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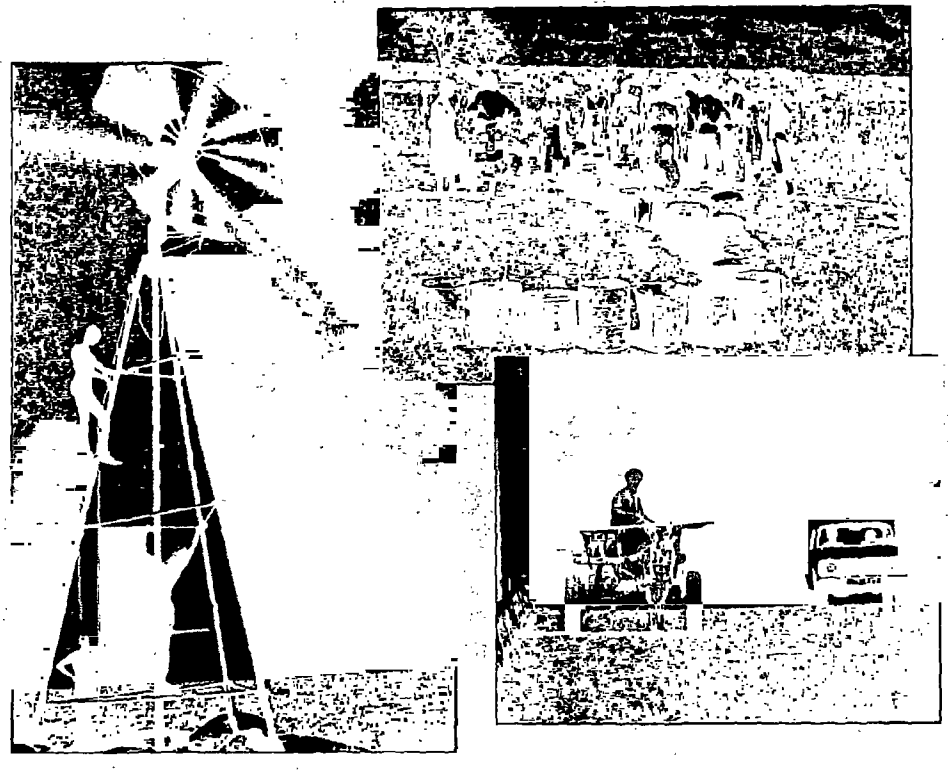
# Generating Public Sector Resources to Finance Sustainable Development

## *Revenue and Incentive Effects*



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*Environment Series*

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# Foreword

Ensuring that sufficient resources will be available to finance the internationally agreed development goals was at the heart of the discussions at the World Summit on Sustainable Development (WSSD), held in Johannesburg from August 26 to September 4, 2002. Resources will have to come from both the public and private sectors, and innovative approaches will have to be designed to make financing mechanisms more effective.

In this context, staff of the World Bank, the International Monetary Fund (IMF), and the United Nations Environment Programme (UNEP) have worked together to explore options for financing sustainable development.

This paper is one of the results of that co-operation. It does not aim to cover all of the complex issues related to Official Development Assistance (ODA) and Foreign Direct Investment (FDI). Its specific objective is to explore potential avenues to generate more resources for the public sector to invest in sustainable development. This paper, together with UNEP's companion paper on mobilizing private sector resources, was used to prepare a joint synthesis report, *Financing for Sustainable Development*.

We hope that this paper will be a valuable input to discussions on financing for sustainable development. We welcome your comments.

*Kristalina Georgieva*
Director, Environment Department

# Abstract

Achieving the objective of sustainable development will require considerable resources and creative use of existing and additional resources. Although Official Development Assistance (ODA) will continue to play an important role in financing sustainable development, it is likely to be insufficient to meet the tremendous needs even with with the increases in flows agreed at the Financing for Development (FfD) conference. Other sources of resources must also be sought. Where will these resources come from and how can they be applied to most effectively address sustainability challenges?

This paper discusses how developing countries can generate some of the resources they need for sustainable development. Developing country governments already expend significant amounts of resources on a variety of activities. But the evidence suggests that there is sometimes substantial scope for them to generate additional resources and—perhaps more important—to free up substantial amounts of resources which are currently being used inefficiently.

The primary objective of this paper is to attempt a rough scoping of the magnitude of resources that might be generated or freed up by a variety of public sector actions. The paper begins by examining the potential to reform many existing policies which are not only costly but often unsustainable and environmentally damaging. Reforming them would both free up resources for more valuable uses, and often directly improve sustainability. The following section then turns to potential means for generating new financial flows, by capturing a greater share of the rents from natural resources and by instituting 'green' levies. Wherever possible, we attempt to estimate potential revenue flows or resource savings, although data limitations sometimes prevent this. Numerical estimates are complemented with case studies detailing the experience of specific countries.

Several main lessons emerge:

- There is substantial potential to generate additional public sector resources, although the amounts vary considerably across sectors and countries. The most important potential source of additional revenue comes not from efforts to generate new revenues, but from freeing up available resources by improving the efficiency with which they are spent—in particular, by reforming subsidies that are expensive and, often, environmentally harmful. Even when the sums involved appear limited, reform can help make subsectors financially self-sustaining rather than wholly dependent on the public purse.
- Reforms can have important incentive effects. In addition to generating new resources or freeing up existing ones, many of the reforms discussed in this paper can also help reduce environmental damage, by providing incentives that tend to discourage environmentally-harmful activities and encourage more sustainable ones. In many cases this outcome would be as or more important as the resource generation itself.
- Reform is not anti-poor. Though many policies claim to be pro-poor, they often are not. Reducing these subsidies would, therefore, not only not harm the poor, it might well benefit them if the resources that are freed up are used in more appropriate ways. However, any policy reform must take considerable care not to inadvertently harm the poor.
- Reform will require political will, but also good governance, capacity building, and investment.
- One size does not fit all. There is substantial variation in the needs, opportunities, and constraints facing different developing countries. Even within countries, there is substantial variation in capacity to implement public reform programs across regions or sectors.

# Acknowledgments

This paper was prepared by a joint team from the Policy and Economics Team in the Environment Department of the World Bank and the Fiscal Affairs Department of the International Monetary Fund (IMF) headed by Stefano Pagiola. The members of this team, with their primary responsibilities, were:

- Hiba Ahmed (water)
- Katharine Bolt (natural resource rents)
- Kirk Hamilton (natural resource rents)
- Muthukumara Mani (environmental levies)
- Roberto Martin-Hurtado (energy, waste management, environmental levies)
- Stefano Pagiola (user fees, innovative conservation mechanisms)
- Priya Shyamsundar (environmental levies, forests, international resource flows)
- Patricia Silva (user fees, forests, international resource flows)

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This paper has also benefited from numerous comments and discussion made in the course of a month-long open "e-discussion" on the web, organized by the World Bank Institute (WBI), which attracted almost 200 participants from all over the world. We are grateful to all who commented, to Vesselina Hekimova and Cary Anne Cadman of WBI for organizing the e-discussion, and to Patricia Silva of the University of California at Santa Barbara for moderating it. The paper also benefited from comments made by participants in the Conference on Financing the Environmental Dimension of Sustainable Development organized by the OECD Global Forum on Sustainable Development in Paris on April 24-26, 2002.

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# Abbreviations

| | |
|---|---|
| ADB | Asian Development Bank |
| BOD | Biological Oxygen Demand |
| CDM | Clean Development Mechanism |
| CEE | Central and Eastern Europe |
| c/kwh | US cents per kilowatt-hour |
| CI | Conservation International |
| $CO_2$ | Carbon dioxide |
| CRS | Creditor Reporting System |
| CVM | Contingent valuation method |
| DAC | Development Assistance Committee |
| EAI | Enterprise for the Americas Initiative |
| EBRD | European Bank for Reconstruction and Development |
| EU | European Union |
| FDI | Foreign Direct Investment |
| FFEM | *Fonds Français pour l'Environnement Mondial* (French GEF) |
| GDP | Gross Domestic Product |
| GEF | Global Environment Facility |
| ha | hectare |
| IBT | Increasing Block Tariffs |
| ICBG | International Cooperative Biodiversity Groups |
| IDB | Inter-American Development Bank |
| GTZ | *Deutsche Gesellschaft für Technische Zusammenarbeit* (German Corporation for Technical Cooperation) |
| IEA | International Energy Agency |
| IMF | International Monetary Fund |
| INBio | *Instituto Nacional de Biodiversidad* (National Biodiversity Institute of Costa Rica) |
| lcd | liters per capita per day |
| LPG | Liquefied petroleum gas |
| MDG | Millennium Development Goal |
| MINAE | Ministry of the Environment and Energy (Costa Rica) |
| MSWM | Municipal solid waste management |
| NGO | Non-Governmental Organization |
| NIH | National Institute of Health |
| NSF | National Science Foundation |
| O&M | Operations and Maintenance |
| OA | Official Assistance |
| ODA | Official Development Assistance |
| OECD | Organisation for Economic Cooperation and Development |
| OFF | Other Financial Flows |
| OLADE | *Organización Latinoamericana de Energía* (Latin American Energy Organization) |
| PACT | Protected Areas Conservation Trust |
| PES | Payment for Environmental Services |
| $SO_2$ | Sulphur dioxide |
| TCM | Travel cost method |
| TNC | The Nature Conservancy |
| UFA | *Unité Forestière d'Aménagement* (Forest Management Unit, Cameroon) |
| UNCED | United Nations Conference on Environment and Development |
| UNDP | United Nations Development Programme |
| UNEP | United Nations Environment Programme |
| USAID | United States Agency for International Development |
| USDA | United States Department of Agriculture |
| VAT | Value Added Tax |
| WRI | World Resources Institute |
| WSP | Water and Sanitation Program |
| WSSD | World Summit on Sustainable Development |
| WTP | Willingness to Pay |
| WWF | World Wildlife Fund |

All monetary values are in 1999 US dollars, unless otherwise indicated.
A billion is a thousand million.

# 1. Introduction

The 1992 Earth Summit in Rio de Janeiro clearly established the objective of sustainable development. Definitions vary, but the spirit is captured by the notion put forth by the Development Assistance Committee of the OECD that "Sustainable development entails balancing the economic, social and environmental objectives of the society—the three pillars of sustainable development—integrating them wherever possible, through mutually supportive policies and practices, and making trade-offs where it is not possible. This includes, in particular, taking into account the im-pact of present decisions on the options of future generations." Ten years later, that objective remains the goal of the world community, having been most recently restated in the Millennium Declaration and the Millennium Development Goals (MDGs) and at the World Summit on Sustainable Development in Johannesburg.

Achieving this objective will require considerable resources and creative use of existing and additional resources (Devarajan and others, 2002; World Bank, 2002a). Official Development Assistance (ODA) will continue to play an important role in financing sustainable development. Even with the increases in flows agreed at the Financing for Development (FfD) conference in Monterrey, Mexico, however, ODA is likely to be insufficient to meet the tremendous needs. Other sources of resources must also be sought. Where will these resources come from and how can they be applied to most effectively address sustainability challenges? This paper seeks to contribute to answering these questions.

This paper discusses how developing countries can generate some of the resources they need for sustainable development. Developing country governments already expend significant amounts of resources on a variety of activities. But the evidence suggests that there is sometimes substantial scope for them to generate additional resources and—perhaps more important—to free up substantial amounts of resources which are currently being used inefficiently.

The primary objective of this paper is to attempt a rough scoping of the magnitude of resources that might be generated or freed up by a variety of public sector actions. The paper begins by examining the potential to reform many existing policies which are not only costly but often unsustainable and environmentally damaging. Reforming them would both free up resources for more valuable uses, and often directly improve sustainability. The following section then turns to potential means for generating new financial flows, by capturing a greater share of the rents from natural resources and by instituting 'green' levies. Wherever possible, we attempt to estimate potential revenue flows or resource savings, although data limitations sometimes prevent this. Numerical estimates are complemented with case studies detailing the experience of specific countries.

Throughout the paper, we focus on approaches that developing countries can undertake largely at their own initiative, and do not discuss the various proposals that have been made for funding mechanisms that would require widespread international agreement (such as a Tobin tax). Developing countries would not need to wait for a global consensus to undertake the measures outlined here. We also focus on the potential to generate resources within sectors that are particularly critical for sustainable development, and where the potential for 'win-win' solutions that reduce environmental damage while generating resources is greatest.

In addition to the resources they might generate, many of the actions examined in this paper are also likely to contribute to sustainable development directly, by changing the incentives for environmental and natural resource use. Reforming energy policy, for example, would not only reduce a very significant drain on government resources but also lead to reduced energy use, thus diminishing the attendant pollution. A second objective of the paper, then, is to examine the nature and extent of such changes in incentives. As we will see, in some cases this effect may well be more important than revenue generation.

Many of the actions discussed in this paper are likely to affect the poor. Indeed, fear of harming the poor is often used as a justification to avoid undertaking these actions. We examine these concerns in each case. As we will see, the concerns that reforms would harm the poor do not tend to be borne out. Although reforms do have to be undertaken with some care, in many cases they seem likely to be beneficial rather than harmful for the poor.

Many of the paper's conclusions are equally applicable to developed countries. Subsidies to energy, for example, tend to be much higher in per capita terms in developed countries, and to have equally detrimental effects on public finance and the environment. The report, however, focuses on developing countries as their need for additional resources to help finance sustainable development, and to get incentives right, is particularly acute.

It is of course impossible for a paper such as this to cover the myriad issues which affect sustainable development. We focus narrowly on the issue of generating additional resources to finance sustainable development, and do not discuss how these resources are to be employed.

# 2. Freeing Up Existing Resources

One of the biggest potential sources of resources for many developing countries would come from freeing up existing resources for better uses rather than from generating new resources. Many important goods and services are mis-priced as a result of policies in place. In many cases, they are priced too low. Predictably, this results in over-use of these goods, with consequent adverse effects on efficiency and on the environment. Reforming them would free up substantial amounts of budgetary resources, as well as improving the efficiency of the sector and, often, reducing environmental pressures.

We define subsidy policies broadly, as any policies whose effect is to reduce the costs of an activity relative to what they would have been in the absence of the policies. Some subsidies are explicit, such as selling electricity to consumers for less than its cost of production, with government funds covering the deficit of the electricity producer. Other subsidies are implicit, such as selling fuel domestically for less than its value on the world market, which results in the government forgoing potential income from that sale. Under this approach, the extent of subsidies for input use is given by the difference between what users pay for that input and what they would have paid in the absence of all policies, multiplied by the quantity used.

A depressingly common story emerges in each of the following sections: a sector is highly subsidized, either explicitly or implicitly. Typically, consumers are not charged at all for the capi-tal costs of providing goods and services such as electricity or irrigation water, and are only charged a small proportion of operating costs. This leads to two parallel—and entirely predictable—results. First, the good being supplied is used very wastefully, since low prices provide no incentive to conserve. In addition to the inherent inefficiency it causes, this waste can also have important adverse environmental effects: excessive energy use results in high levels of air pollution, and excessive water consumption places pressures on aquatic ecosystems. Second, high levels of use coupled with minimal cost recovery leave the institutions overseeing the sector chronically short of funds. Consequently, their ability to manage, maintain, and expand the sector's infrastructure diminishes, until the infrastructure crumbles from neglect—and sometimes collapses entirely.

An equally common aspect of this story is that although many of the subsidies discussed below are often justified as protecting the poor, there is substantial evidence that they are in fact often regressive. This is due in part to leakage (the non-poor reap some of the benefit when consuming the subsidized good; subsidized kerosene, for example, is also bought by the non-poor), and in part to mistargeting (the poor fail to benefit from the subsidy because they do not consume the subsidized good; few of the poor, for example, are connected to the electric grid). Moreover, the parlous financial condition of public utilities that results from these subsidies often prevents them from expanding coverage of services such as electricity and clean water, leaving the poor using more expensive and often inferior substitutes.

## 2.1 Reducing Energy Subsidies

Traditional justifications for energy subsidies in industrialized countries include ensuring security of energy supply, increasing competitiveness of industries, and protecting employment. In developing economies, the list also includes social protection and economic development. While energy subsidies in industrialized countries tend to favor producers, in developing countries they tend to favor consumers.

Subsidies are not always bad; some can be successfully used to correct for market failures. However, energy subsidies are increasingly identified as perverse (Myers and Kent, 2001; van Beers and de Moor, 2001). It has long been recognized that energy subsidies encourage wasteful energy use and prompt negative environmental impacts.[1] In addition, energy subsidies in developing countries often fail to reach their target of assisting the poorest, instead being consumed by richer groups. The welfare economics of electri-

city subsidy are discussed in more detail in Appendix B. The need for reform, however, makes itself more pressing when it becomes evident that these subsidies are a drain of the public budget that is increasingly unsustainable.

As noted above, we define energy subsidies as measures that lead the prices of energy products to be lower than they 'should' be.[2] This lends itself to use of the price-gap approach to measure the size of subsidies, wherein the prices currently paid by consumers are compared to reference prices. The selection of reference prices is straightforward in theory, but contentious in practice. For internationally traded goods (such as petroleum products), the relevant reference price would be the international price adjusted by distribution costs (augmented in the case of net oil importers, and reduced in the case of net oil exporters).[3] For non-traded goods (such as, generally, electricity) the reference price would the long run marginal cost of provision.

- In the case of electricity, setting tariffs below cost of provision, supplying the sector with subsidized infrastructure and fuels, allowing for excessive losses in distribution (whether due to crumbling infrastructure or to theft), and not enforcing payment, all contribute to the 'effective' price being lower than the long run marginal cost of provision, and hence to a subsidy. In what follows, we attempt to catch the combined effect of low tariffs and subsidized infrastructure and fuels, but will not address the excessive losses and non-payment elements.
- In the case of petroleum products (gasoline and diesel), we will go one step further. These products are not usually subsidized, in the sense of their price not covering the economic cost of production. However, differential taxation of petroleum products (within one country and across countries[4]) leads itself naturally to the analysis of the potential revenues of matching a certain benchmark, whether this is designed to cover road transport sector costs, or to help financing the general budget.

### Current energy subsidies

Energy is among the most heavily subsidized sectors in the world. According to the figures compiled by van Beers and de Moor (2001), energy accounted for over 20 percent of world subsidies or nearly 1 percent of world GDP in the mid-1990s. Developing countries have been extra-

**Table 2.1: Annual costs of energy subsidies, 1995-98**

(US$ billion per year)

| | *OECD* | *Non-OECD* | *World* |
|---|---|---|---|
| Fossil fuels | | | |
| Coal | 30 | 23 | 53 |
| Oil | 19 | 33 | 52 |
| Gas | 8 | 38 | 46 |
| *Subtotal* | *57* | *94* | *151* |
| Electricity | a | 48 | 48 |
| Nuclear | 16 | Negligible | 48 |
| Non-payments and bail-out[b] | 0 | 20 | 20 |
| **Total** | **82** | **162** | **244** |
| Per capita (US$) | 88 | 35 | 44 |

*Notes:* [a] Subsidies for electricity in OECD countries have been attributed to fossil fuels according to the corresponding shares in electricity generation

[b] Subsidies from non-payments and bail-out operations have not been attributed to energy sources

*Source.* Van Beers and de Moor, 2001.

ordinarily keen on subsidizing energy, with the energy sector absorbing nearly 50 percent of subsidies, representing some 3 percent of GDP. The electricity subsector attracts the largest share of subsidies (see Table 2.1).

A recent IEA (1999) study confirms that pervasive under-pricing of energy resources occurs in eight of the largest countries outside the OECD: China, India, Indonesia, Iran, Kazakhstan, Russia, South Africa, and Venezuela, which collectively represent a quarter of world energy use. On average, end-use prices in these countries are about 20 percent below their opportunity cost or market-based reference levels, despite substantial progress in recent years to move towards more rational pricing and market-based policies (see Table 2.2). This results in a total of over US$83 billion in subsidies for energy products, including over US$7 billion for petroleum products, US$41 billion for electricity, US$26 billion for natural gas, and nearly US$9 billion for coal. However, as these are all large

**Table 2.2: Energy subsidies in eight developing countries**

| | *China* | *Russia* | *India* | *Indonesia* | *Iran* | *South Africa* | *Venezuela* | *Kazakhstan* | *Total* |
|---|---|---|---|---|---|---|---|---|---|
| **Value of subsidies (billion US$)** | | | | | | | | | |
| Gasoline | 0.00 | 0.59 | 0.00 | 0.00 | 0.50 | 0.00 | 0.28 | 0.00 | 1.37 |
| Diesel | 0.00 | 0.00 | 0.00 | 0.30 | 0.76 | 0.00 | 0.06 | 0.00 | 1.13 |
| LPG | 0.00 | 0.00 | 0.51 | 0.00 | 0.16 | 0.00 | 0.04 | 0.00 | 0.71 |
| Kerosene | 0.00 | 0.00 | 1.58 | 0.44 | 0.63 | 0.01 | 0.01 | 0.00 | 2.67 |
| LFO | 0.00 | 0.05 | 0.00 | 0.25 | 0.45 | 0.00 | 0.04 | 0.00 | 0.79 |
| HFO | 0.00 | 0.00 | 0.00 | 0.01 | 0.34 | 0.00 | 0.01 | 0.00 | 0.37 |
| Electricity | 22.03 | 11.17 | 4.60 | 0.00 | 0.41 | 1.14 | 0.96 | 1.19 | 41.49 |
| Natural gas | 0.49 | 21.67 | 0.55 | 0.19 | 2.15 | 0.00 | 1.17 | 0.09 | 26.32 |
| Steam coal | 3.28 | 0.00 | 1.24 | 0.00 | 0.00 | 0.04 | 0.01 | 0.14 | 4.71 |
| Coking coal | 3.77 | 0.00 | 0.27 | 0.00 | 0.00 | 0.00 | n.a. | 0.00 | 4.05 |
| **Total** | **29.58** | **33.49** | **8.75** | **1.20** | **5.41** | **1.19** | **2.56** | **1.42** | **83.60** |
| % GDP | 3.1 | 7.6 | 2.1 | 0.5 | 5.3 | 0.8 | 2.6 | 6.3 | |
| **Subsidy rates (%)** | | | | | | | | | |
| Gasoline | 0.0 | 9.3 | 0.0 | 0.0 | 59.4 | 0.0 | 26.6 | 0.0 | |
| Diesel | 0.0 | 0.0 | 0.0 | 40.2 | 93.9 | 0.0 | 35.9 | 0.0 | |
| LPG | 0.0 | 0.0 | 31.6 | 0.0 | 89.7 | 0.0 | 26.1 | 0.0 | |
| Kerosene | 0.0 | 0.0 | 52.6 | 55.2 | 89.5 | 2.0 | 4.9 | 0.0 | |
| LFO | 0.0 | 1.5 | 0.0 | 45.5 | 82.3 | 0.0 | 19.3 | 0.0 | |
| HFO | 0.0 | 0.0 | 0.0 | 7.8 | 88.1 | 0.0 | 39.4 | 0.0 | |
| Electricity | 38.2 | 42.0 | 24.2 | 0.0 | 48.1 | 20.3 | 63.0 | 56.6 | |
| Natural gas | 18.7 | 46.1 | 22.5 | 28.4 | 77.8 | 0.0 | 85.6 | 55.7 | |
| Steam coal | 8.3 | 0.0 | 13.1 | 0.0 | 0.0 | 8.1 | 91.9 | 20.7 | |
| Coking coal | 73.1 | 0.0 | 42.3 | 0.35 | 0.0 | 0.0 | - | 2.7 | |
| **Total** | **10.9** | **32.5** | **14.2** | **27.5** | **80.4** | **6.4** | **57.6** | **18.2** | |

*Note:* Figures are in 1999 US billion dollars. Original data are for 1997 (Russia, Indonesia, Iran, South Africa) and 1998 (China, India, Venezuela, Kazakhstan).

LPG: Liquefied Petroleum Gas.

LFO: Light Fuel Oil.

HFO: Heavy Fuel Oil.

*Source:* Adapted from IEA, 1999.

energy producers, it is not possible to extrapolate the results to the rest of the developing world.

In this section, we focus on two subsectors: electricity and transport fuels. Electricity subsidies represent an important share of energy subsidies. In addition to direct subsidies, electricity also benefits from a significant portion of subsidies to coal, oil, and gas, which lower the cost of fuels employed in electricity generation. Box 2.1 illustrates the importance of including this upstream component in the evaluation of electricity subsidies. Electricity generation represents 40 percent of the use of coal, 10 percent of the use of oil, and nearly 20 percent of the use of natural gas in developing countries (IEA, 2001a). In our analysis, we will attribute this form of 'indirect subsidization' to the electricity sector, so our results will not be directly comparable to previous studies.[5]

**Box 2.1: The effects of coal mispricing in India**

The differential pricing of fuels in India promotes consumption of the most damaging varieties. While most coal prices have been deregulated, power station grades of domestic coal are still priced below the cost of production. The true value of the better grades is underestimated, while cleaner imported fuels are priced too high by comparison with domestic coal. In addition, prices for the transport of goods by rail, including coal, are generally subsidized, further encouraging the use of the domestic product and its high ash content. As a result, (1) Indian coal is preferred as a fuel for power generation over other fuels with lower ash content, (2) the relative prices of different grades of coal give no incentive to coal producers to increase output of better-quality coals, (3) distorted prices for transport affect the choice between pit-head and load-center plants, shifting the location of environmental impacts, and (4) demand is maintained at artificially high levels.

*Source.* World Bank, 1999a.

In addition to electricity, we focus on the pricing practices of petroleum products used for transport, namely gasoline and diesel. The transport sector represents 40 percent of the use of oil in developing countries (IEA, 2001a), with gasoline and diesel accounting for half of this figure. Altogether, our analysis of both electricity and transport fuels encompasses roughly 40 percent of coal consumption, 30 percent of oil consumption, and 20 percent of natural gas consumption. Despite the importance of coal consumption from an environmental and health perspective, we do not offer a treatment of coal subsidies. Bulky coal is not traded widely, so its consumption within the developing world is highly localized in a handful of coal-producing countries—mainly India, China, and South Africa (IEA, 1999).

*Electricity*

Electricity attracts 30 to 50 percent of energy subsidies (van Beers and de Moor, 2001; IEA, 1999). In the IEA's sample of eight countries electricity subsidies amounted to about half of total energy subsidies (IEA, 1999). In early 1991, electricity subsidies in developing countries were estimated to be US$54 billion, or US$64 billion in constant 1999 dollars (World Bank, 1997a).

For this report, we have carried out a new estimation exercise, combining tariff data for 79 countries, with a conservative estimate of long run marginal cost. Our tariff data come from a range of international sources: IEA (1999; 2001), OLADE (2000), EBRD (2001) and World Bank (1998a; 1999b; 2000f). Based on the estimates offered in IEA (1998) and Rodnick (2000), we use the following costs of generation, in US cents per kilowatt-hour (c/kwh): coal 3.6 c/kwh; natural gas 3.1 c/kwh; nuclear 3.2 c/kwh; hydro 1.9 c/kwh; and oil 6.7 c/kwh. We use a mark-up for transmission and distribution costs of 2 c/kwh for industrial customers and 4 c/kwh for non-industrial customers in our calculations. The difference in mark-up is due to the higher cost of serving non-industrial customers than industrial customers. Industrial customers consume larger quantities, requiring less distribution infrastructure per kilowatt-hour consumed, and can be served at higher voltage levels, reducing distribution losses. Our sample accounts for 92 percent of developing world electricity consumption. In what follows we have scaled up the results to account for 100 percent of consumption.

Our crude measure of subsidy encompasses the two main ways in which electricity is subsidized. The first is the sale of fuels (such as natural gas and fuel oil) to electricity generators at prices below the export price. This issue applies to the case of oil exporting countries. The second main

form of subsidy results from infrastructure costs not being fully incorporated in electricity prices. This may result from financial transfers from the government, or by not spending money in maintaining existing infrastructure.[6]

According to our estimates, 51 of 79 developing countries subsidize electricity. The results indicate that in 1999 the developing world subsidized electricity at a rate of 46 percent of long run marginal cost, for a total subsidy of US$102 billion. This represents 2 percent of the developing world's GDP. Table 2.3 summarizes our results by region, and Figure 2.1 illustrates them. The Former Soviet Union, with ample access to electricity and very low prices of the fuels employed in its generation, leads the electricity subsidy league. By contrast, Sub-Saharan Africa, with low access to electricity, and

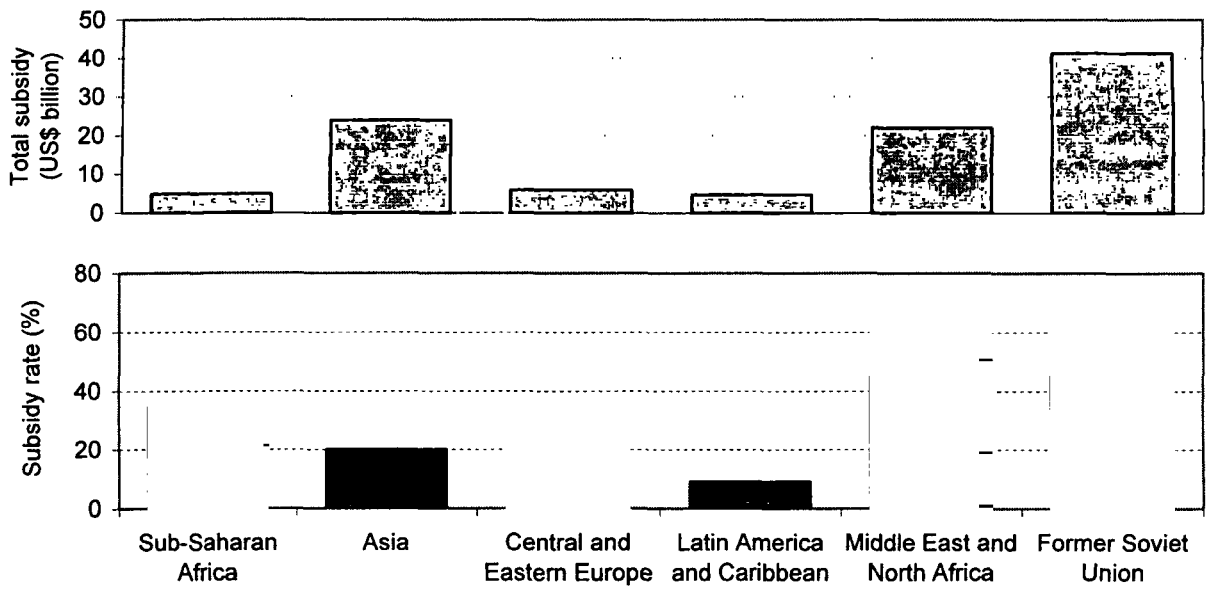
**Table 2.3: Electricity subsidies in developing regions, 1999**

| | *Subsidy (billion US$)* | *Subsidy rate (%)* | *Subsidy (% GDP)* |
|---|---|---|---|
| Sub-Saharan Africa | 4.8 | 35 | 1.6 |
| Asia | 23.8 | 20 | 0.9 |
| Central and Eastern Europe | 5.8 | 21 | 1.5 |
| Former Soviet Union | 41.3 | 76 | 13.7 |
| Latin America and Caribbean | 4.6 | 9 | 0.3 |
| Middle East and North Africa | 21.9 | 59 | 3.7 |
| **Total** | **102.4** | **34** | **1.7** |

*Notes:* The results are based on a sample of 79 countries representing 92 percent of consumption and have been scaled up. Estonia, Latvia and Lithuania have been included in the Central and Eastern Europe grouping.

*Source:* Authors' estimates.

**Figure 2.1: Electricity subsidies in developing countries, 1999**




*Source:* Authors' estimates.

Latin America and the Caribbean, which has restructured the sector in the past decade, account together for less than 10 percent of the US$102 billion.

The results of our estimations for individual countries are shown in Appendix B. Extreme care must be taken in interpreting these results. The global benchmarks used in the estimates cannot capture individual countries' characteristics. Although we are confident on our results at the global level, the degree of accuracy of the results diminishes at more disaggregated levels. In the case of Sub-Saharan Africa, the results are driven by one country (South Africa represents over 70 percent of regional consumption), and so even interpretation at a regional level requires consideration of the estimation's shortcomings.

Our approach for calculating subsidies cannot account for cross-subsidies. Cross-subsidies happen when a group of consumer is charged a price above the cost of production, while another group is charged a price below cost. In the case of electricity, industrial consumers typically cross-subsidize non-industrial ones. As a consequence, the two effects cancel each other. Although cross-subsidization generates allocative inefficiencies, decision-makers often justify it on equity grounds. To evaluate the importance of cross-subsidies in the power sector in developing countries, we compare the prices for industrial and non-industrial consumers using a simple rule. We define cross-subsidization as occurring when the price for non-industrial customers is below the price for industrial customers plus a mark up of 1.5 c/kwh.[7] Our data indicate that while 51 countries in our sample (or 65 percent of countries) subsidize electricity, in 65 countries of our sample (or 83 percent of countries) there is cross-subsidization. This result, entirely expected, highlights the fact that our main results can be considered a lower bound of electricity subsidies in developing countries.

Because of differences in methodologies, our results are not strictly comparable to earlier studies. Nevertheless, it seems likely that electricity subsidies are increasing *in absolute terms*. Our estimate of some US$100 billion in subsidies in 1999 represents a very significant increase over the estimate of US$64 billion in 1991 reported in World Bank (1997a)[8]—sufficiently large that the difference is unlikely to be due solely to differences in methodology. This is in contrast to the trend observed in other energy products. For example, coal subsidies have experienced a rapid decrease in the 1990s, mainly due to policy changes in China (chiefly, the partial liberalization of the coal market) and the economic downturn experienced in the 1990s by Russia and other transition countries (IEA, 1999).

Although the absolute amount of subsidies appear to have increased, subsidy rates appear to have declined somewhat. In 1991, subsidy rates were over 50 percent in transition countries, over 40 percent in China and India, and over 30 percent in other countries (World Bank, 1997a). Our figures suggest that while the situation in the transition countries has not have improved, the rest of the developing world may have experienced significant reductions in subsidy rates and in the size of subsidies *as a percentage of GDP*. That the absolute amount of subsidies has nevertheless increased is due to a 25 percent increase in electricity consumption in developing countries over the 1991-1999 period (in spite of the economic downturn in Eastern Europe and the Former Soviet Union).

**Box 2.2: The financial burden of electricity subsidies in India**

The growing financial burden of electricity subsidies in India is unsustainable. In 1992-93, the total financial losses of the power sector came to US$1.7 billion. In just three years, these losses doubled. Three years later, they had doubled again. In 2001 combined state utility losses are estimated at somewhat more than US$5 billion a year. If current trends continue, in another three years, state utility financial losses will reach US$10 billion a year. To put this magnitude of losses into perspective, US$5 billion is half of what all the states governments in India combined are spending on all levels of education every year. It is double what they are all spending on health, and three times what they are spending on water supply. If power sector financial losses were reduced by only one-third, the savings in a single year would be sufficient to fill every teacher vacancy in the country and provide every school with running water and toilet facilities.

*Source:* Lim, 2001.

**Box 2.3: Quasi-fiscal energy activities in the Former Soviet Union**

Despite a decade of transition, most countries of the former Soviet Union (FSU) continue to maintain largely unreformed energy sectors, characterized by mispricing, a high degree of government ownership, vertical integration, political interference, high levels of payment arrears, cross-subsidization, large technical and other losses, and other operational problems. In many of these countries, energy companies continue to function as quasi-fiscal institutions and social safety nets, providing large implicit subsidies to households and (state-owned) enterprises. In most countries of the former Soviet Union, quasi-fiscal activities in the energy sector have remained large and pervasive in recent years, often accounting for 5 percent or more of GDP.

Energy sector quasi-fiscal activities create sizable economic distortions and inefficiencies (such as overconsumption and underinvestment), they provide opportunities for rent seeking and for nontransparent and unjust (re-) distribution of income, while having adverse environmental effects. Energy sector quasi-fiscal activities disguise and obfuscate the true extent of government involvement in the economies of these countries, providing untargeted implicit subsidies to consumers and enterprises. They can also pose a risk to macroeconomic stability and sustainable growth. Accumulated arrears often tend to be cleared through credit expansion, which fuels inflation; external imbalances are created by running up external payment arrears; and fiscal policy is inhibited by the emergence of large payment and tax arrears.

*Source* Petri and others, 2002

The size of electricity subsidies has traditionally tended to increase for two main reasons. First, the gap between prices and economic costs has tended to widen. While production costs increase with inflation, regulated prices (tariffs) are usually fixed and infrequently updated (for example, until a recent increase in tariffs, Uganda had not revised their electricity tariffs for nearly a decade). Second, the quantity of electricity consumed tends to increase both as the economy grows and as consumers switch to the subsidized good (for instance, Yugoslavs find it cheaper to heat their homes with electricity than to invest in insulation,). India represents a case in point, with electricity subsidies doubling every three years (see Box 2.2). For some individual countries, the situation is getting out of control, with electricity and other energy subsidies becoming an important liability for the stability of the public budget and macroeconomic performance (see Box 2.3).

### *Transport fuels*

Gasoline and diesel are not generally thought of as subsidized products, except in oil producing countries. However, the subsidy bill in these countries can be substantial. In addition to selling transport fuels at prices below production costs, there is the issue of externalities. Transport users generate local and global air pollution, congestion, and depreciation of transport infrastructure. Low prices encourage greater consumption and larger attendant externalities.

For this report we have carried out two estimation exercises, based on two different reference prices that can be used for calculating transport fuel subsidies. The 'traditional' measure is the economic cost of producing and distributing the fuels. Following Metschies (1999, 2001) we use prices of gasoline and diesel of 23.8 and 21 US cents per liter respectively for 1999 as crude global references. However, in the case of transport fuels, under the 'user pays principle' we can devise a second reference price which includes a mark-up to account for transport infrastructure depreciation costs. We call this the 'transport sector' measure. The World Bank's Road Maintenance Initiative suggests that developing countries should levy a fuel tax of about 10 US cents per liter to cover the cost of road maintenance.[9] Note that this tax would *not* cover environmental externalities (air and noise pollution) and other externalities (congestion and accidents). We use this mark-up to generate a second reference price for gasoline and diesel of 33.8 and 31 US cents per liter respectively. When the price of the fuels is below the reference price, the difference would represent a subsidy on the fuel. Neither of these reference prices are fully accurate for each individual country, but they are useful to estimate fuel pricing and taxation policies on a global scale. We have used the transport fuel prices reported in Metschies (1999; 2001) to create average prices for the year 1999[10] for a sample of 105 countries, representing nearly 100 percent of the consumption of transport fuels in the developing world.[11]

**Table 2.4: Fuel subsidies in developing regions, 1999**

| | *Gasoline subsidies (billion US$)* | | *Diesel subsidies (billion US$)* | | *Total (percent of GDP)* | |
|---|---|---|---|---|---|---|
| | *Traditional measure* | *Transport sector measure* | *Traditional measure* | *Transport sector measure* | *Traditional measure* | *Transport sector measure* |
| Europe and Central Asia | 0.3 | 1.6 | 0.5 | 3.5 | 0.09 | 0.6 |
| Middle East and North Africa | 3.1 | 6.2 | 8.2 | 14.8 | 1.90 | 3.5 |
| Sub-Saharan Africa | 0.2 | 0.5 | 0.2 | 0.6 | 0.23 | 0.36 |
| Latin America and Caribbean | 0.9 | 1.9 | 0.6 | 1.5 | 0.09 | 0.19 |
| South Asia | 0.0 | 0.0 | 0.0 | 3.1 | 0.00 | 0.54 |
| East Asia and Pacific | 0.7 | 3.0 | 3.0 | 7.0 | 0.20 | 0.54 |
| Total | 5.1 | 13.2 | 12.5 | 30.5 | 0.30 | 0.74 |

*Notes:* 'Traditional measure' refers to the size of the subsidy when the reference price is the economic cost of the fuel. 'Transport sector measure' refers to the size of the subsidy when the reference price takes into account the costs of maintaining the transport infrastructure.

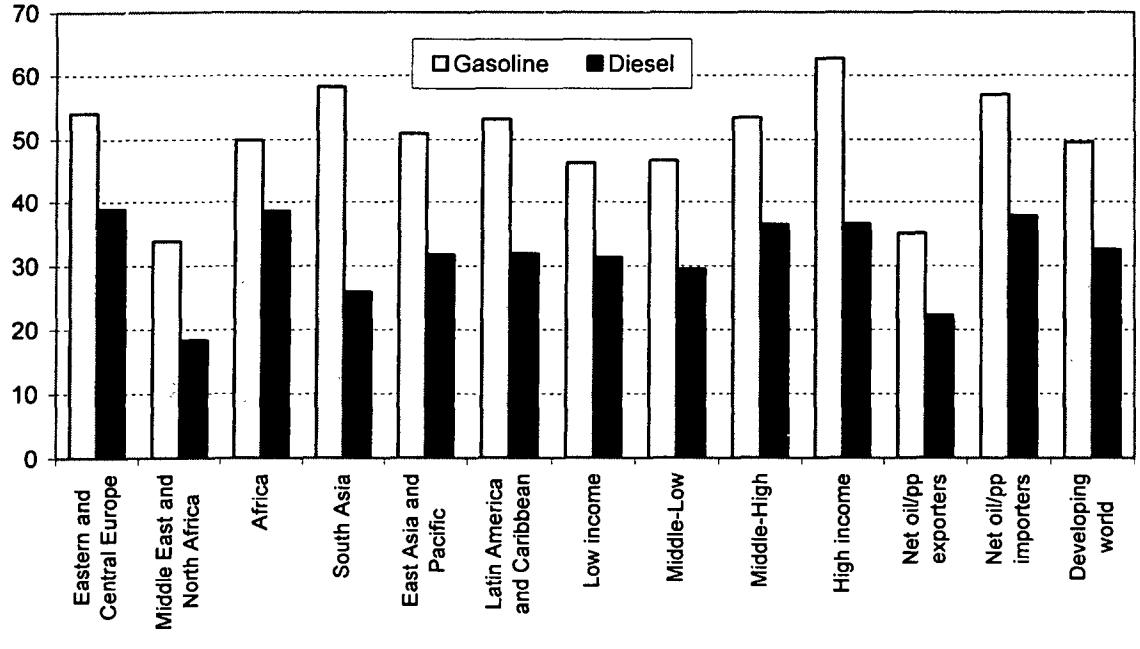
*Source:* Authors' estimates.

Using these two reference prices as benchmarks, the fuel policies of developing countries can be assigned to one of the following categories:

- **Subsidizing countries**, where fuels are sold at prices below the world market reference price. This group comprises around 15 countries.
- Countries pursuing a **low price policy**, with an average tax of less than 10 US cents per litre. Although these countries would not be subsidizing the fuel, they would be subsidizing road transport. This group comprises around 25 countries.
- Countries pursuing a **medium price policy**, with average fuel prices roughly between those of the United States and those of the European Union.[12]

**Figure 2.2: Average fuel prices in developing countries by group, 1999**

(US cents)




*Note:* Un-weighted averages.

*Source:* Authors' estimates based on data in Metschies, 1999 and 2001

- In the sample analyzed, no developing country pursues a **high price policy** such as that prevalent in the European Union.[13]

Our results, shown in Table 2.4, indicate that subsidies to transport fuels in developing countries are substantial, amounting to 0.3 to 0.7 percent of the developing world's GDP, depending on the benchmark used. Implicit subsidies to gasoline amount to about US$5 billion, and subsidies to diesel to about US$13 billion, for a total of about US$18 billion. When transport infrastructure costs are taken into account, the amounts increase to US$13 and US$31 billion respectively, for a total of about US$48 billion. This last figure must be taken with care. While road transport in the developing world represents 98 percent of the consumption of gasoline, it only represents 80 percent of the consumption of diesel,[14] the rest being consumed in the industrial and agricultural sectors (IEA, 2001a).

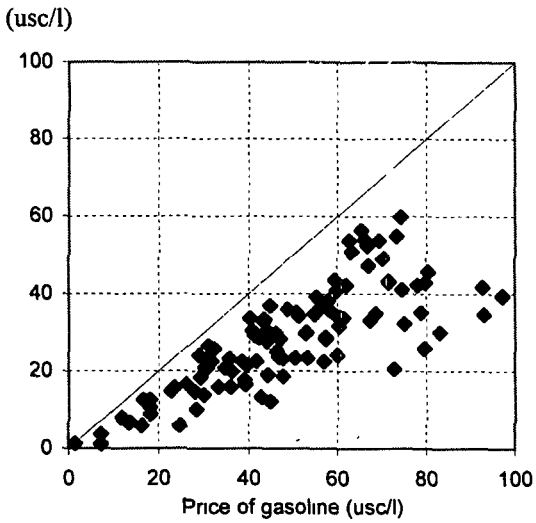
There are significant regional differences in the prevalence of subsidies to transport fuels. The Middle East and North Africa region predictably stands out (see Table 2.4). This region is responsible for 60 percent of transport fuel subsidies, representing 2 percent of regional GDP, or over 3.5 percent of regional GDP when road transport infrastructure costs are factored in.

A further point to notice is that diesel is priced consistently below gasoline (see Figure 2.2 and Box 2.4), despite being more environmentally harmful. We expand on this issue below.

**Box 2.4: Differential pricing of fuels**

Gasoline is generally taxed much more than diesel. This policy has its origin in diesel being an 'industrial' fuel (intermediate good), while gasoline is generally consumed by house-holds (final good). According to tax theory, only final goods should be taxed, if a number of conditions are met, including absence of environmental externalities. The financial advantage of diesel improves even further when its greater fuel effi-ciency is considered. This is unfortunate from an environmental point of view, as conventional diesel is a more polluting fuel. Yet large differences in prices via taxation encourage fuel switching to diesel.

**Equivalent price of diesel after adjusting for energy content**




*Source:* Authors' estimates based on data in Metschies, 1999 and 2001.

### Energy subsidies and the environment

In addition to the burden they place on public finances, existing energy subsidies and pricing policies often result in significant adverse environmental effects by encouraging increased energy consumption, which results in high levels of air pollution. Fuel prices affect the levels of emissions by influencing aggregated or fuel-specific demand.

Urban air pollution resulting from fossil fuel use causes substantial economic costs. The main damages from fuel combustion are: (1) adverse health effects of exposure to ambient air pollution in urban areas (for example, increased respiratory illness and premature deaths); (2) local nonhealth effects (reduction in visibility; increased soiling); and (3) effects on global climate change. The largest share of environmental damage is associated with the impacts of pollution on human health. Every year an estimated 0.5-1.0 million people die prematurely from respiratory and other illnesses associated with urban air pollution throughout the developing world, and millions more suffer from these disorders (Kojima and Lovei, 2001). Globally, urban (outdoor) air pollution is highest in China, India, and a number of cities in Asia and Latin America.

A recent World Bank study (Lvovsky and others, 2000) finds that marginal damage costs from fossil fuels use are comparable to their market prices and, for some fuel uses, may exceed

them. In a sample of six cities (Bangkok, Krakow, Manila, Mumbai, Santiago, and Shanghai), marginal damages range from 60 percent of market price for unleaded gasoline and 50 percent for fuel oil to more than 200 percent for automotive diesel. The social costs of all environmental impacts totaled US$4.2 billion per year (or US$84 per urban citizen), of which health impacts amounted to 68 percent, climate change impacts to 21 percent (using a shadow price of US$20 per ton of carbon emissions), and local nonhealth effects contributed 11 percent. According to these figures, the environmental cost of fossil fuels represent over 7.5 percent of the sampled cities' GDP, with local costs representing 6 percent of the cities' GDP.

Air pollution from urban transport is of particular concern. Vehicle emissions, occurring as they do near ground level and in densely populated areas, cause much greater human exposure to harmful pollutants in the immediate locality than do sources that emit at higher elevations and farther away from population centers. Furthermore, vehicle exhaust particles, especially those in diesel exhaust, are among the most damaging to public health: they are small, and there is growing evidence that some are carcinogens. Because motorization generally rises with increasing income, pollution abatement in the transport sector is likely to become an increasingly important part of urban air quality management in the coming years in developing countries (Kojima and Lovei, 2001). According to the World Bank study, emissions from transport fuels contribute 45 percent of the local damage of fuels in the sampled cities (or US$1.6 billion per year), and 12 percent of the global damage (or US$0.1 billion) (Lvovsky and others, 2000). The environmental costs imposed by transport fuels represent 3 percent of GDP in urban areas, with local costs representing 2.7 percent of GDP. For the limited sample analyzed, the local damage of transport fuels adds to over US$1.5 billion. Diesel is responsible for over 70 percent of this amount.

In contrast, the environmental costs of power generation represent only 7 percent of the environmental cost of fossil fuels, and are largely in the form of global costs (that is, climate change). Although power generation represents 29 percent of global damage of fossil fuels in large urban cities in developing countries, it only represents 1 percent of local environmental costs (Lvovsky and others, 2000). Table 2.5 reports the environmental costs of fossil fuels for six cities, by sector.

### Energy subsidies and the poor

Energy subsidies are often motivated as helping the poor. Access to modern energy is a vital dimension of poverty alleviation and development. The poor use proportionately more wood, dung, and other biomass fuels in traditional ways, and less electricity and LPG, which tend to be more expensive and cause adverse problems such as indoor air pollution.

**Table 2.5: Environmental costs of fossil fuels in six developing country cities**

| | *Total damage* | | *Local damage* | | *Percent of total damage* | *Percent of local damage* |
|---|---|---|---|---|---|---|
| | *(million US$)* | *(% GDP)* | *(million US$)* | *(% GDP)* | | |
| Power plants | 296 | 0.5 | 29 | 0.05 | 7 | 1 |
| Industrial and commercial boilers | | | | | | |
| Large | 713 | 1.3 | 329 | 0.6 | 17 | 10 |
| Small | 1,158 | 2.1 | 1,068 | 1.9 | 27 | 31 |
| Households | 528 | 1.0 | 460 | 0.8 | 12 | 14 |
| Vehicles | 1,625 | 2.9 | 1,513 | 2.7 | 38 | 45 |
| All sectors | 4,317 | 7.8 | 3,397 | 6.1 | 100 | 100 |

*Notes.* Sample of six cities (Mumbai, Shanghai, Manila, Bangkok, Krakow, and Santiago) with a combined population of 46 million people and a combined GDP of US$55 billion. Original calculations refer to 1993, but have been converted to 1999 US dollars Local damage includes health and non-health costs. Total damage includes, in addition, climate change costs. Health costs were valued using the Value of Statistical Life (VOSL) approach. Climate change costs were valued using a shadow price of US$20 per ton of carbon emissions.

*Source* Lvovsky and others, 2000, and authors' calculations based on their data.

**Box 2.5: Income and health effects of access to modern energy**

For cooking, the urban poor often pay more for wood or charcoal than they would for LPG, after adjusting for the end use efficiencies of the fuels. Kerosene lamps produce about 200 times less light than an electric light bulb, create unhealthy particulate and volatile hydrocarbon emissions, are cumbersome to transport, and are a serious fire hazard (ESMAP, 2001a). Families using electricity for lighting experience the ability to extend the day; children can study longer hours, which raises educational levels; and the household has lower lighting expenditures than those using kerosene. In rural Nepal – where lighting is generally achieved by the use of kerosene lamps and amounts to around 1 percent of rural energy consumption – the kerosene bill accounts for 10 percent to 20 percent of a typical family's earnings (HLF, 2001).

Fuels such as fuelwood, charcoal, and dung are major source of indoor air pollution. Exposure to indoor air pollution, in turn, is a major factor contributing to the global burden of disease. Epidemiological studies in developing countries have linked exposure to indoor air pollution from traditional fuels with at least four major categories of illness: acute respiratory infections in children; chronic obstructive lung diseases such as asthma and chronic bronchitis; lung cancer; and stillbirths and other problems at birth. There is also evidence of links to blindness, tuberculosis, and cardiovascular diseases (Smith, 1999). Estimates indicate that exposure to indoor air pollution in developing countries causes over 2 million deaths each year (Smith, 1996; Lvovsky, 2002), with 75 percent of these deaths occurring in rural areas, and 25 percent in urban areas (Smith, 1996).

The use of cleaner fuels such as kerosene or liquefied petroleum gas (LPG) would have a major impact in reducing exposure to indoor air pollution and its impact in child mortality. More than half of the world's households cook and heat using unprocessed solid fuels, particularly biomass (wood, dung, and crop residues), typically in open fires or simple stoves, mostly indoors, and rarely with adequate ventilation or chimneys (Lvovsky, 2002). In India, where 75 percent of households use biomass as primary fuel, and the exposure to indoor air pollution causes an estimated half a million premature deaths every year, the transition to cleaner fuels would reduce between a third and a half the mortality rate for children under the age of five in rural areas (ESMAP, 2000). Although some technical interventions to reduce exposure to indoor air pollution exist, the only feasible long-term remedy is to improve access to cleaner modern energy (Smith, 1999).

Recent microeconometric work by the World Bank's Environment Department (Wang, 2002) suggests that household access to electricity has a large and significant effect on reducing child mortality. Although the mechanism is not clearly understood, the effect is independent of income. According to this study, it would be possible to avert 1 under-five child death per 1,000 births by expanding household access to electricity by 0.6 percent. For economic growth alone to have the same effect, a growth rate of 6 percent would be required.

The detrimental health effects of traditional biomass energy go beyond exposure to harmful smoke. In Nepal, rural women are so busy with their daily chores that they are forced to give local beer to children to keep them quiet as they gather fuel and feed the stoves. Nepalese women suffer a high incidence of uterine prolapse that is likely the result of carrying heavy loads of wood soon after delivery. In rural India, women spend six hours a day collecting fuelwood and fodder and cooking. In some areas this extreme physical drudgery causes serious reproductive problems and mental disorders in women (ESMAP, 2001c).

The case for subsidizing energy access for the poor rests on two arguments. The first is that it would bring substantial welfare benefits, by both reducing the energy costs faced by the poor and giving them access to cleaner, less polluting fuels (see Box 2.5). There would thus be both income and health effects. The second is that the up-front investments required to reach new customers and the small ensuing revenue flows result in service providers—whether public or private—having little incentive to market energy services to the poorer segments of the population. Moreover, the poor often lack the means to pay for energy, and in particular would be unable to pay the upfront costs involved (which include both connection charges and the acquisition of suitable equipment such as gas-burning stoves or electric appliances).

The evidence indicates, however, that the bulk of energy subsidies is received by the better-off. Most obviously, subsidies are often provided for energy sources not used by the poor. This is most clearly the case with electricity. As shown in Table 2.6, the poor tend to have much lower access to electricity. Many energy subsidies are thus *mis-targeted* if their objective is to assist the poor.

**Table 2.6: Access to electricity in selected countries, 1997-1998**

(% of population)

| | *Wealth Quintiles* | | | | | |
|---|---|---|---|---|---|---|
| *Country* | *Poorest* | *Second* | *Middle* | *Fourth* | *Richest* | *Total* |
| Kenya | 0.0 | 0.2 | 0.1 | 1.8 | 56.7 | 11.7 |
| Niger | 0.0 | 0.0 | 0.0 | 0.5 | 38.9 | 7.9 |
| Togo | 0.0 | 0.2 | 0.4 | 6.2 | 67.7 | 14.9 |
| Indonesia | 35.0 | 76.3 | 91.9 | 98.9 | 99.9 | 80.4 |
| Kyrgyz Republic | 98.7 | 100.0 | 100.0 | 100.0 | 100.0 | 99.7 |
| Philippines | 6.9 | 58.4 | 94.1 | 99.8 | 100.0 | 71.8 |
| Vietnam | 20.5 | 78.9 | 87.9 | 96.6 | 99.9 | 76.7 |
| Bolivia | 3.6 | 59.5 | 96.2 | 99.8 | 100.0 | 71.8 |
| Nicaragua | 2.4 | 48.7 | 92.4 | 98.5 | 98.6 | 68.1 |

*Source:* World Bank, 2000a.

Even when the poor do use the subsidized energy source, much of the benefit often flows to the better-off. The case of Indonesia illustrates this *leakage* problem. Indonesia provides a 55 percent subsidy on kerosene sales, for a total of US$0.44 billion in 1997 (see Table 2.2). Most of the benefit of this subsidy, however, goes to better-off households. The poorest 10 percent of the population consume slightly over one liter of kerosene per person per month, while the richer households consume up to four or five times that amount (SMERU, 2001). Similarly, in Ecuador cheap kerosene was diverted to the transport sector, and much of it never reached the poor, especially in rural areas (ESMAP, 1994). Thus, even though the poor receive some benefits from kerosene subsidies, the bulk of the benefits are captured by better-off households. The same problem of leakage can be seen in many electricity subsidies (see Box 2.6).

**Box 2.6: Leakage in electricity subsidies in Guatemala**

Following privatization of energy distribution companies, Guatemala introduced a 'social tariff' (*tarifa social*) which caps domestic tariffs for households consuming up to 300 kWh per month at 8 c/kwh The *tarifa social* costs US$50 million annually. Although aimed at protecting the poor, the *tarifa social* largely fails to reach poor households. Low connection rates among poor households combined with a high consumption threshold result in about 65 percent of beneficiaries being non-poor households. Non-poor households capture about 90 percent of the total value of the subsidy. 60 percent of poor households receive no benefits at all from the scheme, as they do not have an electricity connection. A much more pro-poor policy would be to use the resources allocated to the *tarifa social* to expand electricity coverage to unserved households. Households without electricity (70 percent of whom belong to the poorest segment of the population) pay implicit prices of more than 1,100 c/kwh (more than 100 times the price of electricity) to illuminate with candles and wick lamps and to power appliances with dry cell batteries, compared with full cost electricity tariffs of 11 to 15 c/kwh. An estimated 50,000 additional new connections each year could be financed with the current expenditure of the *tarifa social.*

*Source:* Foster and Araujo, 2001.

The poor may not only fail to benefit from energy subsidies—they may often actually be harmed. While better-off households receive subsidized electricity, the poor are often forced to continue using much more expensive and often much dirtier fuels. In India, for example, pricing distortions and mounting subsidies for kerosene and LPG create perverse incentives for illegal diversions to the commercial and transport sectors, thereby limiting the availability of modern fuels for cooking, in a country where 75 percent of households burn wood, dung, and crop residues (see Box 2.7). The case of electricity is even more prominent. Artificially low tariffs lie at the root of the poor financial performance of many state-owned energy companies in the developing countries. In turn, this poor performance seriously reduces the ability of those companies to invest to meet the increasing demand, especially to those consumers who do not yet have access to commercial energy. Low tariffs also reduce the incentives for utilities to expand coverage, as each

**Box 2.7: Petroleum product subsidies and poverty in India**

India has a two-tier pricing system under which state-owned suppliers sell kerosene and LPG at subsidized prices to domestic users, and at market prices to private sector distributors. This structure leads to substantial leakage, as subsidized fuels are diverted from domestic to commercial users. The poor, for whom these subsidies were designed, do not usually use kerosene or LPG for cooking (although they use kerosene for lighting). A 1994 survey of households in Hyderabad 1994 showed that 63 percent of the subsidy went to the richest 40 percent of the population, while only 17 percent of it went to the poorest 40 percent. Although these across-the-board subsidies are an enormous drain on the government budget—US$1.1 billion for LPG and US$1.9 billion for kerosene in 1999-2000—their overall effect may be to reduce the accessibility of these fuels to low income households. Mounting subsidies do not give incentives to the government to expand the distribution of kerosene. The response of the Government of India to mounting losses has been to freeze the total amount of kerosene distributed, and decrease the allocation where possible. More effective policy interventions to support the use of cleaner fuels would be to promote local microcredit facilities to finance the up-front costs of fuel switching, and to target subsidies to enable switching.

*Sources:* ESMAP, 2000, 2001b

additional connection would automatically mean increased losses.

The poor are also harmed disproportionately by the adverse environmental consequences of high energy use spurred by subsidies. Although there are few data on the distributional impacts of these environmental costs, there are reasons to believe that the urban poor bear the brunt of air pollution. The poor often live in densely populated neighborhoods located close to traffic corridors and industries, and they travel in open vehicles or walk and spend a great deal of time outdoors (Lvovsky, 2002). The poor are also expected to suffer disproportionately from the impacts of climate change (IPCC, 2001). To the extent that energy subsidies contribute to preventing the expansion of coverage, they also contribute to the toll imposed on the health of the poor by continued use of low-quality fuels (see Box 2.5 above).

Movement up the energy ladder[15] to cleaner and more efficient fuels is historically a natural trend, and policies to encourage and accelerate it are amongst the most promising ways of reducing exposures and health effects. Although there are successes, finding ways to efficiently encourage movement up the energy ladder remains a challenge. Simple subsidies of cleaner fuels can be costly for governments, and they often backfire by distorting markets while providing little actual benefits to households (Smith, 1999).

### Reforming energy subsidies

Energy subsidies have a well-earned reputation of being perverse, because they not only encourage wasteful consumption of a natural resource but also cause important negative externalities—both local (air pollution, congestion) and global (climate change through carbon emissions). Removing these subsidies, therefore, would not

**Table 2.7: Effects of phasing out energy subsidies in eight developing countries**

| | *Energy savings* | *Economic efficiency gains* | *Emissions reductions* | |
|---|---|---|---|---|
| | *(%)* | *(% of GDP)* | *(%)* | *(million tonnes)* |
| China | 9.4 | 0.37 | 13.44 | 421 |
| Russia | 18.0 | 1.54 | 17.10 | 249 |
| India | 7.2 | 0.34 | 14.50 | 128 |
| Indonesia | 7.1 | 0.24 | 10.97 | 28 |
| Iran | 47.5 | 2.22 | 49.45 | 141 |
| South Africa | 6.4 | 0.10 | 8.11 | 28 |
| Venezuela | 24.9 | 1.17 | 26.07 | 38 |
| Kazakhstan | 19.2 | 0.98 | 22.76 | 29 |
| **Total sample** | **12.8** | **0.73** | **15.96** | **1,058** |
| World | 3.5 | - | 4.59 | |

*Notes:* Data for 1997 (Russia, Indonesia, Iran, South Africa) and 1998 (China, India, Venezuela, Kazakhstan).
*Sources:* From data in IEA, 1999.

only free substantial budgetary resources for other uses, but also increase efficiency in energy use and reduce environmental damage. Table 2.7 gives a sense of the potential gains that could be obtained by phasing out energy price subsidies in the eight countries analyzed by the IEA (1999). Primary energy consumption would fall by 13 percent; GDP would increase by almost 1 percent through higher consumption; and carbon dioxide ($CO_2$) emissions would fall by 16 percent.

Despite its potential benefits, removing energy subsidies has proven a difficult challenge. Although it would bring high overall benefits for society, some groups would lose. Nigeria and Indonesia have repeatedly experienced the roll-back of announced reform, following the mobilization of the expected losers. Box 2.8 describes the possible approaches to energy subsidy reform.

**Box 2.8: Approaches to energy subsidy reform**

Two distinct approaches are possible to bring energy prices in line with economic costs. In a 'big bang' approach the intention is to close the gap quickly by means of large increases in prices, while in a 'gradualist' approach the gap is closed gradually, in a series of steps involving a longer transition period. The big-bang approach capitalizes on political will to reform, while the gradualist approach risks reforms being reversed as political will erodes with time and affected constituencies get organized to oppose the reform. However, the big-bang approach can have greater social costs (as consumers do not have time to adapt to the new situation), and risks provoking social unrest that may be able to stop the reform (as happened, for example, in Indonesia and Nigeria). Experts remain divided on which approach is preferable. For the gradualist removal of subsidies, it has been suggested that price increases, however frequent, should be kept below 10 percent each time, even if this represents a small increase in absolute terms. Other implementation measures could include informing consumers that they are being currently subsidized (for instance, by explicitly itemizing subsidies on electricity bills), to make changes in prices automatic (by some kind of indexing), and to link price increases to service improvements.

The issues involved in reforming energy subsidies differ across regions (IEA/UNEP, 2001). Efforts in transition economies need to focus on raising energy prices to market levels and improving collection rates: non-payment of energy bills constitutes a major source of implicit subsidy. For African countries, the challenge is to structure subsidies to alleviate poverty and raise living standards by improving access to modern forms of energy in an environmentally acceptable and financially viable way. In Asia, the recent financial crisis and surge in international prices, which have led to higher end-user prices and put enormous strain on government finances, have heightened the necessity for a move to more market-based energy pricing while highlighting the need for continued support to poor people. And most Latin American countries recognize the necessity to reform energy subsidies and have already engaged in reform processes where access to electricity seems to be the overarching theme.

### *Effects of electricity subsidy removal*

The effects on consumption of electricity subsidy removal would likely be very important. Our calculations indicate that increasing tariffs to cover long run marginal cost would generate a cash flow of some US$35 billion, and will save US$67 billion in production costs. A most relevant concept from an economic perspective, however, is efficiency gains (see Appendix B). Our calculations indicate that these would amount to some $20 billion.

Assuming a –0.5 elasticity of demand, a constant elasticity inverse demand function, and a maximum reduction of consumption of 50 percent, removing electricity subsidies entirely would result in an average decrease in electricity consumption of 22 percent (see Table 2.8). This figure is driven by the situation in the Former Soviet Union, where very low tariff levels and widespread non-payment have resulted in important inefficiencies.

The environmental effects are more difficult to ascertain. The impact of reduced consumption on carbon emissions varies from country to country and from year to year, depending upon the generation mix. For instance, in countries that rely primarily on hydroelectricity, the reduction in consumption would not have significant effects on greenhouse gas emissions. We generated country-based carbon emission coefficients to calculate the potential reduction in emissions. Our results indicate that phasing-out subsidies to electricity would reduce carbon dioxide emissions by about 195 million tons.

**Table 2.8: Estimated effects of removing electricity subsidies in developing countries**

| | *Decrease in consumption* | | *Efficiency gains* | *Reduction in $CO_2$ emissions* |
|---|---|---|---|---|
| | *(TWh)* | *(%)* | *(% of GDP)* | *(million tonnes)* |
| Sub-Saharan Africa | 56 | 25 | 0.22 | 17 |
| South and East Asia | 235 | 13 | 0.08 | 59 |
| Central and Eastern Europe | 56 | 13 | 0.21 | 10 |
| Former Soviet Union | 426 | 49 | 3.41 | 65 |
| Latin America and Caribbean | 52 | 7 | 0.04 | 5 |
| Middle East and North Africa | 193 | 41 | 0.86 | 37 |
| **Total** | **1,017** | **22** | 0.33 | **193** |

*Source:* Authors' estimates.

The difficulties in reforming electricity subsidies should not be underestimated. In the case of electricity, at least four elements need to be combined in a successful reform: increase of tariffs, improvement of collection payments, improvement of service, and strengthening disconnection capacity. The optimal combination of these elements is not clear. Cash-strapped utilities struggle to improve service, consumers are unwilling to pay for unreliable services, and (given the social costs of disconnecting hospitals, schools, and even households in cold climates) utilities frequently lack the capacity to enforce payments. Utilities need cash to improve both service and collection; without increase in tariffs and collection no cash can be generated; without improvement in service increase in revenues may be politically unfeasible.

### *Effects of fuel subsidy removal and fuel taxation*

Fuel subsidy removal and fuel taxation can have remarkable effects on both public finance and the environment. The public finance aspect is especially important in developing countries, where weak institutional capacity makes many taxes difficult to collect (Bacon, 2001). The characteristics of fuel taxes—straightforward to administer, relatively price inelastic, and income elastic—make them specially attractive to these countries. However, designing fuel taxes when there

**Box 2.9: Optimal taxation of fuels**

Tax theory suggests that where the government's sole aim is to raise revenue for public expenditure, goods for which demand is least sensitive to price increases should tend to bear the highest tax rates. Goods that are close substitutes should be taxed at similar rates to prevent demand from switching from the higher- to lower-taxed good, reducing government revenue.. In addition, where equity is an important consideration, goods accounting for a larger share of budgets for the rich than for the poor should be taxed more heavily. Goods that produce large negative externalities (such as emissions from automotive fuel use or congestion from excessive road use) should also be taxed at high rates, to discourage their consumption and reduce social harm. For fuels, these principles do not always work in the same direction, so the relative importance of each principle needs to be evaluated in each case. For example, emissions from diesel fuel are more harmful than those from gasoline, but encouraging the use of diesel-powered mass transit may be desirable as a way of relieving congestion. Kerosene is particularly problematic in developing countries, since it can be used to adulterate both gasoline and diesel. As a result, setting lower taxes on kerosene (to reduce the cost of lighting and cooking fuels for the poor) can erode the total tax collected (necessitating an increase in the general tax level to produce a given revenue). And where kerosene replaces gasoline, lower taxes lead to higher emissions and worse vehicle performance. Higher taxes on kerosene can hurt poor households, however, as they tend to spend a larger share of their budgets on this fuel than better-off households. But this also means that if governments wish to offset the effect of higher kerosene taxes on poor households, they can do so through targeted assistance rather than across-the-board kerosene subsidies.

*Source:* Bacon, 2001.

**Table 2.9: Impacts of fuel subsidy removal and fuel taxation**

| | *Reduction in consumption (Mt)* | *Reduction in consumption (percent)* | *Net effect on public budget (billion US$)* | *Reduction in $CO_2$ emissions (million tonnes)* |
|---|---|---|---|---|
| **Impacts of eliminating subsidies to gasoline** | | | | |
| Eastern and Central Europe | 0.8 | 1.5 | 0.3 | 1.9 |
| Middle East and North Africa | 13.6 | 33.8 | 3.1 | 31.7 |
| Sub-Saharan Africa | 0.5 | 3.4 | 0.2 | 1.1 |
| Latin America and Caribbean | 2.2 | 3.1 | 0.9 | 5.2 |
| South Asia | 0.0 | 0.0 | 0.0 | 0.0 |
| East Asia and Pacific | 1.5 | 2.0 | 0.7 | 3.5 |
| **Total** | **18.6** | **7.0** | **5.2** | **43.3** |
| **Impacts of bringing gasoline prices to regional average** | | | | |
| Eastern and Central Europe | 9.8 | 17.5 | 11.0 | 22.8 |
| Middle East and North Africa | 20.8 | 51.8 | 8.7 | 48.5 |
| Sub-Saharan Africa | 2.3 | 16.1 | 2.2 | 5.3 |
| Latin America and Caribbean | 9.7 | 13.8 | 9.8 | 22.7 |
| South Asia | 0.2 | 2.3 | 0.3 | 0.4 |
| East Asia and Pacific | 16.2 | 21.3 | 17.4 | 37.8 |
| **Total** | **58.9** | **22.3** | **49.4** | **137.4** |
| **Impacts of eliminating subsidies to diesel** | | | | |
| Eastern and Central Europe | 1.6 | 2.4 | 0.5 | 3.8 |
| Middle East and North Africa | 59.8 | 82.0 | 8.3 | 139.7 |
| Sub-Saharan Africa | 0.4 | 3.1 | 0.2 | 1.0 |
| Latin America and Caribbean | 2.2 | 2.8 | 0.6 | 5.1 |
| South Asia | 0.0 | 0.0 | 0.0 | 0.0 |
| East Asia and Pacific | 11.3 | 8.4 | 3.0 | 26.4 |
| **Total** | **75.4** | **18.1** | **12.6** | **176.1** |
| **Impacts of bringing diesel prices to regional average** | | | | |
| Eastern and Central Europe | 11.1 | 16.5 | 4.3 | 25.8 |
| Middle East and North Africa | 53.7 | 73.6 | 8.0 | 125.5 |
| SubSaharan Africa | 1.8 | 12.5 | 0.7 | 4.2 |
| Latin America and Caribbean | 3.0 | 3.8 | 0.8 | 6.9 |
| South Asia | 5.1 | 10.2 | 2.9 | 11.9 |
| East Asia and Pacific | 21.7 | 16.1 | 5.9 | 50.6 |
| **Total** | **96.3** | **23.1** | **22.6** | **225.0** |
| **Impacts of bringing gasoline prices to global average** | | | | |
| **Total** | **18.5** | **7.0** | **37.8** | **43.2** |
| **Impacts of bringing diesel prices to global average** | | | | |
| **Total** | **148.4** | **30.3** | **41.0** | **346.5** |

*Source:* Authors' estimates.

are multiple policy objectives to be attained is not simple (see discussion in Gwilliam and others, 2001). Box 2.9 illustrates some of the insights of tax theory for fuel taxation, and the complications generated when poverty reduction objectives and the possibility of interfuel substitution are added.

We have estimated the effects of removing fuel subsidy and increasing fuel taxation. Table

2.9 presents the results of a simulation that assumes a –0.4 price elasticity of demand and a constant elasticity inverse demand function. The effects of eliminating gasoline and diesel subsidies (as conventionally understood) would lead to a reduction in consumption of 7 percent and 23 percent respectively; a positive effect on the public budget of US$18 billion; and a reduction in $CO_2$ emissions of nearly 220 million tons. For countries with fuel prices below regional averages,[16] raising prices to match those averages would generate US$71 billion. In this case, consumption for both fuels would fall by 23 percent, and $CO_2$ emissions would fall by nearly 360 million tons. When using the global average prices[17] as benchmarks, the net effect on the public budget reaches some US$79 billion.

The high environmental costs of fossil fuels highlight the substantial social gains, mainly in public health, that could be achieved by eliminating price distortions caused by subsidies, protection of domestic oil or coal monopolies, and unbalanced taxation of similar products with little regard for their true social costs (Lvovsky and others, 2000). Eliminating fuel subsidies and imposing higher taxes on dirtier fuels would reduce their consumption and the associated environmental costs. Removing these subsidies would produce domestic environmental benefits, including reduced local air pollution, as well as positive effects on a global scale. Energy consumption would be cut by 3.5 percent, thus improving world energy intensity significantly. World $CO_2$ emissions would fall by 4.6 percent.

### *Impact on the poor*

A priori, it might seem evident that removing energy subsidies will affect the poor adversely. However, it is important to distinguish cases where the poor do not have access to the energy carrier from those where they do. In the first case, which is typical of electricity, the poor simply will not be directly affected by subsidy removals. In the second case, when the population has grown used to extremely low prices—such as Indonesia and Nigeria, for fuels, and the Former Soviet Union, for electricity—even the poor are energy-hungry, and as a consequence the sudden removal of subsidies could severely hurt them, especially in the absence of safety nets.

A recent review concludes that the impact of energy sector reform on the poor has been positive in countries where the reform is most complete and mature (Albouy and Nadifi, 2000). While the direct impact is often a tariff increase for many users, in these cases the poor were protected against increases or benefited as group from the improvements that reform brought about in the sector—better access and service—in government finances and in the economy at large. Reforms indirectly benefit the poor in three ways: (1) enabling energy delivery mechanisms (whether off-grid electricity, LPG bottles, or other) that expands energy access, voice, and choice for consumers; (2) freeing fiscal resources for high priority fiscal spending; and (3) reducing the health impacts of energy supply to which the poor are most exposed.

Finally, the real impact of energy subsidy removal on the poor should come from the use of the funds liberated. In countries where lack of access is an important issue, some form of assistance may be required to help poor households obtain higher quality energy services. Such assistance should be directed at encouraging access to services rather than subsidizing the operating costs of providing the services. In countries where affordability is the main issue, as in Eastern Europe and Central Asia, safety nets (such as raising pensions or providing targeted assistance) must be put in place in parallel to the tariff increases. When the temperature is –40°C, energy prices obviously cannot be raised without concern for affordability. This highlights the fact that subsidy reform must be contemplated in the context of broader policy reform, not merely as a sector intervention, and must be tailored to the specific circumstances of each country.

## Conclusions

Removing energy subsidies would support the three principal aims of sustainable development: social welfare, environmental protection, and economic growth. Funds supporting subsidies could be directed to social benefits and income redistribution. Environmental benefits accrue from proper pricing, which could reduce both local and global pollution (including $CO_2$ emissions). Economic growth would be boosted through improved efficiency and reduced budget

costs. Subsidy removal can also have a longer-term impact. It contributes to per capita welfare over time by eliminating one stimulus for over-consumption (which leads to the rapid depletion of the stock of natural capital) and stimulates technologies capable of enhancing sustainable development (IEA, 2001b).

**Revenue impacts.** Given the current size of energy subsidies, it is not surprising that the revenue potential from phasing them out should be substantial. For the developing world, revenue from phasing out subsidies to gasoline and diesel could be as much as US$18 billion. Moreover, if countries with low taxes on those fuels where to increase them to regional levels, the positive effect in the public budget would jump to over US$71 billion. Electricity subsidies alone account for some US$102 billion. This figure encompasses the opportunity cost of fuels, and the non-incurred costs of keeping up infrastructure, adding to some US$67 billion, and the additional cash flow that will be generated, estimated to be US$35 billion. An important consideration is that of the financial sustainability of subsidies, especially electricity ones. These subsidies, under a combination of growth-driven increase in demand and fixed tariffs that are quickly outpaced by inflation, are growing to the point of threatening public finance stability.

**Environmental impacts.** The removal of energy subsidies, by eliminating pricing distortions, would encourage energy savings that would be translated in environmental improvements. In addition to local benefits regarding air pollution, there are important global benefits to be gained in the field of climate change, as reduced consumption would translate into reduced carbon dioxide emissions. Phasing out subsidies on electricity, gasoline and diesel could reduce those emissions by roughly 0.6 billion tons of $CO_2$. This represents 4.6 percent of the developing world emissions, and 2.4 percent of global emissions. The potential trading of those emissions reductions can be valued at US$1.7 billion.

**Poverty impacts.** Energy subsidies in the developing world are often justified in terms of protection of the poor. However, there is ample evidence that they are regressive, with the non-poor capturing up to 90 percent of subsidies. For subsidies to benefit the poor, the problems of *leakage* and *mistargeting* would need to be addressed. Still, phasing out subsidies would require the establishment of safety nets, such as increases in pensions. This would make assisting the poor much cheaper, but the technical and institutional demands should not be understated. Another major issue is that of access to modern energy. With the poor currently paying higher prices for lower quality energy, at least reforming electricity subsidies to address the capital costs of expanding service coverage and taking them away from subsidizing consumption should go a long way in eliminating incentives to over consumption and better targeting the poor.

## 2.2 Reducing Water Subsidies

Water is indispensable, both as an input into agricultural production and for consumption. In both the irrigation and the domestic water supply sectors, however, similar patterns emerge: only a very small fraction of the costs of providing water are collected from users. Although based on well-meaning policies, these patterns have typically had dismal results: water is used wastefully by those who have access to it, even while many suffer from lack of access; governments bear substantial financial burdens to sustain water deliveries; nevertheless, water providers are chronically short of funds, preventing them from maintaining their infrastructure—which sometimes decays to the point of collapse—and from expanding it to reach unserved users. Ironically, although low water prices are often justified as protecting the poor, their impact tends to be regressive: available subsidies are captured mainly by the better off, while lack of funds prevents the extension of water deliveries to the poor. Reducing water subsidies could, therefore, both alleviate a very substantial financial burden on governments (freeing up resources for other uses, including better ways to provide water to the poor) while increasing the efficiency of the sector and reducing its adverse environmental impact.

### Irrigation

Investments in irrigation infrastructure have played an important part in increasing food production in developing countries. Continued expansion of irrigated agriculture is essential for future

food security. A 24 percent increase in net irrigated area of the world by the year 2025 is necessary to keep supply and demand for food and cereals in equilibrium at prices that are affordable for the poor (Gonzalez, 2000). Accordingly, irrigation will require US$175-250 billion of productivity enhancing investments between 1997-2020 to meet future food demand—not taking into account the costs of operating and maintaining existing systems (Rosegrant and others, 2001). But this need for increased irrigation is running into numerous obstacles.

- In recent years, irrigation expansion has slowed dramatically due to sharply lower investments (Gonzalez, 2000). Investments in new irrigation projects are expected to continue their decline, based on capital commitments of developing country governments and international donors.
- Increased demand for irrigation water faces the reality that water scarcity is increasing year after year. Expanding agricultural production to meet the future food demands of increased populations will require nearly 20 percent more water within the next 25 years. Yet water is already scarce in many countries (Gleick, 1996; Seckler and others, 1998).
- Moreover, much of the existing irrigation infrastructure is in poor conditions.

Throughout the developing world most irrigation, especially large-scale irrigation, is publicly financed. With some exceptions, private irrigation in developing countries is on a very small scale and is a family affair for most farmers (Briscoe, 1999b). Supporting irrigation is costly and requires substantial financial resources on the part of the public sector. Every year, an estimated US$10 to 15 billion are spent for public investments in irrigation in developing countries. However, under current pricing policies for irrigation water, very few countries recover irrigation costs.

### Charges for irrigation

Countries have different experiences with charging users for irrigation water (Box 2.10). For agriculture, all developing countries set water charges on the basis of average rather than marginal costs of supply. Authorities generally calculate charges by dividing the average cost of service by area irrigated, often adjusting the results by season, type of crop, or type of technology used. Charges are not generally adjusted by region within a country or for the technology used for water supply, even though both can result in different costs of supplying water (Dinar and Subramanian, 1997).

**Box 2.10: Charging for irrigation water**

Charges for irrigation water can be either volumetric or non-volumetric.

- Volumetric charges are based on a measure of the volume of water consumed. They tend to encourage efficient water use, but their implementation costs are relatively high. They require the water authority to establish consumption measurement equipment, and then set the price, monitor use, and collect fees.
- Non-Volumetric methods are used when information on water consumption is inadequate. Possible approaches include output pricing (charges a fee for each unit of output produced by water users), input pricing (charges users for water consumption through a tax on inputs), and area pricing (charges on a per unit area basis, often with different rates depending on crop choice, area irrigated, method, and season). These methods tend to be easier to implement and administer, as they are usually based on already-monitored indicators. However, they provide little incentive for efficient water use.

Under either approach, the water prices can be set either administratively or via market forces. In practice, most countries set water prices administratively.

Although cost recovery is highly preferred it is worth noting that establishing the right fee to cover irrigation costs is not an easy task, especially for irrigation systems that provide different services to multiple water users. The assessed total cost of water supply (and drainage services) must be calculated and then distributed among different water users such as farmers, villages that receive water supply from irrigation canals, and those benefiting from flood controls downstream or from hydropower. With such complexity, a specific target revenue, and hence a target price range for irrigation water, can be identified with difficulty. Moreover, O&M costs often vary over time or by season or in the face of major events such as floods and other problems. Changing the pricing schemes in the face of these changes might not be easy to do.

**Table 2.10: Irrigation water charges in selected countries**

| | *Non-volumetric charges (US$/ha or US$/season)* | *Volumetric charges (US$/m³)* |
|---|---|---|
| Algeria | 3.79 – 7.59 | 0.019 – 0.22 |
| Brazil | 3.5 | 0.0042 – 0.032 |
| India | 0.164 – 27.47 | |
| Israel | | 0.16 – 0.26 |
| Madagascar | 6.25 – 11.25 | |
| Namibia | 53.14 | 0.0038 – 0.028 |
| Pakistan | 1.49 – 5.8 | |
| Portugal | | 0.0095 – 0.0193 |
| Sudan | 4.72 – 11.22 | |
| Taiwan | 23.3 – 213.64 | |
| Tanzania | | 0.26 – 0.398 |
| Tunisia | | 0.02 – 0.078 |

*Source:* Dinar, 2000.

**Table 2.11: Irrigation water charges and cost recovery**

| | *Basis for water charges* | | *Cost recovery* | | |
|---|---|---|---|---|---|
| *Country* | *Volume* | *Area* | *O&M* | *Capital* | *Comments* |
| China | | Yes | Partial | No | Labor contribution by users |
| Egypt | | | No | No | No charges, but users are responsible for O&M |
| India | Yes | Yes | Partial | Partial | Very different methods for charging across the country |
| Indonesia | | | No | No | No charges, but users are responsible for O&M |
| Iraq | | Yes | | | Government owned |
| Jordan | Yes | | Partial | No | Water supplied on demand |
| Mexico | Yes | Yes | Partial | No | Sophisticated pricing methods applied |
| Morocco | Yes | | Mostly | Partial | |
| Nigeria | | Yes | Partial | No | |
| Pakistan | | Yes | Partial | | |
| Peru | | Yes | Partial | Partial | Charges only in scarcity regions |
| Philippines | | Yes | Partial | | Additional water rights fee charged |
| Zimbabwe | | Yes | Partial | No | New uniform charges based on crop profitability |

*Source:* Tsur and Dinar, 1995.

Table 2.10 shows water charges in a sample of developing countries. Both volumetric and non-volumetric charges are used in developing countries. In some countries, such as Algeria and Brazil, these two types of charges are practiced in combination, forming a two-part tariff. As can be seen, there is considerable variation in water charges, even within a country. In many cases, however, water charges are extremely low. Table 2.11 illustrates some of the main issues in charging users for irrigation water in a sample of developing countries. Use of volumetric charges is limited in practice. In most cases, area charges are used as the basis for setting water charges.

Table 2.11 also highlights the most important problem of charging users for irrigation water:

cost recovery being mostly partial or non-existent. Few countries even attempt to recover capital costs. But even the limited objective of recovering annual O&M costs is seldom achieved. A review of World Bank projects found that only 30 percent of the projects recovered O&M costs (World Bank, 1994). For example, receipts covered only 13 percent of costs in Pakistan, 25 percent in China, and 10 percent in the Philippines (Briscoe, 1999b). In India, revenues from water charges accounted for 10 percent of the states' expenditures on irrigation (World Bank, 1998b). Although India's National Water Policy states that "water rates should be adequate to cover the annual maintenance and operation charges and a part of the fixed costs", all states have set charges at very low levels. Moreover, they have tended to keep them unchanged over many years, resulting in a cumulative decline in real terms. In 1997, for example, Punjab went so far as to withdraw all charges for water and power for irrigation.

### *Impacts on expenditures*

As a result of low water charges, the public sector incurs substantial financial burden when supporting irrigation systems throughout the developing world. Table 2.12 shows public spending on irrigation for a sample of countries. As can be seen, the average total public spending on irrigation varies substantially among different countries, from US$26 to US$275 per irrigated hectare.[18] In countries with large irrigation sec-

**Table 2.12: Average public expenditures on irrigation for a sample of countries**

| | *Irrigated area, 1998* | *Average public expenditure* | |
|---|---|---|---|
| *Country* | *(Million ha)* | *(US$ million/year)* | *(US$ per irrigated ha)* |
| India | 59.0 | 5,000 | 85 |
| Pakistan | 18.0 | 475 | 26 |
| Mexico | 6.5 | 250 | 39 |
| Bangladesh | 3.8 | 160 | 42 |
| Egypt | 3.3 | 200 | 61 |
| Viet Nam | 3.0 | 80 | 27 |
| Morocco | 1.2 | 135 | 113 |
| Colombia | 0.8 | 35 | 44 |
| Nigeria | 0.2 | 55 | 275 |
| Ethiopia | 0.1 | 20 | 200 |

*Source:* Calculated using data from ICID and public expenditure reviews.

**Table 2.13: Average unit costs for irrigation**

| *Activity* | *Unit Cost (US$/ha)* | | *Unit Cost (US$/ha)* |
|---|---|---|---|
| By type of irrigation system: | | By region: | |
| Gravity Irrigation | 5,600 | East and South Asia | 2,800 |
| Pump Irrigation | 3,800 | East Asia | 4,300 |
| Mixed | 3,700 | South Asia | 1,400 |
| New Construction | 7,700 | India | 1,400 |
| Rehabilitation | 1,600 | Middle East | 5,100 |
| Rehabilitation and Extension | 3,200 | Africa | 13,000 |
| | | North Africa | 5,000 |
| | | Sub-Sahara Africa | 18,300 |
| | | Latin America and the Caribbean | 3,900 |

*Source:* Jones, 1995.

tors, such as India and Pakistan, total expenditure can be substantial.

Investments in irrigation can be expensive. An evaluation of 208 World Bank funded irrigation projects shows that the unit costs (calculated as actual project costs divided by the number of hectares of completed irrigation area) can reach US$7,700 per hectare for some irrigation activities (Table 2.13). World Bank experience indicates that unit costs are generally low where minor improvements are made to existing systems. New construction projects are much more expensive than rehabilitation and/or extension projects. Gravity irrigation costs are 48 percent higher than pump irrigation costs in Bank funded irrigation projects worldwide. Unit costs also vary substantially by region. Table 2.13 also provides average unit costs per hectare in World Bank-financed projects in several regions. The high figure for unit costs in Sub-Saharan Africa reflects the difficulties of implementing and completing irrigation projects. This makes justifying irrigation investments in the region very hard as high on-farm benefits are needed to justify such high unit costs.

Further costs are then incurred for the operations and maintenance (O&M) of existing irrigation systems. The high budgetary requirements involved in establishing and then operation irrigation systems are not matched by any inflow of resources, however.

The lack of public revenues from providing irrigation services has substantial consequences on the sector's performance. In many countries, the irrigation sector is caught in a vicious cycle of downward-spiraling performance in which the lack of public sector resources results in inadequate operation and maintenance, leading to poor irrigation and drainage services and eventually to farmer dissatisfaction. Dissatisfaction then translates into low collection rates of irrigation service fees, further weakening irrigation budgets (Perry, 2000; Gonzalez, 2000).

Examples of this cycle abound. Central Asia is perhaps the most prominent (see Box 2.11). In Pakistan, one main reason for irrigation system's deterioration is the deferred maintenance due to a consistent shortfall in maintenance funding for the O&M of canals. Inadequate funding was determined to be the major reason for deferred maintenance, which has been threatening the operational safety of the irrigation system. Actual funding available to O&M of system canals was 49 to 29 percent less that realistic O&M escalating needs identified for proper working of the irrigation system in 1994-1998 (Pakistan National Program, 1998).

**Box 2.11: Irrigation in Central Asia**

Substantial investments in irrigation during the Soviet era have led to a massive dependence on irrigated agriculture in the Central Asian republics in the Aral Sea Basin. Agriculture, almost all of which is irrigated, provides 20-40 percent of GDP and employs some 28 million people. None of these irrigation systems charged more than nominal water fees, resulting in extremely high levels of water use, with water applications per hectare 50 percent higher than comparable countries such as Pakistan. The environmental consequences of this system have been well documented. They include, most spectacularly, the drying up of the Aral Sea, but also substantial salinization problems that affect downstream agriculture and the health of riparian populations. Over the last decade, lack of funding has resulted in plummeting investment in irrigation and drainage systems, and a near-collapse of maintenance. As a result, as much as 70 percent of water abstracted for irrigation is wasted before it reaches fields, and many drainage systems are almost inoperable. Unreliable or scarce water supply have reduced the area irrigated substantially, usually affecting poorer households disproportionately.

*Source*: World Bank, 2002b.

### *Impacts on water use*

Low water prices also result in very high rates of water use. At present, farmers account for about 80 percent of water use (Perry, 2000). In many parts of the world, the water volume being extracted for agriculture and other uses is already beyond sustainable yield. Increased demand for irrigation services, coupled with a reduction in new irrigation investments and increased water scarcity, makes increasing the productivity and efficiency of existing irrigation systems essential to improve food security and reduce poverty. The main challenge is to increase water productivity so as to achieve more crop per drop.

One desirable effect of charging users for irrigation water would be to discourage waste and reduce demand. To achieve such responses the

charge for irrigation water must be directly related to the volume delivered. Charging schemes that do not influence water input directly, area pricing or output pricing, lead to inefficient allocations of irrigation water. When fixed charges are in place—for example, where there is a fixed water charge by crop or area—the marginal water price is often zero and does not vary with the quantity of water used. In this situation, even if the full costs of the service are recovered there is no incentive for farmers to save water; if the fixed price allows a profit, they will use as much water as they want, or if not they will not irrigate at all (Perry, 2000).

*Impacts on the poor*

As with many other subsidies, low irrigation water charges are sometimes justified based on their supposed effect on the poor. However, the extent to which water pricing methods can affect income redistribution among different farmers is limited. Farm income disparities are due mainly to such factors as farm size, location, and soil quality, rather than to water (or other input prices). Water prices have been found to be a poor means to reduce income inequality among farmers (Seagraves and Easter, 1983; Tsur and Dinar, 1995). On the other hand, where irrigation charges are low, or not collected, the direct beneficiaries of irrigation, who typically are a privileged group in most agrarian economies, receive their service at the expense of the economy in general (Perry, 2000).

## Conclusion

The low prices charged for irrigation water are a major factor in the difficulties facing the sector. Not only do they impose high budgetary burdens on the government, but they also starve the sector of the resources it needs for operations, maintenance, and expansion, and it induces unsustainably high rates of water use. Thus pricing irrigation water is often seen as vital to increase irrigation system efficiency, to reducing the budgetary burden of supporting irrigation departments, and to helping conserve and improve water usage in the sector. Irrigation pricing reform, however, is a sensitive issue in most of the world, with complex political, historical, social, cultural, and economic dimensions (Abu Zeid, 2001). Setting the right price is also a very complex matter in practice, as it requires substantial regulatory arrangements, operational requirements, and financial commitments (Perry, 2000; Johansson, 2000).

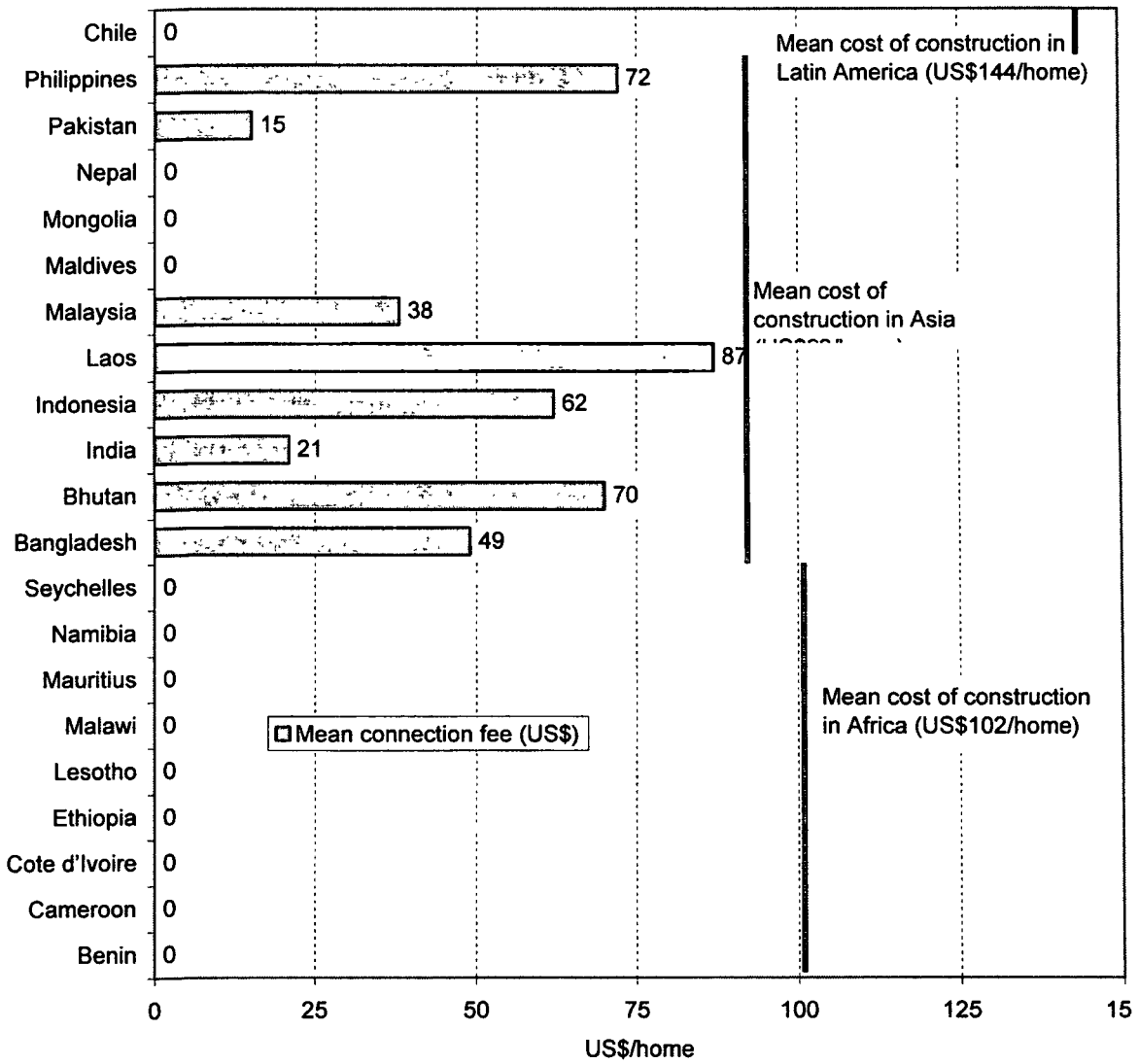
## Domestic water

Domestic water service has serious effects on the health, economic productivity, and well-being of nations (Fass, 1993; OED, 2000; Ahmed, 2000; Imschoot, 1992). Recognizing this, efforts to improve service coverage in developing countries have increased substantially in recent decades (WHO and UNICEF, 2000).

Domestic water service, however, is often provided with a philosophy that embraces two concepts: that the right of access to water service must be guaranteed to all, and that most people in developing countries are either too poor or unwilling to pay for water service at a price that reflects its cost of provision (Briscoe, 1999b). This welfare philosophy is often used to justify keeping water tariffs artificially low through a range of explicit and implicit subsidies (Foster and others, 1999), with significant impact on public revenues, water resources, and the poor.

Water subsidies pose substantial burdens for public revenues and cause the sector to perform poorly, in terms of coverage and quality of service, in most developing countries (Idelovitch and Ringskog, 1995; Briscoe, 1999b; Kessides, 1997). Water subsidies also result in enormous water waste, by both water users and water utilities. Low tariffs, especially when non volumetric, do little to encourage water conservation by users (Cestti and others, 1997), while limited revenues lead to inadequate maintenance of distribution systems (Ahmed 2000; Briscoe, 1996, 1999a; 1999b; Saghir and others, 2000). Despite their stated purpose of helping the poor, water subsidies also tend to adversely affect the poor. Inadequate design means that water subsidies have often benefited the middle and upper classes rather than the poor—who remain unconnected to the service (Walker and others, 2000). Poor service imposes substantial losses of time, health, effort, and money, especially for the poor, who are continually adapting to such inadequate service (Rada Research, 1996; Bhatia and Falkenmark, 1993).

**Figure 2.3: Connection fees and cost of construction for in-home water service**




*Source:* WSP, WHO, UNICEF data.

As in the previous section, we use a tariff-gap approach to measure the size of water subsidies, wherein the water tariff currently paid by consumers is compared to a reference per unit cost of water service provision.[19]

## Current water subsidies

Water utilities face two major costs in providing service: capital costs, and operation and maintenance (O&M) costs. To be financially sustainable, utilities need adequate resources to cover their capital investments (often through connection fees) as well as their O&M costs (often through delivery tariffs). But water utilities seldom collect sufficient revenues to cover even their operating costs, let alone capital costs.

### *Connection fees*

A review of 15 water utilities in Africa and nine utilities in the Middle East yielded a connection fee that is close to zero (WSP, 1998). Figure 2.3 shows the connection fees charged for in-home water service connections in 21 countries for which data are available. Within this sample, 13 countries provide in-home connections free. Data on the cost of construction for in-home

connections was not available for individual countries, but the figure shows the regional average. Even in countries that charged for connections, such as most Asian countries, the fees fell short of the cost of providing the connection. In countries where many households enjoy in-home connections, these subsidies represent a significant financial burden.

For other types of water facilities, such as stand posts, the situation is similar. In most developing countries, the public sector fully covers the cost of construction, with no fees charged to consumers. The average construction cost per person served by stand posts in large cities is about US$31 in Africa, US$64 in Asia, and US$41 in Latin America and the Caribbean (WHO and UNICEF, 2000).

*Water charges*

Throughout the world, few developing countries charge users the total cost of providing water service (Briscoe, 1999b). A recent global assessment showed that more than half of developing countries impose water charges that are less than the total cost of providing water (WHO and UNICEF, 2000). In the Middle East, for example, most countries subsidize charges for urban water supply. Only in Tunisia, Morocco, and Iran do revenues cover O&M costs and generate a modest surplus necessary to partially cover capital costs (Saghir and others, 2000). Similarly, while few utilities in Central America have explicit subsidy policies for piped water, a comparison between existing water charges and the estimated efficient cost of providing water shows that most undercharge substantially, leading to a generalized implicit subsidy and to accelerating de-capitalization of their systems (Walker and others, 2000). In Asia, cost recovery of working expenses of rural water supply was reported to be as little as 1.8 percent and less than 1.3 percent of total costs (including capital costs) in some countries. In India, for example, no state collects tariffs that cover O&M apart from isolated district or village projects (WSP, 2001). Table 2.14 shows median water tariffs for a sample of countries for which data are available and compares them to the median unit cost of providing water (WHO and UNICEF, 2000). As can be seen from the table, subsidies often are often quite high, reaching 93 percent of the cost for some countries.

Table 2.14 also estimates the total magnitude of these subsidies, based on the volume of water used. These estimates show that even when unit subsidies are low, they can result in substantial financial outflows because of the substantial amount of water used. Subsidy costs in this sample of countries alone reach almost US$8 billion a year.

The impact of low tariffs on revenues is exacerbated by low collection rates. Poor records on the number of actual consumers and the amount of water actually consumed, combined with inadequate billing and collection practices, create substantial financial losses to domestic water supply agencies. Most water utilities actually cover more customers than they know or have on records since most of those unconnected eventually get their water from the system indirectly. Unreported shared connections and illegal connections often exist without the knowledge of the water utility (Rada, 1996). Low collection rates in some countries often result from laws prohibiting discontinuing water services in case of customer payment default, because water is considered a basic human need (Idelovitch and Ringskog, 1995). In some countries, only 15-30 percent of billings are actually collected (WSP, 2001).

**Box 2.12: Explicit water subsidies**

In addition to implicit subsidies resulting from under-pricing of water, many countries provide a range of explicit subsidies. A review of water supply policies in Panama, for example, revealed three different explicit subsidy mechanisms:

- A subsidy benefiting some 20,000 residential customers in the metropolitan area who are regarded as 'social cases'. They represent about 7 percent of the customer base. Eligible households have their entire bill paid directly by the Ministry of Health at a total cost to the state of US$3 million per year.
- A 33 percent discount on the tariff, benefiting about 60 percent of residential customers at a cost of about US$1.6 million per year.
- A 25 percent reduction in the tariff (up to a maximum monthly expenditure of US$10) for pensioners. The total cost of this subsidy was not reported.

*Source:* Foster and others, 1999.

**Table 2.14: Water subsidies on delivery tariffs in selected countries**

| Country | Water tariff (US$/m³) | Cost (US$/m³) | Subsidy (US$/m³) | Subsidy (% of cost) | Domestic withdrawals (million m³/year) | Total subsidy (million US$/year) |
|---|---|---|---|---|---|---|
| **Africa** | | | | | | |
| Burundi | 0.17 | 0.66 | 0.49 | 74 | 36 | 18 |
| Egypt | 0.07 | 0.30 | 0.23 | 77 | 3,100 | 713 |
| Lesotho | 0.52 | 0.55 | 0.03 | 5 | n.a. | n.a. |
| Malawi | 0.20 | 0.36 | 0.16 | 44 | 95 | 15 |
| Namibia | 0.29 | 0.78 | 0.49 | 63 | 71 | 35 |
| Nigeria | 0.02 | 0.16 | 0.14 | 89 | 1,125 | 158 |
| Senegal | 0.66 | 0.99 | 0.33 | 33 | 68 | 22 |
| Sierra Leone | 0.30 | 0.54 | 0.24 | 44 | 26 | 6 |
| Tanzania | 0.20 | 0.30 | 0.10 | 33 | 101 | 10 |
| Zimbabwe | 0.10 | 0.30 | 0.20 | 67 | 171 | 34 |
| **Asia** | | | | | | |
| Bangladesh | 0.09 | 0.20 | 0.11 | 55 | 1,704 | 187 |
| Georgia | 0.01 | 0.20 | 0.19 | 94 | 728 | 136 |
| India | 0.04 | 0.20 | 0.16 | 80 | 25,000 | 4,000 |
| Indonesia | 0.19 | 0.20 | 0.01 | 4 | 4,729 | 47 |
| Iran | 0.10 | 0.20 | 0.10 | 50 | 4,395 | 440 |
| Nepal | 0.09 | 0.20 | 0.11 | 55 | 246 | 27 |
| **Latin America** | | | | | | |
| Barbados | 0.35 | 0.93 | 0.58 | 62 | 62 | 36 |
| Bolivia | 0.20 | 0.30 | 0.10 | 33 | 124 | 12 |
| Colombia | 0.25 | 0.30 | 0.05 | 17 | 5,233 | 262 |
| Costa Rica | 0.04 | 0.30 | 0.26 | 86 | 757 | 195 |
| Cuba | 0.07 | 0.30 | 0.23 | 77 | 2545 | 585 |
| Ecuador | 0.04 | 0.30 | 0.26 | 88 | 2,100 | 554 |
| El Salvador | 0.29 | 0.30 | 0.01 | 3 | 246 | 2 |
| Honduras | 0.13 | 0.92 | 0.79 | 86 | 61 | 48 |
| Paraguay | 0.35 | 0.96 | 0.61 | 64 | 65 | 39 |
| Venezuela | 0.20 | 0.30 | 0.11 | 35 | 1,800 | 198 |

*Notes:* Tariffs shown are median tariffs.
Cost estimates were derived in different ways, and may not be completely comparable. Some were obtained by estimating a univariate cost function using regression analysis, and some by averaging reported production costs from different utilities in the same country. Where no country-specific data were available, the median regional unit production cost of urban water supply is used.

*Source:* Authors' calculations based on data from World Bank, WSP, and WHO and UNICEF.

This analysis is unavoidably incomplete. A reliable estimate of the magnitude of subsidies in the water sector would requires data on connection fees, delivery tariffs, capital costs, and O&M costs for each type of water facility in a given country. Such data are rarely available. Nevertheless, enough data are available to conclude that explicit and implicit water subsidies requires substantial financial outflows. As a result, water systems often fall into a low-level equilibrium trap in which utilities provide limited or low-quality service because of insufficient resources, and inadequate service leads to few resources being collected. Inadequate service is often

reflected in the lack of new connections or in unreliable service. Both have serious consequences for service users' resources, especially those of the poor, who often incur substantial costs to seek alternatives.

*Impact on water resources*

Low water tariffs provide little incentive to conserve water and result in substantial over-use. Low tariffs do little to encourage consumers to reduce their waste and fix leaky faucets and pipes. Studies have found that a large share of the water used by some buildings—around 350 liters per capita per day (lcd)—is due to faulty toilets valves and leaky faucets (Cestti and others, 1997).

The impact of low tariffs is particularly marked when they are non volumetric, as there is then no incentive whatsoever to limit consumption. In developing countries water tariffs are not only low but also mostly non-volumetric. Most cities and rural areas in the developing world are not metered. Table 2.15 provides a review of 111 utilities all over the world and shows that around 95 percent of utilities do not meter their customers (WSP, 1998). In Asia, cities with un-metered water supply have total consumption levels of about 600-630 lcd, well above consumption in metered cities, which range between 200-400 lcd (Cestti and others, 1997). A similar pattern exists in Latin America, where un-metered communities use around 400 lcd, while consumption in metered cities like Santiago is only 240 lcd. In Panama, metering lowered consumption by over 20 percent in four months (Cestti and others, 1997).

In addition, if low water charges are accompanied with low sanitation charges, the cost of getting rid of wastewater will be low and discourages reducing water waste. Households that are not connected to sanitation systems and pay high costs for getting rid of waste water consume less water and are more careful about water leakage and waste than those who are connected to the system and pay low sanitation tariffs (Rada Research, 1996).

Further pressure on water resources comes from inefficient distribution. Due in part to the lack of financial resources to perform routine maintenance and replace old and leaky pipes, public water utilities are often inefficient in terms of their use of water. For example, about 45 percent of water is unaccounted for in Bogotá, 58 percent in Manila (Briscoe, 1996), 65 percent in Damascus, and around 50 percent cities such as Amman, Algiers, and Sana (Saghir and others, 2000). In many utilities the situation is so bad that losses are controlled by having water in the distribution system for only a couple of hours a day, and by keeping pressure very low (Ahmed, 2000; Hoehn and Krieger, 1996). In Madras, it is estimated that if supply was to increase from 2 hours a day at 2 meters of pressure, to 12 hours a day at 10 meters of pressure, leaks would account for almost three times the current city supply (Briscoe, 1999b). In Cairo, reducing domestic leakage by 10 percent, system-wide leakage by 3 percent, and institutional leakage by 15 percent, would allow up to seven hours of additional service to be provided to those connected to the water system. Since most households have a high willingness to pay for continuous water service, reducing leakage and using the saved water to improve service could result in substantial benefits—as much as US$3 million per month,

**Table 2.15: Utilities that do not meter users**

| *Region* | *Number of countries* | *Number of utilities* | *Number of utilities with no metering* |
|---|---|---|---|
| Africa | 9 | 15 | 15 |
| East Asia and Pacific | 19 | 41 | 35 |
| Eastern and Central Europe | 11 | 27 | 27 |
| Latin America the Caribbean | 1 | 3 | 3 |
| Middle East and North Africa | 6 | 11 | 11 |
| South Asia | 7 | 14 | 14 |
| **Total** | **53** | **111** | **105** |

*Source*: WSP data.

depending on how the saved water is allocated (Ahmed, 2000).

*Impacts on the poor*

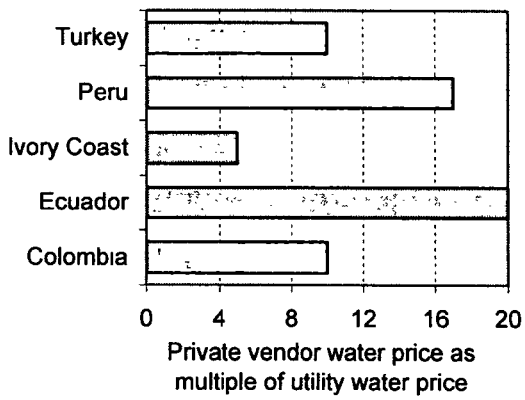
Although protecting the poor is put forward as an important rationale for the current tariff structure, in most cities of the developing world current tariffs tend to heavily subsidize the rich (Briscoe, 1999b). A recent study shows that there is little income-related differentiation in effective piped water tariffs. Each of the cities studied had volume-based tariffs, which would have generated cross subsidies from the rich to the poor if the rich were to consume more water. However, the demand for water in the cities studied varied little with income. As a result, the richest 60 percent of the households captured most of the subsidy (Walker and others, 2000).

**Box 2.13: Water subsidies: the case of increasing block tariffs**

For households that have private and metered water connections, charges are often based on Increasing Block Tariffs (IBTs), in which two or more prices are set for water, with each price applying to consumption within a defined block and prices rising in each successive block (Boland and Whittington, 2000). A survey of urban water utilities in Asia, for example, found that 20 out of the 32 utilities surveyed used IBTs (ADB, 1993). Some experts argue that IBTs have the potential of implementing marginal cost pricing principles (Hall and Hanemann, 1996). However, in practice developing countries often subsidize such tariffs by applying IBTs so that the first block price does not cover the cost of providing the service. Moreover, utilities in such countries find it difficult to limit the size of the initial block. About 4-5 cubic meters per month are required for basic needs (based on a family of five), but most utilities set the first block in excess of 15 cubic meters per month (Boland and Whittington, 2000; Asian Development Bank, 1993). This means that most connected households can include all their consumption within the first subsidized block.

Not only do the poor generally derive few benefits from water subsidies, they also tend to suffer disproportionately from the poor service that results from utilities' financial difficulties. The poor are often at the end of the line in terms of new connections and reliability of existing service. As a result, they continue to depend on traditional sources of supply, which are often afflicted by declining access (as new sources

**Figure 2.4: Comparison of vendor and utility water prices in selected countries**




*Source.* From data in Bhatia and Falkenmark, 1993.

become fewer and fewer) and quality (due to contamination from poor sanitation and industrial affluent) (Bhatia and Falkenmark, 1993). In most developing countries, the poor pay very high prices for alternative water supplies (Briscoe, 1999b). Water vendors often charge prices that are many times higher than those charged by public utilities in some cities, as illustrated in Figure 2.4. In Nigeria, for example, water vendors were found to collect about 24 times as much revenue as the public water utility (Whittington and others, 1991). Poorer households also have more difficulty in adapting to unreliable service. For example, few of Cairo's poorer households have water pumps that increase pressure, as such pumps can cost as much as 100 percent of annual household income (Rada, 1996).

## Reforming water tariffs

Reforming water tariffs would seem strongly justified from both a financial and an environmental perspective. However, reform needs to be undertaken carefully. Policy changes require paying attention to consumers' ability and willingness to pay for water. The removal of subsidies involves some implementation costs. Removing subsidies on delivery charges can be costly, as it requires water utilities to implement a mechanism to measure water usage, most probably through metering, and to enforce its new pricing policy. Metering can be costly and its benefits need to be evaluated (Cestti and others, 1997). Removing subsidies on connection fees is usually rather less

complicated. Having to pay substantial lump sums at once may well cause problems to many consumers, however.

## Conclusion

The reformulation of tariffs and subsidy policies is crucial to reforming water services in developing countries. Reforms have proposed to improve the provision of such services through a combination of measures that encourage private sector participation (to improve efficiency), the removal of subsidies (to permit for sustainability), improving volumetric pricing (to allow for less water waste), and better targeting of existing tariffs (to ensure that reform does not harm the poor). The removal of subsidies will have substantial impacts on public revenues, the water resource, and the poor.

## Notes

1 Unless natural gas were to be subsidized more than other fossil fuels. In theory, the use of the cleaner fuel could offset the environmental impact of greater consumption.

2 We follow the International Energy Agency (IEA) in using the broadest possible definition of subsidy: "An energy subsidy is any government action that concerns primarily the energy sector and that lowers the cost of energy production, raises the price received by energy producers, or lowers the price paid by energy consumers" (IEA, 1999: 43).

3 It can be argued that, for OPEC countries, the existence of export quotas reduces the opportunity cost of fuels from the level of international prices to that of production costs. We follow IEA (1999) in assuming implicitly in the analysis that each OPEC country could leave (implicitly or explicitly) the cartel and sell in the international markets the amount of oil consumed domestically without affecting the international price of oil. Since this assumption cannot be sustained if a significant number of OPEC countries decide to leave the cartel, our global estimates of subsidies – obtained by aggregating the subsidies computed for individual countries – would represent an over-estimation. In what follows we do not attempt to correct for those 'global equilibrium' effects.

4 An important aspect of inter-country tax differences is fuel smuggling. Extensive smuggling of fuels out of Indonesia or Nigeria, for example, represent large costs for those governments and benefits to those in other countries.

5 Previous studies (such as IEA, 2001a) aim to measure total subsidies in the energy sector, and so exclude the subsidies to products employed in electricity generation in order to avoid double counting. We are here specifically interested in the total subsidies embedded in the electricity subsector.

6 This latter form of subsidy is not reflected in a financial burden to the government in the current year, but in increased future costs. Put another way, our results reflect an 'economic' measure of subsidies, rather than a 'financial' one.

7 This mark-up is intended to reflect the higher costs of serving non-industrial customers, as explained previously. We use a mark-up of 1.5 c/kwh instead of 2 c/kwh as a conservative estimate, in order to avoid including in the cross-subsidization results countries where the differential distribution costs between industrial and non-industrial customers is particularly narrow due to individual circumstances.

8 Here and elsewhere, estimates from other reports have been adjusted to 1999 prices for comparability.

9 This is the estimated amount that would cover all expenditures for road maintenance, depreciation, debt servicing, and new highway construction in the United States. However, it would pay little more (if at all) than road maintenance in developing countries, where traffic density is much lower. In addition, since heavy good vehicles with few axles, typi-cally powered with diesel, do most of the damage, our 'transport sector measure' results may over-estimate the 'subsidy' for gasoline, and under-estimate the 'subsidy' for diesel.

10 Metschies (1999, 2001) reports the prices for gasoline and diesel for over 160 countries, in a day in the last quarter of 1998 and 2000, respectively. To create an average price for 1999, we have combined prices for 1998 and 2000, giving the a 0.75 weight to those in 1998 and 0.25 to those in 2000.

11 Data on the consumption of gasoline and diesel in every single country do not exist. Our sample represents some 98 percent of the developing world's GDP, and is likely to represent a similar percentage of transport fuels consumption. For Sub-Saharan Africa, however, our sample represents only around 85 percent of the region's GDP. We have decided not to scale up the results, since we do not have a direct measure of the non-represented consumption and it is likely to be a small figure.

[12] United States: gasoline 36.5 usc/l, diesel 33.7 usc/l. European Union (unweighted average): gasoline 103.3 c/l, diesel 83.7 usc/l.

[13] Although four countries (Namibia, Sri Lanka, Turkmenistan, and Ukraine) present gasoline prices in the range of those in the European Union (that is, higher than 85 usc/l), the same does not happen with diesel (in none of them diesel reaches 70 usc/l).

[14] Numbers range from around 90 percent in Latin America and the Middle East to around 70 percent in Sub-Saharan Africa and the former Soviet Union.

[15] It must be noted that the concept of the energy ladder is contentious. Households do not abandon one fuel completely to move up the energy ladder until their income rises to very high levels. Rather they tend to use multiple fuels, especially if biomass is abundant.

[16] See Figure 2.2 above for average regional gasoline and diesel prices.

[17] These are the unweighted average of the 105 economies in the sample: 49.6 usc/l for gasoline and 37.7 usc/l for diesel. Note that average prices in all regions except the Middle East and North Africa are above these prices. Note also that these prices do not even reach 50 percent of the average prices in the European Union.

[18] International donors have also made substantial financial commitments. Irrigation is the largest recipient of public agricultural investment in developing countries. Active World Bank commitments (covering 229 projects) for irrigation totaled over US$7 billion in 2000, for example (Gonzalez, 2000).

[19] Ideally, long run marginal costs of water supply should be used. However, data constraints preclude this.

# 3. Generating New Resources

Improving the use of existing resources is important, but will likely not be sufficient by itself. In this chapter, we examined the potential for generating new resources. This potential is substantial, but varies significantly across countries. We examine here three main approaches, in sectors which are particularly relevant for sustainable development. We begin by examining the potential for capturing a greater share of natural resource rents, focusing on the potential in the forestry sector. We then examine the possibility of charging for services which are currently provided free or nearly so, such as access to protected areas and waste management. Next, we discuss the potential for a range of taxes and charges. Finally, we briefly review the potential for new mechanisms, such as Payments for Environmental Services (PES), to generate financing for specific conservation activities.

## 3.1 Capturing Natural Resource Rents

The value of a natural resource is defined by its value when extracted—the *resource rent*—which is the difference between its market value and the full cost of extracting it. Full extraction costs include wages and salaries, depreciation of the capital stock (production machinery and structures), and the opportunity cost of the capital employed (typically an assumed 'normal' rate of return on capital). Total resource rent is therefore equal to the economic profit of extraction.

The bulk of potential revenue from rents is, of course, from mineral fuels and minerals. These rents are probably already being mostly captured, however. While there may be some scope for some marginal improvements in rent capture, these resources provide limited scope for generating additional revenue. In contrast, the potential for additional rent capture is substantial in the forest sector. The potential revenues from this sector are clearly much smaller, amounting to about US$9 billion, and evidence indicates that only a small part of these potential revenues is currently being captured in developing countries. Moreover, increasing rent capture in the forestry sector would encourage more sustainable practices. Clearly, this potential is limited to forest-rich countries, particularly in East Asia and Latin America. However, such rents could provide very significant revenue sources for a number of smaller countries.

This section begins with a brief overview of the theory and rational for natural resource rent capture, with a focus on minerals and mineral fuels. It then concentrates on forest rents and the means to capture them. It also briefly review efforts to capture rents from bioprospecting, which was once thought to have the potential to provide a significant flow of additional funds. As will be seen, these hopes have largely been disappointed. The final part of the section provides some rough estimates of the overall potential for natural resource rent capture from different sectors.

### Rationale

All governments tax economic activity in order to finance social and economic policies. However, there are two main reasons why governments should tax natural resources in particular:

1. natural resources usually belong to the government, and
2. over-exploitation of natural resources can occur in the absence of fiscal incentives.

Natural resources are typically in the public domain, but are exploited by the private sector. This is the prime motivation for governments to capture some portion of the economic profits (*rents*) from resource extraction. There can also be important incentive effects when resources are inadequately taxed as well: the private operator will be tempted to exploit the richest ores or forest concessions as quickly as possible, before the government wakes up, leading to dynamic inefficiencies.

Under perfect competition, economic profits can be reduced to zero with a potentially unlimited number of agents entering the market. However, natural resources do not permit unlimi-

ted entrants, given the fixed number of resource deposits known at any point in time. Under these circumstances economic profits can persist simply because supply cannot be increased indefinitely.

In an ideal world, these economic profits or resource rents will go to the resource owner, the government. The focus of this section is on the capture of resource rents through fiscal instruments.

The capture of rent involves a series of considerations. For instance: When should the payment be made? On what basis should the payment be made? How much should be paid? There exists a myriad of policy instruments available to a developing country government that fall under the broad heading of resource taxation.

Uncertainty is a key aspect of the extraction of subsoil assets simply because they are underground, 'unseen' and fixed in supply. While the extent of forest resources is more readily measured, there can be considerable uncertainty concerning resource quality and harvest cost. Uncertainty regarding available resource rents therefore exists at various levels: (1) the quantity and quality of subsoil resources; (2) extraction costs; and (3) future resource prices.

These uncertainties create a degree of risk facing the extraction companies and the government. A combination of instruments can be an effective way of sharing the risk between public sector and private resource-extracting firms. From the companies' point of view there is the risk that extraction costs may be too high and resource prices too low, to the point where profits are zero or negative. From the government's perspective, there is the risk that the revenue streams derived from the taxation of extraction companies may be highly variable.

Resource taxation regimes that defer taxation—a tax holiday of 10 years for example—are commonly seen in developing countries. While this approach is used as an incentive to attract investment in the resource sectors, it raises issues for the realization of government revenues. Pri-vate firms operating under such a regime may be tempted to 'high-grade' the resource (exploit the richest sources first, often to the detriment of the exploitability of the remaining resource). If these firms have written off their capital investment within the tax holiday period, it may be optimal for them to shut down rather than pay the deferred taxes, leaving the government with no rental payments.

Two common approaches to resource taxation involve production sharing and specific taxes (royalties). Under a production sharing agreement, a share of the gross proceeds of the sales of the resource is paid to the government. While this approach shares the market risk between government and the exploiting firm, it represents in effect a tax on gross proceeds. Such a tax can severely impact a company's bottom line when market conditions are unfavorable or production costs increase.

Royalties, typically administered as a specific tax on physical quantities of resource (per ton or cubic meter), are among the oldest of fiscal instruments. However, these also represent a tax on gross proceeds, with the attendant problems from the point of view of the resource exploiting firm. In addition, as a fixed unit tax, the government is not in a position to benefit from buoyant resource prices without changing royalty rates.

A balanced approach to resource taxation often combines instruments, in particular the combination of a royalty and a profits tax. The royalty is set low, to limit risks to firms, while the profits tax captures at least some portion of the economic rents from exploitation.

There are several guiding principles for designing fiscal regimes for natural resources. Fiscal instruments should ensure:

- an adequate return to government, reflecting its role as resource owner and the sovereign taxing authority;
- timely receipt of revenue through the life cycle of the mineral deposit or forest concession;
- risk sharing between the private sector and the government that permits efficient development of the sector without exposing the budget to excessive revenue variability.

## Forests

This section discusses some key issues involved in resource taxation related to the forestry sector. We examine the extent to which developing country governments have been able

to extract rents from the use of forest resources. We analyze some country case studies and identify revenues obtained from forests in these countries. We also examine some of the constraints faced by governments in increasing the efficiency of forest resource use. Our analysis is selective due to the limited amount of information available and the variation in forestry issues from country to country.

A basic justification for increasing rent capture in the forestry sector is because doing so will reduce the above normal profits currently enjoyed by many logging companies. A redistribution of rent from the private to the public sector will free up resources for sustainable development. Further, reducing the profits logging companies obtain, through appropriate pricing thar reflects the scarcity value of trees, can provide an incentive for more efficient timber extraction and decrease waste (Gillis, 1990). When governments collect part of the rents of harvesting timber accruing to private companies, arguably there is less incentive to indiscriminately fell trees.[1]

Table 3.1 shows potential rents that could be collected from timber in the top 10 developing countries, ranked by size of potential resource generation and by the contribution of these resources to GDP. As the table shows potential forestry rent in forest–rich countries ranges from US$3 million to over US$2 billion. If this rent could be captured by governments, several countries would have significant additional resources available for development activities. For example, governments from large countries such as China and Brazil may be able to generate over US$1 billion annually from forest rents. In many smaller countries, potential forest rents make up a non-trivial component of GDP.

Our review below suggests that only a very small portion of these potential rents from forest is currently being captured by developing country governments. In many cases, forest rent accrues primarily to logging firms, or is being simply allowed to dissipate because of inefficiencies.[2] In the following pages, we discuss some of the reforms being undertaken by governments which could increase rent extraction from the forestry sector.

### Taxes and fees applied to the forestry sector

Governments have a variety of fiscal policy instruments that they can use to capture rents from

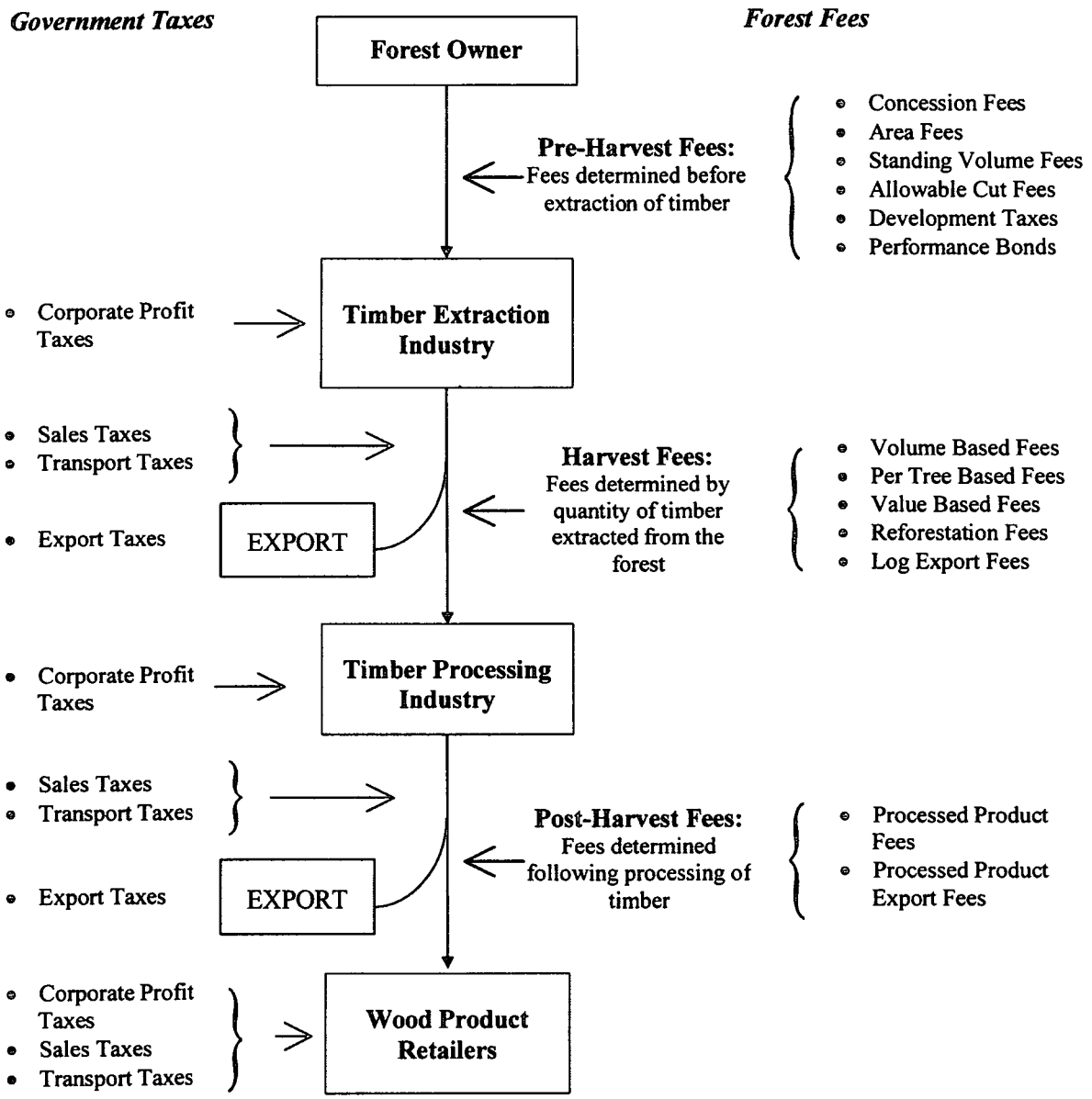
**Table 3.1: Potential rents from timber in forest-rich countries**

| *Top 10 countries by potential revenue* | | | *Top 10 countries by % GDP* | | |
|---|---|---|---|---|---|
| *Country* | *US$ million* | *% GDP* | *Country* | *US$ million* | *% GDP* |
| China | 2,249 | 0.2 | Solomon Islands | 16 | 6 0 |
| Brazil | 1,489 | 0.3 | Central African Republic | 18 | 1.8 |
| Indonesia | 703 | 0.5 | Papua New Guinea | 69 | 1.8 |
| India | 635 | 0.1 | Guinea-Bissau | 3 | 1.6 |
| Malaysia | 488 | 0.5 | Gabon | 57 | 1 2 |
| South Africa | 394 | 0.3 | Guyana | 8 | 1.1 |
| Mexico | 252 | 0.0 | Lao People's Democratic Republic | 19 | 1.1 |
| Chile | 222 | 0.3 | Chad | 16 | 1.1 |
| Poland | 207 | 0.1 | Paraguay | 69 | 0.9 |
| Nigeria | 194 | 0.5 | Mongolia | 8 | 0.8 |

*Notes:* 1999 data. Assumes that 50 percent of total available resource rent can be captured. Omits fuelwood.

*Source:* Derived from World Bank data, see Appendix Table C.3 for details.

**Figure 3.1: Flow of timber through the forest sector and application of taxes**




*Source:* Jiwanji, 2001.

the forestry sector. Figure 3.1 provides an overview of the types of fees that apply to the forestry sector. As the Figure shows, governments can extract rent through pre-harvest, harvest, or post-harvest fees. A number of routinely used taxes are also levied on the forestry sector.

The most common type of fees that apply to forest sector activities are stumpage fees or royalties based on the amount of timber harvested. These types of fees can be based on the volume of timber harvested (per cubic meter, $m^3$), the number of trees harvested, or the value of the trees harvested. Each type of fee has its own advantages. However, fees based solely on the quantity of timber extracted may lead to 'high-grading'—the practice of selectively extracting only the most valuable tree species, leaving harvestable timber in the forest. This is economically inefficient in the long run, because it creates disincentives for silvicultural practices that would

maximize the net present value of log production under sustained production—that is, the entire value of areas set aside for logging is not being captured. It can also result in increased wasteage because trees are often damaged or destroyed in the process of getting to high-value trees scattered in large forest segments. In general, stumpage fees and royalties have the potential to capture a high proportion of rents if they are differentiated enough across species and are updated frequently to reflect market conditions. Their key disadvantage is that they can be quite complex to determine, and can be a considerable burden on understaffed and poorly-funded forestry agencies that are in charge of measuring and classifying timber harvest.

Fees can also be applied to timber after it has been extracted and processed into other wood products such as sawn wood, veneer, and plywood. Fees on processed products are classified as post-harvest fees, as opposed to the harvest-based fees discussed above. One of the main advantages of post-harvest fees is that they can be applied to logs that are illegally harvested. In countries where a large proportion of timber is processed for exports, and illegally harvested timber makes up a large portion of processed wood products, post-harvest fees can raise signifi-cant revenues. They are also administratively easier to apply since it is relatively simple to measure the quantity of products manufactured or exported. Post harvest fees are quite common and many governments apply post-harvest fees (or even outright export restrictions) on un-processed logs to encourage domestic processing of timber. However, because post-harvest fees are often estimated based on the amount of timber that *would* be required to produce a given amount of processed wood, these fees can penalize more efficient processing firms.

Governments have increasingly adopted pre-harvest fees, such as concession fees and areas fees, in addition to harvest-based fees. There are some advantages to using pre-harvest fees from a revenue perspective. Pre-harvest fees are independent of the amount of timber harvested, and encourage an intensive use of the forest with high recovery rates of timber from all valuable tree species.[3] They also tend to be simpler to collect, since fees are defined in the concession agreement and do not require measuring and classifying the harvested timber. However, such fees could result in inefficient harvesting of low value timber and un-necessary destruction of forest biodiversity. Setting the correct fees may require a considerable amount of information on the quantity and quality of timber at specific sites, unless the government auctions concessions. Auctioning concessions may require less information, since governments can establish a minimum price for the concessions and the burden of evaluating the full value of such a concession falls on bidding companies. Under competitive conditions, auctions can be a mechanism to extract a high proportion of the rents available. However, the auctioning process is not free from political maneuvering problems, as shown in the Cameroon case study below.

In addition to fees specific to the forestry sector discussed above, other types of government taxes and charges may apply to activities in this sector. Just like other types of economic activities, the forestry sector may be subject to sales, export, and corporate profit taxes. While the primary motive for such taxes is to raise revenues, they do capture some amount of rent if forest-specific fees are below efficient levels. These taxes can sometimes be easier to collect, since they rely on institutions and procedures that are a part of the normal tax raising functions of a government. But because such taxes are not specifically designed to capture resource rents, they are usually inefficient mechanisms for this purpose, and have little or no incentive impact on the logging and wood processing industry.

Table 3.2 provides some examples of forestry taxes currently collected in selected developing countries. As can be seen, most countries rely on several instruments—stumpage fees, reforestation fees, area taxes, export taxes, profit taxes, and so on—to raise revenue from the forestry sector. Annual revenues from the sector range from some US$12 million in Laos PDR to over US$300 million in Brazil. While these revenues are small in relation to total GDP, they still represent scarce resources that developing country governments can put to good use. Further, comparing these numbers to the potential rents in Table 3.1 above shows that in all cases, except for Cameroon, the rents available to governments can be increased considerably by improving the tax mechanism.

**Table 3.2: Forestry policy instruments and revenue generated in selected countries**

| *Country* | *Current Policy* | *Revenue (million US$)* | *% of GDP* | *% of Potential Rent*[a] |
|---|---|---|---|---|
| Brazil[b] | • Regulations limit amount of area that can be harvested in private lands<br>• ICMS, a value-added tax, is primary source of revenue | 345.0 | 0.07 | 23 |
| Cameroon[c] | • Stumpage fees: 2.5% of FOB price<br>• Export taxes: US$12 to US$24/m$^3$<br>• Area taxes: US$2.40 to US$3.90/ha/year<br>• Transfer taxes: US$0.16/ha | 59.5 | 0.65 | 104[h] |
| Gabon[d] | • Processed wood fees: US$0.3 to US$0.6/ m$^3$<br>• Export taxes: 5% (processed wood) and 11% (logs) of FOB price, treasury tax of 0.2% of export taxes and duties, port tax of US$0.9 per metric ton<br>• Area tax: US$0.006 to US$0.03 | 31.7 | 0.75 | 56 |
| Indonesia[e] | • Stumpage fees: US$16 to US$20/ m$^3$<br>• Area tax: US$3 to US$10/ha/year<br>• Export taxes: 20% on logs and sawn wood | 199.0 | 0.14 | 28 |
| Laos[f] | • Royalties<br>• Reforestation Fees<br>• Provincial/Local Development Fees | 12.6 | 0.87 | 66 |
| Russia[g] | • Government sets minimum stumpage prices, for which municipalities can charge fees (in 1997 these fees amounted to less than US$1/m$^3$, on average)<br>• Competitive auction of lease rentals have been recently introduced and bids have been as high as US$10/ m$^3$<br>• Profit tax is the primary source of revenue (export taxes were abolished in 1996) | n.a., see notes | | |

*Notes and sources:*

All figures have been adjusted to 1999 US dollars

FOB = free on board (that is, the market value of the tree)

n.a. = not available

[a] Derived by dividing actual rents by the potential rents shown in Table 3.1.

[b] Revenue figures are for 1998 and only for the Amazon region, which includes the states of Para, Mato Grosso, and Rondonia. These states provide 93 percent of the timber production. *Source*: World Bank, 2000b.

[c] Revenue figures are for 1997 Export taxes apply to volume of raw logs exceeding allowed quota and in 1997 generated almost 80 percent of revenues from forestry taxes. *Source*: Cameroon, 1998.

[d] Revenue figures are for 1997. Other fees include: pre-harvest fees ($0.60 per hectare), timber marking tax (US$0.3 to 4.20), reforestation tax applied to wood exported, to name just a few. Export taxes accounted for 85 percent of revenues from forestry taxes in 1997. *Source*: Global Forest Watch, 2000a.

[e] Revenues figures are for 1998 and include only revenues from the *Dana Reboisasi* (DR) and the *Iuran Hasil Hutan* (IHH), the two largest forestry fees. Revenues were significantly lower than in 1996 (US$340 million) due to the devaluation of the Rupiah. *Sources*: World Bank, 2000c, 2000e; D W. Brown, 2001.

[f] Revenues are from Royalties for 1998/99. *Source*: World Bank/Sida/GOF, 2001.

[g] A World Bank study estimated the potential tax revenue from the forestry sector in 1996 was between US$900 million (under the most conservative estimate) and as high as US$5.5 billion, depending on assumptions about wood production levels and profitability of harvesting companies and wood processors. The calculations assumed stumpage fee rates ranging from US$3 to US$10 per cubic meter and a profit tax rate of 35 percent. *Sources*: European Forest Institute, 2000; World Bank, 1997b.

[h] In calculating potential rent, it is estimated that the government can capture 50% of total estimated rent. This figure shows that the Cameroonian government is able to obtain more than 50% of rent.

## Case studies

In this section, we review several case studies that illustrate the potential and pitfalls of attempting to capture resource rents in the forest sector. In general, the case studies illustrate the need for forest sector reform and careful monitoring of newly instituted policies.

### *Cameroon*

Reform of Cameroon's forest policy was linked to structural adjustment lending conditions that followed the onset of the economic crisis in the late 1980s. The reforms introduced four major changes: allocation of concessions through an auction system, new pricing and taxing mechanisms, requirements for management plans, and provisions for community forestry. These reforms have increased the amount of revenue the government collects from the forestry sector. Efforts to introduce auctioning of logging licenses proved particularly troublesome in the implementation of new reforms. An audit conducted by the Global Forest Watch (2000b) found that 56 percent of licenses in 1997-98 were operating irregularly—licenses had either expired, were operational in a protected area, or had been improperly allocated after 1994. Also, 21 of the 31 concessions (*Unités Forestières d'Aménagement,* UFAs)[4] allocated did not go to the highest bidder. It is estimated that the Cameroon government lost at least US$2.5 million, or 4 percent of potential forestry tax revenues, by not allocating 14 UFAs to the highest bidders in 1997. As a result of auction problems in 1997, allocation of UFA concessions were temporarily stopped. Logging companies either obtained *a vente de coupe*[5] or an *autorisation de recuperation,*[6] to continue operation in the profitable logging sector or engaged in illegal harvesting.

Recent evidence suggests that continued pressure on Cameroon's government to clarify the rules of the bidding process has had a positive impact on the forestry sector. Public disclosure of information from an independent observer, in particular, appears to be leading to stronger enforcement of the new regulations. Evidence of this is the government's recent suspension of licensed activities of 32 logging companies for failure to pay taxes amounting to US$4.1 million (ITTO, 2001). Further, latest reports suggest that the most recent round of concession allocations (in June 2000) were far more transparent than in the past. The changes made are expected to result in the government earning approximately US$6.5 million in revenue per year. In fact, revenue per hectare has increased by three times the amount obtained in 1997 (Collomb and Bikie, 2001).

### *Gabon*

Gabon, like Cameroon, is a major exporter of tropical logs from Central Africa (ITTO, 2000). Gabon also derives most of its forestry sector revenue from export taxes, as Cameroon does. Yet Gabon collected only half as much in revenues from the forestry sector in 1997 even though it produced 2.7 million cubic meters of logs, approximately the same volume of logs as Cameroon's 3 million cubic meters. Total forestry taxes in Gabon were $32 million in 1999 dollars, compared to $60 million in Cameroon. Area taxes were 75 times lower than in Cameroon. Thus, forest reforms in Gabon are likely to pay high dividends in terms of increased revenue to the government.

There is considerable scope for change in Gabon's forest sector. Most forestry taxes in Gabon have not changed in the past 25 years despite high inflation. The more than 12 different types of forestry taxes that exist also make monitoring difficult. In addition, forestry agents police on average over 800 square kilometers of logging concessions per agent, which further aggravates the problem of rent collection (Global Forest Watch, 2000a).

Reform of Gabon's Forestry Law began in 1996. The new laws propose long and medium term management plans for some types of logging concessions, allocate logging permits through an auction to pre-qualified companies, and simplify the existing tax structure (Global Forest Watch, 2000a). Thus far, implementation of the new measures has proceeded quite slowly.

### *Brazil*

The forestry sector in Brazil, while extensively regulated, is characterized by a weak institutional environment and weak enforcement. Regulations governing the exploitation of natural forests have followed more of a command and control approach than a pricing approach. Regu-

**Box 3.1: "Conservation concessions" in the Guyana Shield region**

Conservation concessions are a new conservation mechanism that allow conservation groups to lease forest tracts from the government in the same way a timber company would – except that these areas are used for conservation instead of logging. Environmental NGO Conservation International (CI) established Guyana's first 'conservation concession' in its upper Essequibo/Takutu Region in 2000. CI approached the government of Guyana for the establishment of this concession after it carried out a similar project in Suriname, where CI established a trust fund to support the management of the new Central Suriname Nature Reserve. The trust fund has so far received pledges of over US$18 million from multilateral donors. These resources will enable Suriname to manage protected areas covering nearly 15 percent of the country's total area. Suriname harbors more rain forest than all of the Central American countries combined. The reserve created is part of the Guyana Shield region, one of the largest unfragmented tropical forest blocks which extends from the northern part of Brazil to Venezuela and Colombia. Suriname, and Guyana are two of the most "forest rich" countries (90 percent and 80 percent of their land area are under forests, respectively) whose economies depend heavily on natural resource extraction. Both countries have been under pressure to exploit these forest resources which until recently were largely undisturbed. Export of timber generated a mere US$6 million for Suriname in 1995 and less than US$1 million for Guyana, much lower than the estimated "forest rent" potential in these countries. "Conservation concessions" present a feasible alternative to generating revenues from a conservation-based development strategy, as opposed to an export-based development strategy.

*Sources:* Hadden, 1999; Conservation International, 2000a, 2000b; Hardner and Rice, 2002.

lation of the forestry sector falls primarily into six areas: environmental impact assessments, burning and clearing permits, property-specific cutting restrictions, geography-specific cutting restrictions, forest management requirements, and restrictions on the export of forest products. For example, the Forest Code requires that 80 percent of forested area on private lands in the Amazon must remain under forest cover, although small holders may be exempted from this requirement. These and other regulations of logging activity, when enforced, amount to an implicit tax on the industry. However, these restrictions are not much of constraint since over 80 percent of logging in the Amazon region is illegal (Lele and others, 2000).

Tax evasion in the forestry sector is estimated to be very high. The primary source of revenue from the forestry sector comes from a value-added tax. When calculations based on the rate of uncollected taxes in the state of Para (88 percent) are extended to the entire Amazon region, the amount of revenue loss would be in the order of US$225 million in 1998 (Lele and others, 2000).

### *Indonesia*

Indonesia is endowed with the second largest expanse of tropical moist forest in the world. The actual extent of forest cover remaining is not known for lack of reliable data, but is believed to be somewhere between 92 and 112 million hectares (World Bank, 2000e). With such an abundant endowment, it is inevitable that some deforestation will occur in the pursuit of economic development. In fact, the government of Indonesia has exploited its natural resources in an export-led development strategy, which resulted in a sustained and rapid rate of economic expansion lasting nearly three decades. However, accounting for the loss of natural capital may reduce Indonesia's performance from impressive to ordinary (Hamilton and Clemens, 1999).

Evidence that the rate of forest exploitation was unsustainable began accumulating by the late 1990s (Seymour and Dubash, 2000). As the economic crisis and devastating fires of 1997-98 showed, Indonesia's economy was built on questionable foundations. Nowhere is this weak foundation more evident than in the forestry sector, where timber concessions were used for political patronage. The traditional rights of indigenous forest dwellers and communities dependent on forest resources were subordinated to the industrial interests of the APKINDO plywood marketing cartel, which received incentives that generated large economic rents for license holders (World Bank, 2000e). It is estimated that the rents flowing to plywood producers have soared since the economic crisis, from an estimated US$25-$80/m$^3$ to US$172/m$^3$ in the first few months of

1999. In addition, windfalls occur to timber producers because the government of Indonesia collects stumpage fees at artificially low exchange rates. In all, these policies are estimated to have cost the government of Indonesia over US$10 billion dollars in forgone tax revenue from 1990 to 1999 (Brown, 1999).

Reform of the forestry sector was made a part of the second adjustment lending package that the IMF and World Bank provided to restore stability in the Indonesian economy in 1998. The reform package included measures to increase taxation from the forestry sector by raising stumpage fees, auctioning concessions, implementing performance bonds, and reducing marketing and investment restrictions in the forestry sector. The results of these reforms have been mixed. Some progress has been achieved in dismantling forest product marketing monopolies. But spirit of the reforms appear to have been undermined in several ways (Seymour and Dubash, 2000). For example, the proceeds collected from the performance bond still go into what is called a 'reforestation fund', which has been primarily used to subsidize plantations of exotic hardwood species. The export tax was lowered from 200 percent to 30 percent in 1998 as stipulated. However, export taxes have not generated any significant amount of revenue because the Ministry of Trade and Industry's delays in approving export licenses effectively acts as a non-tariff trade barrier (World Bank, 2000e). In fact Indonesia appears to have recently re-instituted the log export ban. Thus, lack of good governance and consequent revenue losses continue to be challenges in the forestry sector in Indonesia.

### *Lao PDR*

Forests cover nearly half of Lao PDR. Of this, nearly 2.5 million ha are officially designated as production forests. Production forestry is considered one of the country's few potential sources of sustainable economic growth, and poverty reduction. In fact, forestry is estimated to account for 5 percent of GDP. However, like elsewhere, Laos forest resources are threatened by unplanned and undisciplined exploitation (World Bank/Sida/GOF, 2001). Annual deforestation, due to shifting cultivation, encroachment, fire, and unsustainable logging, is estimated to be between 0.3 percent to 1-2 percent of the national forest area (Lao PDR, 1999).

Log production in Laos has been growing at an increasing rate since the 1980s, particularly from the mid 1990s onwards. In 1998, 34 percent of total export value came from forest products. As other exports are heavily based on imported inputs, the importance of the forestry sector is even larger in terms of *net* foreign exchange earnings. Royalties on logs have been an important source of revenue to the government of Laos. In 1998-99, the government of Laos earned about US$12.6 million from timber royalties. However, it is estimated that the government of Laos lost some US$114 million in revenues from 1994 to 1998/99 due to low royalty collection (World Bank/Sida/GOF, 2001).

Payments for logs consist of three components: a royalty and a reforestation fee that are payable to the national treasure, and a local development tax/fee that varies across provinces. Wood buyers may be exempted from the reforestation fee if they plant trees. However, in general, the scale of planting does not match the amount harvested. Royalty rates also differ according whether the log is processed or exported. This system creates inefficiencies and high-grading, with even medium quality fully utilizable logs left behind in forests (World Bank/Sida/GOF, 2001).

Recently, changes have been introduced to the regulatory system that may increase revenues and provide some flexibility. A recent Prime Ministerial Order allows provincial authorities to establish contract prices in negotiations with the buyer. Thus, a minimum royalty is fixed at the federal level and the provinces have an opportunity to fix a higher royalty and reap the additional benefits. This system is yet to be tested and is worth carefully watching as it gets implemented.

## Conclusions

The main lesson to draw from the case studies and the information on potential rents from forests is that the forestry sector offers significant opportunities for resource-constrained governments to raise domestic revenues. Currently, a large proportion of forestry rents is being captured by the private sector. Rent

**Table 3.3: Magnitude of illegal forest activities in the Asia Pacific region**

| *Country* | *Assessment* |
|---|---|
| Malaysia | One third or more of forest exports was illegal in the early 1990s. |
| | Forest products exports to Japan were underdeclared by 40% in the early 1990s. |
| Cambodia | Households and enterprises perceived corruption as the leading problem for citizens and enterprises. |
| | Illegal exports were coming through the Thai border. |
| | In 1997, a minimum of US$184 million worth of timber was felled in Cambodia, much of it received by corrupt officials. |
| | In 1997, only 10% of logging was legal. |
| Cambodia, Vietnam | Substantial illegal logging trade exists between the two countries. |
| Indonesia | 95 percent of exports were illegal in the early 1990s. |
| | Malaysian companies were accused of logging illegally and smuggling logs to Malaysia. |
| | In the mid 1990s, 84% of timber concession holders failed to obey the law. |
| | Losses due to illegal logging was estimated to be US$3.5 billion per year in the mid 1990s. |
| | 84% of timber concessionaries did not follow the law. Illegal logging was taking place in national parks. |
| | As much as 40% of pulp and paper wood supplies came from undocumented sources. |
| Myanmar | In 1995, some 276,000 m3 valued as US$86 million, or almost half of the country's forest exports were undeclared. |
| Papua New Guinea | Foreign companies bribed politicians and leaders, illegally logged and exported timber, and transferred funds abroad illegally. |
| | Senior officials obtained logging rights in exchange for bribes. |
| | Fraudulent activities in the forestry sector led to an estimated loss in national income equivalent to the annual aid the country received from Australia: more than US$180 million in 1998. |
| | In 1994, Forester Minister Tim Neville estimated that US$1 million was lost daily to illegal practices. Foreign corporations gave bribes to local leader, national ministers, members of the Parliament, and to at least one secretary of the Department of Forests. |
| Philippines | 16 million ha of forest have shrunk to 70,000 mainly due to illegal logging. |
| | During the 1980s, the country lost US$1.8 billion a year due to illegal logging. |
| | A large ADB-financed Afforestation project reportedly was affected by widespread corruption, with money diverted to finance the agendas of local politicians. |
| Russia | The deputy head of the Federal Forestry Service, Dmitry Odinstov, recently complained about the rise in illegal operations, noting that there are "some timber procurement offices controlled by organized criminal groups engaged in illegal timber exports." Poachers cut down about 20% of the official harvest in Russia's Far East. |
| | About 20% of timber logged in Russia violates the law. |
| | As much as 50% of logging in the Primorsky and Khabarovsk regions may be illegal. |
| | There is substantial export trade from Siberia to China. |

*Source* Contreras-Hermosilla, 2001.

collection would result in social re-distribution of rent between the state and the private sector and free up resources for social and environmental investments.

Economic theory very broadly suggests that increasing rent capture in the forestry sector could lead to more efficient use of forest resources, which may indirectly lead to reduced deforestation. This is another reason for promoting forest taxes. However, the theoretical results on the links between rent capture and resource efficiency are not definitive. Definitions of rent vary, and different taxes and competitive mechanisms

penalize certain conservation practices and encourage others. Further, most "experts" in the field conclude that the specific economic and institutional context of individual countries determines whether and to what extent resource taxation enhances resource use and harvesting efficiency.

Low rent capture in developing countries is closely tied to illegal harvesting and implicit and explicit contractual agreements that benefit a few interest groups. Illegal logging is a major problem for nearly all forest-rich countries in the developing world. This is illustrated in Table 3.3, which presents a summary assessment of illegal timber extraction in selected countries. In such situations, increasing taxes may provide a higher incentive for illegal logging and may prove counterproductive.

Good governance can make a huge difference to sustainable development by increasing revenues available and by discouraging illegal forestry activities. Recent evidence from Cameroon shows that sound reforms that enhance transparency can result in significant increases in rent to the state. A key message here is that forest policy reforms must take into account the willingness and ability of governments to implement these reforms. However, it is important to note that this reform was an internal initiative, and not driven by outside sources. In the latter case, success may be more difficult to achieve or may take longer, as the Indonesia case study shows. It will be important for countries such as Gabon and Laos, which are in the process of adopting new forestry measures to take these lessons into account.

Finally, the impact of forest policy regulation (including tax policy) on the availability of timber and non-timber forest products for poor rural communities is another important consideration. A quarter of the world's poor depend heavily on forest resources for construction materials, fuel, fodder, food, and medicines. Sometimes 10 to 25 percent of income comes from non-timber forest products for low-income farming households (Scherr and others, 2001). The development of markets for forest products where small poor producers may have a competitive advantage (because of their lower opportunity costs or lower transportation costs) can be an important poverty reduction strategy that can be accomplished through forest policy reform.

Data quality and availability will continue to be key challenges in the process of making informed policy decisions in most developing countries. Such limitations, however, should not be seen as excuses for not paying particular attention to the effects of forest policy reform, especially on the poor who depend on forest resources for their livelihood. It is also important that fiscal reforms in the forestry sector be accompanied with monitoring of logging activity to ensure that revenue enhancing reforms also improve efficiency of resource use.

## Bioprospecting

In the early and mid-1990s, biodiversity prospecting ('bioprospecting') was expected to provide an important new source of financing for forest conservation (Farnsworth and Soejarto, 1985; McAllister, 1991; Principe, 1989; Pearce and Puroshothaman, 1992; Reid and others, 1993). It has not turned out that way. While some pharmaceutical companies have proven willing to pay for access to samples of genetic material, the sums involved have been much smaller than anticipated (Laird and ten Kate, 2002).

Interest in evaluating the extent to which bioprospecting might generate resources has led to several efforts to quantify the value of biodiversity. The methodology of these studies and the values they sought to estimate varied considerably and, not surprisingly, produced a wide range of estimates. Some early studies focused on estimates of the 'value of undiscovered drugs' and tended to find very large values. The methodologies used typically involved multiplying the price of a drug by the quantity consumed to obtain an average value per 'plant based' drug or untested plant species, estimating the patent value of a drug, or using the value of a statistical life times the number of lives saved per drug or the avoided illness costs (Farnsworth and Soejarto, 1985; Ruitenbeek, 1989; Principe, 1991; McAllister, 1991; Pearce and Puroshothaman, 1995). The results of these studies varied from US$28.4 million to US$190 per year per untested species (Pearce, 1999). The wide range is driven primarily by assumptions made about the success rate of

discovering new drugs and how the value of a successful drug is determined (that is, drug sales, value of a statistical life, or patent value).

The approaches followed by the above studies have several problems. First, the value of a drug should not be entirely attributed to the plant material it is derived from, especially when other substitute inputs are available (alternative to plants or synthetic materials). Second, only a handful of research leads will result in valuable discoveries, and then only after a considerable amount of time—usually measured in decades. Third, these early studies estimated average values. Later studies have focused on the marginal value of genetic material. Finally, studies should carefully distinguish whether private or social values are being estimated and which is the appropriate value to answer the desired question. The private value to pharmaceutical companies, estimated through drug sales or patent values, is useful in determining whether these companies have incentives to conserve these plant resources. The social value takes a broader view of benefits and addresses the question of whether conservation is justified from the viewpoint of society. As most authors agree that the social value of biodiversity is large enough to justify efforts to preserve it (especially when considering the full range of values, and not just the direct use value provided by drugs derived from natural compounds), later studies have focused on estimating the private value of bioprospecting to pharmaceutical companies. The focus of values estimated in later studies, whether private or social, also changed from the value of the drug to the value of a research lead or discovery per hectare of land conserved. Their estimates, therefore, are not directly comparable to those from these early studies (Pearce, 1999).

The values estimated in the later bioprospecting studies are also very sensitive to model assumptions. The benchmark study in this category is Simpson, Sedjo, and Reid's 1996 paper, "Valuing Biodiversity for Use in Pharmaceutical Research." The authors find that the value of the 'marginal unit' of genetic resources is small due to uncertainty in the discovery process and redundancy among leads. Their estimates of the scarcity rent of genetic resources range from US$0.20 to US$20.63 per hectare for 18 biodiversity "hot spots." By relaxing the assumption in the Simpson, Sedjo, and Reid model that bioprospecting firms conduct random testing of leads, Rausser and Small (2000) use a sequential search model that yields rents estimates that vary from US$0 to US$9,177 per hectare for the same areas. In their models, high probability leads provide information rents, which are in addition to the scarcity rents that depend on the total number of leads available for testing. However, the authors themselves acknowledge that the information rents could be large enough to provide an incentive for conservation in only some special cases. Criticisms to the models developed in these papers point out that different drugs may be used to treat the same condition, such as the use of taxol in combination with other cancer drugs that attack the cancer via different mechanism, and therefore one discovery does not reduce the value of remaining leads for the same condition. Alternatively, more than one drug may be derived from the same lead, as is the case with taxol and taxorete (Day-Rubistein and Fisvold, 2001).

Craft and Simpson (2001) reconsider the question of the value of biodiversity in pharmaceutical research when products can be differentiated to address the concerns discussed above. The two competition models developed attempt to bridge the gap in the early literature, which in calculating the average value of species failed to take into account competition between different products derived from different sources, and the latter literature, which is unsatisfactory in treating different products derived from different species as either perfect substitutes or being completely unrelated. While the models specified give different estimates of social values, the authors find that the private incentives for biodiversity preservation are small in both cases. No numerical calculations or estimates are carried out, however.

Most of the literature cited above focused on determining whether the rents from bioprospecting are large enough, in principle, to induce resource conservation. Even if they are, this is not by itself sufficient to ensure that resources are conserved. Equally or even more important is that these rents are distributed in a way that induces local inhabitants to undertake conservation, because "if the rents do not accrue

to local land users who ultimately make conservation or conversion decisions, the debate surrounding the size of bioprospecting rents is irrelevant" (Barret and Lybbert, 2000). The long term potential of bioprospecting to provide incentives for conservation is also diminished due to the "quasi-option" nature of the value of biodiversity for pharmaceutical research. As knowledge of species, or other potential scientific progress in developing cures for diseases, such as combinatorial chemistry, evolves, the conservation value will diminish. This will also happen if the genetic material which provides the lead is then synthesized instead of being harvested from the source to produce the medicine.

The much publicized bioprospecting agreement between the National Biodiversity Institute of Costa Rica (INBio) and Merck Pharmaceutical Ltd. stands as one of the very few successful examples of bioprospecting's potential to generate funds for conservation (INBio, 2002). Announced in 1991, the agreement between INBio and Merck was the first of such kind. Merck paid INBio US$1 million for the right to evaluate the commercial potential of a limited sample of plant, animal, and microbial samples collected from Costa Rica's 11 conservation areas. Merck also provided equipment and technical assistance for processing samples at INBio. The agreement stipulated that 10 percent of research budgets and 50 percent of any future royalties be awarded to the Ministry of the Environment and Energy (MINAE) for reinvestment in conservation. The agreement between INBio and Merck was renewed twice and INBio has also signed similar agreements with other American pharmaceutical companies, such as Bristol Myers Squibb, Akkadix Corporation, and Givaudan Roure as well as European companies. INBio reports that since it started its activities in 1991, the bioprospecting deals it has entered have generated more than US$2.5 million in direct financial contributions to other divisions in INBio, the conservation areas, MINAE, and national universities. This is a small sum compared to the amounts generated in 1993 by the forestry sector, US$28 million, and the tourism industry US$421 million. Royalty rates are kept in strict secrecy, partly so that INBio may be able to negotiate more favorable terms in future agreements (Crook, 2001). However, most industry analysts believe that royalties are in the one to three percent range of profits from successful compounds developed.

Another successful bioprospecting venture has been established by the International Cooperative Biodiversity Groups (ICBG), which was the outcome of a international workshop on drug development, biodiversity conservation and economic growth held in 1991. The National Institute of Health (NIH), National Science Foundation (NSF), and US Agency for International Development (USAID) granted six awards of approximately US$500,000 per year for five year research projects in Latin America, West Africa, and Southeast Asia. In 1995 USAID withdrew from the partnership, and the US Department of Agriculture (USDA) joined. In 1998, the ICBG granted similar awards for a new five-year cycle, some for continuing the earlier projects and others for new projects (ICBG, 2001). Funding level in 1999 was US$3.7 million (Rosenthal and others, 1999). Each ICBG is a consortium of academic institutions, local and international private voluntary organizations, and private pharmaceutical companies. Six of the eight projects involve pharmaceutical partners, such as Bristol Meyers Squibb, Monsanto, and Glaxo Wellcome, which make mostly contributions in kind to develop the technological capacity to developing countries to process samples.

The ICBG program has three principal goals: first, to improve the human health through the discovery of new therapeutic agents to treat diseases of importance to both developed and developing countries; second, to conserve biodiversity through valuation of diverse biological organisms and the development of local capacity to manage these natural resources; and third, to promote sustainable economic activity in less developed countries by sharing the benefits of the drug discovery and conservation research processes (Rosenthal, 1997). Like the INBio/Merck agreement, ICBG agreements include equipment, training, and infrastructure for capacity development in the host country, in addition to royalty and advance payments for access and collection of samples. Each ICBG is also establishing or associated with a trust fund for conservation. In Suriname, for example, the ICBG established a

benefit sharing plan where the monetary benefits of advance payments and royalties are to contribute to the "Forest Peoples Fund" and five local governmental and non-governmental organizations. The agreements also require that locally important, but understudied, diseases and indigenous therapies be investigated by commercial and scientific partners. The ICBG approach is not without critics, who argue that financing pharmaceutical research and development is a roundabout way to encourage conservation (Simpson, 2001).

## Estimates of potential resource rent capture

As the preceding discussion has indicated, when it comes to taxing resource revenues, the public and private sectors generally share the risks and uncertainties associated with resource extraction and harvest. If resource taxes are set at too high a level or are assessed on gross revenues then the private sector will view resource sector investments as being too risky to undertake; if resource taxes are too low then the government is giving away the patrimony and creating incentives for over-exploitation of the resource.

In estimating potential resource rents, therefore, an assumption as to risk sharing is required. *We assume in what follows that potential rent capture is 50 percent of the total available resource rent.*

Estimates of total resource rents are taken from the breakdown of resource rents published in the *World Development Indicators* (World Bank, 2001d). There are two adjustments that need to be made to the WDI data, however. First, the WDI reports only rents on net forest depletion, where harvest exceeds growth in a given country. Second, the WDI includes rents on fuelwood as well as commercial timber. The figures reported in Table 3.4 on potential resource rents are adjusted to reflect total rents on commercial timber. Country by country estimates of available resource rents are presented in Appendix Table C.3.

The rent estimates presented below exclude two key resources: fish and diamonds (which has

**Table 3.4: Estimated potential resource rents, 1999**

| | *Mineral fuel rents ($ million)* | *Mineral rents ($ million)* | *Timber rents ($ million)* | *Total resource rents ($ million)* | *Total resource rents (% GDP)* |
|---|---|---|---|---|---|
| **World** | **190,245** | **12,864** | **31,580** | **234,689** | **0.76** |
| **By income group** | | | | | |
| Low income | 19,734 | 1,715 | 2,357 | 23,805 | 2.30 |
| Middle income | 113,782 | 7,186 | 6,424 | 127,393 | 2.31 |
| Lower middle income | 57,896 | 2,371 | 3,130 | 63,397 | 2.43 |
| Upper middle income | 55,886 | 4,815 | 3,294 | 63,995 | 0.22 |
| Low and middle income | 133,516 | 8,901 | 8,781 | 151,198 | 2.31 |
| High income | 56,728 | 3,963 | 22,799 | 83,491 | 0.34 |
| **By region** | | | | | |
| East Asia and Pacific | 14,317 | 2,295 | 3,927 | 20,539 | 1.08 |
| Europe and Central Asia | 32,235 | 205 | 353 | 32,793 | 2.99 |
| Latin America and Caribbean | 26,808 | 4,443 | 2,393 | 33,644 | 1.64 |
| Middle East and North Africa | 49,743 | 346 | 53 | 50,142 | 8.17 |
| South Asia | 3,575 | 693 | 748 | 5,017 | 0.86 |
| Sub-Saharan Africa | 6,619 | 872 | 1,124 | 8,614 | 2.66 |

*Notes:* Assumes that potential rent capture is 50 percent of the total available resource rent.

Regional aggregates include developing countries only.

*Source:* Derived from data in World Bank, 2001d, see Appendix Table C.3 for full country breakdown.

particular ramifications for countries such as Botswana, Namibia, South Africa). Both are excluded for reasons of data availability. In the case of fish there are additional considerations—typically governments do not tax small-scale fishing and, in any event, the available rents have been driven to zero in many fisheries owing to excess fishing effort.

Table 3.4 tells an interesting story. First, potential resource rents globally are a small percentage of world product, 0.76 percent. The bulk of these rents (81 percent) are from mineral fuels. Over 13 percent of total rents derive from timber harvest, while over 5 percent derive from minerals. Within the timber harvest figures, over twice the value of rents accrue to softwood harvest in high income countries compared with the rents on hardwoods in low and middle income countries.

Potential rents, principally on mineral fuels, make up the bulk of the rents in middle income countries and amount to over 5 times the rents in low income countries. However, as a percentage of GDP the resource rents exceed 2 percent in low and lower middle income countries, compared with low figures of 0.22 percent in upper middle income countries and 0.34 percent in high income countries.

The regional distribution of potential resource rents is also of some interest. South Asia and East Asia and the Pacific exhibit the lowest ratio of total rents to GDP, with moderately higher levels in Latin America and the Caribbean. Relative high ratios to GDP, over 2.6 percent, can be seen in Sub-Saharan Africa and Eastern Europe and Central Asia. Finally, the Middle East and North Africa have potential rents of over 8 percent of GDP owing to the high dependence on exports of crude oil in the region.

## 3.2 Charging for Services

Many services are currently being provided at little or no charge to their users. By charging for use of these services, developing country governments could at the very least reduce the budgetary burden they bear to provide them. We focus here on two such services: the recreational services provided by protected areas, and the management of municipal solid waste.

### Protected areas

Natural habitats provide a variety of benefits. Many important benefits are indirect: regulation of hydrological flows, for example. Others are derived from direct use, such as recreation and extraction. At present, many of these benefits are not priced, or are priced at very low levels. Better pricing for the use of these resources could generate significant financial flows, and help better manage the resources themselves. This section examines the potential for using user fees to capture part of the benefit that recreational users gain from the use of protected areas. The potential flow of financial resources from such measures is not huge, but it could at the very least make a significant contribution to offsetting the costs of conservation.[7]

Visitors receive significant benefits from the recreational opportunities provided by protected areas. In many cases, however, there is little or no charge for the enjoyment of these benefits. As a result, protected areas themselves are chronically short of funds for conservation and protection. Instituting user fees could generate funds that would help fill this budget gap. Although data are scarce, the evidence suggests that there is scope to substantially increase user fees in many protected areas. This would both generate revenue and provide a valuable management tool. It is important, however, to realize that user fees cannot be simply raised arbitrarily and without limit. Visitors will resist excessive fees and go elsewhere. Perhaps most important, the ability to charge high fees depends on offering higher levels of services than are currently available—one needs to spend money to make money. User fees, therefore, are not a blank check.

This section begins by reviewing available information on user fees charged in protected areas in developing countries. These include not only entrance fees but a growing array of ancillary fees. It then reviews the literature on visitors' willingness to pay for the recreational benefits provided by protected areas. A comparison shows that visitors appear to be willing to pay substantially more than they are currently charged. It is difficult to estimate how much additional resources might be generated by raising fees, as data on visitation rates to protected areas

**Table 3.5: Tourism receipts**

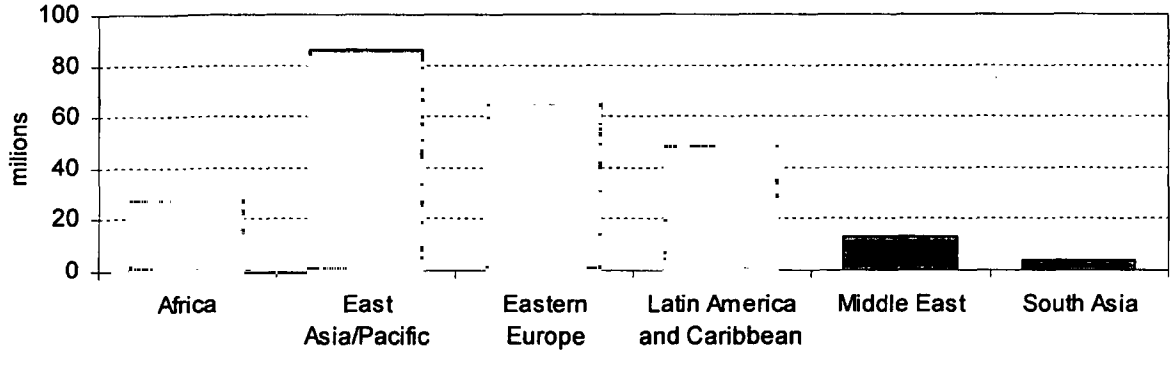
(as percent GNP and exports, and per capita)

| *Country* | *Percent GNP* | *Country* | *Percent Exports* | *Country* | *Per capita (US$)* |
|---|---|---|---|---|---|
| Maldives | 99.1 | Antigua and Barbuda | 83.3 | Antigua and Barbuda | 4,062 |
| Antigua and Barbuda | 83.3 | St. Lucia | 63.4 | Austria | 1,877 |
| St. Lucia | 45.9 | Maldives | 57.4 | Barbados | 1,788 |
| Seychelles | 31.0 | Barbados | 56.3 | St. Kitts and Nevis | 1,595 |
| Barbados | 27.4 | Dominican Republic | 48.6 | Malta | 1,578 |
| Jamaica | 26.7 | Seychelles | 43.2 | St. Lucia | 1,333 |
| St. Vincent and the Grenadines | 24.9 | St. Vincent and the Grenadines | 41.5 | Switzerland | 1,109 |
| Belize | 24.4 | Belize | 38.0 | Denmark | 728 |
| Malta | 21.8 | Grenada | 38.0 | Spain | 567 |
| Grenada | 18.1 | Jamaica | 37.0 | Belize | 540 |
| Gambia, The | 15.3 | Dominica | 25.8 | Maldives | 496 |
| Fiji | 14.8 | Egypt | 25.2 | Iceland | 496 |
| Vanuatu | 14.3 | Fiji | 24.3 | St. Vincent and the Grenadines | 495 |
| Dominican Republic | 13.9 | Gambia, The | 24.0 | Ireland | 463 |

*Source:* IFC/World Bank/MIGA, 2000.

**Figure 3.2: International tourist arrivals**

(1996-98 average)




*Source:* World Tourism Organization data.

is either scarce or non-existent in most countries. Some crude estimates are made based on international arrivals rates, to provide a very rough order of magnitude. The potential for the use of user fees as a management tool for protected areas is discussed next.

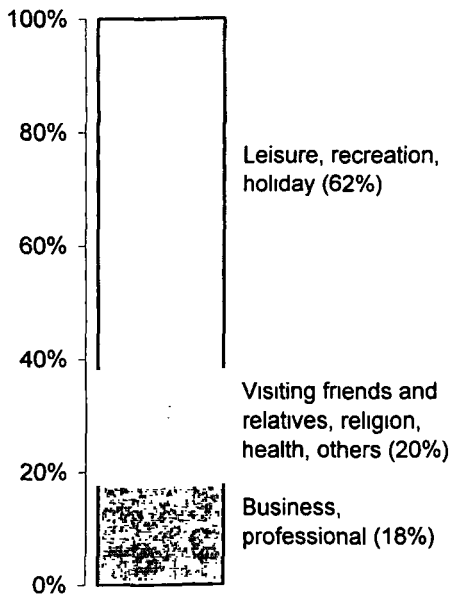
## Current use of user fees

Tourism has been growing rapidly worldwide. For many countries, it is already one of the principal income sources, and particularly valuable as a source of foreign exchange. Although events such as the September 11 attacks as well as local and regional problems can lead to sharp fluctuations in tourist numbers, the overall trend is expected to continue to increase. Table 3.5 presents some basic information on tourist numbers, while Figure 3.2 shows the number of arrivals in the different regions of the world.

The World Tourism Organization predicts a substantial increase in international tourist arrivals, with the percentage of tourists taking part in

"ecotourism" being one of the fastest growing segments of the industry (Figure 3.3).[8] Nature travel, which is a broader category than "ecotourism", has been growing at a 10 to 30 percent annual rate, according to several estimates (UNEP, 2001). The increasing environmental consciousness worldwide, nature films, and publications on specific destinations have been the most important factors affecting the increasing demand of the nature based tourism sector. Visiting protected areas is often a major attraction for a majority of leisure tourists.

**Figure 3.3: International tourism by purpose of visit, 1998**




*Source:* World Tourism Organization data.

A survey of protected areas in the early 1990s suggests that only about half of the world's protected areas charged entrance fees (Giongo and others, 1994). Table 3.6 shows the fees charged by parks and other protected areas in a selection of developing countries identified as popular ecotourism destinations in a survey of travel industry experts (Mercer and others, 1995; Weaver, 1999) and the availability of fee information, gathered from various travel guides and country's national park service or tourism promotion websites.

As seen in the above table, countries practice a variety of pricing strategies at national parks and other types of protected areas.

- **Multi-tiered pricing.** Most countries with well-developed nature-based tourism industries charge different fees to different categories of visitors. Higher fees for foreign visitors have been defended for several reasons, including that foreign visitors do not pay taxes to support the parks visited, do not bear the opportunity cost of preserving these natural resources, and that they demonstrate a higher willingness and ability to pay higher fees than national citizens.
- **Park-specific fees.** Several countries also differentiate fees across parks, sometimes to generate more revenue from popular parks, sometimes in an attempt to steer visitors to less popular parks and even out the impact of nature based tourism on these sensitive ecosystems. This may be the result of a national policy, such as the categorization of parks by the Kenya Wildlife Service or perhaps the result of a decentralized system where each park management authority decides on its own fees. A noticeable exception in this group is Costa Rica, which instituted a set of differential fees across parks in late 1995, but later adopted a uniform fee for all national parks.
- **Additional fees.** Another common pricing strategy at several parks and protected areas is to charge additional fees for vehicles, cameras, and guided tours. In India, for example, the actual cost of visiting a park may be two to three times the cost of the entrance fee at the gate. Entrance fees do not include the cost of activity related fees, such as a jungle walk or elephant ride, which can vary widely by park. While most parks charge generally low fees, there is one exception, at the popular Corbett Tiger Reserve. The reserve is divided into five zones, each with its own separate entrance fee. The most popular visited zone charges an entrance fee of US$8, valid for three days. In addition, there is a vehicle fee of US$3. In Madagascar, visitors are required to hire a guide to accompany them on their visits. Travelers' guides also note that while Uganda's national park entrance fees are lower than neighboring parks in Kenya and Tanzania, additional fees at Uganda's parks can make the total cost of a visit sometimes more expensive than in similar parks in Kenya and Tanzania.

**Table 3.6: Park fees in selected developing countries**

(US dollars)

| *Country* | *Entrance fees charged* | *Other fees charged* |
|---|---|---|
| Belize | $2–5 | |
| Costa Rica | $6 for national parks; $8–12 for private reserves; $105 Coco Island | Guided tours at private reserves $12–15; Coco Island also charges a $28 dive tax. |
| Guatemala | $5 in general | |
| Brazil | $1.65–3.30 (Lindberg and Halpenny 2001) | |
| Ecuador | $5–20 for most parks; $100 Galapagos Island | |
| India | $0.35–4.65 for most parks; $8+ for Corbett Tiger Reserve (see comments) | Most parks also charge a vehicle fee and a camera fee, so actual cost of visit is 2 to 3 times the entrance fee |
| Indonesia | $0.30 to $0.50 | |
| Nepal | $7 Royal Chitwan NP (largest and most visited park); $15 Sargomatha NP (base camp of Everest) | |
| Thailand | $5.30 most national parks; $2.10 Thai Elephant Conservation Center, at Doi Phukha NP | Less visited parks charge between $0.25 and $1.50 for admission and camping/hiking |
| Kenya | $15–27 depending on park category; $10 mountaineering fee | |
| Tanzania | $20–100 | |
| Uganda | $15 Bwindi , Mgahinga, Murchinson Falls and Queen Elizabeth NP; $7 for all other protected areas | $250 gorilla permit fee at Bwindi and Mgahinga in addition to entrance fee. Other additional fees apply (see discussion) |
| Benin | $8.12, Parc National de la Pendjari | $1.62 camera fee |
| Burkina Faso | $8.12, Parc National d'Arli | $1.62 required tour guide fee |
| Cote d'Ivoire | $3.25, Canoe NP ; $32.50, Tai NP | Fee for Tai NP includes lodging and park guide (required for visit) |
| Gambia | $2.63, Abuko Natural Reserve; Free, Kiang West NP | |
| Ghana | $10, Mole NP and Kakum NP | Additional $2–3 fee to hike specific trails |
| Niger | $6.50, Parc National du W | |
| Nigeria | $1, Yankari NP | $1 camera fee |
| Senegal | $3.25, Oiseaux du Djoudj NP, Alikolo-Koba NP and Delta du Saloum NP | $8.12 vehicle fee |
| Botswana | $26 entrance fee for most national parks | $6.50 camping fee, $2.15–10.80 vehicle fee |
| Namibia | $4.91, Etosha NP; $1.63–4.91, Namib-Naukluft NP (fees vary by gates) | $3.27 vehicle fee and $11.45–21.28 camping fee |
| South Africa | $1.96–10.64 | |
| Swaziland | $2.45–3.37 for most NP and nature reserves; $40.91 annual entry permit | $1 car fee, $13 game drive fee at some parks |
| Zimbabwe | $2 25 to $20 | |
| Madagascar | $7.95 (valid for 3 days) at National Parks; $7.95 Kaleta private reserve; $68–154 per person at Berenty private reserve (most visited reserve in the country) | $3.98–12.73 required guided tour fee at NP. |

*Notes.* Entrance fees reported for individual foreign adults in most cases. Not enough information to determine if fees are differentiated between foreigners and nationals in the following countries: Guatemala, Brazil, India, Indonesia, all West African countries, Namibia, South Africa, and Zimbabwe.

*Sources.* Central America: *Lonely Planet*; South America: *Let's Go—Peru , Ecuador, Bolivia* (2002 edition), Lindberg and Halpenny (2001) for Brazil ; Southeast Asia. *Lonely Planet—Southeast Asia* (October 2001 edition), *Let's Go—Southeast Asia* (2002 edition), *Let's Go—India and Nepal* (2002 edition); East Africa: *Lonely Planet—East Africa* (June 2000 edition), KWS website; West Africa: *Lonely Planet—West Africa* (April 1999 edition); Southern Africa: *Let's Go—South Africa and Southern Africa* (2002 edition); Madagascar: *Lonely Planet—Madagascar* (May 2001 edition).

- **Indirect fees.** Some countries use indirect taxes rather than user fees to capture revenue from visitors. For example, the Turks and Caicos Islands have established a 1 percent hotel and meal value surcharge that is earmarked to finance all marine parks. The revenue generated by this tax was about US$0.5 million in 2000—less than what is needed for the purpose (no entry fees are charged at MP). The Cook Islands have a US$10 airport tax, 20 percent of which is earmarked for the Environment Protection Fund (Lindberg and Halpenny, 2001). Belize's US$3.75 airport tax generates approximately US$500,000 a year, in addition to user fees charged at national parks and marine parks, to support protected areas (Spergel, 2001).

**Box 3.2: Using revenue from fees to improve park management**

In 1993 and 1995 the World Conservation Monitoring Center (WCMC) surveyed over 600 protected areas agencies throughout the world to obtain data on their budgets and staff level. The differences between developed and developing country statistics are significant. The mean budget for protected areas was US$2,059 per $km^2$ in developed countries and US$157 per $km^2$ in developing countries. Priority countries identified by the study for increased financial assistance, based on low budget inputs and high biological richness, included the countries in the Congo river basin region of Africa, the Indo-China Peninsula, and Meso-America. The extent to which user fees can be used to generate revenue for parks in these areas will likely depend on the amount of investment these countries can make to attract tourists.

If sufficient resources are available, parks can be an effective way to preserve biodiversity. A recently study of 93 protected areas in 22 tropical countries found that the most significant factors determining the effectiveness of parks in protecting biodiversity are the number of guards, demarcation of borders, and existence of compensation mechanism to the community. The assessment concludes that the amount of environmental degradation in parks are much lower than in the unregulated surrounding areas and therefore a modest increase in funding to these protected areas, to hire more guards, establish management plans, and so on, would increase the parks' effectiveness in protecting biodiversity.

*Sources:* Green and Paine, 1997; Bruner and others, 2001.

The use of fees, however, has been a rather underutilized tool (Laarman and Gregersen, 1996). The concept that 'nature' is a free good has often created the expectation of free access to national parks and protected areas. In the US, national park fees were prohibited by law for many years. While very little information on actual revenues raised from park fees is available for developing countries, we notice that in general, because these countries cannot afford to subsidize park recreation, tourism has become a large source of income for park agencies.[9] The South African National Park System, for example, recovers 80 percent of its budget costs from fees and tourism business it operates in parks (Eagles, 2001).

### Potential for higher user fees

A review of the economics valuation literature finds that foreign visitors are willing to pay (WTP) considerably higher amounts than the fees currently charged for visits at developing country natural areas (Lindberg and Aylward, 1999). For developing countries in particular, where most protected areas are viewed as 'paper parks' since they lack the funds to support a management strategy, user fees can become an important source of income to fund conservation, protection, and visitor impact activities. See box above.

Table 3.7 shows available estimates of foreign visitor willingness to pay for visits to protected areas in developing countries.

Even a casual comparison of these estimates to those of fees currently being charged suggests that there is considerable scope for increased use of user fees. However, several caveats must be borne in mind:

- **Restricted sample.** Almost all available estimates of tourist WTP have been made in a few flagship parks in a few flagship countries, such as Costa Rica, Kenya, and Ecuador. Whether these estimates are applicable to different parks, and to parks in different countries is an open question. It is likely that not all parks are sufficiently attractive to sustain fees as high as some of those shown here. Parks able to charge very high fees such as the Galapagos (Ecuador), Coco Island (Costa Rica), and some East African safari parks are exceptions rather

than the rule. Location, uniqueness of attractions, and other factors influence the demand elasticity and therefore the revenue raising potential of fees charged. Most attractions within a country would not command such high fees and likely have a limited potential to raise revenue for conservation.

- **Methodology.** These estimates are based on two main methodologies: travel cost methods (TCM), which derive estimates of WTP from observed behavior, and Contingent Valuation methods (CVM), which are based on survey methods. Both are subject to important methodological limitations (see Box 3.3). Moreover, the quality of their application has been uneven.
- **Interpretation.** Most studies have focused almost solely on valuation, and have not taken the further step of examining the impact of specific pricing mechanisms. They often provide little guidance to park managers and national governments making decisions on what fees, if any, to charge (Lindberg and Aylward, 1999).

**Table 3.7: Estimates of foreign visitor willingness to pay for protected area visits**

(1999 US$)

| *Site* | *Mean WTP* | *Survey question/design* | *Source* |
|---|---|---|---|
| Monteverde Cloud Forest, Costa Rica | $48.7 | Entrance fee implied by dividing per capita consumer surplus to travel to the country by the number of protected areas (TCM) | Menkhaus and Lober, 1996 |
| Poas Volcano and Manuel Antonio NP, Costa Rica | $24.6<br>$15 | WTP higher fee for improved infrastructure and services at the site (CVM) | Shultz and others, 1998 |
| Irazu Vocano, Poas Volcano, and Manuel Antonio NP, Costa Rica | $23.3<br>$23.1<br>$26.6 | Highest fee WTP to visit the site (CVM) | Chase and others, 1998 |
| Lake Nakuru NP, Kenya | $80–88 (TCM) | Recreational value of flamingo viewing, per visitor per day | Navrud and Mungatana, 1994 |
| | $134–140 (CVM) | Highest increase in total trip cost WTP to still visit Lake Nakuru | |
| Beza Mahafaly Special Reserve, Madagascar | $324–422 | Regression of visitation rate on airfare cost (TCM) | Maille and Mendelsohn, 1995 |
| Mantadia NP, Madagascar | $30.5 (TCM) | WTP for a 10 percent increase in quality at the park | Mercer and others, 1995 |
| | $72 (CVM) | WTP to add a visit to the park | |
| Komodo NP, Indonesia | $11.70 | WTP for access to the park (CVM) | Walpole and others, 2001 |
| Montego Bay MP, Jamaica | $21.4 first time visitors<br>$10.7 repeat visitors | WTP entrance fee to preserve area in its current state (CVM) | Dharmaratne and others, 2000 |
| Barbados NP | $37.4 first time visitors<br>$8.6 repeat visitors | WTP entrance fee to create a NP to protect area in its current state. Fees currently charged for activities in the proposed park area (CVM) | Dharmaratne and others, 2000 |

*Notes:* NP = national park
MP = marine park
WTP = willingness to pay
TCM = travel cost method
CVM = contingent valuation method

*Source* Adapted in part from Lindberg and Aylward, 1999, other sources as indicated.

**Box 3.3: Measuring visitor willingness to pay**

The **Travel Cost method** (TCM) was first applied by economist Harold Hotelling, who suggested that the use value of a recreation site can be inferred from the travel costs, that is, transportation, food, lodging, and so on, that one incurs to visit the site. This approach was later refined by taking into account that visitors from different distances may incur different cost and an inverse relationship between the number of visitors and the travel cost could be used to estimate a demand curve. From the estimated demand curve, an individual's willingness to pay (WTP) for a visit to a recreation site can be established. One of the advantages of the TCM is that it is based on observed market behavior. However, the survey methods used to elicit this information from visitors to a site may not draw a representative sample of the population in question. Also problematic, in the context of international tourism, is the fact that international travel fares do not necessarily vary in proportion with the distance from the site visited and how to attribute travel expenses of multi-purpose visits to one specific site visited (Menkhaus and Lober, 1995).

The studies surveyed that apply the TCM have used different approaches to overcome these difficulties. Maille and Mendehlson (1993) used of a sample of visitors from 11 different nations (so as to get some variation in airfare cost, the only independent variable in the regression equation estimated), but have been criticized for using a rather simplistic approach, based only on a small sample to only one site to generalize the value of all ecotourism to Madagascar. Other studies, such as that by Navrud and Mungatana (1994), attempt to separate the value of a trip to Kenya from the value of a visit to Lake Nakuru, and therefore infer the recreational value of viewing the lake's main attraction, the flamingos. It must also be noted that the TCM has been developed as an indirect way to infer the recreational value of a specific site in question and to take the estimated value of an annual visit to one site, as Menkhaus and Lober (1996) do, to infer an entrance fee for all parks in a country may be quite a stretch in the application of the methodology.

While the TCM method uses revealed information, the **Contingent Valuation method** (CVM) relies on stated information. The CVM uses visitor responses to hypothetical scenarios about fee types and amounts to infer how much they value a visit to a specific recreations site. The values reported are contingent on the specific scenario described and in order to elicit meaningful responses from those surveyed the scenario must be realistic and the survey question to elicit the information must be carefully designed. Due to the hypothetical nature of CVM, the values elicited are subject to a number of biases, which can be classified into three main types of biases: (1) incentives to misrepresent responses; (2) implied value cues, such as a starting point bias or range bias when using payment cards; and (3) scenario misspecification bias. The effects of those biases on survey responses have been widely debated in the economics literature, however, a recent expert panel has judged that by adhering to specific set of guidelines, these surveys can produce reliable starting points for valuation purposes. Using both the TCM and CVM has also been suggested, as a way to provide a check on the validity of the methods (Navrud and Mugatana, 1994).

## Potential for increased revenue generation

Substantial anecdotal evidence suggests that nature-based tourism has been increasing, but "it is not possible to comprehensively report on the total volume of recreational use in recent years or its change over time," apart from individual country reports (Eagles, 2001). Estimating the potential revenues that might be generated with user fees requires information on visitation to protected areas. Unfortunately such data either do not exist or are largely inaccessible. Most national tourism agencies do not keep statistics on the market sectors, such as nature-based tourism or park-based tourism. Most parks in developing countries are poorly designed to document visitation levels. Even when this information is collected, problems arise due to different procedures for collecting data at different entrances or across parks. Most parks do not have enough staff covering all entrances at all times of the day and all months of the year, and very often shoulder season information is poorly documented. The World Commission on Protected Area, a subgroup of the World Conservation Union, released the first guideline for measurement of public use of parks and protected areas in 1999.[10]

**Potential revenue generation from user fees.** In the absence of information on actual visitation rates to protected areas, we carry out some admittedly very crude calculation to gain a sense of the order of magnitude of financial resources that might be generated. If we assume

25 per cent of all international tourists visit at least one park or protected area during their visit and assume a nominal US$10 fee is charged, then the amount of revenue collected would be about US$600 million; a US$20 fee would generate about US$1.2 billion, assuming inelastic demand for visits (see below). Greater numbers of visitors would obviously result in proportionally greater revenues. These are clearly very crude estimates. In countries that draw a lot of visitors due to their natural attractiveness, the percentage of arrivals corresponding to visitors to protected areas may be much higher. A survey of visitors carried out by the Costa Rican Tourism Institute reports that approximately two third of all visitors to Costa Rica visit at least one national park (Ecotourism Society, 1998). Moreover, many visitors might visit more than one protected area, and thus pay user fees at several. As the studies cited in Table 3.7 show, some areas can probably charge fees substantially higher than US$10 or US$20. Under reasonable assumptions of number of visitors and reasonable fee levels, therefore, one can estimate the potential revenue that might be generated as being between about US$1 billion and about US$3 billion. Note that where fees are already being charged, some proportion of this amount is already being captured. These estimates are not estimates of net new financial resources that might be generated, but of the gross total financial resources that might be generated.

**Elasticities.** In order to determine the impacts of increasing user fees at national parks and protected areas, estimates of the price elasticity for various types of recreational activities at these sites are needed. Previous research suggests that, in most cases, the demand for nature based tourism is price inelastic. One reason one can expect demand to be inelastic is that fees are a relatively small component of the overall trip price. The uniqueness of the site visited will also affect the elasticity–the more substitutes that are available, the more responsive visitors are likely to be to price changes. Table 3.8 shows some estimates of price elasticity of demand for visits to protected areas.

### User fees as visitor management tools

The increasing number of visitors to protected areas and other sensitive ecological habitats have been a cause of concern due to the negative environmental impacts that may result. About half of Manuel Antonio National Park, one of Costa Rica's most popular national park, has been closed to tourists in an attempt to protect the ecosystem that is home to one of the last surviving

**Table 3.8: Estimates of price elasticity of demand for visits to protected areas**

| *Location* | *Elasticity estimates* | |
|---|---|---|
| **Costa Rica** | Chase and others (1998) | Lindbergh and Aylward (1999) |
| Poas Volcano | –2.87 | –0.051 |
| Irazu Volcano | –1.05 | –0.296 |
| Manuel Antonio | –0.96 | –0.238 |
| **Bostwana** | –1.35 | Lodge users |
| | –0.68 | Campsite users |
| | –0.93 | Both |
| **Kenya** (Lake Nakuru) | –0.17 to –0.84 | Foreigners |
| | –1.77 to –2.99 | Residents |

*Notes·* An elasticity of -2.0 would imply that a 10 percent increase in user fee would result would reduce the number of visitors by 20 percent, meaning that demand is very responsive to a price change and therefore total revenue would fall. Elasticity values closer to –1.0 would mean that the percentage increase in price is proportional to the percentage decrease in visitor numbers (so total revenues raised from fees would not be significantly affected), while an elasticity closer to zero would mean that demand is not very responsive to price and therefore increasing the fee would significantly increase revenues.

The Chase and others elasticity estimates are based on the CV method, while the Lindberg and Aylward estimates are based on actual data.

populations of spider monkeys in that country. Visitors' WTP for a visit to the park is several times the current US$6 fee charged. Economic theory would suggest an increase in the entrance fee as one mechanism to control visitation levels. However, as will be discussed in the case study section below, political opposition to fee increases often undermine a government's ability to take advantage of this tool. There is also the possibility that when confronted with difficult decisions trading off additional revenue for reduced visitation levels for ecosystem protection (that is, when demand is elastic), park management agencies or other government agencies that depend on the revenues generated by fees will give higher priority to budgetary considerations.

In other cases, higher fees have not decreased the number of visitors. For example, the Galapagos Islands have substantially increased fees to foreign visitors since the 1990s and have continually received higher number of foreign visitors.[11] It has been suggested that visitation levels on the archipelago have reached critical levels. The unwillingness to further increase fees may be in part due to the significance of tourism sector, which employs approximately 80 percent of the people living on the islands and generates 60 percent of all tourism revenues earned by the

**Table 3.9: Major environmental impacts of tourism**

| *Pressures on natural resources* | *Pressures on other local resources (energy, food, raw materials, etc)* | *Pollution and waste* | *Social and cultural pressures relating to conservation/sustainable use of biodiversity* |
|---|---|---|---|
| **Land and landscape:** sand mining, beach and sand dune erosion, soil erosion, urbanization, road and airport building, resulting land degradation, loss of wildlife habitat, landscape deterioration.<br>**Marine resources:** recreational impact (scuba diving, snorkeling, sport fishing), damage to coral reefs and subsequent impacts on coastal protection and fisheries.<br>**Atmosphere:** high energy use by tourism facilities and transportation.<br>**Freshwater:** overuse of critical water resources by hotels, swimming pools and golf courses; this is of particular concern in regions such as the Mediterranean (where water is scarce and tourists consume over 200 liters a day). | Harm to wildlife **habitat** and habitats, with associated biodiversity loss.<br>**Biological resources:** disruption of wildlife habitats, clearance of vegetation for tourism development, increased pressure on endangered species due to trade and hunting, increased demand for fuelwood, forest fires.<br>**Ecologically fragile areas such as rainforests, wetlands, mangroves, coral reefs, sea grass beds:** if not properly planned and managed, nature tourism threatens the world's most ecologically fragile areas including parks and natural World Heritage sites. | **Land:** solid waste and litter (tourists produce on average around 1kg of waste a day).<br>Freshwater: pollution by sewage.<br>**Marine waters and coastal areas:** sediment run-off, pollution from land-based hotels and marinas, wasted and litter associated with marine sports and cruises (in 1995, it was estimated that cruise ships in the Caribbean alone produced over 70,000 tonnes of waste per year).<br>**Air:** at local level, air pollution from transporting tourists; global impacts, especially from carbon dioxide emissions, relating to energy use in transportation, air-conditioning and heating of tourist facilities, etc.<br>**Noise:** from ground and air transportation. | **Social and cultural impacts:** disturbance of local way of life and social structures, changes in traditional practices that contribute to conservation (including conservation of biodiversity).<br>**Adverse impacts on livelihoods:** lack of benefit sharing with those who bear both human and environmental costs.<br>**Resource use conflict:** competition between tourism and local populations for limited water, sanitation and energy resources, competition with traditional land uses (especially in heavily used areas such as coastal zones). |

*Source:* UNEP, 2001.

Ecuadorian government (Honey, 1999). Critics have pointed to the increased dependence on the tourism economy, which has slowly replaced traditional productive activities of the island inhabitants, as well as generated increased migration and construction in the region (Parra-Bozano, 2001). Therefore the use of entrance fees for visitor management is somewhat constrained by other political and economic concerns, that may not always have conservation and protection as its primary objectives. Table 3.9 summarizes some of the environmental impacts of tourism often discussed in the literature.

## Case studies

Three case studies, based on countries for which better data are available, serve to illustrate some of the potential and some of the difficulties involved in increasing user fees for protected areas. It should be stressed that all three of these case studies are based on countries with well-developed nature-based tourism industries. As such, both the numbers of visitors involved and the fees that they are able to charge will be substantially higher than in most other countries. Moreover, all three of these countries devoted substantial amounts of resources to achieving their current status, both in developing tourism infrastructure and in marketing themselves to potential visitors. Other countries attempting to follow in their footsteps will not be able to do so overnight, nor for free.

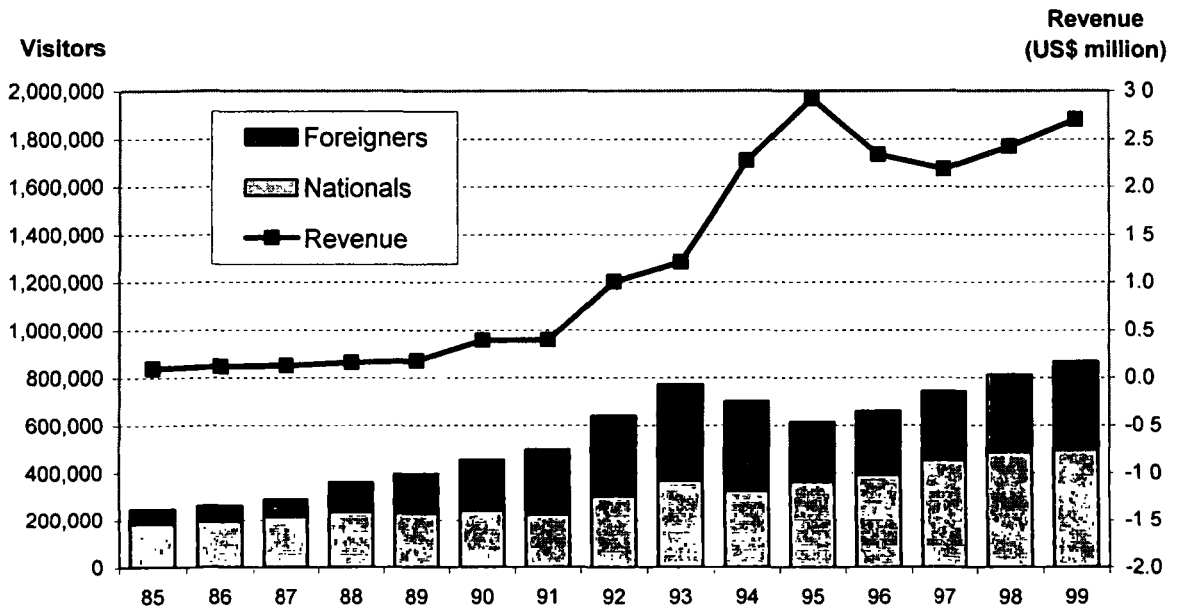
### *Costa Rica*

Costa Rica has established itself as Central America's 'special jewel', a stable democracy with a reputation for its enlightened conservation policies. National parks cover 12 percent of the land area, and forest reserves and Indian reservations bring the total amount of land protected to 27 percent. The country's natural attractions include active volcanoes and tropical forests (cloud, dry, and moist), which provide habitat for a variety of wildlife, including 850 bird species, many types of monkeys, sloths, armadillos, jaguars, and tapis. The high density of biodiversity attracts nature lovers from all over the world.

The booming tourism industry, however, requires spending on infrastructure and to maintain quality at the most visited sites. The government of Costa Rica will reportedly spend US$0.8 million to improve facilities at the Liberia airport, in order to attract more scheduled flights to the northwestern region and relieve the main airport in the capital city. The privately run San Juanita International Airport in San José will receive US$120 million in loans from the World Bank and other international banks to increase the number of gates from 6 to 16 and continue improvements at the facility—a much needed investment for a country of 3.7 million that wishes to accommodate 1 million visitors a year. Investments will also be made to triple the size of Manuel Antonio, one of the most popular parks with about 150,000 visitors a year. The additional area will allow for more dispersion of visitors along the park's pristine shoreline and along its overused trails.

In the 1990s, international donations of funds to protected areas decreased. Faced with a financial emergency that required a reduction in the budget allocated to park services, Costa Rica began experimenting with increases in entrance fees to national parks. While park fees changed only slightly in the early 1990s, in September 1994 Costa Rica dramatically increased its fees to all national parks from US$1.57 to US$15 for foreigners. Revenues nearly tripled, but foreign visitor numbers fell by approximately one third. Political opposition to the new fees was fierce, particularly from the tourism industry. Despite the substantial increase in the amount of revenues generated, Costa Rica changed its fees again in 1995, creating a complicated system of differentiated fees. A ticket at the gate for foreigners remained at US$15 for all national parks, but tickets purchased in advance cost only US$10 for the most popular parks and US$7 and US$5 for parks with medium and low visitation rates. A pass, allowing visits to up to four national parks was also available for US$29. Tour operators paid only US$5 for bulk ticket purchases. Political opposition remained strong, especially as a black market for tickets developed. In addition, the inability of the Park Services to handle advance purchases led Costa Rica to set a US$6 entrance fee for foreigners at all national parks in April of 1996. Fees for residents remained at about US$1. Foreign visitation rates have increased by an average of 10 percent every year after the fees were lowered to US$6. Visitation by nationals has also

**Figure 3.4: Visitors and revenue in Costa Rica's national parks**




*Sources*: Visitor numbers from Eagles (2001), revenue calculated by the authors.

been steadily increasing, although at a declining rate, over the past five years.[12]

Costa Rica's three most popular protected areas, Poas Volcano, Manuel Antonio, and Irazu Volcano, have been the subject of several valuation studies (see Tables 3.7 and 3.8 above), allowing the consequences of fee increases on revenues and visitation rates to be examined more closely. In 1996, these three parks accounted for almost 60 percent of all visits to protected areas (Weaver, 1999). Using the elasticity estimates obtained from actual visitation data, Lindberg and Aylward estimate that an increase in the entrance fee from US$5 to US$10 would increase revenue at these three parks from US$0.9 million to US$1.6 million, or slightly less than doubling. If fees increased to US$15 (still below the values suggested by WTP studies), revenues would increase to US$2.3 million. Whether such fee increases are feasible, however, is another matter. The previous attempt to increase fees to US$15 in 1995 was met with resistance by the tourism industry and foreign visitors alike. Unless visitors see an improvement in the quality of a visit to these sites to justify the higher fees, visitation rates may fall and the tourism industry that depends on their visits may suffer substantial losses. Competition from other travel destinations may act as a constraint on increasing fees to the levels suggested by valuation studies.

*Belize*

Tourism is one of the most important sectors of Belize's economy, accounting for 18 percent of GDP and 25 percent of foreign exchange earnings in 1999. It is estimated that tourism provides one in four jobs (Ceballos-Lascurain, 2001). Belize's marine parks have been the country's major tourist attraction. The Meso-American Caribbean Reef, the fourth largest reef system in the world and home to a broad range of marine life, has some of the best diving in the world. Blue Hole, Half Moon Caye, and Turneffe Islands are the only three coral atolls in the western hemisphere. Although travel inland is difficult because the country has only three paved roads, the dramatic Mayan ruins and 'ecolodges' in the dense jungle also attract many visitors. While only 28 percent of tourists visited a national park, 60 percent reported participating in snorkeling and 30 per cent in scuba diving (C. Brown, 2001).

The Conservation Division of the Forest Department, which oversees most of Belize's national parks and protected areas, receives no

**Table 3.10: Visitor numbers and fees for selected Belizean parks and protected areas**

| Park | Fee for foreign visitors (US$) | Visitors 1997 | Visitors 1998 | Visitors 1999 | Estimated Revenue[c] ('000 US$) |
|---|---|---|---|---|---|
| Guanacaste NP[a] | 2.55 | 2,582 | 2,567 | 2,788 | 5,322 |
| Crooked Tree WS[a] | 4.00 | 2,074 | 1,484 | 1,619 | 4,857 |
| Cockscomb Basin WS[a] | 5.00 | 3,488 | 4,078 | 3,603 | 13,511 |
| Blue Hole NP[a] | 4.00 | 5,017 | 7,098 | 6,162 | 18,486 |
| Half Moon Caye NM[a] | 5.00 | n.a. | 7,310 | 7,940 | 29,775 |
| Belize Zoo and Tropical Education Center | n.a.[d] | 37,029 | 40,855 | 39,838 | -- |
| Mountain Pine Ridge | n.a.[d] | 32,262 | 17,896 | 25,835 | -- |
| Community Baboon Sanctuary[b] | n.a.[d] | 4,931 | 4,676 | 4,011 | -- |
| Hol Chan Marine Reserve | 2.50 | 41,380 | 38,737 | 37,954 | 71,164 |
| **Total** | | | | | **143,115** |

*Notes:* [a] Managed by Belize Audubon Society

[b] Managed by an association of village landowners, earning revenue from renting rooms or selling meals to tourists.

[c] Assumes three quarters of all visitors are foreign visitors

[d] There is a US$10 night tour fee at the Belize Zoo, as well as other activity fees (canoeing trips, lodging, etc) that raise revenues for the zoo, in addition to membership/donation fees.

NA = Not applicable.

*Source:* C. Brown, 2001, Belize Audubon Society, and travel guides; revenues from own calculations.

governmental appropriation. It did receive US$118,000 to pay the salaries of four employees, some administrative costs, and some equipment maintenance in 2000-2001. Parks managed by the Conservation Division do no have management plans, infrastructure, or onsite management, therefore visitors may enter and leave as they please, even though in some protected areas public access is prohibited (C. Brown, 2001). Parks and protected areas in Belize do receive financial support from the Protected Areas Conservation Trust (PACT), but competition for funds is fierce and grants are limited to US$17,500. PACT also receives 20 per cent of revenues earned by parks managed by other NGOs, such as the Belizean Audubon Society (BAS). BAS manages two national parks, two wildlife sanctuaries, two natural monuments, one nature reserve, and one private nature reserve. BAS is authorized by the government of Belize to charge and collect entrance, concession and other activities fees. The remaining profits that are not allocated to PACT are spent on managing the protected areas and building infrastructure and security for these areas.

### *Kenya*

Kenya is the heart of the African safari country, with the most diverse collection of wild animals on the continent. The Masai Mara, one of the most popular game parks in Kenya, is a 320 $km^2$ reserve where visitors can witness the migration of some 2 million wildebeest, zebras, and gazelles in their pilgrimage for food and water. From the vast plains of the south, to the bamboo forest of the Mount Elgon and Mount Kenya, and the beaches on the east coast of Mombasa, Kenya offers a variety of attractions for tourists. Kenya got an early start in the development of nature tourism and ecotourism, relative to its neighbors, such as Tanzania and Uganda, and by 1987 tourism had become Kenya's number one foreign exchange earner.

The 1990s, however, have not been a good decade for tourism in Kenya. The number of tourists to East African fell during the Persian Gulf War in the early nineties. Kenya also began to face competition from Tanzania, Uganda, Zimbabwe, and South Africa. Kenya's share of

the African tourism market fell from 9.3 percent in 1989 to 7.1 percent in 1993, and its receipts dropped from US$420 million to US$413 million during the same period. Political unrest, crime, and the bombing of the US embassy in the late 1990s continued to hurt the tourism industry (Honey, 1999). The government's recent decision to require visas from all incoming visitors, which costs tourists US$50 in addition to the US$40 departure airport tax, has also had an impact on the number of tourists. Safari operators, the hotel industry, and airline employees have all complained about the new law, that the difficulty in obtaining applications overseas, and slow-moving lines at entry points.

Kenya has received a considerable amount of foreign aid in order to develop its tourism industry, which among other things required financial support for the creation and maintenance of national parks and game reserves. Following a policy that wildlife must 'pay its way' the government set up experimental programs at the Masai Mara Game Reserve and Amboseli National Park to address poaching, hunting, and cropping in the private and communal lands around protected areas. With 60 to 75 percent of its wildlife living outside national park boundaries, it was necessary to elicit community participation in the management of these areas, as well as to provide compensation for restrictions imposed on the use of resources belonging to local communities.

The Maasai are pastoralists who have traditionally grazed and watered their herds on the lands surrounding the Maasai Mara and Amboseli. In 1961 the government of Kenya recognized that "it was imperative that these people come to see wildlife as a positive economic benefit, worth protecting" and established and reached an agreement that these and a few other reserves would be managed by the local district or county councils rather than the central government (Honey, 1999, p. 309). The income derived from tourism by the community was viewed as the key factor in reducing poaching activity and contrary to the situation in the rest of Kenya, the number of elephants and rhinos were on the rise.[13] As one elderly Maasai put it, the agreement to share revenues with the local community acted as if "the national park has gained two thousand extra pairs of eyes to help watch out for poachers" (Honey, 1999, p. 319). However, problems developed because of a lack of transparency on how much and where revenues generated were spent and corruption. As the number of tourists began to fall in the 1990s, the deterioration of tourism infrastructure due to a lack of investment became evident. Disputes over the distribution of revenues from park entrance fees and tourist operations escalated. The quality of tourists' experience declined, while tourists themselves were becoming more environmentally aware and more discriminating in their choice of destination (Honey, 1999).

## Summary

**Potential for resource mobilization.** Once widely neglected, the potential for resource generation from protected areas has been the subject of increasing attention in recent years. Throughout the world, user fees at protected areas have been instituted and/or raised. At least some of the potential for revenue generation from this source is already being exploited, although studies indicates that scope remains for more. Nevertheless, several caveats must be borne in mind. First, there is a need for realism on how high fees can be raised. Although visitor price elasticities are likely to be low, they are not zero. In particular, they depend heavily on the availability of substitutes (both in-country, in other countries). Only the most unique protected areas are likely to support very high user fees.[14] It should also be borne in mind that user fees are only part of the benefits provided by tourists to a nation's economy. Increasing park revenue by higher user fees may cause shortfalls elsewhere, due to lower visitor numbers. Unfortunately, few studies on the net effect of park pricing policies exist. Second, high user fees can only be sustained if: (1) the protected area itself remains in good condition, which may require significant expenditures on conservation activities; and (2) supporting infrastructure (roads, hotels, and so on) exists to handle the visitors. As in many things, you have to spend money to make money. These factors together suggest that user fees from protected areas are unlikely to provide a significant income source for any country. They could, however, provide a great deal of the financing requirements for the protected area systems themselves, thus reducing that burden on the government's budget. For this to occur, however, the revenue generated from user fees needs

to remain in the protected area system rather than being siphoned off to the central treasury, as is usually the case.

**Direct incentive effects.** The possible impact of higher user fees on visitation also creates the possibility of using prices as tools to encourage or discourage visitation to particular areas. To date, this potential remains under-utilized. User fees have seldom been used with the main purpose of visitor management. Restrictions on where visits are permitted within a park and on the range of activities permitted, and limits on the total number of visitors or on visitation at particular times of the year remain the preferred approaches. These approaches sacrifice considerable potential revenue, however.

**Poverty implications.** A frequently cited objection to higher user fees for protected areas is that they would limit access by poorer sectors of society. As with many other such arguments, however, the truth is that the bulk of the benefits are captured by better-off members of society, as they are the ones who typically take advantage of the recreational opportunities offered by protected areas. Moreover, two-tiered pricing systems or off-peak pricing schemes could be used to guarantee access to target groups. The other important poverty dimension of protected areas is that they were often created by fiat, and often cut off local communities from resources they had depended on. Higher user fees will not change this, but offer the potential to provide resources to compensate local communities for the resources they have lost. Again, this depends on the resources generated by user fees remaining in the protected area system and being used for this purpose. Such efforts would not only have an equity dimension, but also a practical one: by increasing the benefits that local communities derive from protected areas, it would reduce their incentive to encroach upon them.

## Municipal solid waste

Inefficient collection methods, insufficient coverage of collection systems, and improper disposal of municipal solid waste are important threats to environmental quality and public health in developing countries. Although pollution control and environmental management have historically been given little or no attention in many developing countries, environmental quality in many urban areas in developing countries has deteriorated to such a degree that it can no longer be ignored (Diaz, 2001). In cities such as Dar es Salaam, mismanagement of solid waste is increasingly becoming a public health threat and environmental burden (Mato, 1999).

This situation is driven, among other factors, by financing problems. Solid waste management consumes substantial financial resources, accounting for an important share of municipal expenditure across the developing world. At the same time, cost recovery levels are very low. The main consequence of the resulting financial constraints is the lack of coverage of the collection system, which affects primarily to the poorer sectors of the population. In principle, cost recovery could be enhanced in several ways. Although poor households may not be willing to pay the full cost of basic waste collection and disposal services—in contrast to services such as drinking water—there is scope for improvement in the generation of revenues to finance expanded service.

### Municipal solid waste management in developing countries

Municipal Solid Waste Management (MSWM) is a major responsibility of local government. MSWM encompasses the functions of collection, transfer, treatment, recycling, resource recovery, and disposal of municipal waste. Municipal solid waste is defined to include refuse from households, non-hazardous solid waste from industrial, commercial, and institutional establishments (including hospitals), market waste, yard waste, and street sweepings (Schübeler and others, 1996).

Although it is essential to environmental protection and public health management, solid waste management is highly unsatisfactory in most developing country cities. Although much of the solid waste generated is collected and disposed of through collected incineration or burial in sanitary landfills, substantial amounts continue to be burned in the open or dumped haphazardly. Such practices are putting an increasing pressure on land, air, and water quality, and posing threats to human health. These threats

will be exacerbated by projected increases in total waste generation. In developing countries, municipal solid waste is often disposed of with ash, human waste, medical waste, and industrial waste. For this reason, municipal solid waste in developing countries is sometimes more dangerous to human and ecological health than it is in industrialized countries (Beede and Bloom, 1995).

Most MSWM systems have three basic components:

- **Collection and transport:** gathering and removing MSW from its point of generation to safeguard public health, limit congestion, and preclude unpleasant odors and aesthetically offensive sights.
- **Processing:** transforming the physical characteristics of MSW by recycling, composting, burning, or compacting in order to reduce the threat it poses to human health and ecosystems, improve its disposability, and possibly capture value from the waste.
- **Disposal:** isolating and containing the residual waste that is left after processing.

Some MSWM systems ignore or incompletely implement one or more of these key components. Typically, developing country cities only collect 50 to 70 percent of MSW (Cointreau-Levine, 1994). Landfill disposal usually involves discarding the waste in open dumps (Bartone and Bernstein, 1993) (see Box 3.4). This practice is inadequate because sitting landfills in areas with a high water table or constructing them without clay liners may lead to the formation of leachate that can seep out of the landfill and pollute groundwater and surface water. To the extent that hazardous waste is present in the MSW stream, leachate could seriously contaminate the water supply.

MSWM in developing countries displays three other important characteristics. First, it is labor intensive, partly because labor is relatively cheap and capital relatively expensive, and partly due to over-hiring for political reasons. Second, recycling is widespread. Labor-intensive collection and processing of recyclable materials are found throughout the developing world. Households bring their recyclables to redemption centers, and small-scale entrepreneurs purchase recyclables door to door. The Zabbaleen in Cairo, for example, provide collection services in exchange for the opportunity to extract recyclable materials and food waste for resale. In Manila, collection workers routinely take with them on their routes scavengers who pick out and sell recyclable materials and share the proceeds with the collection workers. And scavengers sift through waste at transfer stations and final dumpsites. It is estimated that about 7,000 scavengers work at the MSW dumps in Manila, 8,000 in Jakarta, and 10,000 in Mexico City (Cointreau-Levine, 1994). Third, MSWM is often inefficient. In addition to the excessive labor force in public service providers, collection techniques are inefficient. For example, when crews sweep up discarded food waste in the streets of the old quarters of Moroccan cities residents, some of it spills back onto the streets; and in Shanghai, uncovered collection trucks also spill some of their loads back onto the streets (Beede and Bloom, 1995).

**Box 3.4: Regional differences in landfilling practices**

In many **African** countries, much of the basic infrastructure for solid waste management has yet to be established. The majority of the African countries use open dumps to dispose of solid waste. While decision-makers in the region are aware that their countries have to upgrade open dumps to sanitary landfills, this is not regarded as a priority in most countries. At the national and municipal levels, few countries have taken steps towards constructing, maintaining, or operating landfills.

Countries in the **East Asia and Pacific** region are actively investing in solid waste projects, thanks to partnerships with lenders and donors. Landfills in the region are being upgraded from open dumps to sanitary landfills. While most capital cities in the region are serviced with some level of landfill practice, the majority of the waste in the region is still disposed in open dumps.

*Source:* Johannessen and Boyer, 1999.

There are limited economies of scale available in MSW collection. Although urbanization raises the concentration per square meter of MSW, which may lower the average cost of collection, it also tends to increase the cost of MSWM because low-income urban areas often have narrow or congested streets that cannot support large collection trucks (Cointreau-Levine,

1994). Disposal and treatment seem to display greater economies of scale associated with transfer stations, landfills, and other MSW management facilities. This suggest that collection services are best provided on a decentralized basis, whereas it may be more cost-effective for disposal and treatment facilities to be consolidated at a regional or metropolitan area level (Bartone and Bernstein, 1993).

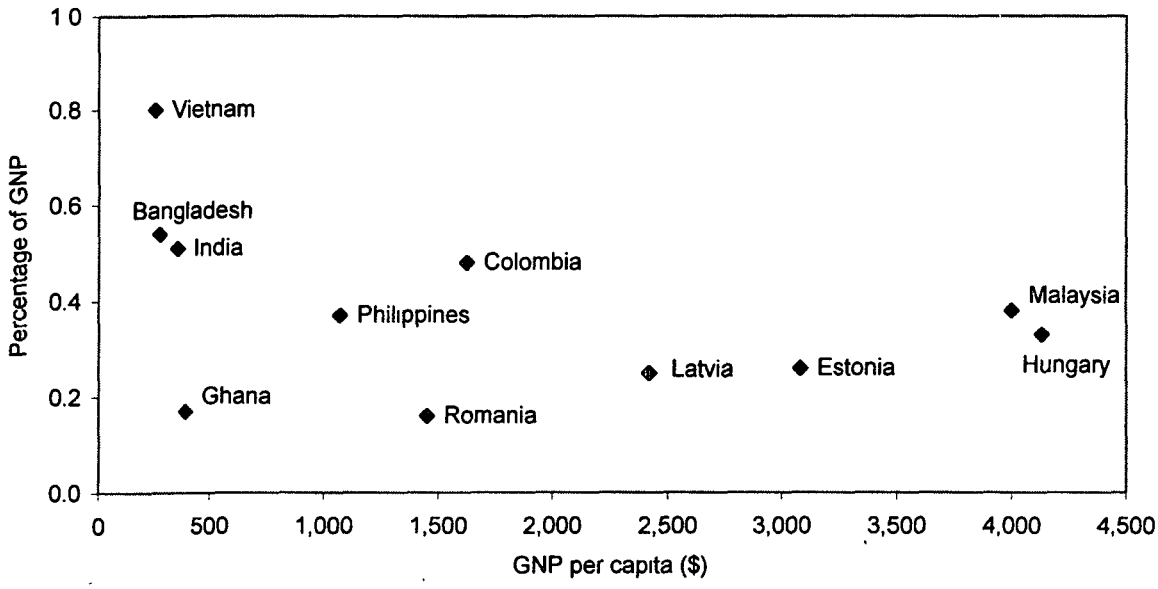
The public health implications of inadequate MSWM are important. Poor collection or disposal practices attract and promote the breeding of insects, rodents, and pathogens that can cause and transmit diseases, particularly several of the diseases in the tropical cluster: schistosomiasis, South American trypanosomiasis, and Bancroftian filariasis (Beede and Bloom, 1995). The burden to developing countries from these diseases alone was 8 million disability-adjusted life-years in 1990, or about two life-years per 1,000 people. An estimated 25 percent of these might have been averted through "feasible interventions" (World Bank, 1993), such as covering the waste delivered to a dumpsite with fifteen to thirty centimeters of soil at the end of each day. Although the direct contribution of inadequate MSWM to the burden of disease in developing countries is modest, the indirect contribution is larger. For example, waste may clog open drains, creating breeding grounds for malaria- and dengue-transmitting mosquitoes, or causing floods in rainy seasons, which may increase human contact with pathogen-infected feces contained in the waste (Beede and Bloom, 1995). Losses in productivity due to a decline in public health have reached alarming levels in some developing countries (Hemelaar, 1999). In addition, improperly vented dumps can cause explosions and fires.

Solid waste problems are growing throughout the developing world (Beede and Bloom, 1995). This is partly because of population growth and partly because rising per capita incomes have led to rising per capita generation of waste. Urbanization combined with rising per capita income in many developing countries, have led to burgeoning concentrations of solid waste in metropolitan areas. These trends drive up the average cost of collection, processing, and disposal and strain the administrative capacities of city governments.

### Financial burden of MSWM in developing countries

Solid waste management represents a heavy financial burden for local governments in developing countries. MSWM expenditures account for an estimated 0.4 percent of GDP (World Bank,

**Figure 3.5: Public expenditure in MSWM, 1994-95**




*Source:* Elaborated from data in World Bank, 1999c.

1999c). In most developing countries, the management of municipal solid waste has traditionally been a primary responsibility of local governments. In many medium-sized municipalities, MSWM can use between 20 and 50 percent of the total municipal budget (Diaz, 2001; World Bank, 1999c; Schübeler and others, 1996).

Municipalities in low and middle income countries allocate the majority of their solid waste management budget to collection and transportation services. Collection and transfer make up 70 percent of the cost, of which 80 percent is labor costs (World Bank, 2001b). Final disposal costs are minimal because disposal is usually accomplished through open dumping.

Cost recovery levels from service users are very low. Analysis of the financial records of many developing country cities shows that current practices for cost recovery for solid waste are very weak. Recovery rates of less than 10 percent are not uncommon (World Bank, 2001b).

Government cost-sharing arrangements include matching grants from higher levels of government and general fund subsidies from local governments. Matching grants are used to induce local governments to provide a socially and environmentally desirable level of solid waste management, while general fund subsidies recognize the public good and equity aspects of solid waste management.

Two factors complicate the task of estimating the size of the implicit subsidies embedded in MSWM services in developing countries. As in other cases, the absence of detailed statistical data is an important constraint. In addition, MSWM has both private and a public (environmental and health externalities) good components. The public good component justifies the existence of subsidies in MSWM, in the form of public sector financing of the service. Thus any discussion of subsidies in MSWM must refer exclusively to the private good component of MSWM services. Given these constraints, some crude assumptions are needed to arrive at a ballpark figure. First, we assume as first cut that the private and public good components of MSWM each represent 50 percent of the benefits provided by MSWM services. We also assume that 20 percent of municipal budgets is spent in MSWM and that 15 percent of these costs are recovered. We further assume that 15 percent of MSWM expenditure is undertaken by the private sector (Hanrahan, pers. comm., 2002). Combining regional data on muni-

**Table 3.11: Implicit subsidies in municipal solid waste services, 1999**

| | | *MSWM subsidies* | | |
|---|---|---|---|---|
| Region | *Costs (billion US$)* | *Total (billion US$)* | *Per urban citizen ($)* | *Share of GDP (%)* |
| Middle East and North Africa[a] | 1.6 | 0.6 | 3.8 | 0.10 |
| Sub-Saharan Africa[b] | 0.9 | 0.3 | 1.2 | 0.10 |
| Asia Pacific[c] | 44.3 | 15.5 | 12.6 | 0.70 |
| Latin America and the Caribbean | 8.0 | 2.8 | 7.2 | 0.14 |
| Eastern Europe and Central Asia[d] | 24.6 | 8.6 | 22.6 | 1.03 |
| **Total** | **79.4** | **27.8** | **11.4** | **0.47** |

*Notes:* [a] Excludes Iran, includes Sudan

[b] Excludes Sudan

[c] Includes Iran, excludes Mongolia, Lao, and Cambodia

[d] Excludes Turkey, includes Slovenia, Mongolia, Lao, and Cambodia.

Assumptions: (a) 20 percent of municipal budget is spent in MSWM, (b) 15 percent cost recovery rate, (c) 15 percent expenditure in MSWM is undertaken by the private sector, (d) MSWM is 50 percent a private good and 50 percent a public good.

*Source* Authors' calculations, using data on urban population and municipal expenditure from UNCHS, 2001.

cipal expenditure and urban population from UNCHS (2001) with those assumptions, we estimate implicit subsidies embedded in MSWM management in developing countries to be about US$27 billion per year (see Table 3.11).

### Improving financial sustainability

There are two ways of improving the financial sustainability of MSWM services: phasing-out what we have termed "MSWM subsidies" by improving cost recovery, and reducing and controlling costs. We briefly analyze these measures, along their poverty, environmental, and incentive effects.

**Enhancing cost recovery.** Any effort to enhance cost recovery encounters the obstacle of low willingness to pay for improved MSWM service. This may be either because households place little value on improved management or because they do not believe that the supposed levels of service will be achieved (Beede and Bloom, 1995). The costs of MSWM can be recovered either from user charges or general revenues. There are three types of user charges: "garbage taxes", volume or weight based fees, and tipping fees. The direct collection of garbage taxes is very expensive (so they are usually linked to property taxes or to utilities), while volume or weight based fees require a very sophisticated refuse collection system and lead to dumping behavior. Other potential sources of revenues are: property taxes, business licenses, utility surcharges, and general fund subsidies (including transfers). These other methods do not comply with the polluter pays principle, and their incentive effects are limited. Choosing among them depends upon the relative importance of various criteria: whether revenues are adequate and easily collected, whether the polluter pays for the damage inflicted, whether the option is politically acceptable, and whether payment of the revenue can be enforced (World Bank, 2001b). Table 3.12 examines the available options.

In over 90 percent of cities worldwide where there is a garbage fee, it is collected with the property tax bill, usually as a separate item (Bartone, pers. comm., 2001). Since property taxes are so weak in developing countries, the cost recovery rates are quite low. A better practice is to collect garbage fees with another utility bill (electricity is best) so that the threat of cutoff is credible. For example, in Colombia and Eastern Europe, some cities have a single utility bill that covers multiple services such as water, sewerage, telephone, electricity, and solid waste (Bartone, pers. comm., 2001). There is little economic justification for linking garbage services to other utilities, but it is a pragmatic solution. It can be argued that electricity or water consumption is a proxy for income and consumption leading to waste generation, and hence a reasonable surrogate. In the case of large single point producers such as industrial or commercial enterprises, volume or weight-based charges may be more appropriate. This has the advantage of linking waste revenues to the actual volume of services provided (Schübeler and others, 1996).

Finding successful models of cost recovery in solid waste management is difficult. However, a few interesting cases suggest that there is room for greatly improving cost recovery. Private sector operations show that certain urban areas can generate revenue to cross-subsidize others, and that there are successful experiments in linking waste charges to other (more valued) utilities.

- In Dhaka, Bangladesh, there are more than 250 small scale waste collection programs, each covering 200 to 1,000 families. They are totally private and un-regulated and charge fees of US$0.3 to US$1 per month per family. Most of them operate in high and middle income residential and commercial areas. More than 90 percent of users have been paying the fees. Several of the programs have been operating for more than 4 years (Ali, pers. comm., 2001).
- In Lusaka, Zambia, the private sector is regulated through the Environment Council of Zambia (ECZ), while the size and powers of the conventional city council has been reduced. The private sector only serves the commercial sector and some middle and high income residents. The fees and profit margins are very high and un-controlled. Low income areas do not receive any service at all (Ali, pers. comm., 2001).
- In Ecuador, the central government allows cities to attach a surcharge of 10-12 percent to electricity bills. This has allowed sufficient cost recovery to greatly improve the service (Bartone, pers. comm., 2001).

**Table 3.12: Options for enhancing MSWM cost recovery**

| | *Adequate Revenues?* | *Easily Collected?* | *Polluter Pays?* | *Politically Acceptable?* | *Enforceable?* |
|---|---|---|---|---|---|
| **User charges** | | | | | |
| "Garbage tax" | Can generate adequate revenues if rates are set based on costs, and are updated as needed | Often collected with property tax; Direct collection is expensive (about 10-13% of total costs) | Only to extent that rate depends on surrogate for waste generation, like lot size, property value | Requires political will to set and update rates | Difficult to withhold service for non-payment; Inefficient when collected with property tax |
| Volume or Weight Based Fees | As long as fees are set based on costs and updated as needed | No, requires sophisticated refuse collection system; | Yes | No | Leads to dumping behavior without local inspection and enforcement capacity |
| Tipping Fees (for use of disposal facilities) | Yes, if based on full costs of investment and operation | Yes, if weigh-bridges are utilized | Yes, if fees are passed on by hauler to waste generator | Municipalities are often reluctant to pay fair share | Yes, but must verify that trucks go to disposal site |
| **Other revenues** | | | | | |
| Property Taxes | Suffers from typical weakness in property tax collection | Yes | No, except to extent that property tax is surrogate for waste generation | Requires political will to collect property tax and update rates | Evasion commonly observed |
| Business Licenses | Yes | Yes | No | Yes | Yes |
| Utility Surcharges | Yes | Yes | No, except to extent that energy use is surrogate for waste generation | Not easy to get utility cooperation; often legally challenged | Yes |
| General Fund Subsidies (including transfers) | Yes, but at expense of other needs | Yes | No | Low political priority for disposal services | No guarantee that funds will be allocated |

*Source:* World Bank, 2001b.

There are significant regional differences in the use of cost recovery instruments (see Box 3.5). Africa relies heavily on central government transfers; East Asia/Pacific is trying deposit-refund systems and volume-based fees; South Asia makes ample use of property taxes; Eastern Europe is turning to the private sector; and in Latin America several cities are experimenting with charges associated to utilities.

In addition, limited evidence suggests that there is room for improving cost recovery in disposal operations. Comparisons on tipping fees (see Table 3.13) show that countries with similar levels of GNP per capita charge very different

**Box 3.5: Regional differences in the use of cost recovery instruments**

In Africa, the central government generally finances MSWM and other municipal activities through taxes collected by the Treasury. Although direct municipal charges are an emerging instrument for cost recovery in African cities, their use is not yet widespread. In general, residents pay via indirect local taxes. User fees are based on flat rates for collection services to households and commercial establishments. Examples of cities using municipal user fees include Accra, Conakry, and some suburbs of cities in South Africa. Special taxes are also used to raise revenue for MSWM services. In Dakar an MSW collection tax is imposed by the central government and is collected by the Treasury. In Bamako a cleaning tax is levied based on property value and direct user fees are also employed in some areas.

Throughout the East Asia/Pacific region there is a range of methods by which costs are being recovered via user fees. The deposit-refund system for many recyclables is being expanded in cities like Bangkok, Singapore, Tokyo, and Jakarta. Volume-based fees are also being tried out.

In the Indian subcontinent, cities and towns have to rely upon municipal taxes—mainly property taxes—for MSWM funds. The property tax base for municipal services has had implications for equitable coverage: illegal settlers, such as squatters, are not deemed eligible for collection services in most cities. Municipal managers are discussing the introduction of fees, decentralized modes of payments, and higher specific charges

Eastern European countries are finding it difficult to finance the centrally controlled model of MSWM service delivery and are turning increasingly to the private sector to finance MSWM activities, including collection and disposal. In some cities, residents are paying fees directly to private collectors.

In most countries of Latin America, households pay for MSWM services through property taxes. Under this system, costs are seldom recovered, especially for the poorer districts of the cities, because it requires the municipality to have an updated register of households. In some cities—mainly in Bolivia, Colombia, and Ecuador—charge fees through other utility bills (usually through the electricity bill, but sometimes also through the water bill, as in Panama). A number of studies show that this system is fair because the volume of waste generated correlates reasonably highly with electricity and water consumption. This system is highly efficient and generally finances most, if not all, solid waste operations. Unfortunately, this system is not always feasible, particularly in countries where utilities have been privatized.

*Source:* UNEP, 1996.

amounts. This happens both when comparison are made across regions or within the same region: Indonesia and Philippines (around US$1,100 GNP per capita) charged US$9.7 and US$1.3/ton; Peru and Colombia (around US$2,200) charged 5 and 11 US$/ton; South Africa (around US$3,140) charged US$12/ton while Malaysia ($4,300) charged US$1.2/ton. Furthermore, considerable differences within countries can also be found.

Sometimes, the barrier to enhancing cost recovery is not one of affordability but of the credibility of the providing agency. For instance, in Bangkok, a proposed raise in fees from 4 to 40 Thai baht (US$0.14 to $1.4) per month encountered bitter opposition, even though many residents pay 20 to 30 baht (US$0.7 to $1) per month directly to the waste handlers to ensure removal, (Blore and Nunan, 1997).

**Reducing and controlling costs.** The potential for increasing revenues from solid waste operations exists, but it is limited. Some specialists point out the most effective way to ensure financial sustainability may be through cost reduction (for instance, Schübeler and others, 1996). There are almost always opportunities to significantly reduce the operational costs of MSWM services. Cost reduction measures include providing appropriate levels of service, allowing for a greater role of the informal sector, and embracing public-private partnerships.

To ensure the long-term economic sustainability of MSWM systems, investments in system development should correspond to the level of resources which the society can make available for waste management. Development aid has in many cases financed high-service capital intensive waste management systems—mirroring those of the donor countries—that are expensive to maintain and are not adapted to the characteristics and service needs of the recipients, the existence

**Table 3.13: Tipping fees in selected developing countries**

| *Country* | *Tipping Fees ($/ton)* | *1996 GNP per capita ($)* |
|---|---|---|
| Argentina | 5-18 | 8,410 |
| Chile | 5-17 | 4,920 |
| Brazil | 5-18 | 4,360 |
| Malaysia | 1.2 | 4,300 |
| México | 4-17 | 3,640 |
| South Africa | 12 | 3,140 |
| Peru | 5 | 2,410 |
| Colombia | 11 | 2,190 |
| Philippines | 9.7 | 1,190 |
| Indonesia | 1.3 | 1,090 |
| China | 2.5 | 750 |

*Source:* Johannessen and Boyer, 1999.

of livelihoods related to recycling, and the limited financial resources of the municipalities.

Public waste collection costs may be reduced through the participation of residential communities in local solid waste management (Schübeler and others, 1996). In most cases, this involves hiring of small scale enterprises or informal waste collection workers directly by the households. Informal waste recovery and/or scavenging also contributes to cost savings by reducing the volume of waste which needs to be transferred and disposed (Schübeler and others, 1996). For low-income countries, one option may be to remove sanctions on informal sector collection and recycling enterprises, integrate them with other MSWM strategies, and explore ways that these enterprises can economically divert more municipal solid waste from landfills (Beede and Bloom, 1995).

In addition, important cost reductions may be achieved by introducing competition through public-private partnerships for waste management. Private enterprises are highly motivated to lower costs and may introduce innovations and efficiency-raising measures to this end. At the most fundamental level, cost reduction implies a better utilization of available manpower and equipment, improved maintenance of equipment, introduction of appropriate technologies and the elimination of inefficient bureaucratic procedures (Schübeler and others, 1996). Some evidence shows that public agencies bidding against private firms for contracts can be about as efficient as their competitors; the efficiency gains from competition do not depend on the form of ownership of the collection service (Beede and Bloom, 1995).

**Table 3.14: Potential for revenue generation and the cost of expanding service**

| *Region* | *Revenue generated by increasing cost recovery rate to 50% (billion US$)*[a] | *Current level of formal disposal (%)* | *Expenditure needed to expand formal disposal to 75% (billion US$)*[b] | *Expenditure needed to expand formal disposal to 90% (billion US$)*[b] |
|---|---|---|---|---|
| Middle East and North Africa[c] | 0.7 | 44 | 0.9 | 2.1 |
| Sub-Saharan Africa[d] | 0.3 | 31 | 0.8 | 1.2 |
| Asia Pacific[e] | 21.5 | 59 | 10.6 | 20.3 |
| Latin America and the Caribbean | 2.7 | 66 | 0.7 | 1.8 |
| **Total** | **25.2** | | **13.0** | **25.4** |

*Notes:* [a] Assuming zero elasticity of demand.
[b] Assuming formal disposal is a linear function of expenditure.
[c] Excludes Iran, includes Sudan.
[d] Excludes Sudan.
[e] Includes Iran, excludes Mongolia, Laos, and Cambodia.

*Source:* Authors' calculations. Current level of formal disposal from UNCHS (2001).

Actual data on MSWM services and financial expenditures is difficult to come by. In Table 3.14 we report data on current levels of formal disposal from UNCHS (2001) as a proxy for overall MSWM services coverage. Combining this figures with our estimates on current levels of expenditure, allow us to calculate the cost involved in reaching two service benchmarks. Comparing this cost with the potential revenue generated by increasing cost recovery rates to 50 percent in currently serviced areas, illustrates that there is significant potential for expanding service financed by an increase in cost recovery rates, even if cost recovery in the newly serviced areas—where the poor live and where willingness to pay may be lower—falls short of that 50 percent.

### Solid waste management, cost recovery, and the poor

There are two main issues linking MSWM and poverty: access and affordability. Lack of finance for full waste collection, combined with political economy issues, mean that low income areas are often left without waste collection services. In many developing countries, poorer residents cannot afford the fees though they have a relatively high willingness to pay (Korfmacher, 1997). While the economic demand for waste collection services may cover primary collection costs, it seldom covers full transfer, treatment and disposal costs, especially among low-income groups (Schübeler and others, 1996; Porter, 1993). Due to the environmental and health externalities involved in the case of solid waste, the failure of willingness-to-pay to reach cost recovery levels does not imply that service should not be expanded. To achieve equitable service access, some degree of cross-subsidization and/or financing out of general revenues will be required. In many low-income residential areas, community-based solid waste management is the only feasible solution (Schübeler and others, 1996). At the same time, systems for improving cost recovery by attaching waste collection charges to the billing of another service may be made progressive, in the sense that large users would pay a higher rate per volume of collected waste than small users.

The issue of privatization cuts across the issues of access and affordability. Recent MSWM efforts have emphasized increased private sector participation for urban waste services, with full cost recovery from the users. However, the city-wide cost recovery models may not be appropriate for all income groups due to a number of reasons (Ali, pers. comm., 2001), including:

- The large-scale private sector is reluctant to serve the low income areas, unless the service is subsidized.
- While users of the service are non-homogenous groups of people with different capabilities and assets, the service fee is often set on the basis of an imputed 'ability to pay' as indicated by 'legitimate' assets such as property values, income, or plot size, and does not take into account human and social assets.
- The current working practices overlook that poor people could successfully undertake the management and operation of a significant proportion of waste services in their own areas. The poor could offer useful recycling services that not only reduce the amount of waste but also provide a useful source of livelihood.
- The formal models are generally weak in satisfying customers through increased participation, consultation, improved image of the provider, transparency, and accountability. Attention to these aspects could lead to improved cost recovery.

Efforts to improve cost recovery could help the poor. The argument runs as follows. The poor suffer a lack of coverage of MSWM services. Alongside political economy issues, lack of financial resources is the main reason for this lack of service. Increasing cost recovery rates to 50 percent, in order to match the private good component of MSWM services, would liberate substantial financial resources that could be used to improve the service. Since the poor are the ones that suffer more the shortcomings of current MSWM practices, they could benefit from such a change.

### Conclusions

In practice, municipal government performance in the collection of waste service fees is often quite poor. People are reluctant to pay for municipal waste collection services which are perceived to be unsatisfactory; at the same time, poor payment performance leads to a further deterio-

ration of service quality, and a vicious circle may arise. With current urbanization and lifestyle trends, the business-as-usual scenario on waste management finances would be increasingly unsustainable. The situation, in short, is that a large number of poor remain without the service, local authorities and private sector remain short of expected cost recovery, and adverse environmental and health consequences remain unabated. As Box 3.6 illustrates, those consequences may reach disaster levels, and when that happens the poor are likely to be more affected.

**Box 3.6: The disastrous consequences of improper MSWM in Manila**

Manila, the capital of the Philippines, is home to the infamous Smokey Mountain, a dumpsite right in the center of the city. Improper waste management at this dumpsite has long affected air and water quality in the area. Available data showed that Smokey Mountain was a major source of pollutants, such as chemical oxygen demand, chloride ions and lead. Ninety percent of drinking water samples in the dumpsite revealed bacterial contamination. After public protests, Smokey Mountain was closed and leveled in the mid-1990s.

In July, 2000, an enormous wall of garbage collapsed in Manila's main dump in Payatas, crushing a row of shacks and killing over a hundred people. The victims were impoverished squatters, including many children, who lived in the area and picked through the dump to collect items they can sell. The Payatas dumpsite was to be closed permanently in December 2000, but plans were postponed.

These examples illustrate the tragic human and environmental consequences of improper waste management.

*Source:* World Bank, 2000g.

**Potential for resource mobilization.** User charges can generate substantial revenues and provide incentives to minimize waste, especially if structured so that those who pollute more, pay more ('polluter pays principle'). Although user charges can be imposed at different stages of solid waste management (including collection and disposal), in many cities they do not cover the full costs of solid waste management activities. While citizens and enterprises are generally willing to pay for solid waste to be collected, they are often unwilling to pay the full cost of disposing of the waste in a sanitary manner (Porter, 1993; World Bank, 2001b). For current levels of service, achieving a cost recovery rate of 50 percent, to cover for the private good component of MSWM services, would generate an increase in revenues of US$25 billion in developing countries (excluding countries in transition). Investing these financial resources on expanding coverage would boost the level of service.

The potential for improving waste management financing through cost recovery needs to be qualified. Social and institutional issues—such as low rates of property tax collection and distrust of government—are limiting factors for improving cost recovery. Besides, the option of linking waste 'pricing' to utilities pricing will be hampered down the road by the privatization of the utility companies.

**Poverty implications.** The poor are willing to pay for MSW services, but this may not be sufficient to cover costs. Hence, enforcing full cost recovery on an individual basis may hurt the poor. Although some cross-subsidization may be needed, it is in principle preferable to make subsidies transparent. Full cost recovery for better-off segments of the urban population, combined with improved cost recovery for the poorest, should have beneficial impacts on the poor via better coverage. Current practices leave the poor without service and, as a result, at greater health risk. Improving cost recovery would generate funds that would allow to extend service.

**Direct incentive effects.** Reaching adequate levels of cost recovery may require the use of effective instruments, such as associating a garbage tax to the electricity bill. In this case, no direct incentive effects can be expected. Setting tipping fees in line with costs would offer incentives to industrial and commercial clients to reduce waste generation. However, it would also increase the risk of open dumping. Experience in many countries has shown that charging the full costs of disposal may create incentives for littering and open dumping, especially if the enforcement of regulatory standards (that is, no dumping) is weak and entities can avoid paying the user charge by disposing of the waste themselves (World Bank, 2001b). Finally, implementing a scheme where poor people undertake tasks of management and operation would increase recycling, reducing the amount of waste to landfill.

## 3.3 Imposing Green Levies

The 1980s and 1990s saw a rapid increase in the use of economic instruments to improve environmental management. The United States implemented tradable emission permits and environmental charges, while European countries instituted several environmental taxes. Environmental taxes in a broad sense (including energy taxes, transportation taxes, pollution charges, and fees) represent a relatively small, but growing, source of revenue in many OECD countries. The advances made on this front in developing countries have not been as significant. Environmental taxes and charges or, more broadly, 'environmental levies' make the tantalizing promise of helping to generate revenue while simultaneously addressing problems of resource and environmental degradation. In this section, we discuss the fiscal and environmental implications of environmental levies in developing and economies in transition. We identify case-studies and success stories where taxes and charges have worked to improve the environment. We also attempt to provide estimates of the revenue gains from instituting such levies. Different methods of recycling the revenues from these levies can have very different efficiency consequences. In practice, however, revenues from environmental levies are often earmarked to particular spending programs. Often, political feasibility may require some earmarking and compensation for payers.

### Green levies in theory

Taxes and charges are seen as key instruments to decrease pollution because they can have the same environmental impact as a regulatory intervention but at lower cost to society. While regulation can to some extent ensure basic compliance with minimum environmental and social requirements (although enforcement is usually far from perfect), use of positive incentives can unleash creativity and entrepreneurship which can lead to results far beyond the minimum. Also, regulations are usually set based on what is viewed as feasible with today's technology whereas incentives can stimulate the development of tomorrow's technologies.

The theory underlying the use of environmental levies is well known. An optimal environmental levy, often referred to as a Pigouvian charge, is set at the level where marginal costs from pollu-tion abatement equal marginal benefits from abatement, thereby 'internalizing' the full social marginal costs.[15] If it is cheaper for a firm to abate pollution than to pay the levy, it will do so. The theoretical expectation is that firms will continue to abate pollution up to the point where it is cheaper for them to pay the levy rather than bear the cost of abatement. At this point, overall pollution will have declined to the socially optimal level at which any social benefits from an extra unit of pollution match costs. Box 3.7 summarizes some of the taxes and charges that are broadly defined as environmental levies.

**Box 3.7: Definition of environmentally related taxes and charges**

**Emission charges** or pollution charges are payments that are directly related to measures (or estimates) of pollution, whether emitted into air, into water, or onto soil. Emission charges generally deal with one type of emission at a time. For example, there may be a tax per ton of sulfur dioxide ($SO_2$) emitted into the air and a tax per unit of Biological Oxygen Demand (BOD, a measure of water pollution) emitted into the water. Thus, there may be more than one emission charge related to any given activity.

**User charges** are payments related to the service delivered. Only households/individuals/industries connected to the relevant public service are charged. The revenues raised are generally used to provide a service, such as the collection and public treatment of effluents or sewage.

**Product taxes** may be levied to price environmental effects correctly, and could be used to correct externalities other than pollution. A product tax may be levied on the units of harmful substance contained in products: for instance a carbon tax is based on the carbon content of each particular fossil fuel. The product (or excise) tax may also be levied per unit of the product, if the objective is to reduce usage of the product generally. This may be in the form of consumption taxes (for example, on disposable products or non-fuel efficient cars) or production taxes (for example, on coal, diesel, or plastic).

A pure Pigouvian charge would create a strong incentive for individuals and firms to decrease pollution by choosing least cost options. In reality, implementing a Pigouvian charge is difficult since it would require full information on social benefits and costs associated with changes

in pollution. For example, a Pigouvian charge on carbon would entail taxing units of carbon emissions and knowing how a unit increase in carbon would affect social welfare and abatement costs borne by industries. Such information is not usually available. As a compromise, environmental levies are generally of two types: (1) emissions charges that allow an industry to meet a certain regulatory standard; or (2) product taxes, generally imposed on goods that produce pollution rather than on the pollutants themselves (for example, on diesel rather than the sulfur content of diesel).

**Box 3.8: Is there a "double-dividend"?**

In the 1980s a new literature emerged focusing on the revenue implications of environmental taxes and charges and hinted at the potential for getting a "double-dividend" from green taxes. In addition to reducing environmental problems, environmental levies, it was suggested, could also increase overall economic efficiency if the revenues they generated were used to reduce rates on other, more distortionary taxes (OECD, 2000d; Bosquet, 2000). While the double dividend hypothesis gained considerable ground in the 1980s, a number of recent analytical papers have cast doubt on its validity. The work of Bovenberg and de Mooij (1994) and others (Parry, 1995; Oates, 1995; Goulder, 1995; Ligthart, 1998) has shown that this hypothesis ignores an important source of interaction between environmental taxes and pre-existing taxes. They argue that since environmental taxes raise the cost of producing output they tend to discourage labor supply and investment, and thereby exacerbate the efficiency costs associated with tax distortions in labor and capital markets. The costs from this interaction effect may dominate any efficiency benefits from recycling environmental tax revenues in other tax reductions. Nonetheless, the possibility of revenue-neutral tax reforms has made environmental taxes politically feasible in many European countries. In some countries—particularly in Finland and Sweden, and to a lesser extent in Germany—green tax reform has been revenue negative: that is, increases in green levies have been accompanied by decreases in other taxes with the net effect being a decline in the overall tax burden to tax payers (Bosquet, 2000).

The relationship between the revenue implications of environmental levies and their environmental impacts is not straight-forward and can often be at odds. Although a pure Pigouvian charge may have a strong impact on the environment and provide revenues to local and national governments, the majority of such revenues should be viewed as short-term revenues —since they will exist only until firms and individuals introduce pollution abatement technologies. Revenues will decrease over time and can be sustained only at a lower level. Non-Pigouvian charges or taxes targeted mainly at revenue generation may have smaller incentive effects, but tax revenues are likely to be sustained over a longer period of time (see Box 3.8).

### Green levies in practice

Since the early 1990s, revenues from green taxes in all OECD countries have been increasing slowly. In 1997, they accounted for slightly less than 7 percent of total taxation and 2-3 percent of GDP on average (OECD, 1999).[16] Energy and transport taxes accounted for more than 90 percent of the total revenue from environmental taxes in most countries. In the Eastern European economies in transition, our estimates based on data from the Regional Environmental Center for Central and Eastern Europe (REC 2001) suggest that revenues from green taxes plus charges are in the range of US$7 billion. Amounting to about 8 percent of total tax revenues on average, green levies are clearly a significant source of tax revenue in these emerging economies. While less information is available on the developing world, environmental taxes appear to be still in their infancy in these countries. Even in China, with one of the most extensive pollution charge systems, green tax revenues account for only about 1.1 percent of the total tax revenue.[17] However, these environmental levies do seem to contribute critical resources for environmental purposes in several countries.

A number of developing countries have introduced market-based instruments such as environmental taxes and pollution charges in recent years. However, there is no comprehensive survey (or database) of the use of these instruments comparable to those done for OECD (1999) and transition economies (REC 2001). Nevertheless, based on a review of the literature on environmental policy in Latin America and Caribbean, Asia, and Africa a few observations can be made.

The primary motivation for environment-related taxes in most developing countries is

revenue generation. The basic environmental policy framework is a regulatory one and environmental taxes are generally designed as complements to regulation. Thus far, emission charges seem to dominate in most countries, with product charges also fairly common. Deposit-refund schemes are beginning to operate in some high-income countries. However, carbon taxation is almost non-existent. Some countries have also used innovative schemes such as public disclosure to complement fiscal and regulatory policies. For example, Indonesia and the Philippines classify factories based on their reported emissions and broadcast the results widely (using simple rating systems), regulators are enabling communities to identify serious polluters and pressure them to clean up . It is argued that such public disclosure programs can curb pollution at modest cost and is better than explicit taxation (World Bank, 2000g). In other cases, governments are also discovering that working with the private sector (in creating the incentive structure) to manage pollution may be more cost-effective than a traditional command and control approach. In the absence of a comprehensive database, we review some regional examples of specific environmental levies here.

### *Taxes and charges in economies in transition*

After the collapse of the Communist systems the countries in Central and Eastern Europe (CEE) initiated a transition from centrally-planned to market-oriented economies. As a part of the process, the governments liberalized prices and initiated the breakup and privatization of state-owned enterprises. The transition (among other things) led to a recognition of the broad-scale environmental degradation that took place during the Communist era. Most countries in the region sought ways to implement more efficient environmental policies to remedy for the past degradation. Several countries introduced legislation to impose environmental taxes/pollution charges on polluters. CEE countries have also been largely motivated by European Union accession policies and the need to adapt domestic laws and practices to fit into the EU framework.

Most CEE economies apply environmental levies to a wide range of sectors, such as energy and transport, and many also have introduced pollution charges on air emissions, water effluents, and waste disposal (see Table 3.15). Aside

**Table 3.15: Environmental taxes and charges in selected economies in transition**

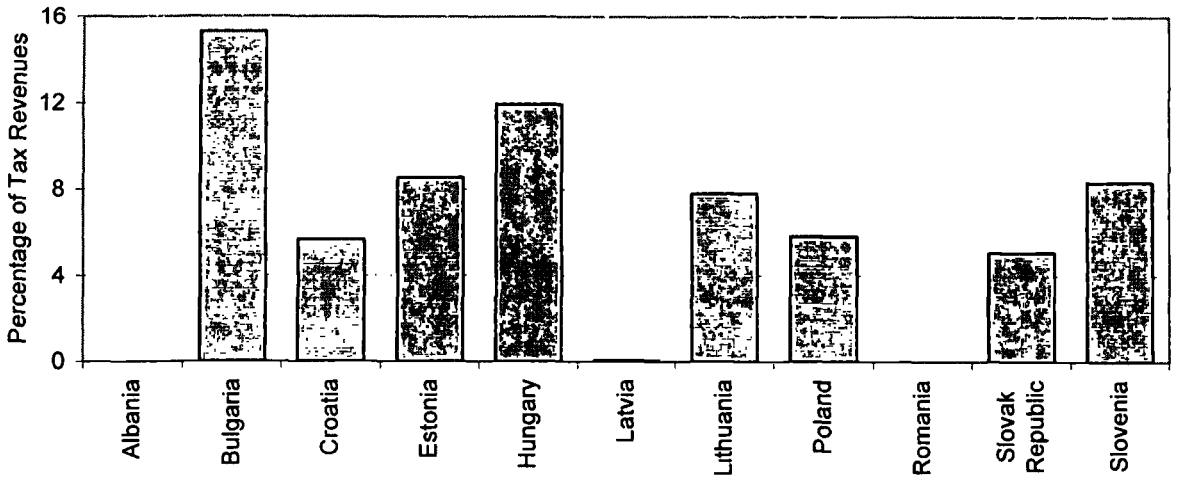
(US$ million )

| | *Energy* | *Air Pollution* | *Water* | *Transport* | *Natural Resources (Mining and Conservation)* | *Wastes* | *Other* | ***Total*** | *Percent of Tax Revenues* | *Percent of GDP* |
|---|---|---|---|---|---|---|---|---|---|---|
| Albania | n.a. | n.a. | n.a. | 22 | n.a. | 1 | n.a. | **23** | n.a. | 0.6 |
| Bulgaria | 489 | 0 | 1 | 19 | n.a. | n.a. | n.a. | **509** | 15 | 4.1 |
| Croatia | 449 | n.a. | n.a. | 17 | 2 | n.a. | n.a. | **469** | 6 | 2.3 |
| Estonia | 91 | 1 | 5 | 21 | 5 | 3 | n.a. | **125** | 9 | 2.4 |
| Hungary | 1,605 | 2 | 22 | 129 | 61 | 122 | 0 | **1,941** | 12 | 4.0 |
| Latvia | n.a. | n.a. | n.a. | n.a. | n.a. | 1 | n.a. | **1** | 0.05 | 0.0 |
| Lithuania | 78 | 5 | 1 | 79 | 31 | n.a. | 11 | **204** | 8 | 1.9 |
| Poland | 2,487 | n.a. | n.a. | 105 | 0 | 21 | n.a. | **2,612** | 6 | 1.7 |
| Romania | 57 | 0 | 5 | n.a. | n.a. | n.a. | n.a. | **62** | n.a. | 0.2 |
| Slovakia | na | 7 | 163 | n.a. | 17 | 122 | n.a. | **309** | 5 | 1.6 |
| Slovenia | 621 | n.a. | 18 | n.a. | n.a. | n.a. | n.a. | **639** | 8 | 3.2 |
| **Total** | **5,878** | **15** | **213** | **392** | **116** | **269** | **11** | **6,894** | | |

*Notes:* n.a. not available.

*Source:* SOFIA database 2001 / World Bank Database (SIMA) 2001.

**Figure 3.6: Revenues from environmental levies in selected CEE countries**




*Source:* SOFIA data / World Bank SIMA database.

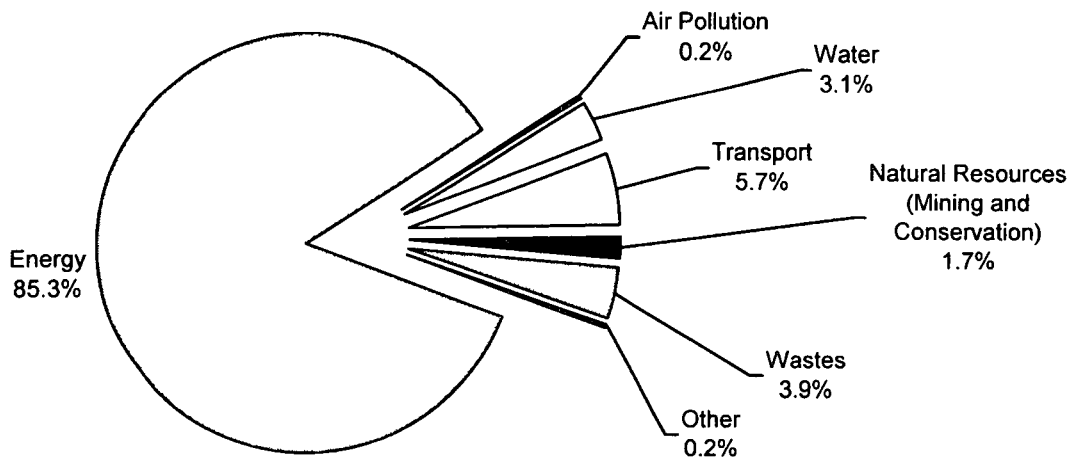
from excise duty on fuels, a number of taxes targeted at fuel use and motoring are in place. The pollution charge system has been motivated in large part by the need to raise revenues for environmental conservation projects.

CEE governments obtained a total revenue of approximately US$7 billion from environmental taxes and charges in 1999. As Table 3.15 shows, the country which used environmental taxes most extensively was Poland, with over US$2.6 billion in revenues. Hungary follows with a revenue of almost US$2 billion. These numbers amount to about 2 percent of GDP in Poland and 4 percent in Hungary. More importantly, these numbers equals 6 percent and 12 percent of tax revenues in Poland and Hungary (see Figure 3.6). These are substantial revenues for resource constrained governments, accounting on the average for about 2-3 percent of GDP. Latvia, Albania, and Romania are stragglers in this impressive effort to use environmental taxes and charges.

Figure 3.7 shows that taxation of energy products continues to be a major source of revenue in most countries, accounting for over 90 percent of the total revenue from environment-related taxes—a level which is very comparable to OECD numbers (Barde and Braathe, 2002). In general, energy taxes have been levied primarily as part of general fiscal measures intended for revenue-raising purposes, rather than as attempts to modify behavior. While carbon taxes or other environmental taxes on energy sources have been discussed in many countries, only a few have so far implemented any systematic energy tax along environmental lines due to inadequate administrative provisions. But this might change quickly as countries prepare themselves for EU accession. Until recently, taxation of motor vehicles and motor fuels—the second largest component of environmental taxes, accounting for about 6 percent of total revenue—also focused primarily on raising revenue. A few countries are now beginning to implement coordinated fiscal and environmental policies, aimed at reducing motor vehicle related pollution.[18]

Air and water pollution charges in CEE countries are relatively low and account for less than 4 percent of total environment-related tax revenues. In general, a base charge rate is applied for permitted emissions (of air and water) and a penalty rate applied if firms and industries are not in compliance. In some countries polluters that invest in cleaner technology or pollution control equipment have received subsidies in the form of tax allowances. The low revenues from emission and effluent taxes are attributed to lack of enforcement and failure to adjust for inflation.[19] Nonetheless, it is useful to note that with the exception of countries with advanced eco-tax programs, some tax rates in CEE are comparable with rates in Western Europe in real terms.

**Figure 3.7: Tax revenues from different sources**




*Source:* SOFIA database 2001.

A number of CEE countries are considering levying explicit carbon taxes: that is, taxes which are related directly to the carbon content of fuels. Since there are essentially fixed coefficients between $CO_2$ emissions and carbon content, for example, the difficulties of monitoring $CO_2$ emissions can be avoided, at little loss, by taxing directly the carbon content of the fuels that generate $CO_2$ when burned.[20] Thus the tax would be specified as some specific amount per tonne of coal, per barrel of oil, or per million cubic feet of gas, the amounts being such as to equalize implied taxes on carbon content.[21] While carbon taxes are gaining prominence in OECD countries, among CEE countries (and even among developing countries in general) only Slovenia has imposed carbon taxes with reasonable success (see Box 3.9). The tax raised US$83 million in 1999, representing an estimated 0.4 percent of GDP, indicating its potential as a source of revenue for developing countries.

Do environmental taxes and charges in CEE adequately help the environment? Some analyses suggests that the pollution charge systems in CEE have often failed to induce investment in abatement technologies, and that the effects on emission levels have been rather small (Soderholm, 1999; Jackson, 2000; Vincent and Farrow, 1997). As the Russian case illustrates (see below), their inability to achieve desired environmental impacts can be attributed to a variety of factors, such as limited information on marginal abatement costs, low charge rates, lack of inflation adjustment, non-compliance, and lack of monitoring capacity (Vincent and Farrow, 1997). However, assessing the environmental impacts of economic instruments in CEE is difficult, because of the lack of baseline data and the number of different factors that have contributed to environmental improvements, such as increased community pressure and donor assisted programs. Some specific instruments, such as air pollution charges in Poland, do appear to have resulted in improvements and the same is expected of recently increased motor taxes in several countries in the region (REC/SIEI, 2001; Anderson and Fiedor, 1997). In general, water pollution charges seem to be more effective than air pollution charges because of higher charge rates and the greater ease of monitoring (Vincent and Farrow, 1997).

The equity and distributional impacts of environmental levies are important issues, but they have not been discussed much in the literature. This is an issue of some concern, as many of these taxes are likely to be regressive. A recent study indicates that CEE countries have increased their motor fuels taxes substantially over the last ten years, in order to be in line with EU. As a result, CEE citizens currently pay some of the highest motor fuel taxes in Europe (REC/SIEI,

2001). Similarly, water and waste related charges have also substantially increased and amount to almost 10 percent of household expenditures for some households. The regressive nature of some of these taxes are best addressed through targeted policy packages that can help the poor.

**Box 3.9: Carbon taxes in Slovenia**

At the beginning of 1997, a $CO_2$ air emission tax was introduced with the adoption of an official decree. The decree stipulates that the tax is paid for the use of fuels and combustion of organic substances. The tax is calculated according to the content of carbon in various fuels: (1) 30 percent of the base rate for coals if they are used for heat and power generation with a total utilization rate exceeding 55 percent; (2) 50 percent of the base rate for coals if they are used for electricity generation in thermal plants with a utilization rate exceeding 33 percent; (3) 100 percent for the base rate for co-incineration of combustible organic substances in combustion units and industrial furnaces and for incineration in waste incinerators; (4) 100 percent of the base rate for all other fuels. Calculation of the tax is based on a sum of pollution units of a purchased quantity of fuels or pollution units of combusted substances. The tax is paid by a seller (or importer) of solid, liquid; or gaseous fuels to end consumer. The tax is added to the retail price paid by the consumer. Where combustible organic substances are used and co-incinerated in heating units and industrial furnace, or waste incinerators, the tax is paid by the manager of the heating unit, industrial furnace, or waste incinerator. Introduced at a rate of 2.2 Slovenian Tolars (SIT) per litre of petrol, 2.6 SIT/litre of diesel, and 3.1 SIT/litre of fuel oil, the rates were tripled in 1998. The current tax rate is equivalent to about US$15/ton $CO_2$ and the tax raised US$82.6 million in 1999 representing an estimated 0.4 percent of GDP.

*Sources:* Speck and others, 2000.

### *Environmental taxation in Russia*

Environmental tax reform has yet to make significant inroads into Russian tax legislation and practice. However, a few recent developments signal a renewed interest for enhancing the fiscal role of the environment and natural resources (Bosquet, 2001). According to the Russian Ministry of Finance, revenue from green taxes (that is, pollution charges and natural resource fees) totaled US$1.8 billion in 1999, making up 3.7 percent of total revenues in the consolidated budget. Of this, natural resource fees (subsoil user fees, continental shelf, forest fees, water fees, and land tax) accounted for over 98 percent of green taxes, and pollution charges slightly over 1 percent. Within the federal budget, green taxes totaled US$424 million, making up for 1.7 percent of the total federal budget, with pollution charges accounting for about 4.4 percent of the total federal green tax revenues (see Table 3.16).

At the *federal level*, an economic strategy has been adopted that intends "to increase the fiscal importance of taxes related to use of natural resources and also of property taxes, which should become the basic source of revenue for regional and local budgets" (cited in Bosquet, 2000). At the *regional level*, provinces such as Komi and Samara have started differentiating some natural resource user fees in order to reflect and capture a greater share of the rent. We describe below the more specific case of the Russian pollution charge system.

Pollution charges in Russia have a more recent history than resource fees, with the first charges being introduced in 1991. The current system of pollution charges covers air and water pollution and waste disposal, relying on a mix of quality-based and technology-based standards. Maximum and temporary emissions permits together determine the corresponding pollution charges. The Russian system is characterized by a great variability in pollution charge rates, which range from less than US$0.01/tonne for within-limit emissions of carbon monoxide or disposal of non-toxic waste generated by the mining industry, to some US$386,000/tonne of lead released in the air outside of temporary limits. In addition to water pollution charges, Russian municipalities also collect fees for water supply, sewage and wastewater treatment. These fees are paid to local water utilities on a cost-recovery basis, and rates vary extensively across regions or municipalities, with firms traditionally cross-subsidizing households (Bosquet, 2001).

Although the current pollution charge system is motivated in large part by the need to raise revenues, the system has been largely ineffective in doing so. This is typically attributed to the lack of enforcement. It is also noted that taxes and fines have not been adjusted for inflation despite a rapidly weakening currency. Even with indexation, the total impact of the charges has been

**Table 3.16: Environment and natural resources in Russia's 1999 budget**

| | *Consolidated budget* | | | *Federal budget* | | |
|---|---|---|---|---|---|---|
| | *Share (percent)* | *Million Rubles* | *Million US$* | *Share (percent)* | *Million Rubles* | *Million US$* |
| Total revenues | 100 | 1,197,454 | 48,284 | 100 | 611,710 | 24,666 |
| Total "green taxes" | 3.7 | 44,575 | 1,797 | 1.7 | 10,496 | 423 |
| Subsoil user fees | 2.5 | 30,077 | 1,213 | 1.2 | 7,190 | 290 |
| Continental shelf | 0.0 | 25 | 1 | 0.0 | 0 | 0 |
| Forest fees | 0.1 | 1,727 | 70 | 0.1 | 447 | 18 |
| Water fees | 0.1 | 1,035 | 42 | 0.03 | 198 | 8 |
| Pollution charges | 0.04 | 461 | 19 | 0.1 | 461 | 19 |
| Land tax | 0.9 | 10,939 | 441 | 0.4 | 2,189 | 88 |
| Other user fees | 0.03 | 312 | 13 | 0.0 | 10 | 0 |
| Other revenues | 96.2 | 1,152,878 | 46,487 | 98.3 | 601,214 | 24,242 |

*Source:* Ministry of Finance, Russia, in Bosquet, 2001.

decreasing dramatically, because of high inflation rates and the lack of profits reported by enterprises in the targeted sectors (Kozeltsev and Markandya, 1997). In terms of environmental impacts, pollution charges have not had the desired effects, as enterprises often failed to obtain technical equipment and other physical resources needed for reducing emissions, which in turn requires that capital markets function well. In Russia these markets are not sufficiently developed or are too thin to provide financing of environmental projects. Moreover, the awareness among firms of the various technological options for pollution control and their associated costs is generally very low (Soderholm, 1999).

### *The Asian experience with market-based instruments*

Environmental charges have traditionally been used in several Asian countries to raise government revenues. China and Malaysia, for example, established a system of pollution levies over twenty years ago. More recently, there has been a more serious effort to fix charges such that they will actually help the environment. Four examples of environmental taxes from Asia are discussed below.

### *Pollution charges in China*

China has had a system of pollution charges, assessed as non-compliance fees, since 1979. Charges are levied on both the amount and concentration of emissions.[22] The system is backstopped by a system of penalties to encourage compliance with standards.[23] Thus far, some 300,000 factories have paid for their emissions. In 1999, some US$600 million in revenues were collected from environmental charges (see Table 3.17). About 80 percent of these funds have been used to finance pollution prevention and control, accounting for about 15 percent of total investment in these activities. A recent World Bank study (Wang and Wheeler, 1999) suggests that although charges provide insufficient economic incentives for compliance (since they are often too low to induce abatement to the legally required level), they have proven highly potent in fighting pollution and cutting pollution intensity. For example, each 1 percent increase in water pollution levy has led to a 0.8 percent drop in the intensity of organic water pollution and each 1 percent rise in the pollution levy has cut the pollution intensity of suspended particulates by about 0.4 percent.). There is, however, considerable variation in terms of the actual charges collected across the provinces.[24] This is explained by two factors: the price a community places on pollution damage, and the community's capacity to understand

**Table 3.17: Pollution charge collection in China, 1992-99**

(US$ million)

| *Year* | *1992* | *1993* | *1994* | *1995* | *1996* | *1997* | *1998* | *1999* |
|---|---|---|---|---|---|---|---|---|
| Total Pollution Charge | 434.3 | 465.1 | 359.4 | 444.6 | 492.7 | 548.0 | 592.1 | 600.4 |
| 1. Above Standards | 331.1 | 337.7 | 250.0 | 297.8 | 315.5 | 342.6 | 314.2 | 318.6 |
| Water | 215.2 | 213.1 | 153.4 | 180.1 | 186.5 | 198.1 | 197.7 | 200.5 |
| Air | 92.3 | 97.2 | 74.8 | 89.0 | 80.9 | 81.7 | 79.1 | 80.2 |
| Solid Waste | 5.6 | 6.4 | 3.7 | 5.7 | 4.5 | 6.0 | 5.3 | 5.4 |
| Noise | 16.1 | 20.7 | 18.1 | 22.8 | 25.7 | 29.4 | 31.9 | 32.3 |
| Radiation | 1.8 | 0.0 | 0.1 | 0.2 | 0.2 | 0.2 | 0.1 | 0.1 |
| 2. Wastewater Discharge | 15.4 | 21.9 | 23.2 | 30.4 | 34.6 | 36.8 | 34.2 | 34.7 |
| 3. $SO_2$ emissions | | | | | 17.6 | 27.3 | 62.2 | 63.1 |
| 4. Four pieces | 87.8 | 105.5 | 86.1 | 116.4 | 142.5 | 168.6 | 181.5 | 184.1 |

*Source:* State Environmental Protection Agency (SEPA) and World Bank staff estimates in Wang and Wheeler, 1999

and act on local environmental problems. The response to pollution levies so far suggests that as the levy rises, the pollution could be reduced far faster than anticipated (Wang and Wheeler, 1996).

In terms of the sheer magnitude, the current Chinese system may be without peer in the world. However, it has been criticized on two principal grounds. First, critics have claimed that there are marked differences in the degree of enforcement across regions, making the current system seem somewhat arbitrary. Second, the incentive properties of the system have been called into question.[25] Using more recent data from 29 provinces, Wang and Wheeler (1999), have countered this criticism, arguing that the stylized facts offer little support for the view that the levy system is arbitrary and ineffective. While effective levies do vary greatly in China, their geographic distribution is correlated with provincial rates of urbanization and industrialization. Furthermore, recent increases in effective levies have been accompanied by large reductions in water pollution intensities and loads.

### *Environmental user fee system in Philippines*

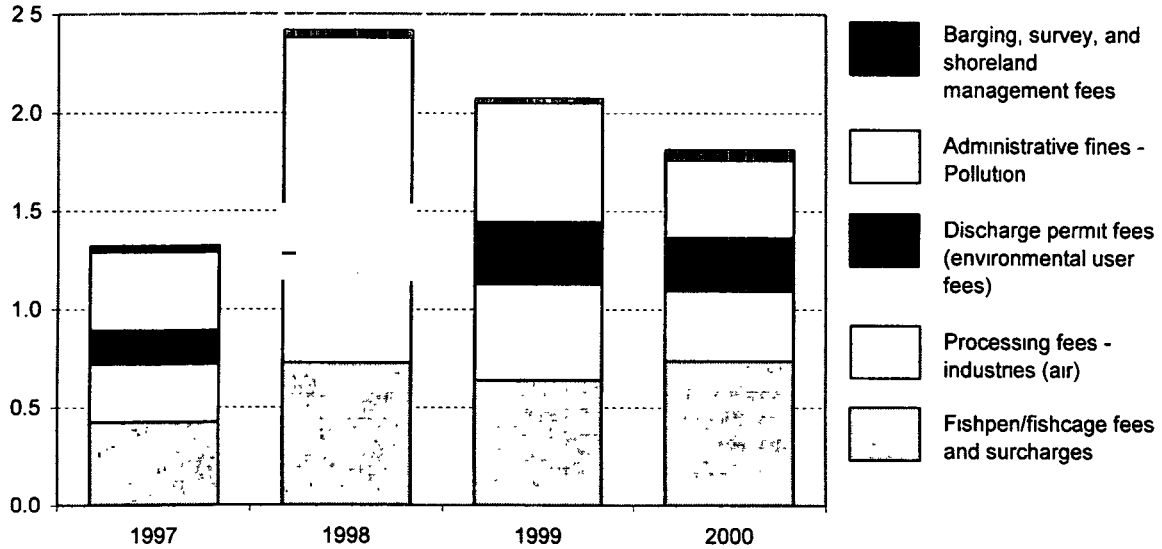
The Philippines has recently introduced a mix of new environmental policies to ensure that its economic growth is environmentally sustainable. These instruments complement the traditional command and control system by using market forces (environmental user fees), public disclosure of information, and engagement of the public through community participation in environmental management.

A good example of an environmental levy in the Philippines is the user fee system first implemented in 1997 by the Laguna Lake Development Authority (LLDA) (Nepomuceno, 2001). Its aim was to curtail pollution of the Laguna lake and to provide incentives for factories to install cleaner technologies. While the Philippines has long maintained a traditional regulatory system, this was an innovative attempt to target and clean-up the Laguna bay which is the second largest and one of the most polluted water bodies in the country. The user fee system had two parts: polluters pay a small flat fee to cover the administrative costs, and an additional charge per unit of emissions that meet the standards and a higher unit charge for emissions above the standard. Figure 3.8 shows the charges levied under the system.

The system now covers 659 industries or establishments, including 100 percent of all factories discharging waste water into Laguna Lake. Eventually, the system is expected to cover all polluting activities from industrial, commercial, domestic, and agricultural sources in the country (World Bank, 2000d). Twenty percent of the revenues are shared with local government units in the program area. The system has led to

**Figure 3.8: Charges from environmental user fees by LLDA, Philippines**

(US$ millions)




*Source:* LLDA Database, Philippines.

significant environmental improvements. Within the first two years of implementation, total BOD discharges from plants dropped by about 88 percent. Revenues from the program have also provided more resources for water quality management programs and to strengthen the existing monitoring and enforcement capability of the LLDA. The government expects to build on the experience of this first phase to mainstream the program throughout the country and across sectors and media. In particular, the Department of Environment and Natural Resources hopes to use the results in drafting the legislation required for applying user fees outside the LLDA area (World Bank, 2000d).

### *The Malaysian effluent charge system*

The Malaysian effluent charge system, one of the oldest in a developing country, was instituted by the Environmental Quality Act, which was adopted in 1974. The Act included provisions for using economic incentives and disincentives, in the form of effluent charges, in support of regulations on discharges. It required that all dischargers pay a fee to obtain a license to discharge waste into public water bodies. The fee varied according to: (1) the class of the premises; (2) the location of the premises; (3) the quantity of wastes discharged; and (4) the existing level of pollution. In 1977, the Department of the Environment decided to combine the effluent charge system with discharge standards and the first discharge fees were collected in 1978.[26] As the quantity of waste discharged increased, the standards became more stringent and the discharge fee also increased.[27] The results have been very encouraging. Despite a 50 percent increase in the number of palm oil mills between 1978 and 1982 and a subsequent increase in palm oil production, the total BOD load released in public water bodies dropped steadily from 22 tons per day in 1978 to 5 tons in 1984. Overall, the regulatory package was clearly effective in reducing pollution and improving the quality of Malaysia's rivers.

The Malaysian system, however, is often faulted for being economically inefficient, because its charges are not based on marginal environmental damage costs but rather on the cost of capital for pollution abatement. Also, the charges are based on BOD rather than on the volume of waste discharged, thus providing an incentive for some firms to dilute their effluent in order to avoid paying the charge. In some cases the surcharge for effluents is too low to act as a deterrent.[28] It has been argued that Malaysia might have reached the same goals more cheaply by relying almost exclusively on pollution charges,

since they would have allowed plant managers the freedom to minimize pollution-related costs (World Bank, 2000d). However, despite its weaknesses, the Malaysian mixed system of command-and-control along with market-based instruments provides valuable lessons for developing countries that are planning to introduce market-based instruments to support environmental legislation. It also shows that efficient enforcement of emission standards can get the job done if public institutions function well, as in Malaysia.

### *User fees and pollution charges in Pakistan*

In Pakistan, environmental taxes and charges have traditionally been designed to meet fiscal goals or to recover costs of providing services. In recent years, growing awareness of environmental issues and increasing pressures on natural resources—annual environmental losses were estimated in the early 1990s to amount to 4 percent of GDP (Brandon, 1995)—have highlighted the usefulness of financial instruments in directing environmental policy.

In the late 1990s, taxes, charges, and fees from environmentally linked sources such as water, forestry, and natural gas contributed between 4 and 8 percent of annual revenues.[29] Most of these charges are at rather low levels and the sectors they are associated with, such as irrigation, tend to be heavily subsidized. Irrigations charges are the most substantive of all the environmental levies and accounted for approximately 38 percent of all user charges and 6 percent of total non-tax revenues in 1999-2000.[30] In this sector, water fees and user charges are again driven by the need to raise revenues for meeting government expenditures.

More recently, there have been efforts to manage pollution and air quality problems by basing policies on the "polluter pays" principle. Pollution levies and fiscal incentives are seen as important components of a recently approved program implementing national environmental quality standards. The program plan calls for pollution charges at an exponentially increasing rate over a number of years, starting with a low base rate that then increases after two years. The proposed base rate is 50 Rupees (US$0.80) per unit of pollution discharged for the first two years after which it increases to 75 Rupees (US$1.20) (Khwaja, 2001).

Other financial incentives that are being considered for inclusion in the program to meet the national environmental quality standards include low import and sales tariffs, duty exemptions, and provision of accelerated depreciation on pollution abatement equipment. The funds collected from these charges are likely to be set aside in provincial environmental trust funds that may receive matching grants from the state, providing additional funds for environmental objectives. Thus, Pakistan is on the verge of instituting a more comprehensive set of incentive-based fiscal instruments for environmental management.

### *Market-based instruments in Latin America and the Caribbean*

Direct regulation traditionally has been the most common approach to environmental problems in Latin America and the Caribbean. However, during the last decade the use of economic instruments for environmental management has started to gain acceptance, especially in countries with greater institutional development. The use of fees for environmental services and contributions for public expenditure incurred in the provision of such services are becoming more common. Colombia, for example, applies pollution and compensatory taxes to waste disposal and emissions; Brazil charges for water extraction and for the disposal of industrial effluent; Chile charges for waste disposal; Mexico charges fees for wildlife utilization as well as fees for industrial waste disposal; Argentina levies taxes on the discharge of residual waste water and Venezuela charges a fee by volume of industrial wastes among others (ECLAC/UNDP, 2001). All of these approaches, in their fashion, attempt to internalize environmental costs. Table 3.18 presents examples of the different types of some of the market-based instruments used in the region.

A recent review by the World Bank (Huber and others, 1998) suggests that the primary role of the market-based instruments in the Latin America and Caribbean region has been to raise revenue. Other potential objectives—such as reduction of environmental impacts or improving the cost-effectiveness of regulations—have been

**Table 3.18: Market-based instruments in Latin America and Caribbean**

| Instruments | Barbados | Bolivia | Brazil | Chile | Colombia | Ecuador | Jamaica | Mexico | Peru | Trinidad and Tobago | Venezuela |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Credit subsidies | X | | X | | X | X | | X | | | |
| Tax/tariff relief | X | | X | X | X | X | X | | | | X |
| Deposit-refund schemes | X | X | X | X | X | X | X | X | X | X | X |
| Waste fee and levies | X | X | X | X | X | X | X | X | X | X | X |
| Forestry taxation | | X | X | | X | | | | | | |
| Pollution charges | | | X | X | X | | | | | | X |
| Renewable resource taxes | | | X | | X | X | | | | | |
| Earmarked conventional tax levy | | | X | | X | | | X | | | |
| Tradable permits | | X | | X | | | | X | | | |
| Eco-labeling | | X | X | X | | X | | X | | | |
| Liability instruments | | X | | | X | | | | | X | |

*Source.* Huber and others, 1998.

underemphasized or not attained. In most cases, institutional weaknesses such as under-funding, in-experience, unclear jurisdiction, or lack of political will, have often limited the effective implementation of these instruments. Their successful use requires adequate legislation and financing, capable institutions, and effective monitoring and enforcement.

### *Colombia's pollution charge system*

Colombia's tax on water pollution is one of the region's relatively successful environmental programs. It has provided funding for environmental activities and generated adequate incentives for reducing water pollution. A salient feature of this program is that each region starts by setting its own pollution reduction goals, imposing the national base charges, and tracking total discharges for six months. The regional regulatory agency then has complete flexibility in terms of the method it adopts for reducing pollution and its options for minimizing costs through less expensive clean-up solutions. The tax is applied progressively over five years, starting with the minimum rate and then increasing every six months by pre-established amounts until agreed regional environmental quality goals are achieved. CORNARE, the pollution control authority in the Oriente Antiqueno region has been a pioneer in instituting this program. The successful collaboration between the agencies and the local business and communities in arriving at the desired environmental goals has been a cornerstone of this program.

Since its inception, the pollution tax has become a source of very substantial revenues in the country. In the period 1997-2000, environmental authorities collected 17.9 billion pesos (US$15 million) for the national environmental system through pollution taxes, over double the total allocations of 8.7 billion pesos (US$6 million) they received from the national budget (ECLAC/UNDP, 2001). The Ministry of the environment is currently working to establish regional funds for cleaning up the environment, which will be financed with the proceeds of water clean-up projects.

### *Environmental taxes in Africa*

At present, environmental taxes are little used to address environmental and resource management problems in Africa, due to the limited scope of the existing tax system and inadequate collection mechanisms. Although user charges of

some kind are being used in some countries, they are often too low to address either revenue issues or environmental and resource management issues. Also, the base of the principle underlying charges is not clear, resulting in charges set haphazardly and not being transparent. The charges are often kept low for equity purposes. They are also seldom adjusted, so that their 'real' value is eroded (Arntzen, 2001). Nevertheless, here we offer some examples of prevalent environmental taxes and charges in Africa.

**South Africa**. The most widely used environmental taxes in South Africa are those imposed on energy products. Among existing and possible future taxes, fees, levies and charges to be imposed in South Africa (SACOB, 2000), eleven can be classified as "environmental" in terms of the expected results, even if their purpose is explicitly revenue generation for non-environmental purposes (see Box 3.9). Energy products account for as many as six out of the eleven "potential environmental taxes", and four out of the five existing "environmental taxes" (the natural parks levy being the fifth one).

**Tanzania.** Tanzania has imposed environmental taxes on a range of sectoral activities, in addition to the traditional taxes on energy products (Kahyarara, 1999). In the primary sector, the most important tax change may have been the removal of subsidies to fertilizers and the imposition of a 5 percent tax, which has resulted in a decline in fertilizer use of about 40 percent. The environmental consequences have been mixed, however, with a reduction in the negative effects of fertilizers on soil being accompanied by a disastrous encroachment by farmers in forest areas, forced by lower crop yields. Local governments administer a number of taxes whose main purpose is revenue generation, but that also attempt to mitigate environmental degradation, such as taxes on livestock, fishing, and mining. The general picture is one of limited behavioral effects due to the low rates of the taxes. Tariffs for water consumption (ranging from US$0.31 per cubic meter for domestic use to US$0.65 for irrigation) are also in place, as is a monthly sewerage charge. In general, environmental taxes in Tanzania are gaining ground, but they are administered mainly by the local governments—with a lack of qualified personnel—leading to a degree of arbitrariness in the setting of rates and a general lack of uniformity and clarity.

**Box 3.10: Current and potential environmental taxes in South Africa**

- *Aviation fuel levy*: 0.15 US cents per litre levy on aviation fuel, used to fund the Civil Aviation Authority.
- *Electrical energy levy*: Estimated at 0.1 USc/kWh over the next ten years (about 5 percent of the average bill) on the net electrical energy sold by licensed generators and importers at the wholesale level, used to fund a National Electrification Fund.
- *Electricity-Regulatory levy*: A dedicated levy of 0.000986 USc/kWh on electricity sales by generators, used to finance the regulatory services provided by the National Electricity Regulator.
- *Fuel levy*: The levy rates applicable from April 2000 are: petrol leaded 8.66USc/litre; un-leaded 8.04USc/litre; gas oil and diesel oil 7.61 USc/litre; kerosene and hydrocarbon mixtures 8.66 USc/litre.
- *Natal Parks Board levy*: Levies range from US$1 per person, per camp for hutted accommodation to US$0.1 per person per entrance gate for gate entry, used to assist neighboring communities (capacity building and development).
- *Electricity tax*: The White Paper on Energy Policy proposes that an "excise tax" be introduced on electricity (specific customer segments may be excluded from the tax) to fund local government.
- *Environmental levy*: The White Paper on Energy Policy announces that the government will investigate the introduction of an environmental levy on energy sales, the proceeds of which would be dedicated to supporting more environmentally benign options, including energy efficiency.
- *Climate change levy*: A policy discussion document issued by the Department of Environmental Affairs and Tourism in 1998 hints at the possible future use of a charge levied in respect of greenhouse gas emissions.
- *Mineral rights tax*: The Green Paper on Minerals and Mining Policy of 1997 discusses a proposal for imposing a tax on privately held mineral rights.
- *Pollution/waste charges*: The White Paper on Integrated Pollution and Waste Management proposes to use various "market-based" instruments designed to improve environmental performance.
- *Water resource use and protection-related charges*: The National Water Act empowers the relevant Minister, with the concurrence of the Minister of Finance, to establish a water use pricing strategy.

*Source*: Jacob, 2000.

**Kenya**. The overriding concern in Kenya's tax policies has been the generation of revenue. However, key tax reforms in 1994 have been significant for the environment. They eliminated the VAT on some fuels and established a road maintenance levy. Taxation on gasoline and diesel was increased while kerosene taxes were reduced.. A beach management levy was introduced as a mechanism for mobilizing resources for clean-up. These changes have had a number of environmental impacts, the most noticeable ones being: reduced air pollution, through reduced vehicle use brought by the vehicle sales tax and the road license fee, and improved quality of the coastal environment (Ayoo and Jama, 1999).

### Earmarking of environmental funds

Earmarked revenues from environmental taxes or charges are increasingly viewed as an important mechanism for financing environmental projects in many parts of the world. In most countries, pollution charges and waste discharge or treatment fees are becoming more closely aligned with the cost of providing basic environmental services, and these revenues are increasingly being retained by the bodies that are responsible for financing those services.[31] At a political level, earmarking is gaining support because it is found that such a "cost-recovery" approach may make it easier to build consensus, remove barriers, and guarantee budget resources to finance environmental programs (Huber and others, 1998).

Although earmarking of revenues is normally avoided in public finance, there are certain conditions under which it can be justified.[32] These circumstances usually arise when: (a) transactions and administrative costs of environmental programs are very high, (b) revenues are related to the explicit provision of a service for a fee, or (c) collection of revenues is politically difficult without clear indication of how the moneys will be used. Earmarked funds provide a means of financing environmental improvements when market, policy and institutional failures impede the emergence of the financing mechanisms characteristic of more developed market economies. In transition and developing economies, these problems can include severe financial constraints on enterprises and households, poorly developed banking systems and capital markets, weak or ineffective enforcement of environmental policy, and uncertainties in fiscal systems. It is sometimes argued that in situations where public budgets are volatile and public investments often cut from year to year, due to the need of macroeconomic stabilization, earmarked funds can provide secure and sustained financing for environmental programs. Even in countries that are relatively more stable and developed, such as Poland or the Czech Republic, public and private sector resources for the environment are constrained.

Earmarked "Environmental Funds" are being used extensively in transition economies, to address broad environmental objectives including education and awareness building, research and institution building, and public and private pollution abatement. In 1997, for example, the aggregate revenues of sixteen "national"' funds of CEE and former Soviet Union Republics amounted to about US$800 million. While their size and level of development vary widely from country to country, earmarked funds of this sort have become quite substantial in some transition economies. In Poland for example, environmental funds accounted for 33 percent of total environmental conservation expenditure, whereas the comparable share for the funds in Hungary, Slovenia and Lithuania was about 20 percent (See Box 3.11 on the Polish experience). In Russian Federation, however, funds provided less than 5 percent of finance for environmental projects.

Based on extensive reviews of existing funds (OECD, 1995; Lovei, 1999; Huber and others, 1998) it is now generally accepted that financing through earmarking of funds are effective only if the underlying reasons for the environmental problems are simultaneously tackled at the policy level. Although incentive effects are important by-products of earmarked direct environmental taxes, efforts to strengthen enforcement capabilities of environmental agencies and upgrading information systems are preeminent in successful funds. Without strengthened environmental regulations and enforcement, environmental funds may end up contributing to existing distortions. Also, the benefits of earmarking are found to be most pronounced when environmental revenues are earmarked to decentralized programs, as in Colombia

**Box 3.11: Polish National Fund for Environmental Protection**

The Polish National Fund for Environmental Protection and Water Management was created in 1989 as an independent financial institution to support protection of the environment. Pollution charges, fees, and fines paid by polluters for exceeding current standards are the Fund's main source of income. Since its creation, it has participated in financing more than 5,000 projects, accounting for 20 percent of total expenditures on environmental protection in Poland. The National Fund spent US$448 million in 1999 on environment-related projects. The main objective of this National Fund is to finance environmental protection investments, including projects described in the "National Environmental Policy" adopted by the Polish Parliament in 1991 or specified in the "Implementation Programme for the National Environmental Policy by the year 2000". Their implementation is supervised by the Minister of Environmental Protection, Natural Resources and Forestry.

National Fund resources are used to finance national and regional public infrastructure projects, support local projects (such as the construction of wastewater treatment plants and potable water systems) whose costs exceed the capabilities of local budgets, and back projects in the fields of special concern. Recipients often include municipalities, industrial enterprises, research and development institutions, and NGOs. Generally, non-commercial organizations receive grants, while commercial enterprises receive loans. The projects are first evaluated by an assessment commission, which issues an opinion on the project's funding eligibility. The final decision is issued by the Minister of Environment, or the Board of Directors. Projects must comply with the national environmental policy (Anderson and Zylicz, 1999).

The National Fund has played a leading role in environmental project financing and serves as an excellent case of a well-managed earmarking program. The discharge of pollutants into the water and air and the accumulation of wastes have decreased considerably recently. For example, 5.3 million cubic meters of wastewater per day (86 percent of all industrial and municipal wastewater discharged into the water) was being treated in 1999 (REC, 2001). In the long-run, pollution abatement expenditures are expected to be financed from private resources in response to the incentive effects of environmental taxes and the improved enforcement of regulations.

(see above). To date, experience in Latin America and the Caribbean has demonstrated that earmarking programs are most successful where: (a) taxes or incentives are linked to existing collection mechanisms, and (b) revenues are made available to decentralized authorities for environmental programming or for institutional strengthening (Huber and others, 1998). Earmarked funds have also been found to be effective when they also strengthen the self-financing capacity of beneficiaries and tackle the causes of financial constraints. Thus co-financing emerges as an important requirement for disbursement of the funds.

Finally, transparency and accountability in the operation of earmarked funds are essential to avoid ad hoc political influence and mismanagement of public funds. Mechanisms for stakeholder participation in the decision making can go a long way in improving the transparency and efficiency of the operations. For example, both in Poland and Czech Republic, local authorities play very important roles in the establishment of priorities and in the selection of projects to be funded. The priorities identified by the local authorities thus serves as a basis for decision making at the national level (Francis and others, 1999)

Earmarking of environmental funds to overcome or mitigate numerous challenges has come a long way in the last decade or so. In many CEE and Latin American countries, the funds have accelerated environmental improvements, leveraged additional finance for environmental investments, and strengthened domestic capacity for project preparation. Experience so far shows that the evolution, effectiveness, and potential of funds is closely linked with the broader progress associated with economic and political reforms, as well as with developments in national environmental policy frameworks.

## Conclusions

Environmental taxes and charges have increasingly found a place in government efforts to control pollution and raise revenues in several countries around the world. Our definition of environmental taxes and charges has included those instruments specifically instituted for pollution control purposes as well as those that have come into existence to raise revenues.

Emerging economies in Central and Eastern Europe have embraced green levies as a policy instrument with considerable enthusiasm. According to our calculations, for the 11 CEE countries for which we have data, revenue amounting to 2 percent of GDP can be attributed to environmental taxes and charges in CEE. In specific countries such as Bulgaria, the revenues obtained are as high as 15 percent of tax revenues and 4 percent of GDP. These substantial revenues suggest that taxes and charges are a well used regulatory tool in CEE transition economies.

Developing countries have not made as much progress with the use of economic instruments in general. Certainly several countries have instituted environmental taxes and charges with revenue collection being a very important goal. The examples of China and Colombia show that using environmental levies is feasible in developing countries. Colombian authorities collected over $15 million between 1997 and 2000 from pollution charges and China collected over $600 million in 1999 alone. However, huge opportunities remain in the developing world for obtaining revenues from environmental taxes.

The potential for environmental taxes and charges in developing countries can be partially assessed by considering the situation in OECD countries. In OECD countries, environmental taxes alone (not including charges) make up approximately 7 percent of total tax revenues. Tax revenues in OECD countries tend to be twice the level of taxes in developing countries. Even accounting for these differences, it is clear that a lot more resources can be raised to finance sustainable development in developing countries.

The environmental impacts of green levies have been very mixed. In CEE countries and Russia, the charges have been rather low and their impact on pollution quite limited. Poland is considered an exception. Here pollution charges have been adjusted for inflation and have resulted in positive environmental outcomes. In general, lack of monitoring and enforcement capacity, lack of information on abatement costs and technology, and low standards have contributed to the disappointing environmental record of green levies in transition economies.

In developing countries, data on charges and environmental impacts is very limited. There are, however, specific examples of cases where pollution charge systems have worked very well. In both Colombia and the Philippines, water charges have resulted in fairly significant improvements in water quality. The Chinese pollution charge system, despite various inefficiencies, has resulted in environmental improvements. In Malaysia, a mixture of command and control and economic instruments has had a positive environmental effect. In general, the charge system is more likely to be efficient when the primary objective of the tax or charge is to curb pollution, the charge is set at a high enough level, there is adequate monitoring, and there is a fair amount of understanding and acceptance among all stakeholders.

Another important issue that needs to be raised relates to the distributional impact of environmental taxes and charges. The impact of environmental taxes on the poor can be gauged by looking at: (1) the direct impact when the price of the taxed good rises and this affects household expenditures; (2) the indirect impact of price increases when the taxed good is used in the production of other goods; (3) the net impact given any improvement in the environment and its impact on welfare and given behavioral changes that result from changes in the price of the taxed good. Studies that have analyzed the incidence of environmental levies on the poor in developing countries are limited. Given the concentration of cars ownership in the upper-income classes, gasoline taxes tend to be progressive. Taxes on diesel have been found to be mildly regressive in developing countries (Gwilliam and others, 2001).[33] As identified in a previous chapter, studies on water user charges suggest that the poor already pay high rates for clean water from other sources; thus, under certain circumstances an increase in user fees may be acceptable if it means better access to clean water.

Finally, while ear-marking and environmental funds have helped speed the pace of environmental improvements in many countries especially in CEE, they should not be seen as substitutes for more fundamental reforms. They should actively support the development of more market-based mechanisms, ultimately leading to stricter, more direct implementation of market-

based instruments. For these reasons, as the use of environmental funds grows, it becomes increasingly important to assess the experience with different funds, to achieve a better understanding of their strengths and weaknesses, and to define the types of practices which can best ensure that they play a positive role as part of the framework of national environmental policies.

## 3.4 Developing Innovative Conservation Financing Mechanisms

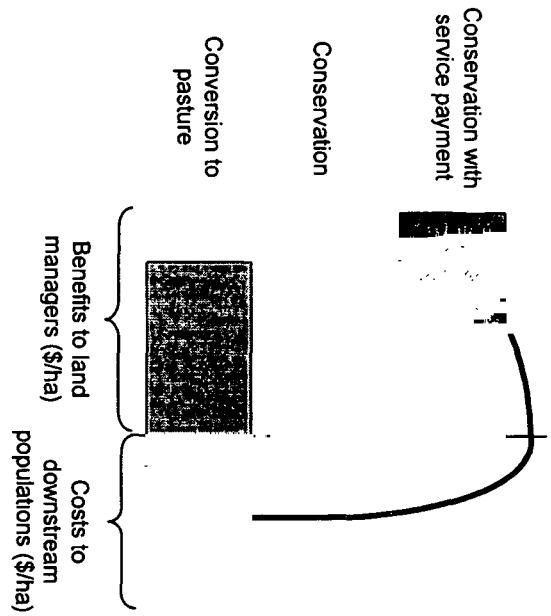
The environmental services provided by natural ecosystems are often taken for granted until they are lost—the hydrological services provided by forests, for example, are only noticed after deforestation results in flooding or reduced water quality, increasing the vulnerability of downstream populations and threatening their health and livelihoods. That such services should be lost despite their value is easy to understand: Land users typically receive no compensation for the services their land generates for others, and so do not take them into account in making land use decisions.

Responses to this problem have tended to rely either on regulations which attempt to dictate particular patterns of land use, or on remedial measures, such as repairing the damage caused by flooding or the construction of civil works aimed at protecting downstream communities from flooding. Neither of these approaches has proved effective. Remedial measures are often imperfect and expensive—often far more expensive than preventive measures. And regulations are extremely difficult to enforce because of the spatial dispersion of land uses. Moreover, it may impose high costs on poor land users by restricting them from undertaking privately profitable land uses.

Recognition of this problem and of the failure of previous approaches to dealing with it has led to widespread experimentation with market-based mechanisms to address these problems. Many believe that market-based approaches can provide powerful incentives and efficient means of conserving forests and the public goods they provide, while at the same time offering new sources of income to support rural livelihoods (Pagiola and others, 2002). A recent review found almost 300 examples of such mechanisms worldwide (Landell-Mills and Porras, 2002), and the list is constantly growing.

**Box 3.12: The simple economics of payments for environmental services**

This figure shows the simple logic of payments for environmental services. Land users receive few benefits from forest conservation—often, less than the benefits they would receive from alternative land uses, such as conversion to pasture. But the latter uses can impose costs on downstream populations, who no longer receive benefits of environmental services such as water filtration. A payment from the downstream beneficiaries of the service can help make conservation more attractive for land users. This payment must obviously be more than the difference between the benefit to land users of conservation and conversion to pasture (or they would not change their behavior) and less than the value of the benefit to downstream populations (or they would not be willing to pay for it).




*Source:* Pagiola and Platais, forthcoming.

Among the mechanisms being developed, one of particular interest here is that of Payments for Environmental Services (PES). The central principle of PES is that those who provide environmental services should be compensated for doing so, and those who receive these services should pay for their provision (see Box 3.12). This approach seeks to align the incentives faced by land managers with those of society as a whole by paying land managers for the environmental ser-

**Box 3.13: Local initiatives on payments for environmental services in Latin America**

- **Costa Rica** pioneered the PES approach in 1997 by developing a country-wide PES system, financed by payments from a fuel tax, sales of carbon emission credits, contributions from water users such as HEP producers, and a GEF payment for bio-diversity conservation (Pagiola, 2002). By mid-2000, the program covered over 200,000 ha of forest.
- In **Colombia**, many water user groups pay for watershed services—sometimes by buying the entire upper watershed. Power companies pay a percentage of their revenues from hydroelectric power generation to the regional corporations that are responsible for watershed management.
- The municipal water authorities of the cities of Quito and Cuenca, in **Ecuador**, are allocating part of their revenues to protect their water sources. In Quito, the money is used to finance improved management in several protected areas from which they receive the bulk of their water (Echevarria, 2002). In Cuenca, the municipal water authority has acquired parts of the upper watersheds that supply the city and kept them under forest.
- Municipalities downstream of El Impossible National Park in **El Salvador** have agreed to make a financial contribution to park management as payment for the watershed services they receive.

**Box 3.14: Payments for environmental services at the World Bank**

Helping countries to find innovative solutions to problems such as the loss of environmental services, which overlap issues of livelihood, vulnerability, and health, is a key element of the Bank's Environment Strategy (World Bank, 2001c). The World Bank is working with several countries to develop PES systems that would help substitute for these missing markets—especially in Central and South America (Pagiola and Platais, forthcoming). Bank-supported operational work on PES includes:

- The *Ecomarkets Project*, which supports Costa Rica's PES program. This project includes a US$32.6 million loan from the World Bank to help the government ensure current levels of environmental service contracts, and US$8 million grant from GEF for the biodiversity services provided through the program.
- The *Regional Integrated Silvopastoral Ecosystem Management Project*, which is piloting the use of PES as a means of encouraging a shift from unsustainable agricultural practices to sustainable silvopastoral practices in Colombia, Costa Rica, and Nicaragua.
- On-going project preparation work in El Salvador, Ecuador, and the Dominican Republic aimed at developing pilot PES programs.
- Assistance to Mexico in carrying out a survey of land management practices in the *ejido* sector (which includes most of the remaining forest area) to help design a PES system and provide a baseline to monitor its implementation.

The World Bank's training and capacity-building arm, the World Bank Institute (WBI) has also developed a training course on PES targeted at technical personnel in ministries, conservation agencies, and NGOs involved in implementing such programs.

vices they generate. It finances these payments by charges to the beneficiaries of these services, thus relieving the government budget from the burden of doing so. It has the further advantage of providing additional income sources for poor land users, helping to improve their livelihoods.

Several countries are already experimenting with such systems (see Box 3.13). Interest has been particularly strong in Central and South America, where the effects of Hurricane Mitch in 1998 made the need to protect environmental services clear. The World Bank has been particularly active in supporting such efforts (Pagiola and Platais, forthcoming) (see Box 3.14).

**Identifying environmental services.** The benefits sought from land use changes typically include (but are not limited to):

- **Hydrological benefits:** Controlling the timing and volume of water flows, and the quality of water.
- **Reducing sedimentation:** Avoiding damage to downstream reservoirs and waterways and hence their uses (HEP generation, irrigation, recreation, fisheries, domestic water supplies).
- **Disaster prevention:** Preventing flooding and landslides.
- **Biodiversity conservation:** Land uses can be more or less friendly to biodiversity.

- **Carbon sequestration:** Many land uses sequester substantial amounts of carbon.

Both qualitatively and, especially, quantitatively, we often know less about the services generated by different land uses than we think we do. This reflects partly the diversity of conditions encountered (hydrological benefits depend on the rainfall regime, on the type of soil and vegetation, and on topography, for example) and on the objectives being sought (regulating waterflows to avoid flooding and dry season deficits may require different interventions than maximizing total water volume).

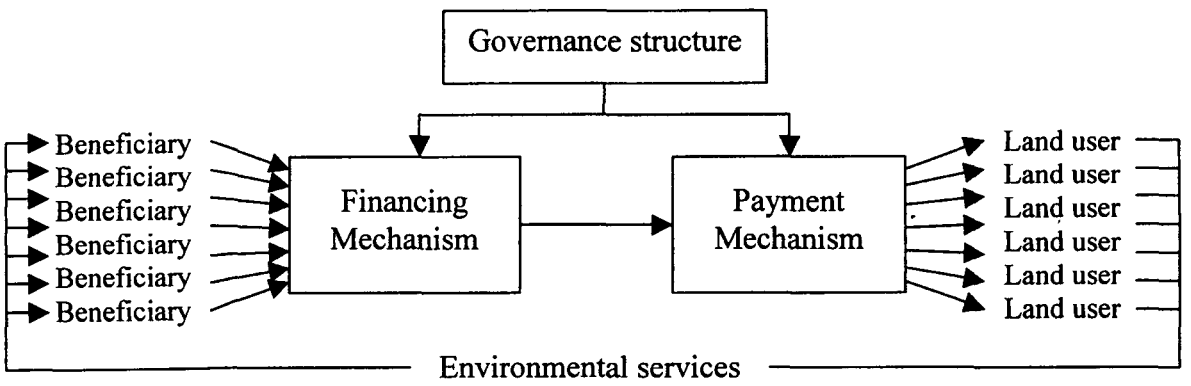
**Financing environmental service payments.** For PES programs to survive, they must have secure sources of financing. This is especially important if payments must be on-going, as discussed in the previous section. The basic principle is that beneficiaries pay for the services they receive. This requires identifying the beneficiaries and the specific services they receive. Beneficiaries do not receive generic "ecosystem services"—rather, they are interested in very specific services. Even within specific services, there are differences. Domestic water supply systems require a constant flow and high quality, but hydroelectric power producers with reservoirs usually prize total volume and care little for water quality, except for the absence of sedimentation. The willingness to pay of any given group of beneficiaries will depend on the specific service they receive, on the value of that service to them (compared to the cost of alternatives), and on the size of the group.

Once beneficiaries have been identified, a means must be devised to capture part of their willingness to pay. This is obviously easiest when they are easily identifiable and already organized, so it is relatively easy to negotiate with them. Should an agreement be reached for them to pay for the water services they receive, they already have the capability of collecting the required funds from their members. An additional fee could be added to water bills paid by municipal water users, for example. Populations in flood-prone areas, in contrast, are not organized (except to the extent that they are included in some of the other three groups) and there is no mechanism to collect payments from them.

Developing systems of environmental service payments that work. PES programs will only have the desired effect if they reach the land users in ways that motivates them to change their land use decisions. In general, several principles are clear:

- **Make payments on-going.** The benefits being sought will generally be enjoyed year after year, as long as appropriate land uses are maintained. For this to occur, land users must receive payments as long as they maintain the land use.
- **Target payments.** An undifferentiated payment system that pays everyone the same will be much more expensive than a targeted scheme. It will also make it difficult to tailor

**Figure 3.9: Institutional framework for payments for environmental services**




*Source:* Pagiola and Platais, forthcoming.

interventions to the particular requirements of given situations. However, a targeted payment scheme may be more expensive to implement than a non-targeted one. A balance needs to be found between the efficiency advantages and the higher costs of better targeting.

- **Avoid perverse incentives.** For example, payments for reforestation can encourage land users to cut down standing trees so as to qualify.

**Establishing the institutional framework.** PES programs require a supporting institutional infrastructure. Figure 3.9 summarizes the functions that must be performed by PES programs. A portion of the benefits received by environmental service beneficiaries must be captured and channeled to land users to provide incentives to protect forests. These systems depend on several prerequisites. Market participants must have access to information on the value and volume of services being exchanged. Participants must have opportunities for finding and negotiating payments. Property rights over service commodities need to be clearly defined and ownership assigned. Monitoring and enforcement mechanisms are required. A network of supporting regulatory and institutional arrangements may be necessary for markets to function effectively. Establishing such market infrastructure is not easy, and rarely cheap.

**Enhancing the poverty alleviation impacts.** Many of the potential supplier of environmental services are expected to be poor; the upper watersheds which are critical sources of water services, for example, are often inhabited by poor subsistence farmers. For these land users, payments for environmental services represent an important potential additional source of income. This will not happen automatically, however. Working with many small, dispersed farmers imposes high transaction costs, so particular efforts are needed to ensure that the poor have access to the new opportunities created by PES programs. In Costa Rica, for example, a system of collective contracting has been developed, in which groups of small farmers can join the PES program as a group rather than individually.

## Notes

1 It is important to note that it is not lowering profits *per se* that will change incentives, but rather increasing the price of each tree felled—a profit tax would have no incentive impact (only a scale impact).

2 This is not a phenomenon seen only in developing countries. Many developed countries subsidize logging activities or fail to charge appropriate stumpage fees. Revenues forgone from low stumpage fees and raw logging export bans in British Columbia, Canada, alone have been estimated to be between US$564–1,164 million. However, this is a more pressing problem in developing countries, which can ill-afford such revenue losses, and where the environmental impact of mis-pricing forest resources is more severe due to weak logging regulations (Sizer, 2000).

3 Note that while pre-harvest fees can maximize the value of timber extraction, they do not necessarily maximize the total value of the forest when forest benefits other than timber are also taken into account.

4 UFAs are concession licenses that allow logging in non-permanent forest domains. They are allocated for 15 years and for a maximum of 200,000ha (Global Forest Watch, 2000b).

5 *Vente de coupe* are more limited logging licenses. These are allocated for one year and for a maximum area of 2,500ha. However, the tax burden on these licenses is much lower than on the larger concessions, creating an incentive for loggers to obtain these licenses. Lack of enforcement of existing regulations also suggests that substantial illegal logging occurs with this type of license. According to one estimate, for every *vente de coupe* that is logged legally, four are logged illegally (Seymour and Dubash, 2000).

6 *Autorisation de récuperation* allow only 30m$^3$ of extraction from non-permanent forest domains for a maximum of three months.

7 The potential for bioprospecting fees to capture part of the benefits of extracting valuable genetic information from natural habitats has already been discussed above.

8 There are several definitions of "ecotourism" in the literature. The two most accepted are by the International Ecotourism Society, which defines ecotourism as "responsible travel to natural areas that conserves the environment and sustains the well-being of local people," and by the International Union for the Conservation of Nature, which

defines ecotourism as "environmentally responsible travel and visitation to relatively undisturbed natural areas, in order to enjoy and appreciate nature (and any accompanying cultural features—both past and present) that promotes conservation, has low negative visitor impacts, and provides for beneficially active socio-economic involvement of local populations."

[9] While revenue information may very well exist, it is not generally reported, except perhaps as part of larger aggregates.

[10] This manual provides standardized terminology for park tourism, outlines a five level system for measurement, provides guidance on measurement techniques and technologies, and provides examples of the use of tourism data in park management (Eagles, 2001).

[11] In the early 1990's foreigners were charged a US$40 fee and the number of foreign visitors was about 25,000. In April of 1993 the fee was raised to US$80, and number of foreign visitors reached 37,000. In 1997 fees were raised to US$100, while the number of foreign visitors continued to increase to just over 50,000 (Honey, 1999).

[12] Revenue figures are estimated using average prices for a given year and multiplying by the number of visitors for that year.

[13] There were incidents of retaliation, however, where the Maasai people at Amboseli began spearing wildlife in response to a proposed government policy in 1971 to take over large tracts of land within the Maasai water basin. The government's failure to keep compensation agreements reached with the community continued to be a source of problems.

[14] There are some examples cited in the literature of higher fees having no impact on visitation rates (Belize, Brazil, Egypt, Indonesia, Italy, Netherlands Antilles (Saba MP), Papua Guinea, and Suriname, reported by Lindberg and Halpenny 2001) and even leading to higher visitation rates due to site improvements (Moremi Game Reserve in Bostwana study by Barnes, cited by Lindberg and Aylward, 1999; and Bonaire Marine Park, in the Netherlands Antilles, where increased fees have been used to maintain coral reefs and have attracted more divers, and St. Lucia's Soufriere MMA in Lindberg and Halpenny, 2001; Galapagos National Park charges US$100 to foreign visitors and still sees the number of visitors increasing year after year, beyond what its estimated carrying capacity, several sources). In Lindberg and Halpenny's review of marine protected areas, they cite many parks that have been able to become financially self-sustainable on the basis of diving, snorkeling, and boating fees charged.

[15] This is often referred to as the "polluter pays principle," which recognizes that polluters should pay for any environmental damage they create.

[16] This estimate only includes taxes, for examples excise duty on petrol, and excludes environmental charges such as water pollution charges, which yield substantial revenues.

[17] This does not include revenue from other sources such as energy and transport taxes, but these taxes are not very high.

[18] For example, Slovenia has introduced a motor fuel $CO_2$ tax and Romania a fuel road tax.

[19] Poland appears to be an exception, since pollution charges are adjusted annually to compensate for inflation (REC/SIEI, 2001).

[20] This makes a carbon tax more appealing than a tax on $SO_2$ emissions, (the source of acid rain) for instance, as the latter would need to be monitored directly.

[21] Of the three major fossil fuels, coal produces the most carbon per unit of energy, followed by oil and then natural gas.

[22] Factories are charged only for pollution in excess of standards, and the charge is levied only on the single air or water pollutant that most seriously violates regulatory standards for each medium. The sectors that contribute the most to the pollution charge system are smelting, chemical, textile, electricity, and coal (World Bank, 2000).

[23] China's regulators do impose serious penalties, including shutdowns, for factories that persistently violate standards.

[24] The official rate is supposed to apply uniformly across China.

[25] Local collection incentives are also affected by the officially-mandated use of the levies collected. The regulations require the use of 80 percent for subsidies or loans to co-finance abatement by polluters who have paid a levy. Local environmental authorities can use the remaining 20 percent and any other penalty fees to support their own operations. For further discussion of the allocation of levy funds, see Yun (1998) and Yang and others (1997).

[26] Operating licenses were issued for a flat M$100 (US$45) fee, plus a charge of M$10 (US$4.50) per tonne of organic pollution discharged into water and a surcharge of M$100 (US$45) per tonne for BOD discharges beyond the allowable limits. Since

the DOE at that time had no way of valuing actual damages from pollution, it intended this charge to be high enough to provide some abatement incentive without being burdensome.

[27] In the ensuing years, the government abandoned the surcharge, maintaining only the M$10 (US$4.50) per tonne discharge fee and specified that the standards would be mandatory.

[28] Some companies find it cheaper to pay the fine than to treat their effluent sufficiently to meet the standard.

[29] In 1999-2000, charges and fees amounted to 5.4 percent of revenue receipts, but was higher at 7.7 percent in 1997-98. Estimate based on World Bank data for Pakistan.

[30] Includes receipts from services provided in the areas of agriculture, fisheries, forestry, fuel and power, industrial and mineral resources, printing, industries, transport, and communications. The estimate is based on World Bank data for Pakistan.

[31] Environmental funds generally derive their revenues from taxes and charges on pollution. These receipts are set aside for environmental purposes instead of being transferred to the general government budget. The funds then are used to provide finance and assistance for investments and other activities to achieve environmental objectives.

[32] In the public finance literature the conventional view is that taxes collected from various activities should be paid into a general fund, from which government expenditures are financed. In other words, there should be no "earmarking" of taxes. The reason for this position is that earmarking introduces inefficiencies and constraints in the way that a government can allocate funds to the different expenditure categories. If environmental taxes are earmarked for expenditure on environmental investments, the level of those investments will be dictated by the tax revenues rather than by the merits of the investments; or the tax rates will be dictated by the abatement expenditure requirements and not by estimates of the environmental damage. The former (expenditures determined by tax revenues) is more common and can result in too low a level of abatement, or too high, depending on what taxes are collected. Also, from a fiscal policy perspective, for example, earmarking has potential dangers: allocating and disbursing revenues outside the government budget may result in economic inefficiencies, particularly over the long term. In addition, if funds are not effective in supporting environmental policy goals, they lose their main rationale. There is a rich theoretical literature on the earmarking of environmental taxes issue (Brett and Keen, 2000; Marsiliani and Renstrom, 2000; Fredricksson, 1997).

[33] This work does not discuss any benefits to the poor from a tax-resulting decrease in pollutants.

# 4. Summary

Several main lessons emerge from this discussion:

- **There is substantial potential to generate additional public sector resources,** although data limitations preclude a comprehensive estimate. The amounts vary considerably across sectors and countries, however. The most important potential source of additional revenue comes not from efforts to generate new revenues, but from freeing up available resources by improving the efficiency with which they are spent—in particular, by reforming subsidies that are expensive and, often, environmentally harmful. Even when the sums involved appear limited, reform can help make subsectors financially self-sustaining rather than wholly dependent on the public purse.
- **Reforms can have important incentive effects.** In addition to generating new resources or freeing up existing ones, many of the reforms discussed in this paper would also help reduce environmental damage, by providing incentives that tend to discourage environmentally-harmful activities and encourage more sustainable ones. Indeed, in many cases this outcome would be as or more important as the resource generation itself. For example, in both Colombia and the Philippines, water charges—although motivated primarily by revenue generation—have resulted in fairly significant improvements in water quality. Likewise, the Chinese pollution charge system has resulted in environmental improvements.
- **Reform is not anti-poor.** Though many policies claim to be pro-poor, they often are not. Electricity and water subsidies are of no assistance to poor people who almost always lack access to these services. Reducing these subsidies would, therefore, not only not harm the poor, it might well benefit them if the resources that are freed up are used in more appropriate ways. However, any policy reform or other effort must clearly take considerable care not to inadvertently harm the poor.
- **Reform will require political will, but also good governance, capacity building, and investment.** In many cases, it will be necessary to spend money in order to make money. Cost recovery in domestic water, for example, will require establishing water metering and creating or strengthening the institutional capacity to read meters. Good governance is critically important for revenue generation from natural resources. Recent evidence from Cameroon, for example, shows that sound reforms that enhance transparency can result in significant increases in forest rents to the state. A key message here is that reforms must take into account the willingness and ability of governments to implement these reforms.
- **One size does not fit all.** There is substantial variation in the needs, opportunities, and constraints facing different developing countries. Even within countries, there is substantial variation in capacity to implement public reform programs across regions or sectors. Although a paper of this size obviously cannot do justice to this diversity, we have tried to point out differences where appropriate.

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# Appendix A. International Financial Flows

This Appendix looks at how the landscape of development financing for environmental purposes has changed since the United Nations Conference on Environment and Development (UNCED) in 1992 in Rio de Janeiro, Brazil. The central issue of the Rio Conference concerned mechanisms for financing sustainable development. The Conference also recognized the need for global cooperation, given increasing economic globalization and simultaneous degradation of global environmental public goods. Five resolutions were passed at Rio, which represented the most universal and coordinated policy response at that time to worldwide concerns about the environmental dimensions of development.[1]

Financial resources to address environmental problems are limited in developing countries, as government budgets are generally severely constrained by social and economic demands. Thus, one of the commitments made by developed countries at the Rio Conference was to increase the amount of their official development assistance relative to their GDP—a reaffirmation to fulfill the target of 0.7 percent of GDP set by the United Nations in 1970. In Agenda 21, it was agreed that "official development assistance ought to be a major source of external financing for developing countries, particularly the most vulnerable among them." However, five years later an appraisal of progress made since the Rio Conference at the nineteenth special session of the General Assembly concluded that little headway had been made with regard to the Rio resolutions (OECD, 2000b). Ten years later, we reach the same conclusions by examining available data on international development assistance.

In section A.1, we examine trends in the total flow of financial resources from OECD countries to developing countries. Section A.2 discusses the extent to which these flows support environmental projects. In section A.3, we focus on specific instruments such as the Global Environmental Facility (GEF) and the contribution of Non-Governmental Organizations (NGOs) in mobilizing resources for environmental causes in developing countries. We also discuss some of the new financial mechanisms used in the 1990s, such as debt-for nature swaps and environmental funds.

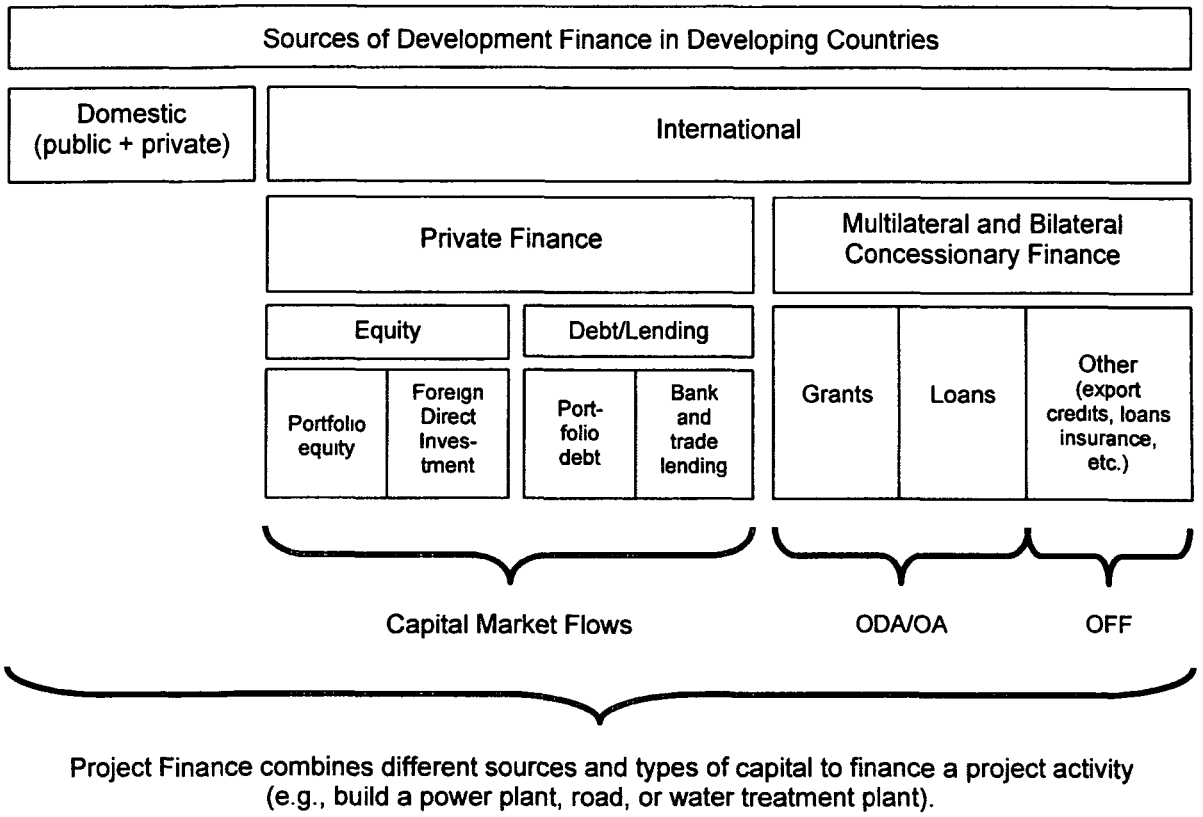
## A.1 International Financial Flows to Developing Countries

Foreign aid is intended to transfer resources, beyond those the recipient country can mobilize either domestically or through trade, for the promotion of economic development. Official public sector flows to developing countries from bilateral and multilateral institutions fall into three categories: official development assistance (ODA) are loans and grants to the poorest countries, official assistance (OA) are loans and grants to middle income countries, and other financial flows (OFF) are items such as export credits and loan insurance. Figure A.1 provides an overview of the sources of public and private financial flows to developing countries. The primary focus of this paper will be on flows of ODA targeted for environmental projects.

Statistics on the flow of aid to developing countries are collected by the Development Assistance Committee (DAC) of the OECD through two reporting systems: the annual aggregated DAC statistics and the activity-specific Creditor Reporting System (CRS). DAC members now provide over 95 percent of all ODA.[2] The DAC statistics provide an overall picture of the geographic distribution or purpose of aid, and the relative importance of each recipient country, region, or purpose in the total. The CRS statistics permit examination of the geographical and purpose breakdown simultaneously (OECD, 2000b).

Figure A.2 shows total commitments of official development financing to developing countries from bilateral and multilateral sources over the last decade.[3] The amount of money flowing from rich to poor countries has remained relatively constant, despite commitments made by developed countries to increase assistance to developing countries. When comparing the ratio of ODA to GDP, we find that flows of ODA have yet to reach the 0.7 percent of GDP target.[4] Disaggregated data from DAC statistics (not shown

**Figure A.1: Overview of public and private financial flows**



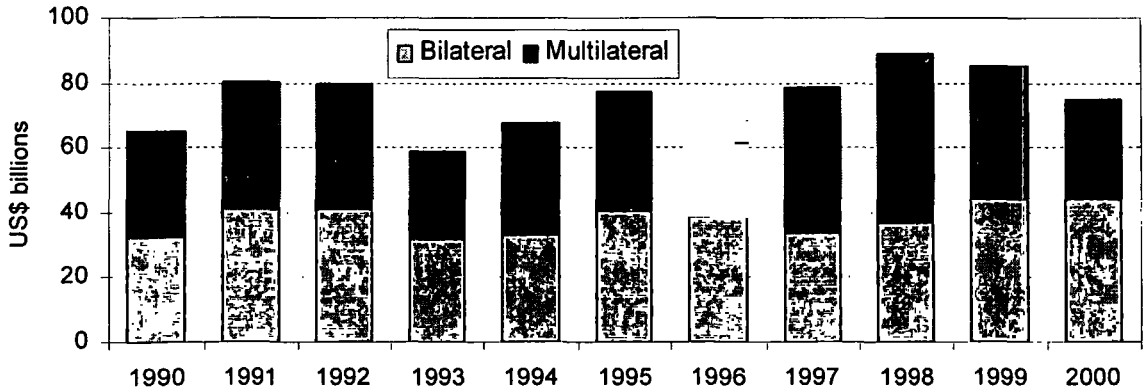

*Sources:* World Bank, 2001a, and OECD DAC-Online 2001.

below) indicate that total ODA declined from 0.33 percent of donor countries GDP in 1992 to 0.22 percent in 1997. This was followed by a slight increase in the years immediately after, which brought the figure up to 0.24 percent in 1999, only to drop once again to 0.22 percent in 2000. *If ODA flows had remained at the peak level of 0.33 percent of GDP, there would have been an additional flow of US$20 billion a year to developing countries.*

ODA is only one component of the total amount of resources flowing to developing countries. Table A.1 below shows the total official public and *private* flows to developing countries over the last decade. In the 1990s, private flows to developing countries, dominated by foreign direct investment (FDI), increased considerably. FDI accounted for 18 percent of all resources flowing to developing countries in the early 1990s, but by 1998 it increased to almost half of resources flowing to developing countries. During this period, official development financing, of which ODA is the largest component, remained more or less at the same level in absolute terms.

The environmental implications of the increase in private sector flows are difficult to assess since there are no reporting mechanisms for this type of activity. It is also much harder to influence private investment to take into account environmental concerns, given the public nature of environmental variables. Preliminary evidence suggests that most FDI flows have been directed at natural resource-extraction industries, such as petroleum and minerals (World Bank, 2001a). Another concern is that most private resource flows have bypassed most poor developing countries. The top 10 recipients received approximately 74 percent of FDI flows going to developing countries.[5] While total FDI flows have grown steadily over the last decade, the share of FDI received by developing countries has actually declined over the same period (Donge and others,

**Figure A.2: Total official development financing to developing countries**




*Sources:* OECD International Statistics online, CRS ODA/OA Commitments.

2001). Therefore, flows of public funds as official development financing will remain an important instrument in addressing poverty/development concerns and environmental outcomes in the process of development.

In general, there has been little change in the total amount of public aid flowing to developing countries during this last decade. Most developed countries have failed to keep their promise to increase their contributions as a percentage of their GDP. We also find that official development financing to developing countries has decreased in importance relative to private sector financing. The implication of this development for environmental concerns is uncertain due to lack of information on the purpose of private flows. The rest of this Appendix looks more closely at public resource flows to developing countries and examines the environmental impact of these flows.

## A.2 Environmental Conservation Financing

Developed countries provide loans and grants exclusively for environmental purposes as part of their ODA. Three formal commitments made during the Rio Conference aimed to: (1) make environmental protection an integral part of the development process, not something to be considered apart from it; (2) apply the 'precautionary principle' in the face of serious threats or irreversible damage and not use the lack of scientific evidence as a reason to postpone cost-effective measures to prevent further environmental degradation; and (3) apply environmental impact assessments for activities that have a significant impact on the environment.[6] In order to achieve these objectives and implement the Rio Conventions on climate change, biodiversity conservation, and to combat desertification, the UNCED Secretariat estimated that an *additional annual* transfer of resources amounting to approximately US$125 billion would be necessary (OECD, 2000a).[7] While it is clear that the level of financing for environmental purposes is nowhere near the goal established, it is important to assess what is the current situation.

### Official development financing for the environment over time

Financial data collected by OECD allows us to examine environmentally targeted bilateral commitments.[8] Environmentally targeted financial flows are defined as activities consistent with:[9] (1) the prevention or control of the release of substances with negative consequences on the health and habitat of living organisms, (2) the reduction of consumption or demand for non-renewable natural resources, and, (3) the protection of ecosystems, endangered wildlife, or global environmental commons (Donge and others, 2001). There are no accepted standards on how to classify aid flows that support environmental protection and natural resource management. We use the World Bank's classification of environmental projects within its lending portfolio, as well as a broader

**Table A.1: Total flows of net resources from OECD DAC member countries**

| | *1991* | *1995* | *1999* | *1991* | *1995* | *1999* |
|---|---|---|---|---|---|---|
| | *(current US$ billions)* | | | *(% of total)* | | |
| **A. Official Development Financing** | **84.5** | **87.6** | **85.9** | **61.2** | **33.2** | **34.2** |
| 1. Official development assistance[a] | 57.1 | 59.1 | 52.1 | 41.4 | 22.4 | 20.7 |
| Bilateral | 41.1 | 40.6 | 37.9 | 30.0 | 15.3 | 15.1 |
| Multilateral | 15.8 | 18.4 | 14.2 | 11.4 | 6.9 | 5.6 |
| 2. Official Assistance | 6.6 | 8.4 | 7.8 | 4.8 | 3.2 | 3.1 |
| Bilateral | 5.0 | 7.1 | 4.9 | 3.6 | 2.7 | 1.9 |
| Multilateral | 1.6 | 1.3 | 2.9 | 1.1 | 0.5 | 1.2 |
| 3. Other types of official financing | 20.8 | 20.1 | 26.1 | 15.1 | 7.6 | 10.3 |
| Bilateral | 13.1 | 14.0 | 10.4 | 9.5 | 5.3 | 4.1 |
| Multilateral | 7.7 | 6.1 | 15.6 | 5.6 | 2.3 | 6.2 |
| **B. Total Export Credit** | **0.6** | **5.6** | **4.0** | **0.4** | **2.1** | **1.6** |
| **C. Private Flows** | **53.0** | **170.7** | **161.1** | **38.4** | **64.7** | **64.2** |
| 1. Direct Investment (DAC) | 24.8 | 59.6 | 145.6 | 18.0 | 22.6 | 58.0 |
| 2. Offshore centers | 6.5 | 6.3 | 37.9 | 4.7 | 2.4 | 8.5 |
| 3. International bank loans[b] | 10.7 | 76.9 | -79.6 | 7.7 | 29.1 | -31.7 |
| 4. Total loans in bonds | 28.7 | 24.7 | 28.8 | 3.5 | 9.4 | 11.4 |
| 5. Other types of loans (including equity)[c] | 7.1 | 3.5 | 59.5 | 5.2 | 1.3 | 23.7 |
| 6. Subsidies from non-governmental organizations | 5.4 | 6.0 | 6.7 | 3.9 | 2.3 | 2.7 |
| **Total flows of net resources (A+B+C)** | **138.1** | **263.8** | **251.0** | **100** | **100** | **100** |

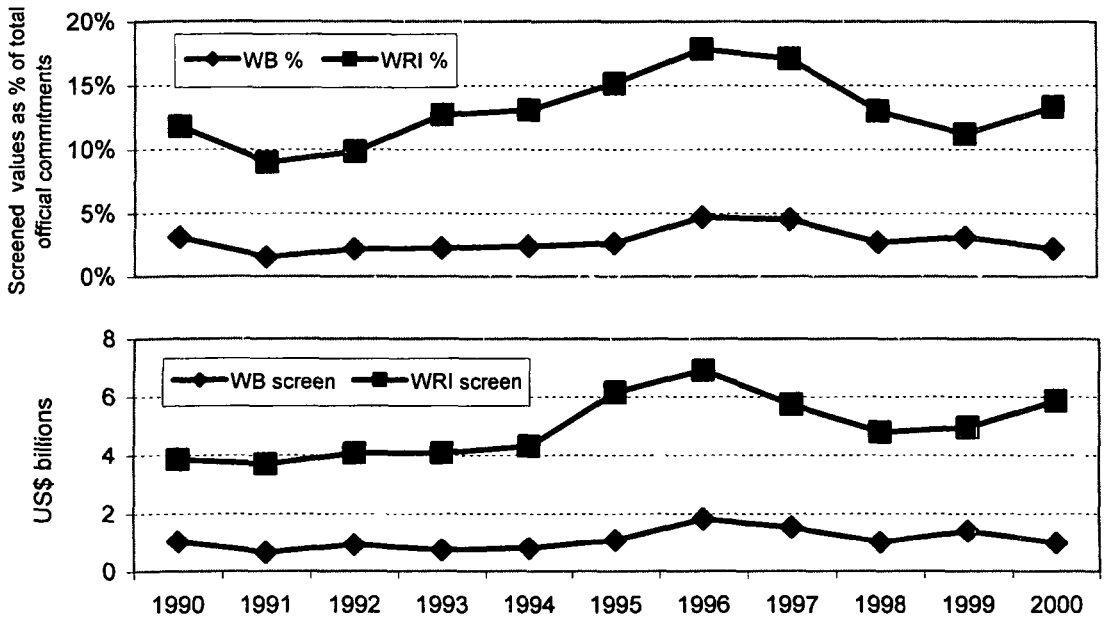
*Notes:* [a] Does not include non-official debt cancellation for 1991 or 1992.
[b] Does not include bank loans (included in C) or guaranteed financial credits (which are included in B)
[c] Incomplete reports for several DAC countries; includes Japan from 1996 on.

*Sources:* OECD, 2000b.

classification suggested by the World Resources Institute (WRI) (Donge and others, 2001).[10] We use OECD data available from the CRS database rather than the DAC statistics database because the former allows more detailed screening according to the identified purpose of the project supported with official development flows.[11]

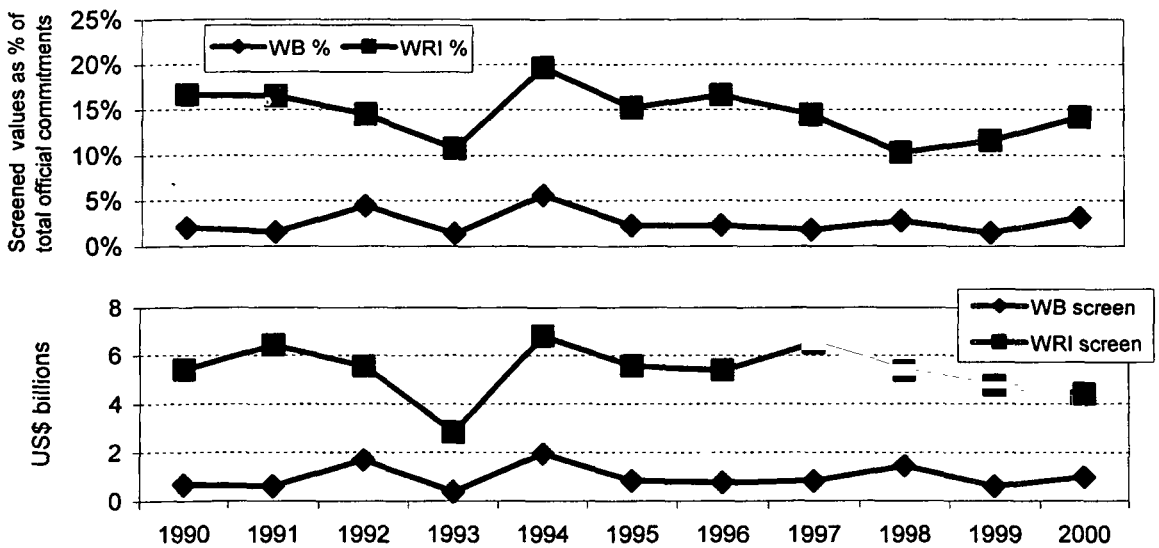
Figure A.3 shows the total amount of environmentally targeted bilateral official development financing commitments using two definitions. The figure also shows these screened values as a percentage of the total official development financing commitments. As the Figure shows, there was only a slight increase in official development financing commitments for environmental purposes following the 1992 Rio Convention. Environmental commitments reached peak levels in 1996 at US$1.8 billion (World Bank screen) and US$6.9 billion (WRI screen). However, under both screens, this increase is almost or totally reversed by the end of the decade. As a percentage of total commitments, under the World Bank definition, we see environmentally targeted aid has stayed relatively constant, averaging around 3 percent of total official development financing commitments. The broader WRI definition fluctuates between 9 and 18 percent, averaging about 13 percent of total commitments.

**Figure A.3: Environmentally targeted bilateral commitments**




*Source·* OECD International Statistics online, CRS ODA/OA Commitments: Form 1—All details.

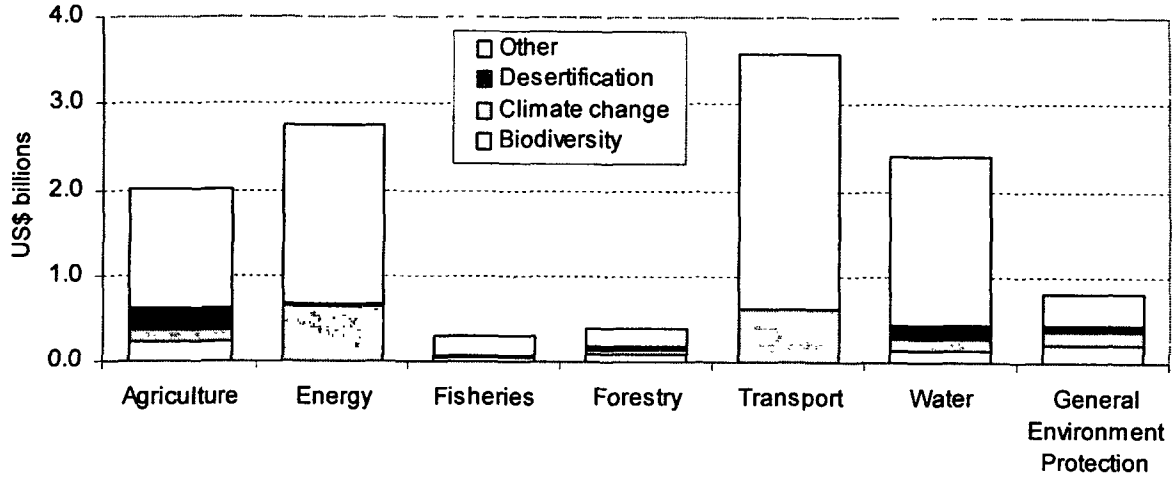
**Figure A.4: Environmentally targeted multilateral commitments**




*Source:* OECD International Statistics online, CRS ODA/OA Commitments: Form 1—All details.

A slightly different pattern emerges when we examine multilateral commitments towards the environment (Figure A.4).[12] In this case, environmentally targeted multilateral commitments saw a sharp decline in 1993, as did total commitments, and have been on a somewhat declining trend after rebounding in 1994. At the peak in 1994, multilateral financing commitments toward the environment amounted to almost US$2 billion and nearly US$7 billion under the two screens. As a percentage of total commitments, under the World Bank definition, multilateral aid has stayed relatively constant just below five percent. Under the WRI definition, multilateral aid has fluctuated a

**Figure A.5: Total environmenal ODA, 1998**




*Source:* OECD, 2000a.

bit more, hovering around 15 percent over the last few years.

Interpretation of the patterns discussed above need to take into account existing difficulties in classifying financial flows into specific categories and the lack of an acceptable definition on how to use existing classification schemes to reflect environmental considerations. However, in general, it is hard to escape the conclusion that there has been little increase in bilateral or multilateral financing of the environmental sector following the commitments made at Rio.[13]

## Bilateral flows to specific environmental problems and regions

In this section, we examine a pilot study carried out by the OECD to measure the extent to which official development assistance contributed to the different *specific* agreements made in Rio (OECD, 2000a). This allows us to examine how total environmental assistance was distributed between different sub-categories. We also present results from study that identified investments over the last decade in support of one the key Rio conventions (biodiversity) in the Latin America and the Caribbean region. While both studies provide only a partial picture of how financial flows have targeted toward Rio goals, examining this data allows us to get a better understanding about what regions and sectors received funds.

### *Official Development Assistance targeting the Rio Conventions*

The information in Figure A.5 provides a snapshot of the relative distribution of ODA in 1998 for different environment related activities, indicating their sectoral distribution and the proportion that was specifically targeted at meeting the goals of the Rio Conventions.[14] The transport sector was the largest recipient of funds (over US$3.5 billion), followed by the energy and the water sectors, which received about US$2.5 billion each. Of these totals, only a relatively small amount was specifically targeted at meeting the goals of the Rio Conventions, although some of the other expenditures undoubtedly also contributed.

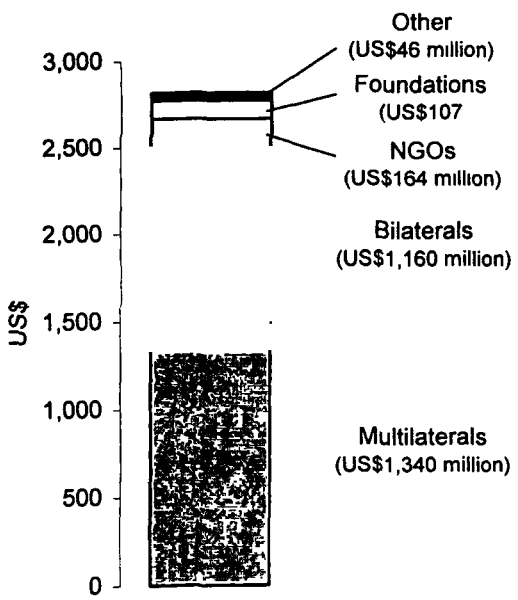
The study found 313 operations for climate-change related activities in 1998, representing a total value of US$1.8 billion.[15] Three-quarters of this assistance went to Asia, and most was allocated to the energy and transportation sectors. The US$778 million used for biodiversity related activities is spread across the agriculture, forestry, water, and general environmental protection sectors. Here too the main recipient of assistance (50 percent) was Asia. Africa, on the other hand, received half of the US$562 million in ODA devoted to activities to combat desertification. These funds have been allocated primarily to-

wards improving agricultural practices, and to a lesser extent to management of water resources.[16]

### *Investment in biodiversity in Latin America and the Caribbean*

Substantial investments have been made to forestall the deterioration of biodiversity in the Latin America and Caribbean region. The United States Agency for International Development (USAID), the World Bank, and the Biodiversity Support Program designed a survey to compile information on funding available for biodiversity conservation at the project level (Castro and Locker, 2000).[17] The results show that a cumulative total of US$3.3 billion of financing was provided between 1990 and 1997 for 3,489 conservation projects. Brazil and Mexico received the most funds, together accounting for 45.5 percent of funds. The countries to receive most funding per square kilometer, however, were Venezuela, the Central American countries, and the Dominican Republic, Ecuador, Haiti, and Jamaica. The southern cone countries and Cuba received the smallest amounts.

**Figure A.6: Sources of financing for biodiversity conservation in Latin America, 1990-97**




*Source:* Castro and Locker, 2000.

Multilateral and bilateral agencies shared almost equally the bulk of the financing of biodiversity projects (see Figure A.6). Thirteen principal financing sources accounted for 77 percent of total funding, including the World Bank (17 percent), the Inter-American Development Bank (IDB) (11 percent), the German Corporation for Technical Cooperation (GTZ) (9 percent), USAID (6 percent), and the GEF (6 percent). Projects relating to management of natural resources and of protected areas accounted for over 70 percent of financing. Of the projects that could be classified by eco region, tropical and subtropical broadleaved forests accounted for 66 percent of funding (Castro and Locker, 2000). Although there is no doubt that some headway has been made on the issue of biodiversity conservation in the last two decades, this has been insufficient, as threats to biodiversity have grown and become more complex.

The analysis in this section shows that the amount of official development financing targeting environmental purposes is only a small share of total financial flows to developing countries (generally between 5 and 15 percent) and has remained relatively constant over the last decade. This is despite the greater awareness of environmental and natural resource management problems and commitments made since the Rio Conference. The analyses of financial flows for environmental purposes is severely constrained by lack of specific data and consensus over definitions of what can be considered "environmental financing." We clearly need more in-depth studies, such as the one carried out for biodiversity investments in Latin America and the Caribbean, to fully assess the extent of financial support for environmental programs.

## A.3 New mechanisms for financing environmental conservation

The Rio Conventions called for 'new and additional' funds for protecting the global environment. For example, the Convention on Climate Change stipulated that the developed countries would provide developing countries with the "new and additional" financial resources necessary to meet the needs arising from the implementation of the Convention. This guarantee

was one of the decisive factors in having developing countries agree, at least in principle, to the process of preventing the risks threatening the global environment. It is difficult, however, to measure the creation of "new and additional" resources over and above commitments of official development aid, given that many countries are not even fulfilling their pledge to target 0.7 percent of their GDP to ODA. Box A.1 discusses some of the difficulties involved in this process of accounting for these two separate commitments.

**Box A.1: The French GEF and ODA: Separate but complementary sources of funding**

The French GEF (*Fonds Français pour l'Environnement Mondial*, FFEM) was established in 1994 and has a portfolio of 99 projects. US$67 million was allocated to the FFEM for the 1994-1998 period, and the fund was replenished with an identical amount for the 1999-2002 period. As far as France is concerned, the spirit of the Rio undertaking is adhered to since these "new and additional" resources have been made the subject of a specific fund, a specific procedure, and specific institutions. The FFEM has deliberately been kept separate from the development aid circuits.

There are three reasons why it is difficult to evaluate the application of the principle of additional resources. First, resources allocated to protecting the global environment are supposed to contribute to development projects rather than cover the costs of purely environmental projects. As a result, the "visibility" of these resources tends to fade away at the field level. Second, in certain countries the new and additional resources may follow the same channels and be governed by the same institutions as the development aid funds. This was one of the reasons why France developed the FFEM.

## The Global Environmental Facility

The Global Environment Facility (GEF) has been a significant source of new funding for the environmental projects in developing countries. The GEF was created in 1991 as an experimental facility and was restructured after the Rio Conference to act as the implementing financial mechanism for the Convention on Biological Diversity and the United Nations Framework Convention on Climate Change. The GEF area of focus also includes international waters and ozone depletion. GEF funds can also allocated to eligible projects that address land degradation problems that fall into above focal areas.

Support for the GEF included a US$2 billion pledge by 34 nations in 1994, followed by another pledge of US$2.75 billion by 36 nations in 1996. Negotiations are in place for a third replenishment of the fund in 2002. From 1991 to 1999, the GEF allocated US$991 million to biodiversity projects, US$884 million to climate change projects, US$360 to international waters, US$155 million to protection of the ozone layer, and US$350 million to combat soil degradation. The GEF finances on average 29 percent of the total costs of country level projects, with the percentage varying by region, and 36 percent of global projects. Therefore, in addition to GEF allocations, mobilization of resources in the amount of US$4.7 billion for climate change and US$1.5 billion for biodiversity-related projects took place in co-financed projects (Barcena and others, 2001). GEF funds in biodiversity-related projects have been particularly important in the establishment of conservation trust funds, as will be discussed below.

## Debt for nature swaps

NGOs pioneered the approach of exchanging external debt from developing countries for environmental purposes. The first such 'debt for nature' swap was conducted for Bolivia by Conservation International (CI) in 1987. This approach was quickly followed by similar initiatives negotiated by the National Parks Foundation of Costa Rica and World Wildlife Fund (WWF) for Ecuador. As a mechanism, debt for nature swaps flourished during the debt crisis of the late 1980s and early 1990s, facilitating debt cancellation in Latin American countries amounting to a nominal figure of over US$90 million (Deacon and Murphy, 1997). These transactions have continued to be conducted and are estimated to have leveraged some US$1 billion to date for conservation purposes (Barcena and others, 2001). While the pace of such transaction declined in the later half of the nineties, recent funding opportunities created by the United States may result in a new wave of debt for nature swaps.

In a debt for nature swap, the debtor government commits to mobilizing domestic resources in local currency for an agreed environmental

**Table A.2: Debt for nature swaps, 1990-1997**

(US$ millions)

| *Year* | *Country* | *Purchaser or donor* | *Cost to donor* | *Nominal value of debt swapped* | *Conservation funds* |
|---|---|---|---|---|---|
| 1993-97 | Mexico[a] | CI | 3.1 | 3.80 | 3.43 |
| 1994 | Madagascar[b] | WWF | 0.0 | 1.34 | 1.07 |
| 1993 | Madagascar | WWF | 0.9 | 1.87 | 1.87 |
| 1993 | Philippines | WWF | 13.0 | 19.00 | 17.70 |
| 1992 | Bolivia[b] | TNC, WWF, CI | 0.0 | 11.50 | 2.76 |
| 1992 | Panama | CI,TNC | 7.5 | 30.00 | 30.00 |
| 1992 | Brazil | CI, TNC | 0.8 | 2.20 | 2.20 |
| 1992 | Chile | EAI | n.a. | 15.90 | 1.40 |
| 1992 | Guatemala | CI/USAID | 1.2 | 1.33 | 1.33 |
| 1992 | Philippines[c] | WWF | 5.0 | 9.85 | 8.82 |
| 1992 | Mexico | CI/USAID | 0.4 | 0.44 | 0.44 |
| 1991 | Guatemala[d] | TNC | 0.1 | 0.10 | 0.09 |
| 1991 | Jamaica | TNC, USAID | 0.3 | 0.44 | 0.44 |
| 1991 | Jamaica | EAI | n.a. | 271.00 | 9.20 |
| 1991 | Bolivia | EAI | n.a. | 38.40 | 1.80 |
| 1991 | Nigeria | Nigerian Conservation Fund | 0.1 | 0.15 | 0.09 |
| 1991 | Ghana[e] | DDC, CI, Smithsonian Institution | 0.3 | 1.00 | 1.00 |
| 1991 | Mexico[d, f] | CI | 0.0 | 0.25 | 0.25 |
| 1991 | Mexico[f] | CI | 0.2 | 0.25 | 0.25 |
| 1991 | Mandagascar[g] | CI | 0.1 | 0.12 | 0.12 |
| 1991 | Costa Rica[h] | RFA, MCL, TNC | 0.4 | 0.60 | 0.54 |
| 1990 | Costa Rica[i] | Sweden, WWF, TNC | 1.9 | 10.75 | 9.60 |
| 1990 | Dominican Republic | Conservation Trust of Puerto Rico, TNC | 0.1 | 0.58 | 0.58 |
| 1990 | Madagascar | WWF | 0.5 | 0.92 | 0.92 |
| 1990 | Poland | WWF | 0.0 | 0.05 | 0.05 |
| 1990 | Philippines | WWF | 0.4 | 0.90 | 0.90 |

*Notes:* CI: Conservation International; DDC· Debt for Development Coalition; EAI: Enterprise for the Americas Initiative; MCL: Monteverde Conservation League; RFA: Rain Forest Alliance; USAID: US Agency for International Development; WWF: World Wide Fund for Nature; TNC: The Nature Conservancy; n.a.: not applicable.

[a] Figures for Mexico aggregated from 10 separate transactions for the time period.

[b] Debt donated by JP Morgan.

[c] Nominal value of debt includes US$0.2 million debt donation by Bank of Tokyo.

[d] Debt donated by Bank of America.

[e] Involves buying blocked local currency funds from multinational. Also includes Midwest Universities Consortium for International Activities and U.S. Committee of the International Council of Monuments and Sites.

[f] Total amount of program is US$4 million

[g] Total amount of program is US$5 million.

[h] Purchase of Central American Bank for Economic Integration Debt.

[i] WWF contributed US$1.5 million to this deal on top of the swap.

*Sources:* Barcena and others, 2001; Kaiser and Lambert, 1996.

purpose in exchange for cancellation of external hard-currency loan payments. The swap accomplishes the twin goals of reducing the country's external debt and increasing the amount of

resources available for environmental conservation. These agreements can be negotiated bilaterally between debtor and creditor governments or, as is more often the case, through an intermediary such as a local or international environmental conservation organization. The intermediary organization often contributes its own funds to acquire part of the debt, which is purchased in secondary markets at a discounted rate.

More than 19 countries throughout the world have been involved in debt for nature swaps and their number continues to grow (Deacon and Murphy, 1997). Table A.2 provides some details on debt swaps carried out from 1990 to 1997. As the Table shows, debt for nature exchanges in the 1990s were dominated by Latin American countries.

The large number of debt for nature swaps in Latin America is attributable to the Enterprise for the Americas Initiative (EAI) launched by the United States in 1990. This scheme resulted in a partial reduction in debt owed to the United States for Latin American countries that subscribed to the Brady Plan. A portion of the capital debt was cancelled and the interest, paid in local currency, was allocated to a trust for environmental protection and sustainable development. Most national environmental funds created in Latin American (including funds in Argentina, Bolivia, Chile, Colombia, El Salvador, Jamaica, and Uruguay) derived from this proposal. The EAI cancelled US$876 million of US debt and generated some US$650 million in project support for Latin America (Bayon and others, 1999).

The pace of debt for nature swaps slowed in the mid 1990s (except for several deals carried out by CI in Mexico). More recently, debt for nature swaps have regained appeal with the passage of the United States Tropical Forest Act in 1998. This Act extended the EAI debt for nature swap to the protection of highly significant tropical forests located in developing countries through out the world. This legislation was due to expire in 2002, but was extended until 2004. The Program, with a budget of US$50 million for 2002, US$75 million for 2003, and US$100 million for 2004, is likely to result in a new wave of nature-debt swaps (Barcena and Acquatella, 2001; Bayon and others, 1999).

Debt for nature swaps have been reasonably effective tools for financing conservation programs in developing countries and emerging economies. While they have so far made little dent in the trillions of dollars of debt owed by these countries, they offer a *tested* mechanism for integrating sustainable development into future debt reduction efforts.

### Conservation trust funds

Conservation trust funds have emerged in several developing countries as a mechanism for financing environmental programs in a sustainable manner. These funds have been established in more than 40 developing countries over the last decade for the purposes of protecting either a specific area or the country's entire protected area system, conservation of a particular species, or financing small grants to local communities carrying out conservation projects, among other things. Several of the debt for nature swaps listed above, have been used to set up a conservation trust fund to manage or establish protected areas.

The GEF has been a major source of capital funds for many existing conservation trust funds, particularly "Park" funds that set up a national park or finance existing park operations. NGOs have made financial contributions to establish conservation trust funds, in addition to playing an important role in mobilizing donations from other donors. NGOs have also made substantial in kind contributions by providing technical expertise (legal assistance in setting up and managing funds established) and paying for the staff and travel costs incurred to hold negotiation workshops.

The most common type of a conservation trust fund is the *endowment fund*. The initial contribution to the fund—the capital or principal amount—is invested in a variety of financial instruments, such as bank deposits, government treasury bonds, and corporate stocks and bonds. The investments generate a flow of annual interest earnings to fund activities specified by fund. One of the main advantages of endowment funds is that they provide sustained long-term funding for a specific purpose, such as the maintenance of parks or protected areas. Some conservation funds have been created to accomplish a specific goal and are therefore managed as a *sinking fund*. This type of fund spends the income generated, as well

as a portion of their capital each year. A *revolving fund*, on the other hand, receives revenues from earmarked taxes or user fees and in general spends all of their revenue in a given year. Sometimes these funds set aside a small percentage of revenues generated to create a reserve fund that may be tapped in case of an economic downturn or sudden political events. Belize's Protected Areas Conservation Trust Fund, financed by a US$3.75 airport tax generates about US$600,000 each year, 5 percent of which goes into a reserve fund (Spergel, 2001).

Experience with conservation trust funds has been limited. Early evaluations of the funds in existence have identified some issue that deserve attention in monitoring the future performance and the impact of conservation trust funds (GEF 1998; USAID, 1996).

- **Governance.** Most funds have a mixed public-private control board, which usually is set up as a non-governmental institution. It is important to ensure that the governing board is free from political influences and that has usually meant governments have one or two representatives and do not have the majority vote.
- **Program Management.** "Park" funds usually have a clearer mandate of their mission than "grant" funds, which need to find their niches to fulfill the fund's established objective. A fund's effectiveness in achieving its objective will depend upon how well the fund's objectives intersect with ongoing government agencies' efforts in a given situation.
- **Financial Management.** Funds differ widely in the amount of initial endowment that they receive and how they are structured. Some funds have been innovative in their management strategy, fundraising to reinvest operating expenses to grow the initial endowment, seeking new sources of earmarked revenue from government sources, etc. A strong commitment to continued fundraising is often necessary to ensure long-term financial stability.

## A.4 Conclusions

Official development financing has not changed significantly since the Rio Conference, despite commitments made by the developed countries to increase them. Official development financing (ODA, OA, and OFF) from bilateral and multilateral sources has averaged around US$85 billion per year over the last decade. On the other hand, private sector financing has increased significantly, going from around US$53 billion in the early 1990s to approximately US$160 billion by the end of the decade. Private financial resources, however, tend to be concentrated in a few countries and sectors and cannot be viewed as substitutes for public financial aid in the development process.

The analysis of official development financial flows targeting environmental concerns shows that these flows have more or less followed the stagnant pattern of overall development financing. Commitment to environmental concerns in bilateral aid averaged at 3 percent of total commitments under the World Bank classification of environmental projects. Using the broader WRI definition, environmental commitments fluctuate between 9 and 18 percent, averaging about 13 percent of total commitments. Multilateral environmental aid averaged between 3 and 15 percent of total commitments, depending on the definition used. On average, bilateral and multilateral environmental aid each ranged between US$1-5 billion per year. Some disagreement over the definitions applied to categorize projects as environmental is possible, making the determination of the exact dollar amount of support debatable. However, no matter what screen is used, the message is clear—financial support to the environment is not consistent with the pledges made by developed countries to support the implementation of the Rio Conventions.

An in-depth analysis of financial flows for a single year (1998) is indicative of how bilateral aid is distributed among different parts of the developing world and the three Rio Conventions —Climate Change, Biodiversity, and Desertification. The data that are available show that climate change received 1.5 times more resources than biodiversity and twice as much resources as desertification. Asia was the major recipient of climate change and biodiversity resources, while most of the desertification related assistance went to Africa.

While flows of official development financing have been the focus of attention in this chapter, we also reviewed the use of other

innovative mechanisms over the past decade to finance environmental objectives. NGOs pioneered the use of debt for nature swaps in the late 1980s and early 1990s. They have also been heavily involved in raising funds and providing technical expertise in the setting up of many environmental/conservation trust funds. The GEF had also played a major role in leveraging funds and supporting the implementation of the Rio Conventions.

In March, 2002, heads of state meeting at the International Conference on Financing for Development in Monterrey, Mexico, adopted the "Monterrey Consensus", a commitment by nations to provide the means to attack poverty worldwide. The agreement set guiding principles for development finance, stressing the need to combine aid with sound economic policies and freer trade. The Conference also saw increased aid commitments by major donors, with EU countries committing themselves to reach an average ODA equivalent to 0.39 percent of national output by 2006, with individual countries reaching at least 0.33 percent and the US pledging to increase its ODA by 50 percent. These commitments would represent an increase in ODA flows of at least US$12 billion a year by 2006 (an additional US$7 billion from the EU, and about US$5 billion from the US). These increases will provide an important additional resources, but will not by themselves be sufficient to meet the financing needs of sustainable development.

## Notes

[1] The five resolutions agreed to at the Rio Conference are: the Rio Declaration on Environment and Development, Agenda 21, the Forest Principles, the United Nations Framework Convention on Climate Change and the Convention on Biological Diversity. Other significant multilateral instruments were agreed upon following the summit, such as the United Nations Convention to Combat Desertification, the Kyoto Protocol and the Cartagena Protocol, and the Global Programme of Action for the Prevention of Marine Pollution from Land-based Sources.

[2] The DAC members are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom, the United States and the Commission of the European Communities, together with the International Monetary Fund, the United Nations Development Programme (UNDP), and the World Bank as permanent observers.

[3] These figures show commitments, not net disbursements, which are presented in Table A.1.

[4] There are marked differences between donor countries in this respect: in 2000 ODA ranged from 1.06 percent of GDP by Denmark, and over 0.8 percent by the Netherlands, Sweden, and Norway, to allocations of less than 0.2 percent by Greece and Italy, and just 0.1 percent by the United States. All DAC members except Switzerland and the United States have accepted the 0.7 percent of GDP target.

[5] The top ten recipients are China, Brazil, Mexico, Argentina, Malaysia, Poland, Chile, South Korea, Thailand, and Venezuela.

[6] These commitments are embodied in Principles 4, 15, and 17, respectively, of the Rio Declaration on the Environment and Development.

[7] It is far from clear how the UNCED Secretariat arrived at this figure, which surpasses the total yearly flow of official development financing to developing countries.

[8] Data for bilateral official development financing includes only DAC member countries and consists primarily of ODA and OA commitments for most countries. Only for the United Kingdom are OFF a significant source of financing, about 10 percent of total aid since the mid 1990's.

[9] The analysis is limited by the way the information is classified in the OECD International Statistics database. While the information available suggests "general environmental protection" assistance has grown since 1990, it is difficult to gauge the full amount of assistance for the environment using this category because it only includes activities *without* sector allocation. An alternative category, the "memorandum items" allow classification of aid according to policy objectives, such as gender equality, aid to the environment, and direct assistance to poor people. Under this classification both sectoral projects (such as those classified under energy generation and supply or water supply and sanitation) as well as "general environmental protection" can be classified as memo items for "aid to the environment." However, reporting by most countries comply only with the sectoral classification of aid and only scattered data is available under memo items.

[10] The World Bank classification is broader than the OECD memo items "aid to environment" category, since it takes into account projects in the energy and forestry sector with clear environmental components. This definition is a close approximation of the how the World Bank classifies its "core environmental portfolio." The classification suggested by WRI is broader, incorporating projects in the water and sanitation, energy, and agriculture (including sub-sectors such as forestry and fishery), among other sectors.

[11] Because the data reported to CRS reflects commitments rather than disbursements, at best what we can assess is the extent of support for the environmental objectives.

[12] The data for official development financing commitments by multilateral institutions is less comprehensive than the data for bilateral donors. The CRS database includes the major regional development banks (African Development Bank, Asian Development Bank, and Inter-American Development Bank), as well as the World Bank Group. Most of the financial flows from these institutions are in the form of OOF, except for the IDA and special development funds of regional development banks

[13] There are considerable differences among DAC donors on the relative shares they provide through multilateral institutions, as opposed to their own bilateral assistance programs. The eight largest donors put widely different emphasis on the share they devote to bilateral aid. Italy and the United Kingdom provide more than 40 percent of their assistance multilaterally. Canada, Germany and the Netherlands all have major bilateral programs, but provide a share of multilateral assistance at or above the DAC average. Japan, the United States, and France all have substantial bilateral programs in which geographic concentration is important, and have decided that perhaps their interests are best served by spending a greater share of their development assistance than the DAC average through the bilateral channel.

[14] Seventeen out of 23 DAC Members contributed to the 1998 study. Countries that provided the data accounted for 96 percent of total bilateral ODA commitments by DAC bilateral donors in 1998. The pilot study sought to test the feasibility of refining the reporting as required. For one year's worth of commitments, DAC members were asked to classify and score individual aid activities against the 'climate change', 'desertification', and 'biodiversity' markers, defined in collaboration with the Convention secretariats.

[15] Data provided by 15 donor countries (Germany, Australia, Austria, Belgium, Canada, Denmark, Spain, Finland, France, Japan, Netherlands, Sweden, Switzerland, United Kingdom, and United States).

[16] It should be emphasized that this study only analyzed flows of bilateral ODA, which represented approximately 40 percent of official development financing in 1998.

[17] The survey was distributed to 118 leading donor organizations and did not included public spending within countries or profit-seeking investments. The results are based on replies from 65 sources of financing (including the most significant ones).

# Appendix B. Welfare Economics of Subsidies: The Case of Electricity

Energy subsidies across developing and transition economies add up to billions of dollars each year. As well as being a drain on the treasury, subsidies also entail net losses of social welfare. This appendix explains the underlying economics and provides some numerical results for electricity. We will assume, for the moment, that the government is the owner of the electricity companies, and that any losses of the electricity companies are financed through the general budget.

Assume for simplicity that the long run marginal cost of producing electricity (generation plus transmission and distribution) is **p** for every production level. As a result the supply curve is flat, at the level **p**. Assume as well that the demand curve is linear. Under these conditions, the quantity of electricity produced and consumed will be **q**, and the price paid for every unit of electricity will be **p**, as seen in Figure B.1. The welfare generated in this transaction is reaped by consumers and is given by the area **A**. This is the difference between what the consumers are willing to pay (the area under the Demand curve for the **q** units consumed) and what they actually pay (**p** times **q**), and is known as *consumer surplus*.

If the government decides to cap the price of electricity at the level **p***, consumers will demand **q*** units. The electricity company will not be willing to supply quantity **q*** at price **p***, since the revenue generated (**p*** times **q***) will not be enough to cover the production costs (**p** times **q***). The difference between those two figures represents the subsidy required by the electricity company to supply **q*** units at price **p***, and is given by the area **B+C+D**. As explained in Section 2.1, we have calculated that across developing and transition economies this amounted to some US$102 billion in 1999.

When the subsidy is in place, consumers are paying **p*** times **q*** for electricity, represented by the area **E+F**. If the subsidy is removed, then consumers will be paying **p** times **q**. Since the elasticity of electricity demand is generally assumed to be lower than 1 (in our case we have assumed it to be 0.5), the result will be an increase in revenue the size of the area **B-F**. We have

**Figure B.1: Welfare economics of subsidies: the case of electricity**

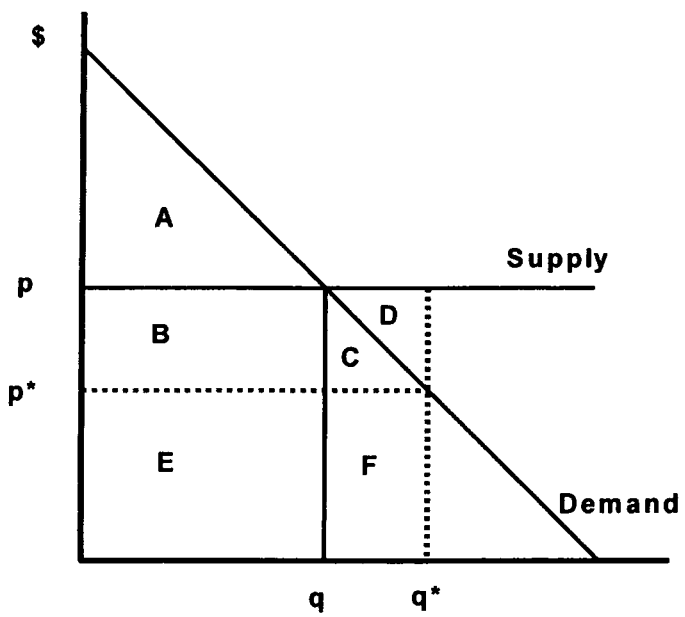


**Table B.1: Regional breakdown of electricity subsidies and welfare losses**

(US$ billions)

| | *Subsidy* | *Potential increase in cash-flow* | *Welfare Loss (potential efficiency gain)* |
|---|---|---|---|
| Sub-Saharan Africa | 4.8 | 1.4 | 0.7 |
| South and East Asia | 23.8 | 8.9 | 2.1 |
| Central and Eastern Europe | 5.8 | 2.2 | 0.9 |
| Former Soviet Union | 41.3 | 14.6 | 10.3 |
| Latin American and the Caribbean | 4.6 | 1.3 | 0.7 |
| Middle East and North Africa | 21.9 | 6.9 | 5.1 |
| Total | 102.4 | 35.2 | 19.8 |

*Note* "Potential increase in cash-flow" refers to revenue increases from subsidy elimination.

*Source:* Authors' calculations.

calculated that across developing and transition economies this adds up to some US$35 billion. In addition to the increase in revenue, there is a decrease in production costs, since fewer units of electricity need to be produced. The decrease in production costs is given by the area **F+C+D**, and in our study amounts to some US$67 billion. The increase in revenue plus the cost savings sum to the area **B+C+D**, US$102 billion, the amount of the subsidy. From a public finance perspective, the total amount of the subsidy is the relevant figure.

In terms of welfare, the establishment of the subsidy implies that the welfare of consumers increases by the area **B+C**. Since this increase in welfare has cost the government the amount represented by the area **B+C+D**, there has been a net welfare loss for society of **D**. This is technically known as a *deadweight loss*. We have calculated that across developing and transition economies this welfare loss amounts to some US$20 billion. From a welfare economics perspective, the welfare loss is the relevant figure. By definition, this US$20 billion represents the efficiency gain from removing the subsidy. Table B.1 summarizes these aggregate figures by region.

Let us return briefly to our assumption that the government finances the losses of the electricity company. In reality, the price of electricity is maintained below the long run marginal cost of production by a combination of direct transfers, under-investment in infrastructure, and subsidized fuels. Whether the cost of the 'subsidy' is assumed by taxpayers (higher taxes to pay for the direct transfers), future consumers (higher prices in the future to pay for updating infrastructure), or oil companies shareholders (lower profits), the sizes of the subsidy and the welfare loss are not affected.

If the government wishes to transfer resources between groups in society (for example, from high income taxpayers to low income households), an electricity subsidy is a highly inefficient way of doing it. In the case of electricity in 1999, governments are spending $102 billion while consumers only receive $82 billion. It would be more efficient (by $20 billion) to simply transfer this amount of money directly. If the government wants to increase the welfare of the poor then electricity subsidies have two added problems. Since the non-poor also consume electricity (and, it can be argued, much more than the poor), only a fraction of the $82 billion actually reaches the poor (this is known as *leakage*). And, since only a fraction of the poor have access to electricity, many poor households will not benefit at all (this is known as *mis-targeting*). In addition, if the poor pay some taxes and the electricity subsidy is at least partly financed by the general budget, then the poor who do not consume electricity end up worse off under the subsidy scheme.

Our estimate of welfare loss represents a lower bound, as in practice there are two other sources of welfare loss. First, since governments rarely transfer to the electricity companies the

resources to fully finance the subsidy enjoyed by consumers, these utilities end up without the resources to extend their distribution network. In fact, there is an incentive not to serve new customers, since additional customers represent additional losses. So consumers who have a willingness to pay higher than the cost of supplying them remain unserved, and their consumer surplus is unrealized, representing a welfare loss.

The final source of welfare loss is the existence of environmental externalities. The main text describes the negative local and global environmental effects associated with electricity production. To account for those externalities, the price of electricity should be established *above* **p** at the level at which the revenue generated would compensate those suffering the externality. Strictly speaking, the calculation of the subsidy and associated welfare loss should be undertaken using this higher price as a reference. In graphical terms, this would imply that the supply curve would be placed at a higher level, making area **D** (the welfare loss) larger.

# Appendix C. Statistical Appendix

**Table C.1: Estimated electricity subsidies and potential efficiency gains from subsidy phase-out**

| | *Subsidy* | | | *Efficiency gains* | |
|---|---|---|---|---|---|
| *Economy* | *U$ million* | *% LRMC* | *% GDP* | *US$ million* | *% GDP* |
| Albania | 80 | 53.1 | 2.2 | 18 | 0.5 |
| Algeria | 707 | 63.4 | 1.5 | 177 | 0.4 |
| Angola | 50 | 68.8 | 0.8 | 13 | 0.2 |
| Argentina | 0 | 0.0 | 0.0 | 0 | 0.0 |
| Armenia | 96 | 40.3 | 5.2 | 8 | 0.4 |
| Azerbaijan | 1,032 | 81.8 | 22.6 | 258 | 5.7 |
| Bangladesh | 0 | 0.0 | 0.0 | 0 | 0.0 |
| Belarus | 887 | 50.4 | 3.3 | 186 | 0.7 |
| Bolivia | 0 | 0.0 | 0.0 | 0 | 0.0 |
| Bosnia and Herzegovina | 17 | 0.0 | 0.4 | 0 | 0.0 |
| Brazil | 0 | 0.0 | 0.0 | 0 | 0.0 |
| Bulgaria | 730 | 46.2 | 5.9 | 133 | 1.1 |
| Chile | 0 | 0.0 | 0.0 | 0 | 0.0 |
| China | 10,609 | 18.4 | 1.1 | 568 | 0.1 |
| Colombia | 0 | 0.0 | 0.0 | 0 | 0.0 |
| Costa Rica | 0 | 0.0 | 0.0 | 0 | 0.0 |
| Cote d'Ivoire | 0 | 0.0 | 0.0 | 0 | 0.0 |
| Cuba | 35 | 3.3 | n.a | 0 | n.a. |
| Czech Rep. | 1,096 | 34.0 | 2.0 | 127 | 0.2 |
| Congo, Dem. Rep. of | 0 | 0.0 | n.a. | 0 | 0.0 |
| Dominican Rep. | 0 | 0.0 | 0.0 | 0 | 0.0 |
| Ecuador | 287 | 54.6 | 1.5 | 69 | 0.4 |
| Egypt, Arab Rep. of | 1,611 | 40.4 | 1.8 | 238 | 0.3 |
| El Salvador | 0 | 0.0 | 0.0 | 0 | 0.0 |
| Estonia | 29 | 8.7 | 0.6 | 1 | 0.0 |
| Georgia | 105 | 26.6 | 3.7 | 9 | 0.3 |
| Guatemala | 7 | 2.5 | 0.0 | 0 | 0.0 |
| Haiti | 0 | 0.0 | 0.0 | 0 | 0.0 |
| Honduras | 0 | 0.0 | 0.0 | 0 | 0.0 |
| Hungary | 510 | 24.3 | 1.1 | 38 | 0.1 |

(...continues)

**Table C.1** (...continued)

| | *Subsidy* | | | *Efficiency gains* | |
|---|---|---|---|---|---|
| *Economy* | *U$ million* | *% LRMC* | *% GDP* | *US$ million* | *% GDP* |
| India | 6,361 | 25.9 | 1.4 | 515 | 0.1 |
| Indonesia | 3,110 | 62.7 | 2.2 | 778 | 0.6 |
| Iran, Islamic Rep. of | 4,106 | 66.0 | 4.1 | 1,027 | 1.0 |
| Jamaica | 0 | 0.0 | 0.0 | 0 | 0.0 |
| Jordan | 228 | 41.1 | 2.8 | 35 | 0.4 |
| Kazakhstan | 1,553 | 60.9 | 9.2 | 388 | 2.3 |
| Kenya | 0 | 0.0 | 0.0 | 0 | 0.0 |
| Kyrgyz Rep. | 371 | 89.7 | 29.7 | 93 | 7.4 |
| Latvia | 0 | 0.0 | 0.0 | 0 | 0.0 |
| Lebanon | 105 | 13.8 | 0.6 | 4 | 0.0 |
| Lithuania | 86 | 19.0 | 0.8 | 5 | 0.0 |
| Macedonia, Former Yugoslav Rep. | 70 | 20.4 | 1.1 | 4 | 0.1 |
| Mexico | 2,124 | 17.9 | 0.4 | 110 | 0.0 |
| Moldova | 82 | 43.6 | 7.0 | 14 | 1.2 |
| Morocco | 0 | 0.0 | 0.0 | 0 | 0.0 |
| Mozambique | 0 | 0.0 | 0.0 | 0 | 0.0 |
| Namibia | 0 | 0.0 | 0.0 | 0 | 0.0 |
| Nicaragua | 0 | 0.0 | 0.0 | 0 | 0.0 |
| Oman | 179 | 35.0 | n.a. | 22 | 0.1 |
| Panama | 0 | 0.0 | 0.0 | 0 | 0.0 |
| Paraguay | 26 | 11.7 | 0.3 | 1 | 0.0 |
| Peru | 0 | 0.0 | 0.0 | 0 | 0.0 |
| Philippines | 0 | 0.0 | 0.0 | 0 | 0.0 |
| Poland | 551 | 8.9 | 0.4 | 13 | 0.0 |
| Romania | 542 | 27.1 | 1.5 | 46 | 0.1 |
| Russian Federation | 29,083 | 79.7 | 15.1 | 7,271 | 3.8 |
| Saudi Arabia | 7,084 | 81.4 | 5.0 | 1,771 | 1.3 |
| Senegal | 16 | 15.5 | 0.3 | 1 | 0.0 |
| Slovak Rep. | 233 | 16.1 | 1.2 | 11 | 0.1 |
| Slovenia | 0 | 0.0 | 0.0 | 0 | 0.0 |
| South Africa | 4003 | 39.9 | 3.1 | 580 | 0.4 |
| Syrian Arab Rep. | 537 | 60.2 | 3.4 | 134 | 0.8 |
| Taiwan, China | 357 | 3.5 | 0.1 | 3 | 0.0 |
| Tajikistan | 675 | 99.2 | 62.2 | 169 | 15.6 |
| Tanzania | 0 | 0.0 | 0.0 | 0 | 0.0 |

(...continues)

**Table C.1** (...continued)

| | *Subsidy* | | | *Efficiency gains* | |
|---|---|---|---|---|---|
| *Economy* | *U$ million* | *% LRMC* | *% GDP* | *US$ million* | *% GDP* |
| Thailand | 1,208 | 21.5 | 1.0 | 78 | 0.1 |
| Trinidad and Tobago | 135 | 50.9 | 2.0 | 29 | 0.4 |
| Tunisia | 36 | 6.4 | 0.2 | 1 | 0.0 |
| Turkey | 0 | 0.0 | 0.0 | 0 | 0.0 |
| Turkmenistan | 283 | 92.2 | 8.6 | 71 | 2.1 |
| Ukraine | 4,783 | 65.9 | 15.1 | 1,196 | 3.9 |
| Uruguay | 0 | 0.0 | 0.0 | 0 | 0.0 |
| Uzbekistan | 2,382 | 89.4 | 27.5 | 595 | 3.5 |
| Venezuela | 1,948 | 59.3 | 1.9 | 487 | 0.5 |
| Vietnam | 269 | 22.3 | 0.9 | 18 | 0.1 |
| Yemen | 100 | 49.5 | 1.4 | 20 | 0.3 |
| Yugoslavia, Federal Rep. of (Serbia/Montenegro) | 1,736 | 86.6 | 17.6 | 434 | 4.4 |
| Zambia | 0 | 0.0 | 0.0 | 0 | 0.0 |
| Zimbabwe | 174 | 26.9 | 3.2 | 15 | 0.3 |

*Notes:* See text for a brief explanation on methodology, interpretation of results, and caveats. Subsidies refer to "economic" as opposed to "financial" ones. The methodology used takes account to a very limited extent to individual countries characteristics, and it is not intended to replace in-depth country evaluations as, for instance, those in IEA (1999). These are preliminary results, where no correction measure has been taken to deal with outliers.

*Source:* Authors' estimates.

**Table C.2: Estimated gasoline and diesel subsidies and potential effects on public budget from price reform, 1999**

| | *Gasoline subsidy (US$ million)* | | *Diesel subsidy (US$ million)* | | *Gasoline and diesel subsidy (% GDP)* | | *Net effect on public budget from gasoline and diesel price reform* | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | *(US$ million)* | | *(% GDP)* | |
| *Economy* | GB1 | GB2 | GB1 | GB2 | GB1 | GB2 | GA | RA | GA | RA |
| Albania | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 671 | 98 | 18.2 | 2.7 |
| Algeria | 0 | 72 | 177 | 514 | 0.37 | 1.23 | 539 | 194 | 1.1 | 0.4 |
| Angola | 0 | 0 | 20 | 87 | 0.32 | 1.41 | 29 | 28 | 0.5 | 0.5 |
| Argentina | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 4 | 3 | 0.0 | 0.0 |
| Armenia | 0 | 0 | 0 | 1 | 0.00 | 0.07 | 66 | 51 | 3.6 | 2.8 |
| Azerbaijan | 0 | 0 | 0 | 38 | 0.00 | 0.84 | 51 | 32 | 1.1 | 0.7 |
| Bahrain | 0 | 25 | 3 | 16 | n.a. | n.a | 267 | 95 | n.a. | n.a. |
| Bangladesh | 0 | 0 | 0 | 63 | 0.00 | 0.14 | 356 | 297 | 0.8 | 0.6 |
| Belarus | 0 | 0 | 41 | 223 | 0.15 | 0.83 | 179 | 219 | 0.7 | 0.8 |
| Benin | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 41 | 18 | 1.7 | 0.8 |
| Bolivia | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 0 | 0 | 0.0 | 0.0 |
| Bosnia | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 0 | 0 | 0.0 | 0.0 |
| Brazil | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 24 | 14 | 0.0 | 0.0 |
| Brunei | 0 | 1 | 4 | 17 | n.a. | n.a | 38 | 44 | n.a. | n.a. |
| Bulgaria | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 0 | 0 | 0.0 | 0.0 |
| Cameroon | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 299 | 0 | 3.3 | 0.0 |
| Chile | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 5,434 | 1,066 | 8.0 | 1.6 |
| China | 0 | 944 | 0 | 538 | 0.00 | 0.15 | 7,145 | 8,715 | 0.7 | 0.9 |
| Colombia | 0 | 176 | 0 | 178 | 0.00 | 0.41 | 1,077 | 1,500 | 1.2 | 1.7 |
| Congo, Rep. of | 0 | 0 | 0 | 0 | n.a. | n.a | 8 | 1 | n.a. | n.a. |
| Congo, Dem. Rep. of | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 53 | 0 | 2.4 | 0.0 |
| Costa Rica | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 48 | 41 | 0.3 | 0.3 |
| Cote d'Ivoire | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 0 | 0 | 0.0 | 0.0 |
| Croatia | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 83 | 63 | 0.4 | 0.3 |
| Cyprus | 0 | 0 | 0 | 42 | 0.00 | 0.46 | 0 | 0 | 0.0 | 0.0 |
| Czech Rep. | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 266 | 0 | 0.5 | 0.0 |
| Dominican Rep. | 0 | 0 | 0 | 98 | 0.00 | 0.56 | 374 | 128 | 2.1 | 0.7 |
| Ecuador | 0 | 0 | 0 | 156 | 0.00 | 0.82 | 1,793 | 823 | 9.4 | 4.3 |
| Egypt, Arab Rep. of | 0 | 125 | 690 | 1,416 | 0.77 | 1.73 | 570 | 164 | 0.6 | 0.2 |
| El Salvador | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 15 | 11 | 0.1 | 0.1 |
| Eritrea | 0 | 0 | 0 | 6 | 0.00 | 0.97 | 5 | 2 | 0.8 | 0.2 |

(...continues)

**Table C.2** (...continued)

| | *Gasoline subsidy (US$ million)* | | *Diesel subsidy (US$ million)* | | *Gasoline and diesel subsidy (% GDP)* | | *Net effect on public budget from gasoline and diesel price reform* | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | *(US$ million)* | | *(% GDP)* | |
| *Economy* | GB1 | GB2 | GB1 | GB2 | GB1 | GB2 | GA | RA | GA | RA |
| Estonia | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 86 | 64 | 1.7 | 1.3 |
| Ethiopia | 0 | 0 | 0 | 28 | 0.00 | 0.44 | 21 | 19 | 0.3 | 0.3 |
| Gabon | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 43 | 33 | 1.0 | 0.8 |
| Ghana | 0 | 20 | 0 | 23 | 0.00 | 0.56 | 171 | 166 | 2.2 | 2.1 |
| Guatemala | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 127 | 77 | 0.7 | 0.4 |
| Haiti | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 14 | 0 | 0.3 | 0.0 |
| Honduras | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 52 | 0 | 1.0 | 0.0 |
| Hong Kong | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 0 | 0 | 0.0 | 0.0 |
| Hungary | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 0 | 0 | 0.0 | 0.0 |
| India | 0 | 0 | 0 | 2,273 | 0.00 | 0.51 | 5,571 | 2,247 | 1.2 | 0.5 |
| Indonesia | 672 | 1,562 | 2,570 | 4,373 | 2.29 | 4.20 | 6,441 | 7,314 | 4.6 | 5.2 |
| Iran, Islamic Rep. of | 1,723 | 2,764 | 3,726 | 5,612 | 5.47 | 8.41 | 3,062 | 7,992 | 3.1 | 8.0 |
| Iraq | 645 | 935 | 1,045 | 1,581 | n.a. | n.a | 263 | 2,885 | n.a. | n.a. |
| Jamaica | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 75 | 55 | 1.1 | 0.8 |
| Jordan | 0 | 0 | 73 | 195 | 0.90 | 2.41 | 314 | 45 | 3.9 | 0.6 |
| Kazakhstan | 0 | 0 | 0 | 114 | 0.00 | 0.67 | 549 | 605 | 3.3 | 3.6 |
| Kenya | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 0 | 0 | 0.0 | 0.0 |
| Korea Dem. Rep. of | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 24 | 0 | n.a. | n.a. |
| Korea, Rep. of | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 0 | 0 | 0.0 | 0.0 |
| Kuwait | 98 | 267 | 38 | 94 | 0.46 | 1.21 | 597 | 360 | 2.0 | 1.2 |
| Kyrgyz Rep. | 0 | 0 | 0 | 3 | 0.00 | 0.27 | 37 | 34 | 2.9 | 2.7 |
| Latvia | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 3 | 0 | 0.0 | 0.0 |
| Lebanon | 0 | 0 | 0 | 118 | 0.00 | 0.72 | 451 | 0 | 2.7 | 0.0 |
| Lithuania | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 25 | 0 | 0.2 | 0.0 |
| Libya | 20 | 207 | 105 | 353 | 1.17 | 5.25 | 974 | 305 | n.a. | n.a. |
| Macedonia, Former Yugoslav Rep. | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 7 | 0 | 0.2 | 0.0 |
| Malaysia | 0 | 375 | 287 | 962 | 0.36 | 1.69 | 2,809 | 2,774 | 3.6 | 3.5 |
| Malta | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 0 | 0 | 0.0 | 0.0 |
| Mexico | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 3,234 | 2,421 | 0.7 | 0.5 |
| Moldova | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 26 | 22 | 2.2 | 1.9 |
| Morocco | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 0 | 0 | 0.0 | 0.0 |
| Mozambique | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 1 | 0 | 0.0 | 0.0 |
| Myanmar | 18 | 48 | 112 | 236 | n.a. | n.a. | 354 | 327 | n.a. | n.a. |

(...continues)

**Table C.2** (...continued)

| | *Gasoline subsidy (US$ million)* | | *Diesel subsidy (US$ million)* | | *Gasoline and diesel subsidy (% GDP)* | | *Net effect on public budget from gasoline and diesel price reform* | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | *(US$ million)* | | *(% GDP)* | |
| *Economy* | GB1 | GB2 | GB1 | GB2 | GB1 | GB2 | GA | RA | GA | RA |
| Namibia | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 43 | 26 | 1.2 | 0.7 |
| Nepal | 0 | 0 | 0 | 10 | 0.00 | 0.20 | 32 | 10 | 0.6 | 0.2 |
| Netherland Antilles | 0 | 0 | 0 | 0 | n.a. | n.a. | 3 | 0 | n.a. | n.a. |
| Nicaragua | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 15 | 4 | 0.7 | 0.2 |
| Nigeria | 218 | 517 | 163 | 406 | 1.09 | 2.63 | 1,367 | 1,799 | 3.9 | 5.1 |
| Oman | 0 | 20 | 0 | 32 | n.a. | n.a. | 247 | 29 | n.a. | n.a. |
| Pakistan | 0 | 0 | 0 | 685 | 0.00 | 1.18 | 1,239 | 757 | 2.1 | 1.3 |
| Panama | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 94 | 46 | 1.0 | 0.5 |
| Paraguay | 0 | 0 | 0 | 40 | 0.00 | 0.51 | 120 | 0 | 1.5 | 0.0 |
| Peru | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 87 | 0 | 0.2 | 0.0 |
| Philippines | 0 | 0 | 0 | 416 | 0.00 | 0.54 | 1,333 | 967 | 1.7 | 1.3 |
| Poland | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 0 | 0 | 0.0 | 0.0 |
| Romania | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 118 | 48 | 0.3 | 0.1 |
| Russian Federation | 0 | 1,107 | 60 | 2,458 | 0.03 | 1.85 | 9,495 | 11,229 | 4.9 | 5.8 |
| Saudi Arabia | 560 | 1,525 | 1,890 | 3,609 | 1.76 | 3.68 | 6,524 | 3,494 | 4.7 | 2.5 |
| Senegal | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 0 | 0 | 0.0 | 0.0 |
| Singapore | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 55 | 0 | 0.1 | 0.0 |
| Slovak Rep. | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 0 | 0 | 0.0 | 0.0 |
| Slovenia | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 0 | 0 | 0.0 | 0.0 |
| South Africa | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 832 | 475 | 0.6 | 0.4 |
| Sri Lanka | 0 | 0 | 0 | 29 | 0.00 | 0.18 | 172 | 34 | 1.1 | 0.2 |
| Sudan | 0 | 5 | 0 | 52 | 0.00 | 0.59 | 179 | 149 | 1.8 | 1.5 |
| Syrian Arab Rep. | 0 | 0 | 391 | 931 | 2.37 | 5.63 | 1,255 | 273 | 7.6 | 1.7 |
| Taiwan, China | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 361 | 48 | n.a. | n.a. |
| Tajikistan | 0 | 30 | 0 | 6 | 0.00 | 3.32 | 224 | 318 | 20.7 | 29.3 |
| Tanzania | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 0 | 0 | 0.0 | 0.0 |
| Thailand | 0 | 79 | 0 | 261 | 0.00 | 0.28 | 2,442 | 1,600 | 2.0 | 1.3 |
| Togo | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 14 | 8 | 1.0 | 0.6 |
| Trinidad and Tobago | 0 | 0 | 2 | 26 | 0.03 | 0.38 | 94 | 75 | 1.4 | 1.1 |
| Tunisia | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 130 | 0 | 0.6 | 0.0 |
| Turkey | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 0 | 0 | 0.0 | 0.0 |
| Turkmenistan | 78 | 126 | 114 | 181 | 5.81 | 9.30 | 252 | 461 | 7.6 | 14.0 |
| United Arab Emirates | 4 | 152 | 38 | 153 | n.a. | n.a. | 601 | 200 | n.a. | n.a. |

(...continues)

**Table C.2** (...continued)

| | *Gasoline subsidy (US$ million)* | | *Diesel subsidy (US$ million)* | | *Gasoline and diesel subsidy (% GDP)* | | *Net effect on public budget from gasoline and diesel price reform* | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | *(US$ million)* | | *(% GDP)* | |
| *Economy* | GB1 | GB2 | GB1 | GB2 | GB1 | GB2 | GA | RA | GA | RA |
| Ukraine | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 648 | 533 | 2.1 | 1.7 |
| Uruguay | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 0 | 0 | 0.0 | 0.0 |
| Uzbekistan | 193 | 353 | 241 | 442 | 2.54 | 4.66 | 913 | 1401 | 5.3 | 8.2 |
| Venezuela | 894 | 1761 | 576 | 1,003 | 1.42 | 2.68 | 3,488 | 5,941 | 3.4 | 5.8 |
| Vietnam | 0 | 0 | 0 | 179 | 0.00 | 0.62 | 728 | 456 | 2.5 | 1.6 |
| Yemen, Rep. of | 0 | 74 | 108 | 184 | 1 58 | 3.78 | 369 | 192 | 5.4 | 2 8 |
| Yugoslavia, Federal Rep. of | 0 | 0 | 0 | 0 | n.a. | n.a. | 0 | 0 | 0.0 | 0.0 |
| Zimbabwe | 0 | 0 | 0 | 0 | 0.00 | 0 00 | 100 | 67 | 1.8 | 1.2 |

*Notes:* See main text for a brief explanation of methodology and meanings
GB1: Traditional measure
GB2: Transport sector measure
GA: Global average
RA: Regional average
n.a. not available

*Source.* Authors' calculations based on data in Metschies, 1999, 2001.

**Table C.3: Estimated potential resource rents by country, 1999**

| Economy | *Mineral fuel rents ($ million)* | *Mineral rents ($ million)* | *Timber rents ($ million)* | *Total resource rents ($ million)* | *Total resource rents (% GDP)* |
|---|---|---|---|---|---|
| Albania | 13 | 1 | 1 | 15 | 0.40 |
| Algeria | 4,728 | 22 | 10 | 4,759 | 9.94 |
| Angola | 747 | 0 | 18 | 765 | 8.95 |
| Argentina | 1,168 | 85 | 60 | 1,313 | 0.46 |
| Armenia | 0 | 0 | 0 | 0 | 0.00 |
| Australia | 1,046 | 2,384 | 363 | 3,793 | 0.94 |
| Austria | 46 | 0 | 173 | 219 | 0.11 |
| Azerbaijan | 666 | 0 | 0 | 666 | 16.64 |
| Bangladesh | 56 | 0 | 16 | 73 | 0.16 |
| Belarus | 0 | 0 | 0 | 0 | 0.00 |
| Belgium | 0 | 0 | 0 | 0 | 0.00 |
| Benin | 0 | 0 | 7 | 7 | 0.29 |
| Bolivia | 54 | 28 | 9 | 91 | 1.09 |
| Bosnia and Herzegovina | 0 | 0 | 0 | 0 | 0.00 |
| Botswana | 0 | 4 | 2 | 6 | 0.10 |
| Brazil | 3,164 | 2,179 | 1,489 | 6,832 | 0.91 |
| Bulgaria | 54 | 22 | 29 | 105 | 0.85 |
| Burkina Faso | 0 | 0 | 11 | 11 | 0.41 |
| Burundi | 0 | 1 | 5 | 5 | 0.74 |
| Cambodia | 0 | 0 | 23 | 23 | 0.75 |
| Cameroon | 240 | 0 | 57 | 297 | 3.23 |
| Canada | 8,314 | 413 | 4,172 | 12,899 | 2.03 |
| Central African Rep. | 0 | 0 | 18 | 18 | 1.69 |
| Chad | 0 | 0 | 16 | 16 | 1.02 |
| Chile | 5 | 1,430 | 222 | 1,657 | 2.46 |
| China | 6,896 | 1,336 | 2,249 | 10,481 | 1.06 |
| Colombia | 2,261 | 56 | 15 | 2,332 | 2.69 |
| Congo, Dem. Rep. of | 0 | 0 | 40 | 40 | 0.71 |
| Congo, Rep. of | 283 | 0 | 13 | 297 | 13.38 |
| Costa Rica | 0 | 0 | 30 | 30 | 0.20 |
| Côte d'Ivoire | 0 | 0 | 64 | 64 | 0.57 |
| Croatia | 55 | 0 | 0 | 55 | 0.27 |
| Cuba | n.a. | n.a. | 7 | n.a. | n.a. |
| Czech Republic | 23 | 0 | 0 | 23 | 0.04 |
| Denmark | 55 | 0 | 16 | 72 | 0.04 |

(...continues)

**Table C.3** (...continued)

| *Economy* | *Mineral fuel rents ($ million)* | *Mineral rents ($ million)* | *Timber rents ($ million)* | *Total resource rents ($ million)* | *Total resource rents (% GDP)* |
|---|---|---|---|---|---|
| Dominican Republic | 0 | 39 | 0 | 39 | 0.23 |
| Ecuador | 981 | 4 | 105 | 1,090 | 5.74 |
| Egypt, Arab Rep. of | 965 | 27 | 3 | 995 | 1.12 |
| El Salvador | 0 | 0 | 12 | 12 | 0.09 |
| Eritrea | 0 | 0 | 0 | 0 | 0.00 |
| Estonia | 0 | 0 | 0 | 0 | 0.00 |
| Ethiopia | 0 | 1 | 39 | 40 | 0.62 |
| Finland | 0 | 13 | 780 | 793 | 0.61 |
| France | 73 | 0 | 523 | 596 | 0.04 |
| Gabon | 330 | 0 | 57 | 387 | 8.89 |
| Gambia, The | 0 | 0 | 2 | 2 | 0.59 |
| Georgia | 0 | 0 | 0 | 0 | 0.00 |
| Germany | 178 | 0 | 551 | 729 | 0.03 |
| Ghana | 0 | 38 | 25 | 63 | 0.81 |
| Greece | 1 | 19 | 13 | 33 | 0.03 |
| Guatemala | 61 | 0 | 9 | 70 | 0.38 |
| Guinea | 0 | 46 | 13 | 59 | 1 70 |
| Guinea-Bissau | 0 | 0 | 3 | 3 | 1.60 |
| Haiti | 0 | 0 | 4 | 4 | 0.10 |
| Honduras | 0 | 4 | 15 | 20 | 0.36 |
| Hong Kong, China | 0 | 0 | 0 | 0 | 0.00 |
| Hungary | 56 | 0 | 30 | 85 | 0.18 |
| India | 2,962 | 693 | 635 | 4,290 | 0.96 |
| Indonesia | 4,361 | 677 | 703 | 5,740 | 4.03 |
| Iran, Islamic Rep. of | 11,425 | 89 | 20 | 11,534 | 10.41 |
| Iraq | n.a. | n.a. | 1 | n.a. | n.a. |
| Ireland | 0 | 28 | 39 | 68 | 0.07 |
| Israel | 0 | 25 | 2 | 27 | 0.03 |
| Italy | 259 | 0 | 66 | 325 | 0.03 |
| Jamaica | 0 | 58 | 5 | 63 | 0.91 |
| Japan | 29 | 0 | 336 | 366 | 0.01 |
| Jordan | 0 | 36 | 0 | 36 | 0.45 |
| Kazakhstan | 1,708 | 0 | 0 | 1,708 | 10.78 |
| Kenya | 0 | 0 | 31 | 31 | 0.30 |
| Korea, Dem. Rep. of | n.a. | n.a. | 27 | n.a. | n.a. |
| Korea, Rep. of | -3 | 20 | 38 | 56 | 0.01 |

(...continues)

**Table C.3** (...continued)

| Economy | *Mineral fuel rents* ($ million) | *Mineral rents* ($ million) | *Timber rents* ($ million) | *Total resource rents* ($ million) | *Total resource rents* (% GDP) |
|---|---|---|---|---|---|
| Kuwait | 6,163 | 0 | 0 | 6,163 | 20.84 |
| Kyrgyz Republic | 0 | 0 | 0 | 0 | 0.00 |
| Lao People's Dem. Rep. | 0 | 1 | 19 | 20 | 1.40 |
| Latvia | 0 | 0 | 0 | 0 | 0.00 |
| Lebanon | 0 | 0 | 0 | 0 | 0.00 |
| Lesotho | 0 | 0 | 0 | 0 | 0.00 |
| Libya | n.a. | n.a. | 2 | n.a. | n.a. |
| Lithuania | 0 | 0 | 0 | 0 | 0.00 |
| Macedonia, Former Yugoslav Rep. | 0 | 0 | 0 | 0 | 0.00 |
| Madagascar | 0 | 0 | 2 | 2 | 0.05 |
| Malawi | 0 | 0 | 8 | 8 | 0.46 |
| Malaysia | 2,245 | 16 | 488 | 2,749 | 3.48 |
| Mali | 0 | 0 | 8 | 8 | 0.32 |
| Mauritania | 0 | 86 | 0 | 86 | 9.01 |
| Mauritius | 0 | 0 | 0 | 0 | 0.00 |
| Mexico | 9,651 | 218 | 252 | 10,120 | 2.09 |
| Moldova | 0 | 0 | 0 | 0 | 0.00 |
| Mongolia | 0 | 33 | 8 | 41 | 4.50 |
| Morocco | 0 | 107 | 12 | 119 | 0.34 |
| Mozambique | 0 | 0 | 21 | 21 | 0.53 |
| Myanmar | n.a. | n.a. | 75 | n.a. | n.a. |
| Namibia | 0 | 4 | 0 | 4 | 0.14 |
| Nepal | 0 | 0 | 16 | 16 | 0.33 |
| Netherlands | 0 | 0 | 14 | 14 | 0.00 |
| New Zealand | 160 | 16 | 0 | 176 | 0.32 |
| Nicaragua | 0 | 1 | 4 | 5 | 0.24 |
| Niger | 0 | 0 | 8 | 9 | 0.43 |
| Nigeria | 4,993 | 0 | 194 | 5,187 | 14.80 |
| Norway | 1,142 | 8 | 121 | 1,271 | 0.83 |
| Oman | 2,388 | 0 | 0 | 2,388 | 15.96 |
| Pakistan | 557 | 0 | 64 | 621 | 1.07 |
| Panama | 0 | 0 | 1 | 1 | 0.01 |
| Papua New Guinea | 179 | 154 | 69 | 402 | 11.21 |
| Paraguay | 0 | 0 | 69 | 69 | 0.89 |
| Peru | 140 | 213 | 32 | 385 | 0.74 |
| Philippines | -1 | 42 | 79 | 121 | 0.16 |

(...continues)

**Table C.3** (...continued)

| *Economy* | *Mineral fuel rents ($ million)* | *Mineral rents ($ million)* | *Timber rents ($ million)* | *Total resource rents ($ million)* | *Total resource rents (% GDP)* |
|---|---|---|---|---|---|
| Poland | 202 | 171 | 207 | 580 | 0.37 |
| Portugal | 0 | 17 | 132 | 149 | 0.13 |
| Puerto Rico | 0 | 0 | 0 | 0 | 0.00 |
| Romania | 383 | 12 | 86 | 481 | 1.41 |
| Russian Federation | 25,721 | 0 | 0 | 25,721 | 6.41 |
| Rwanda | 0 | 0 | 5 | 5 | 0.27 |
| Saudi Arabia | 27,257 | 0 | 0 | 27,257 | 19.56 |
| Senegal | 0 | 5 | 16 | 22 | 0.45 |
| Sierra Leone | 0 | 0 | 3 | 3 | 0.42 |
| Singapore | 0 | 0 | 0 | 0 | 0.00 |
| Slovak Republic | 0 | 0 | 0 | 0 | 0.00 |
| Slovenia | 0 | 0 | 0 | 0 | 0.00 |
| South Africa | 22 | 564 | 394 | 980 | 0.75 |
| Spain | 18 | 30 | 299 | 346 | 0.06 |
| Sri Lanka | 0 | 0 | 17 | 17 | 0.10 |
| Sudan | 0 | 3 | 31 | 34 | 0.35 |
| Sweden | 0 | 95 | 1,168 | 1,264 | 0.53 |
| Switzerland | 0 | 0 | 71 | 71 | 0.03 |
| Syrian Arab Republic | 1,839 | 7 | 1 | 1,847 | 9.53 |
| Tajikistan | 2 | 0 | 0 | 2 | 0.09 |
| Tanzania | 0 | 3 | 24 | 26 | 0.30 |
| Thailand | 69 | 6 | 57 | 133 | 0.11 |
| Togo | 0 | 5 | 6 | 11 | 0.78 |
| Trinidad and Tobago | 433 | 0 | 1 | 434 | 6.32 |
| Tunisia | 198 | 60 | 4 | 262 | 1.25 |
| Turkey | 219 | 46 | 184 | 449 | 0.24 |
| Turkmenistan | 705 | 0 | 0 | 705 | 22.01 |
| Uganda | 0 | 0 | 29 | 29 | 0.45 |
| Ukraine | 1,180 | 0 | 0 | 1,180 | 3.05 |
| United Arab Emirates | 5,640 | 0 | 0 | 5,640 | 11.94 |
| United Kingdom | 2,238 | 0 | 155 | 2,393 | 0.17 |
| United States | 31,366 | 915 | 13,805 | 46,086 | 0.50 |
| Uruguay | 0 | 0 | 32 | 32 | 0.16 |
| Uzbekistan | 1,466 | 0 | 0 | 1,466 | 8.28 |
| Venezuela | 8,889 | 128 | 20 | 9,037 | 8.84 |
| Vietnam | 570 | 10 | 91 | 671 | 2.34 |

(...continues)

**Table C.3** (...continued)

| Economy | *Mineral fuel rents* ($ million) | *Mineral rents* ($ million) | *Timber rents* ($ million) | *Total resource rents* ($ million) | *Total resource rents* (% GDP) |
|---|---|---|---|---|---|
| West Bank and Gaza | 0 | 0 | 0 | 0 | 0.00 |
| Yemen, Rep. of | 942 | 0 | 0 | 942 | 13.81 |
| Yugoslavia, Federal Rep. of | n.a. | n.a. | 0 | n.a. | n.a. |
| Zambia | 0 | 32 | 13 | 45 | 1.44 |
| Zimbabwe | 3 | 79 | 4 | 85 | 1.52 |

*Notes:* Potential timber rents are calculated assuming that 50 percent of total rents can be captured. Total rents are calculated as follows: Industrial Roundwood Production x Average Regional Price x Rental Rate. The regional price is calculated using FAO data on regional export values and quantities for industrial roundwood. Due to the difficulties in collecting production cost data, rental rates were estimated. The rental rate is defined as (market price—unit cost)/ market price. Based on a review of the literature and discussion with World Bank staff, rental rates of between 0.3 and 0.55 were used. Data is from FAO for 2000.

n.a. not available

*Source:* Derived from data in World Bank, 2001d.

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