the project.⁵ The EAs are carried out by the borrower and are often inadequate in addressing all the environmental issues. Furthermore, project teams report rarely having adequate resources to properly address environmental issues during the implementation period.⁶

The potential environmental impacts of infrastructure projects are likely to be more extensive than project-specific safeguard policies are designed to handle. For example, hydroelectric power projects are widely recognized as having broader environmental impacts that need

to be taken into account. The World Dam Commission (2000) has described such impacts in detail.⁷ Ledec and Quintero (2003) noted the environmental impacts of hydro dams are minimized by optimal site selection. From an environmental viewpoint, dams should not be located along major rivers but on their upper tributaries.⁸ Thus, applying safeguards after a site is chosen may be too late to minimize environmental impacts.

There are few positive incentives built into the safeguard policies or project evaluations to encourage staff to take on environmentally complex projects.⁹ On the contrary, IFIs and task managers have incentives to avoid projects which require an intensive environmental impact assessment (EIA), as they are costly to undertake.¹⁰ When there is strong external pressure to do so, thorough environmental assessments and management of projects are undertaken, as with the Chad pipeline project or the Laos Nam Theun 2 dam project. However, task managers often perceive that the rewards for success in undertaking environmentally risky projects are outweighed by the detrimental effects of failure on career advancement.¹¹ These perverse incentives created by the safeguard policies result in “rational” decisions by IFI staff and executing agencies for the IFIs to not be involved in some challenging projects. However, it is possible that alternative financing sources would apply less-stringent environmental standards and oversight than the IFIs. Future evaluation efforts might assess the extent to which this occurs, and the implications for IFI safeguard policies and staff incentives.

Environmental Classification of IFI Projects

This type of procedural compliance undermines the spirit of safeguard policies.¹² The costs associated with environmental assessments may lead IFI staff not to undertake some valuable projects or to misclassify Type A projects as Type B projects. A comparison of road rehabilitation projects funded by the WBG and the AsDB found projects with similar environmental impacts were likely to have different environ-

mental categories at the two institutions. In both the World Bank and AsDB, the rigor with which the environmental safeguards are applied varies across regions. The AfDB has reported instances where projects were misclassified as well.¹³ The AsDB has noted that some projects are specifically designed to exclude components that would get an A rating.¹⁴ With different safeguard requirements for different categorizations, the implications for environmental degradation are clear. Projects with Type A environmental impacts, if misclassified as Type B, would be subject to the less-stringent safeguard policies of Type B projects, placing the environment at risk.¹⁵

Project Success and Environmental Performance

It is common to assume that in order to meet environmental standards, projects must bear additional costs or forgo some benefits. But when consideration of environmental impacts contributes to better project design or negative impacts are otherwise compensated, there may be no such tradeoff. This may involve more extended consideration of the indirect impacts, externalities, or public good implications in estimating the real costs and benefits.

AsDB experience with water projects has demonstrated that successful projects can improve both economic conditions and the environment, while weak design and execution may result in immediate economic gain but lead to detrimental environmental effects which limit the sustainability of these gains or even lead to negative overall results. The Dalian project in China addressed major problems of water shortages and pollution around the city of Dalian, which posed a serious constraint on its economic growth. The project design considered the linkages among water projects and environmental issues, and the project was able to increase good water supplies while treating wastewater and reducing industrial pollutants.¹⁶ However, other AsDB water projects in Sri Lanka and the Philippines have produced poor results due to lack of integrated planning and mitigation processes.¹⁷

A review of transport and power projects by the International Finance Corporation (IFC) illustrates that projects which perform well environmentally also perform well financially, as shown in Table 4.1. The mean rate of return for projects with satisfactory environmental assessment ratings is statistically indistinguishable from the mean for those with unsatisfactory ratings.¹⁸ This simple tabulation illustrates that successful application of safeguards can maintain or improve economic returns. It is consistent with the hypothesis that well-designed and executed projects perform well on both environmental and financial measures.

Monitoring Operation and Maintenance for Environmental Outcomes

Operations and maintenance matter a lot to environmental impact. Projects need to be efficiently managed during their operating lives. Depending on the type of project, monitoring may require following proper operational procedures for the equipment, assuring regular maintenance and repair, and monitoring the activities of users. Yet operations, maintenance, and management of completed public sector projects are generally not monitored by the IFIs.

It is hard to assess the infrastructure-environment nexus if we lack the most basic monitoring data.

Environmental outcomes of projects are evaluated and rated by only three IFIs: the AfDB, EBRD, and IFC, while EIB formally reports on environmental outcomes in its evaluations but does not give a rating. However, the assessments may be hampered by inadequate data or reporting. The lack of monitoring or baseline data also suggests that project design may not have adequately incorporated environmental considerations.

Even where environmental outcomes are evaluated, monitoring of public sector projects is rarely continued after project closing. Insufficient data and too short a monitoring time-frame make it difficult to determine (i) whether the safeguards have been effectively implemented, however well they were designed into a project; (ii) whether environmental strengthening actions have been carried out; (iii) whether the expected benefits have been achieved; or (iv) whether there are significant environmental impacts that need to be addressed. However, longer-term supervision is demonstrably feasible. The IFC and EBRD keep track of private sector projects, including monitoring for environmental factors, until the loan is fully repaid or their equity sold. The EIB requires member countries to respect EU environmental regulations during the operation of its projects, assuring longer-term observance of environmental norms.¹⁹

Table 4.1: Mean Rates of Return by Environmental Assessment Rating, IFC Infrastructure Projects 1996–2004

Environmental assessment rating	Average economic rate of return	Average financial rate of return
Satisfactory	20.8% Min = 5.0% Max = 62.4% (11.1) N = 37	12.7% Min = 2.2% Max = 34.6% (6.3) N = 30
Unsatisfactory	19.2% Min = 11.5% Max = 31.6% (8.8) N = 7	10.6% Min = 3.0% Max = 17.6% (6.0) N = 7

Note: Standard deviations in parentheses. Economic rates of return exclude environmental benefits. Includes power and utilities; transport and warehousing.

Notes

1. World Bank, 2002, *Safeguard Policies: Framework for Improving Development Effectiveness*. The World Bank Group's (WBG) safeguard policies include environmental assessments, natural habitats, resettlement, indigenous peoples, forestry, dam safety, pest management, protection of cultural property, international waters, and disputed areas. The Asian Development Bank's (AsDB) safeguards include policies on involuntary resettlement, indigenous peoples and environmental policy. The IFC's Environmental and Social Performance Standards are included under the umbrella of safeguards. The IFC's standards include policies on social and environmental assessment and management, labor and working conditions, pollution prevention and abatement, community health, safety and security, land acquisition and involuntary resettlement. The focus of this review is on safeguard policies directly related to the environment.
2. World Bank, 2005, "A Common Framework for Environmental Assessment, A Good Practice Note."
3. AfDB uses category I for those with environmental impact and II for those without. The EIB has a double classification. Ex ante, EIB refers to the EU Directives with four categories: A and B with EIA, C with EA, and D without; acceptability (on environmental grounds) and degree of residual environmental risk are measured again with four levels, A being acceptable and low risk, B1 acceptable with moderate risk, B2 acceptable with high risk, and C not acceptable with high risk.
4. World Bank, 2001, *Third Environmental Assessment Review* (FY 96–00), p. 41.
5. See, for example, AsDB, 2005, "Country Assistance Program Evaluation for Indonesia"; EBRD, "Municipal Water and Waste-Water Services, Summary of the Operation Performance Evaluation Review"; IDB, 2003, "Project Performance Monitoring and Classification, Guidelines for Project Performance Monitoring Report"; and World Bank, 2006, "Infrastructure: Lesson from the Last Two Decades of World Bank Engagement."
6. Based on staff interviews and several evaluation reports from ECG members and environmental units.
7. World Commission on Dams, 2000, *Dams and Development: A New Framework for Decision Making*.
8. George Ledec and Juan David Quintero, 2003, "Good Dams and Bad Dams: Environmental Criteria for Selection of Hydroelectric Projects."
9. AsDB, 2006, *2005 Annual Evaluation Review*; IEG, 2002, *Bridging Troubled Waters: Assessing the World Bank Water Resources Strategy*; IEG, 2003, *Power for Development: A Review of the World Bank Group's Experience with Private Participation in the Electricity Sector*; and interviews with WBG staff.
10. For task managers at the World Bank, the risks associated with review by the Inspection Panel are deemed to be great.
11. AsDB, 2006, "Environmental Safeguards."
12. One of the major findings of the AsDB's recent study was an overemphasis on procedural compliance—an application of rules at the expense of results.
13. AfDB, 2004, "African Development Bank Group's Policy on the Environment."
14. AsDB, 2006, "Environmental Safeguards," p. 28.
15. AsDB, 2006, "Environmental Safeguards," p. 28.
16. AsDB, 2003, "Dalian Water Supply Project in the People's Republic of China, Project Performance Audit Report."
17. AsDB, 2002, "Impact Evaluation Study on Water Supply and Sanitation Projects in Selected Developing Member Countries."
18. These results derive from a small sample and should be interpreted with care.
19. EBRD, 2005, *Evaluation Policy*; EIB, 2004, *EIB Environmental Statement*; IFC, "IFC's Policy and Performance Standards on Environmental Sustainability and IFC's Disclosure Policy," and interviews with staff.

CHAPTER 5

Sectoral and National Policies

The preceding section strongly suggests that project-level environmental assessments, by themselves, however well done at the project level, do not adequately handle the nexus issues. ECG evaluations indicate that the environmental analysis of most of their infrastructure projects focuses primarily on issues “within the fence” of the project.¹ They often do not look “beyond the fence” to assess the whole “area of impact.” They do not consider the interactions among projects over time and space, nor do they undertake life-cycle analyses of the project’s impacts, including procurement and sources of inputs to the construction and operation of the project (e.g., fossil fuel production for and transportation to thermal power projects). Infrastructure programs and projects are often not linked to larger national environmental strategies and assessments, nor are alternatives fully considered in environmental assessments, which themselves may be weak, limiting the potential to design projects that strengthen the environment.² The IFC, however, has recognized the need to move beyond the fence, and its recently revised environmental policy emphasizes the need to account for a broader area of impact in environmental assessments.³

Spatial Coordination of Projects

Our analysis indicates that there are considerable advantages to taking a broader view than the project level—a regional, national, or sectoral view. The following section illustrates how the lack of a broader view can lead to environmental problems and how taking a broader view can result in more successful results.

Watershed management is one of the most important areas to look “beyond the fence” when planning projects. A project’s local benefits

can be vitiated by upstream activities or downstream impacts. For instance, hydrologist Ian Calder argues that construction of water catchment structures in small semi-arid Indian watersheds does not increase the total amount of available water; instead, these structures merely shift water from one user to another.

The environment, including links to poverty alleviation, was well embedded in the AsDB strategy documents following an increased emphasis on the environment in the early 1990s; however, in terms of achievement, the results have been mixed. An AsDB evaluation of the Indonesian country assistance program demonstrates that inadequate coordination among activities on environmental matters in a watershed can be detrimental.⁴ Two kinds of coordination problems were reported concerning the \$2 billion of lending for river basin management projects.

First, projects in the same watershed were sometimes not integrated. For instance, separate and uncoordinated projects for land management and coastal management were put in place in Java in the 1990s, even though linkages between land management and the coastal environment were well known. Second, planned coordination was not always successfully implemented. Flood control projects in Java’s short, steep watersheds typically planned to undertake upper watershed management activities such as regreening, sanitation, and controls on forest encroachment to enhance the effectiveness of downstream infrastructure being installed. However, the upper watershed activities—the responsibility of a ministry not involved in the project—were typically not implemented. In some cases the projects were cancelled due to corruption, lack of an

integrated approach, lack of sustainability, weak ownership of environmental resource management, and lack of institutional capacity.

In contrast, the recent experience of planning a Laotian dam is more positive, although it is too soon to draw conclusions about operational impacts.⁵ Hydro dams in Laos have attracted a great deal of attention because of their adverse impact on the environment and the welfare of local people. Broad public concerns over past unsatisfactory performance related to environmental impacts and adverse effects on people led the WBG and the AsDB to create a broadly integrated project management team for Nam Theun 2 to try to assure that all issues were adequately addressed.

These concerns have been monitored closely over 10 years, during which extensive analysis, consultations, and preparation were undertaken. There was considerable involvement of environmental groups, although some criticism remains. Several related projects and grants were made to manage the watershed of the dam and address other environmental and social issues over a longer term. Since the implementation of the Nam Theun 2 project is in its early stages, it remains to be seen whether the integrated approach will continue to produce satisfactory outcomes over the life of the project.

The challenges faced in dealing with such integrated issues are illustrated in the less-prominent Nam Leuk dam. Although the project was rated as successful because it was technically sound and resulted in substantial economic benefits, the AsDB evaluation observed that the project had not generated enough environmental data and had not addressed the longer-term environmental maintenance issues or made provision to manage them over time. It suggested that such projects would benefit from allocating a portion of their revenues to managing the environment in the watershed of the dam to assure its effective operation.

A Chinese project provides an example of successful integrative planning.⁶ The WBG

project for Sustainable Coastal Resources Development in China started with a production-oriented goal of increasing aquaculture production in a coastal area, including some necessary infrastructure. After analysis of the likely environmental impacts of these activities, it became clear that significant changes would be needed to assure sustainability. In mid-course, the project objectives were changed to improve the environment by instituting coastal zone management, by designing project components that fit within local carrying capacity, by conserving endemic species, by taking pressures off of natural stocks, and by assuring environmental monitoring. In short, the project transformed from a narrow “do no harm” approach to the environment to a more inclusive “doing good” approach.

Promoting Efficiency of Infrastructure

Another sector-level issue is to consider the mix of infrastructure investment: spanning the range from new construction, to improved efficiency in new and existing operations, to better management of demand and conservation. Burgeoning demands for water and power can be met either by building new infrastructure capacity or by promoting greater efficiency in the distribution and use of the infrastructure services. From an engineering and project planning perspective, building capacity is simpler. On the other hand, correcting inefficiencies offers the potential for large financial returns and improved environmental outcomes. Inefficiencies can arise from poor design and management or from market failures of various kinds. IFI interventions can have significant impacts in both of these areas. These interventions can take place either on the supply side (e.g., reduction of distribution losses in irrigation, power, or district heating) or the demand side (e.g., promotion of proper pricing and market based incentives, efficient lighting, or drip irrigation).

Promotion of efficiency has been a major concern of the EBRD. Inefficiencies are rife in its area of operation. District heating plants operate with 35–40 percent distribution losses, as compared with a more typical five to seven percent in other regions. There are similar losses

in electricity transmission and distribution. In industry, Russian and Ukrainian steel mills consume 32 percent and 100 percent more energy, respectively, than EU counterparts. Consequently the EBRD invested 11 percent of its total portfolio over 1991–2000 (Ä1.67 billion) in projects to increase energy efficiency. While the projects did not generally incorporate monitoring and evaluation systems sufficient to yield quantitative measures, an EBRD evaluation concluded that 11 of 15 studied projects achieved “good” or “outstanding” improvements in energy efficiency. The review concluded that “it would be adequate to study more carefully the regional energy supply and demand scenarios to make sure that investment in extensive new power generation capacity is really needed. An alternative to new large investments could be investing in better demand side management to reduce the energy demand.”⁷

This alternative is being actively promoted by the Global Environment Facility (GEF) through energy conservation projects. The GEF’s evaluation of a Thailand demand-side management project found impressive results, though the results are sensitive to assumptions about the counterfactual.⁸ The \$60 million project promoted the dissemination and use of high-efficiency light bulbs and refrigerators. It had a benefit-to-cost ratio of 1.7 (evaluated at a 10 percent discount rate) over 1993–2000. This did not include the value of projected greenhouse gas emissions reductions of 25.3–45 million tons of CO₂ over 1993–2004. The project was also estimated to reduce SO_x emissions by 6,600–12,400 tons and NO_x by 66,700–119,900 tons. It was projected to reduce peak electrical demand by about a gigawatt—in other words, effectively substituting for a large generating plant.

Some countries have made progress in reforms to increase efficiency. The AsDB has funded industrial energy efficiency projects in India, China, and elsewhere. India, for instance, has reduced diesel subsidies and set up regulations requiring industrial energy audits. Kerosene, liquid petroleum gas, low-grade coal, and other

energy sources remain subsidized, however, dampening incentives for investments in efficiency.⁹ Four of eleven AsDB India subprojects realized increases in efficiency of 18 percent or more.¹⁰ In China, a multicomponent project succeeded in boosting outputs and improving financial performance while reducing energy intensity at cement and caustic soda plants. The real financial rates of return were in the 8–10 percent range, with higher economic rates of return. At one soda plant, there was a 64 percent reduction in the ambient concentration of particulates, a 92 percent reduction in wastewater flows, and other pollution reductions.

National and Sectoral Policy Issues

National and sectoral policies can have a profound influence on the infrastructure-environment nexus. This is especially true with respect to infrastructure pricing, often set by government policy in the case of publicly owned or regulated infrastructure. There are often political pressures for local or national governments to under-price water, electricity, and fuel. Justified as protecting the poor, subsidies or price controls often end up providing disproportionately large benefits to higher-income people. Evaluations have shown that even poor users are willing to pay for water and other services, if they understand and respect the operation of the project.¹¹ Under-pricing also leads to artificially high demand and thus either to the construction of unneeded infrastructure or to excess demand and shortages. This can intensify environmental damage, as when unreliable power grids induce firms and households to buy small, polluting diesel generators. At the same time, under-pricing jeopardizes operations and maintenance of the infrastructure plants. Pricing policies also affect the willingness of the private sector to participate in infrastructure provision.

Lack of adequate pricing of infrastructure services can adversely affect the management of natural resources, with both economic and environmental impacts. An evaluation of the WBG’s country assistance strategy for Morocco reported the effects of policy distortions on water use.¹² Water is Morocco’s most pressing

environmental problem. About 85 percent of it is used for irrigation, for which fees are collected. However, in the case of the large-scale schemes supported by earlier projects, fees fell well short of covering the costs of operation and maintenance and thus required substantial subsidies to the water suppliers. These water subsidies, in conjunction with trade protection of certain agricultural imports, have encouraged expansion of water-intensive crops in which Morocco has no comparative advantage. The AfDB's analysis confirms Morocco's weak water planning and management, highlighting its failure to adequately link provision of sanitation to extensions of clean water supply, contributing to increased wastewater pollution.¹³ Morocco's key water management issues would be more effectively addressed through policy reforms to remove subsidies and trade barriers to encourage efficient planning, rather than by more infrastructure construction.

Institutional Issues at the Sectoral and National Levels

Investing in institutional capacity building is fundamental to dealing with the nexus at the sectoral and national levels. Three distinctive institutional issues of planning, policy, and implementation have been identified. Two of these are important to the nexus, but broader in scope: setting up systems to fight corruption and encouraging and regulating private sector participation in infrastructure. A third is central to the nexus: the application of strategic environmental assessments and country environmental assessments.

Corruption and Governance

Corruption is increasingly becoming the focus of attention of the IFIs.¹⁴ This paper does not consider broad corruption issues, which are being addressed by other units in the IFIs, but only corruption that directly affects the infrastructure-environment nexus and leads to waste or misuse of project resources and degradation of the environment.¹⁵ WBG has examined the problems corruption poses for infrastructure and other activities in a number of its country evaluations and found that it poses

serious problems.¹⁶ Many of the weaknesses and shortcomings of infrastructure programs and projects stem from corruption that affects their design, contracting processes, and execution, which can lead to more negative environmental impacts stemming from delays in implementation, failure to observe safeguards, misuse of land and other resources, and diversion of resources allocated to addressing environmental issues.

In 2004, local, independent research firms in China, Indonesia, Japan, the Philippines, Thailand, and Vietnam conducted a survey of 132 nongovernmental organizations (NGOs) to assess the relationship between infrastructure and corruption.¹⁷ The respondents were randomly chosen from lists provided by a number of sources. The survey found that: (i) 95 percent of respondents felt that corruption was an obstacle to providing infrastructure; (ii) 91 percent felt that the potential for corruption should be taken into account in planning infrastructure; and (iii) 77 percent felt that their government was not doing enough to prevent corruption in infrastructure. Factors that help explain why corruption is often associated with infrastructure include: (i) monopoly structure provides significant opportunities for rent-seeking; (ii) political protection and intervention blurs financial accountability and provides cover for a range of corrupt activities; (iii) infrastructure providers can inflate levels of capital spending or hide under-investment; (iv) the large scale of infrastructure creates opportunities for large kickbacks in procurement or award of franchises; (v) lack of transparent procedures; and (vi) crony capitalism. There are many examples of these kinds of practices.

While IFI policies (such as for procurement) are important in the fight against corruption, institutionalizing good governance requires additional actions at the local, sectoral, and national levels. The AsDB has analyzed how these factors work, as discussed in Box 5.1. Monitoring the activities of government agencies by the public can help hold a government accountable for its actions and reduce misuse of public funds. One way to do this is to involve the relevant communities in

Box 5.1: Addressing Corruption in the Power Sector

As part of a broader power sector evaluation the AsDB examined corruption in the power sector in the Philippines in 2005. This sector was generally considered to be susceptible to corruption, indicated by various sources, frequent cost overruns in projects, and the general perception that corruption was widespread in the Philippines. Despite extensive legislation against corruption, few cases were brought to court. The AsDB review identified the risks of corruption at each stage of the project cycle, from bidding to execution and management, examined how specific projects had been affected (both

AsDB and other projects), and proposed means of combating corruption under the Keep It Simple and Transparent principle. Measures included increasing transparency, introducing mitigating measures at each stage of the project cycle, making more information available to the public via the Internet, building civil society capacity to monitor and report on projects, monitoring actual payments, and harmonizing activities with other development partners ("Sector Assistance Program Evaluation of Asian Development Bank Assistance to Philippines Power Sector," 2005, OED).

the design and oversight of infrastructure projects and in regularly monitoring project managers. Although few projects try to address this issue, it has been done with positive results, as the Bangladesh case shows in Box 5.2.

Private Sector Involvement

The public-private sector interaction is central to the infrastructure-environment nexus. Privatization of many elements of public infrastructure has been a major component of the IFIs' infrastructure strategies over the past decade and a half. A growing portion of infrastructure is being shifted to the private sector in a number of developing countries to improve the efficiency of production and delivery of services, gain access to private investment funds, and extend the range of services. The private sector has financed 20–25 percent of investment in infrastructure in developing countries in the past

15 years. It peaked at \$128 billion in 1997, and then fell back to \$58 billion in 2005.¹⁸

The results of private sector involvement have been mixed. In some cases, the private sector has done well in providing the needed services, and has often done as well or better than IFI projects in respecting conventional environmental safeguards.¹⁹ The IFC has effectively promoted the Equator Principles, which establish sound environmental guidelines for private investment, and which have been widely accepted among principal private international financing agents. In other cases, progress has been less than expected due to risk factors, ineffective government regulation procedures, problems in establishing profitable rates or levels of subsidies, and concerns about natural monopolies and equitable access to the infrastructure services.²⁰ As a result, the rate of privatization has stagnated.

Box 5.2: Public Accountability to Reduce Corruption: Bangladesh Rural Electrification

The WBG financed this project with the Rural Electrification Board. It was designed to expand access to electricity in rural areas and to prevent corruption. The latter goal was achieved by a series of measures to assure that consumers elected the Boards of each cooperative, approved and monitored the salaries of managers, monitored performance targets, reduced incentives for improper meter reading, and made public the surveys of potential con-

sumers and payments on each part of the distribution network. The project added 600,000 new customers each year, maintained low losses (13 percent), and had high collection rates (97 percent). The rural electrification has increased agricultural productivity, raised education levels, and improved the quality of health services in areas' service ("Scaling Up Infrastructure: Building on Strengths, Learning from Mistakes," 2006, World Bank).

The IFIs are revising their approach to help develop programs and policies that will encourage a resurgence in private investment in infrastructure to meet growing needs. The EIB is promoting EU directives which are in many respects equivalent to (or more stringent than) the Equator Principles.

Promoting more private sector participation in infrastructure requires proper policies and their enforcement at the sector level. It is important to create an effective enabling environment in these sectors to attract more private funds, to assure that their projects are operating effectively, to confirm that they meet the infrastructure needs of all segments of the population, and to provide clear guidance on environmental standards. The experience in Morocco has demonstrated that with these conditions, the private sector can contribute a great deal to expanding infrastructure efficiently. See Box 5.3.

Projects by the EBRD and EIB to facilitate the transformation of eastern European economies regularly deal with improving the management of infrastructure at the local level, as a means to prepare for privatization or to permit long-term concessions. The EBRD is also working to promote compliance with EU environmental standards. See Box 5.4.

Strategic Environmental Assessment, National Capacity, and Public Involvement

“Strategic environmental assessment” (SEA) is a term broadly applied to the scaling up of

environmental assessments beyond the project level to the sectoral or national level. Thus SEAs, if properly institutionalized, would be an appropriate vehicle for addressing the nexus issues. SEAs are sometimes commissioned in connection with IFI projects, but may also be undertaken by national agencies and integrated with the policy process.

A recent WBG (2005) review notes the increasing use of SEAs in connection with sectoral loans, including adjustment (policy) lending.²¹ It looked at six examples of SEA applications to sectoral policies, including assessments of Slovak energy policy, Argentine and Colombian water and sanitation policy, Czech Republic tourism policy, and South African industrial policy. The SEAs varied in their integration into the policy process, from fully integrated (Slovak case) to “late-stage effort” (Czech Republic case) to disintegrated (South Africa). The review found that with the exception of the South African case, all the SEAs influenced policy design—on paper. But the review was unable to confirm impacts on actual policy implementation.

Designing and implementing effective infrastructure programs that respect the environment requires a sound national environmental strategy that identifies key concerns, sets environmental standards, and helps coordinate programs across sectors and over a reasonably long time horizon. To accomplish this, an environmental management agency or other entity must be in place to collect data on key environmental indicators,

Box 5.3: Public-Private Partnerships in Infrastructure: Pragmatism in Morocco

Since the early 1990s, Morocco has pioneered public-private partnerships in the Middle East and North Africa. Beginning with Maghreb Gas Pipeline, the government has extended private participation to cover the full range of infrastructure. While the World Bank has continued to fund some projects, including rehabilitation of services in the water supply and sanitation sector, most infrastructure funding has come from private sources. The Bank has been called upon to provide expertise in various areas to assist the

government in designing and implementing pragmatic methods of engaging the private sector—licensing, concession management contracts, privatization of state-owned companies, etc. As a result, Morocco has attracted over \$13 billion of private investment in infrastructure, improved the management of state-owned infrastructure, and increased access to efficient infrastructure throughout the economy (“Scaling Up Infrastructure: Building on Strengths, Learning from Mistakes,” 2006, World Bank).

Box 5.4: Privatization of Public Water and Wastewater Systems in Central and Eastern Europe

In the Central and Eastern Europe Region, in the early 1990s, most municipalities had existing systems that needed to be upgraded to bring the systems into compliance with EU environmental standards. In Estonia, EBRD worked initially with the national government to commercialize the capital city's water and wastewater system. Once under municipal ownership, EBRD worked with the city to bring the operating plants into compliance with EU standards in preparation for privatization, meeting the EBRD's envi-

ronmental objectives. The system was successfully privatized and the new company has issued shares on the local exchange. In Sofia, Bulgaria, EBRD again worked with the municipality to improve the city's water and wastewater system. This municipality chose a slightly different path and established a long-term (15-year) concession. The system has been upgraded to meet EU standards, partly through EU-Phare co-investments (from EBRD contribution to report).

make the information public, and enforce environmental regulations. National and local authorities must give high priority to the environment, assure staffing is adequate to address environmental matters, and promote coordinated planning among government agencies, multilateral financiers, and the private sector.

The AsDB evaluation of environmental safeguards found that while some developing member countries have relatively well-developed environmental safeguard systems, others do not. To move toward adopting the improved country systems in a phased and concerted manner, the member countries may be divided into at least three groups: (i) countries with well-developed systems that embody most of the objectives and principles of AsDB's policies and with a reasonable track record in implementation; (ii) countries with semi-developed legal, institutional, and policy frameworks and some capacity for environmental safeguards but requiring substantial strengthening; and (iii) countries with weak systems and capacity. Any move toward adopting country systems should not be achieved through watering down AsDB's current environmental safeguard standards. These findings apply to other IFI members as well.

Sound infrastructure sector policies and practices are vital for the success of projects and for meeting sectoral and development goals. ECG evaluations have shown that where

member countries have appropriate legal and regulatory frameworks and accountability systems, and where they encourage transparency and public participation, there are positive effects on integrating infrastructure-environmental programs, and potential gains are realized.²² Without such capacities, or without adequate attention by national authorities and by the IFIs, there may be poorer environmental results. See Box 5.5.

Environmental management requires a host of capabilities in addition to SEAs, including environmental monitoring and enforcement. Countries should be encouraged to create effective national strategies and action programs that provide the basis for assessing their environmental needs and associated risks and to collect the relevant information needed to design and monitor environmentally sound infrastructure projects. The IFIs could assist in preparing these strategies where needed, and could take them (or their deficiencies) into account in preparing their country assistance strategies and sector lending programs. Improving capacity at national and other levels is vital to project and program success, as illustrated by the AfDB's experience in Mozambique. See Box 5.6.

Evaluations also indicate that involving stakeholders and beneficiaries can have quite positive effects on infrastructure investments. The people involved appreciate better what is being provided, how they will benefit, and what

Box 5.5: Yemen Needs Water

The January 2006 WBG-IEG evaluation of Yemen's country assistance strategy pointed out that the paramount environmental concern of water availability had been ignored in the strategies until quite recently. Even when addressed in principle, projects focused on groundwater management and conservation did not receive adequate attention. Lack of specialists

on the team and staff turnover, along with focus on macro policy issues rather than domestic capacity building and providing functioning capital, also contributed to this. Similar problems were observed in the evaluation of the Jordan assistance program ("Republic of Yemen, Country Assistance Evaluation," 2006, IEG (OED)).

the costs will be. They can provide valuable inputs into the design and management of projects and are more willing to bear the costs, up to their capacity. The experiences in Bolivia shown in Box 5.7 illustrate that proper community involvement produces good results, and failure to do so can lead to real problems. The AsDB review of environmental safeguards underlines how the interest of NGOs in mitigating environmental problems has sometimes resulted in achieving better development results by creating pressures for continued AsDB monitoring after project completion.

Local groups can play a pivotal role in initiating sound infrastructure projects. In Ethiopia, a group of women convinced an international NGO to build a large reservoir scheme with 32 community water-distribution points. This investment freed up the women's time that had been spent fetching water, allowing them to engage in more productive activities and improved access to safe water for the community. Community consultations resulted in the management and ownership of the dam being granted to the women, who function through a general assembly and executive board and manage the water sustainably.²³

Box 5.6: Strengthening the Role of Governments: Dealing with Mozambique's Energy Sector

The second power project of the AfDB in Mozambique was designed to extend and rehabilitate the national power grid in 1996. It was initially rated as Category II (no EIA needed). It was later discovered that there would be environmental impacts, and the executing agency (EdM) subsequently carried out an EIA, which recommended a number of mitigating measures. Unfortunately, neither the EdM nor the environmental ministry was able to assure that the contractors carried out these recommendations, and the AfDB did not provide adequate environmental supervision. An environmental specialist participated in

only one of 15 supervision missions. And there was inadequate reporting by the executing agency. As a result, environmental results were only partially satisfactory, but fortunately the damage was not permanent and overall the project has provided substantial benefits in energy availability in Maputo. The AfDB and government have subsequently begun working to improve the environmental management of projects by strengthening national agencies and improving monitoring and supervision. Lessons were learned and progress is being made (AfDB report).

Box 5.7: Community Involvement in Infrastructure: Getting It Right (and Wrong) in Bolivia

Water Supply and Sanitation in Bolivia: Getting It Right. In the 1990s, the World Bank supported two water projects in Bolivia. One, PROSABAR, initially devoted resources to organizing and training communities, which helped pick projects that met local demands in accordance with their ability to pay for operation and maintenance, and which assured that the full benefits of safe water, sanitary excreta disposal, and health education were provided. The other was a general loan to the Social Investment Fund, which concentrated on building projects quickly, with little community involvement and little success. It did poorly. The PROSABAR project was so successful that the general loan project was retrofitted to include the community involvement, with much improved results ("Efficient, Sustainable Service for All?

An OED Review of the World Bank's Assistance to Water Supply and Sanitation," 2003, IEG (OED)).

And Getting It Wrong: In dealing with water in the major cities, the World Bank insisted on privatization of the water providers before making its loan. This led to such popular opposition in the two largest cities that the privatization deals had to be restructured, and the government regulation was inefficient. This resulted in little or no improvement in services, but unacceptable increases in rates in poor areas, due to poor planning and management by the Bank and government. In one city, a participatory consumer cooperative was established, and the results exceeded expectations ("Scaling Up Infrastructure: Building on Strengths, Learning from Mistakes," 2006, World Bank).

Notes

1. See, for example, AsDB, 2005, "Country Assistance Program Evaluation for Indonesia"; IEG (OED), *The Effectiveness of World Bank Support for Community-Based and -Driven Development*; IDB, 2003, "Project Performance Monitoring and Classification, Guidelines for Project Performance Monitoring Report"; and World Bank, 2006, "Infrastructure: Lesson from the Last Two Decades of World Bank Engagement."
2. AsDB, 1998, "Special Evaluation Study on the Social and Environmental Mitigation Measures in Selected Bank-Financed Projects"; AsDB, 2004, "Fourth Rural Water Supply and Sanitation Sector Project in Nepal, Project Completion Report"; World Bank, 2006, "Infrastructure: Lessons from the Last Two Decades of World Bank Engagement."
3. IFC, 2006, "IFC's Policy and Performance Standards on Environmental Sustainability" and "IFC's Disclosure Policy."
4. AsDB, 2005, "Country Assistance Program Evaluation for Indonesia."
5. AsDB, 2004, "Nam Leuk Hydropower Project in the Lao People's Democratic Republic, Project Performance Audit Report"; World Bank, 2005, *Environment Matters, Annual Review*; and World Bank, 2006, "Infrastructure: Lessons from the Last Two Decades of World Bank Engagement."
6. IEG (OED), 2002, *Promoting Environmental Sustainability in Development: An Evaluation*

of the World Bank's Performance.

7. This paragraph is based on EBRD, "Project Evaluation Department. Summary of Special Study: Evaluation of Energy Efficiency in Bank Projects."
8. GEF and World Bank, 2006, "Thailand Promotion of Electrical Energy Efficiency Project, Post-Implementation Impact Assessment."
9. AsDB, 2005, "Industrial Energy Efficiency Project in India, Project Performance Audit Report."
10. AsDB, 2005, "Industrial Energy Efficiency Project in India, Project Performance Audit Report," and AsDB, 2005, "Industrial Energy Efficiency Project in India, Project Performance Audit Report."
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12. IEG (OED), 2001, "Morocco Country Assistance Evaluation."
13. African Development Bank, 2003 (July), *Evaluating Bank's Support for Capacity Strengthening of Urban Water Supply and Sanitation Entities in Regional Member Countries.*
14. IEG, 2006, "Governance and Anti-Corruption: Ways to Enhance the Bank's Impact."
15. AsDB, 2005, "Sector Assistance Program Evaluation of Asian Development Bank Assistance to Philippines Power Sector"; World Bank, 2006, "Infrastructure: Lessons from the Last Two Decades of World Bank Engagement."

16. IEG (OED), 2001, *India: The Challenges of Development: A Country Assistance Evaluation*; IEG (OED), 2004, *China: An Evaluation of World Bank Assistance*; IEG (OED), 2004, *Brazil: Forging a Strategic Partnership for Results: An OED Evaluation of the World Bank Assistance*; IEG (OED), 2005, *Bolivia, Country Assistance Evaluation*; and IEG, 2006, *Pakistan: An Evaluation of World Bank's Assistance*.
17. AsDB, Japan Bank for International Cooperation, and the World Bank, 2005, *Connecting East Asia: A Framework for Infrastructure*, Box 4.3.
18. Oxford Analytica, 2006, "Private Money Needed for Infrastructure." There is a larger share of private infrastructure investment in some countries than others.
19. IEG (OED, OEG, OEU), 2003, *Power for Development: A Review of the World Bank Group's Experience with Private Participation in the Electricity Sector*; IFC, 2006, "IFC Sustainability Report 2005."
20. IEG (OED), 2002, *Bridging Troubled Waters: Assessing the World Bank Water Resources Strategy*; IEG (OED, OEG, OEU), 2003, *Power for Development: A Review of the World Bank Group's Experience with Private Participation in the Electricity Sector*; World Bank, 2006, "Scaling Up Infrastructure: Building on Strengths, Learning from Mistakes."
21. World Bank, 2005, *Integrating Environmental Consideration in Policy Formulation: Lessons from Policy-based SEA Experience*.
22. AsDB, 2006, *Environmental Safeguards, Special Evaluation Study*; World Bank, 2006, "Infrastructure: Lesson from the Last Two Decades of World Bank Engagement."
23. AfDB, 2003 (July), *Evaluating Bank's Support for Capacity Strengthening of Urban Water Supply and Sanitation Entities in Regional Member Countries*.

CHAPTER 6

Conclusions and Follow-Up

Infrastructure investments contribute importantly to growth and poverty alleviation. Better infrastructure and the adoption of appropriate policies can help address the world's environmental problems. But infrastructure generally imposes environmental burdens that must be mitigated or compensated. Based on the ECG evaluations and other studies, this report has presented evidence and arguments underlining the importance of the nexus.

There are many opportunities to mitigate environmental burdens while meeting global demands for energy, transport, and water. Perhaps even more importantly in many cases, the right infrastructure can advance environmental values, especially when projects are properly integrated into the national environmental strategy, well designed, and carefully managed. Many of these opportunities involve promoting efficiency in the use of infrastructure services, thus reducing the need for new construction. The suggestions emerging from this review can be grouped into those for the leadership of the IFIs, those for the evaluators, and finally those for ECG itself.

To the Management and Staff of the IFIs

Seizing these opportunities requires that the IFIs go “beyond the fence” of project-level planning by harnessing their multi-sectoral and policy-advisory experience. But as reported above, we have found that project-level environmental assessments often do not do this. Moreover, application of safeguard policies often is treated more as a matter of procedural compliance than as an opportunity to consider project design in view of broader environmental considerations. ECG evaluations have found that infrastructure

projects tend not to consider the whole area of impact, interactions among projects, or life-cycle impacts. ECG suggests that the management and staff of the IFIs can address these issues by:

- Incorporating environmental considerations well upstream in project selection, design, and implementation. This could entail changes in project mix and greater degrees of sector and cross-project coordination in project selection.
- Shifting from a “checklist” application of safeguards late in project design to incorporating environmental considerations up front in project and site selection in order to improve their overall design and integration into national environmental objectives in relation to the nexus.
- Working with partner countries on strategic planning that combines growth, poverty alleviation, and environmental improvement; that emphasizes removal of perverse subsidies and better maintenance of existing infrastructure; that promotes conservation measures to reduce demand; and that uses natural capital as a substitute for physical capital where feasible.
- Supporting replicable pilot projects that substitute environmental capital for physical capital—for instance, using watershed management to complement water treatment and flood control infrastructure—and incorporating monitoring and evaluation into these projects to promote learning and to replicate successful innovations.

To the Evaluators in IFIs and the Countries

One obstacle to the pursuit of nexus opportunities is a lack of quantitative evaluations of the economic and environmental impacts of policies and projects. This lack is attributable in large part to the failure of the IFIs (or national authorities)

to track environmental performance of projects and sectors. More rigorous analyses of successes and failures in pursuing the nexus could inform the IFIs and national agencies as they undertake strategic assessments. Specifically, there are large potential gains from evaluation processes that:

- Undertake increased and more rigorous assessment of economic and environmental impacts of infrastructure projects and policies
- Track environmental performance over the long term through improved project-level data gathering and monitoring of environmental impacts during construction and post-construction operation
- Enhance national-level systems to check that expected nexus benefits are being achieved
- Use strategic environmental assessments to screen for the right kinds of projects, to ensure spatial coordination of projects, and to identify policy reforms that promote efficiency and use of environmental substitutes for brick-and-mortar infrastructure. The comparative advantage of the IFIs is in promoting more complex, higher-payoff interventions to correct market failures.
- Conducting rigorous analyses of the full costs and benefits of interventions to promote efficiency in infrastructure use, and pooling these analyses to determine the conditions under which efficiency-promoting projects or policies offer high returns.
- Building and sharing databases on the pricing of infrastructure and related services and commodities such as electricity, fuel, water, etc. These could facilitate comparative analyses of infrastructure projects and policies.
- Developing shared geospatial databases of infrastructure projects in order to promote coordination, assess the appropriateness of siting during project design, and facilitate impact evaluation later. For instance, IFIs, bilaterals, and national authorities could pool information on the location of proposed new road links and overlay it on maps of population density, poverty, agricultural potential, biodiversity, and other measures of environmental sensitivity.
- Undertaking case studies of efforts to reform suboptimal infrastructure policies to help their organizations learn from experience. For instance, it would be useful to study cases where perverse subsidies were removed, analyze the political economy of reform, study the results of institutional strengthening, and assess environmental and distributional impacts.
- Carrying out more systematic reviews of policy lending to determine its potential impacts on the infrastructure-environment nexus. This could cover both sector policy lending and development policy lending which affects national policies.¹

To ECG Members

From the evaluation perspective, ECG members have not consistently conducted rigorous cost-benefit analyses of nexus-related projects and programs, nor have they worked together to develop quantitative and qualitative databases that can help to evaluate them. They could consider strengthening their role in analyzing nexus issues by:

Note

1. AsDB, 2006, *2006 Annual Evaluation Review*, chapter II, and IEG (OED), 2005, *The Effectiveness of World Bank Support for Community-Based and -Driven Development* have begun to address some of these issues.

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