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Inclusive Green Growth

The Pathway to Sustainable Development

Overview

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THE WORLD BANK
Washington, D.C.

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The Pathway to Sustainable Development

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This booklet contains an Overview for the forthcoming book, ***Inclusive Green Growth: The Pathway to Sustainable Development.*** See the full report at www.worldbank.org/inclusivegreengrowth.

To order copies of the full-length book, published by the World Bank, please use the form at the back of this booklet.

1818 H Street NW
Washington DC 20433
Telephone: 202-473-1000
Internet: www.worldbank.org

Foreword

Inclusive green growth is *the* pathway to sustainable development.

Over the past 20 years economic growth has lifted more than 660 million people out of poverty and has raised the income levels of millions more, but growth has too often come at the expense of the environment. A variety of market, policy, and institutional failures mean that the earth's natural capital tends to be used in ways that are economically inefficient and wasteful, without sufficient reckoning of the true social costs of resource depletion and without adequate reinvestment in other forms of wealth. These failures threaten the long-term sustainability of growth and progress made on social welfare. Moreover, despite the gains from growth, 1.3 billion people still do not have access to electricity, 2.6 billion still have no access to sanitation, and 900 million lack safe, clean drinking water. Growth has not been inclusive enough.

This report argues that sustained growth is necessary to achieve the urgent development needs of the world's poor and that there is substantial scope for growing cleaner without growing slower. Green growth is necessary, efficient, and affordable. It is the only way to reconcile the rapid growth required to bring developing countries to the level of prosperity to which they aspire with the needs of the more than 1 billion people still living in poverty and the imperative of a better managed environment.

Indeed, green growth is a vital tool for achieving sustainable development. But sustainable development has three pillars: economic, environmental, and social sustainability. We cannot presume that green growth is inherently inclusive. Green growth policies must be carefully designed to maximize benefits for, and minimize costs to, the poor and most vulnerable, and policies and actions with irreversible negative impacts must be avoided.

Green growth also requires improved indicators to monitor economic performance. National accounting indicators like GDP measure only short-term economic growth, whereas indicators like comprehensive wealth—including natural capital—help us determine if growth is sustainable in the long run.

The Conference on Environment and Development, held in Rio in 1992, focused on inclusion and the environment but failed to mention growth. In the lead up to Rio+20, we are reminded that, in 1987, Gro Harlem Brundtland, then Prime Minister of Norway, framed the call for governments to change

their approach to growth: *"What is needed now is a new era of economic growth—growth that is forceful and at the same time socially and environmentally sustainable."*

Today, more than ever, we must pay attention to the triple bottom line. Inclusive growth must be green. Green growth must be inclusive.

Rachel Kyte
Vice President
Sustainable Development Network
The World Bank

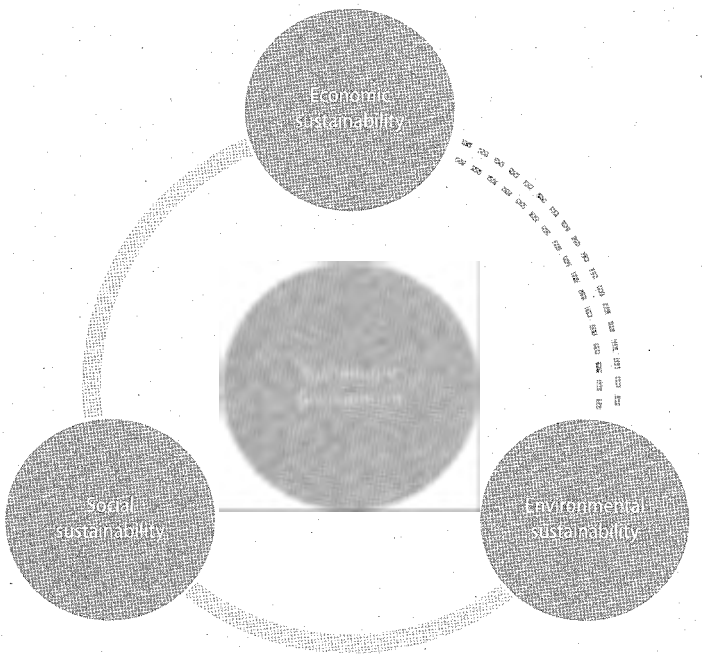
Overview

Key Messages

- *Greening growth is necessary, efficient, and affordable.* It is critical to achieving sustainable development and mostly amounts to good growth policies.
- *Obstacles to greening growth are political and behavioral inertia and a lack of financing instruments*—not the cost of green policies as commonly thought.
- *Green growth should focus on what needs to be done in the next five to 10 years* to avoid getting locked into unsustainable paths and to generate immediate, local benefits.
- *The way forward requires a blend of economics, political science, and social psychology*—smart solutions to tackle political economy constraints, overcome deeply entrenched behaviors and social norms, and develop the needed financing tools.
- *There is no single green growth model.* Green growth strategies will vary across countries, reflecting local contexts and preferences—but all countries, rich and poor, have opportunities to make their growth greener and more inclusive without slowing it.

Our current growth patterns are not just unsustainable; they are also deeply inefficient. As a result, they stand in the way of sustainable development and its objectives of social, environmental, and economic sustainability (figure O.1). The past 20 years have shown that the economic and social goals are not only highly compatible, but also largely complementary. Growth drives poverty reduction (though the extent to which it does so depends on the degree of inequality). And improved social outcomes, such as better health and education and greater equality of opportunity, are good

FIGURE O.1 The three pillars of sustainable development



Note: Economic and social sustainability, on the one hand, and social and environmental sustainability, on the other, have been found to be not only compatible, but also largely complementary. Not so with economic and environmental sustainability, as growth has come largely at the expense of the environment—hence, the dotted line on this figure—which is why green growth aims to ensure that economic and environmental sustainability are compatible.

for growth. Not so with the economic and environmental pillars: for the past 250 years, growth has come largely at the expense of the environment. And environmental damages are reaching a scale at which they are beginning to threaten both growth prospects and the progress achieved in social indicators.

What can be done to turn this situation around? We argue that what is needed is green growth—that is, growth that is efficient in its use of natural resources, clean in that it minimizes pollution and environmental impacts, and resilient in that it accounts for natural hazards and the role of environmental management and natural capital in preventing physical disasters. And this growth needs to be inclusive.

Inclusive green growth is not a new paradigm. Rather, it aims to operationalize sustainable development by reconciling developing countries' urgent need for rapid growth and poverty alleviation with the need to avoid irreversible and costly environmental damage. As such, efforts to foster green growth must focus on what is required in the next five to 10 years to sustain robust growth, while avoiding locking economies into unsustainable patterns, preventing irreversible environmental damage, and reducing the potential for regret.

Moreover, rapid action is needed to keep the costs of greening growth manageable and avoid irreversible losses. This urgency applies to developing and developed countries alike:

- Developing countries—which will account for the vast majority of global growth in income, infrastructure, and population in the coming decades—need to choose whether to build right or risk facing costly policy reversals in the future.
- High-income countries—which, with 16 percent of world population, still account for more than 75 percent of global consumption and 41 percent of global emissions of carbon dioxide (CO_2)—must act according to their responsibility. Most important are changes in the patterns of consumption and production that boost demand for green technologies. This is essential to stimulate technological innovation and the scale of production necessary for prices to drop and green technologies to become competitive. Thus, Germany's aggressive solar feed-in tariff was critical in boosting global demand for solar panels, thereby reducing their cost.

As to *how* to make growth greener, textbooks going back at least to the 1950s offer the basic instruments, with environmental taxation, norms, and regulations being the main tools of a green growth strategy. Today, technology is making it easier to implement these measures and monitor their impacts. However, making these measures work is complex in real-world settings plagued by governance failures, market failures, and entrenched interests and behaviors. It requires complementary policies, including public investments, innovation and industrial policies, education and training, labor market reforms, and communication. Making matters worse is the urgency with which

these policies must be designed and implemented, especially in the face of enormous uncertainty about the future climate and technology.

Although we have much theoretical and empirical knowledge to draw on, green growth raises challenging questions, especially when it comes to the developing world. For example, how can developing countries avoid locking in unsustainable and inefficient socioeconomic systems? Will technology allow developing countries to pursue a less environmentally damaging development path than industrial countries did? What is the best way to manage growth with scarce fiscal resources and limited planning and technical know-how? Is green growth just an aspirational goal—desirable from an environmental and ethical point of view, but unattainable given competing economic needs?

At heart, these are questions of economics, which is why the report takes an economic approach—using the standard tools of mainstream growth and environmental economics—with some forays into what social psychology can tell us about the determinants of human behavior. Chapter 1 examines whether green growth is, in fact, feasible and the implications for welfare—the ultimate goal of economic policy. It argues that our current system is inefficient, thereby offering opportunities for cleaner (and not necessarily slower) growth. And it identifies the flaws in the "grow now, clean up later" argument.

The next two chapters tackle the cross-cutting issues of market and governance failures. Chapter 2 looks at the range of tools that can be marshaled to change behavior with respect to environmental and natural resources—tools that aim to improve social welfare through greener growth. These include effective market signals, properly framed and judiciously used information, and rules and regulations. Chapter 3 explores the need to navigate between market and governance failures through the careful use of innovation and industrial policies, such as research and development (R&D) subsidies for drought-resistant crops, national strategies for electric cars, and efforts to create new green industries (such as China's promotion of solar photovoltaic production).

The subsequent three chapters focus on human, natural, and physical capital and their roles in a greener production function. Chapter 4 tackles the debate on whether green growth will create jobs, with political leaders keen to promote the idea of green jobs to reduce high unemployment levels. It finds that, while there is surely potential to create green jobs, the net impact is what matters, and that will depend largely on the nature of the policy chosen and the soundness of labor markets and the business environment. Importantly, evidence on past regulation suggests that fears about massive job losses are misplaced.

Chapter 5 reviews what we know about managing natural capital. Depending on the type of resource (such as extractable or cultivated renewable), the tools include defining property rights, helping firms to move up the value chain, managing trade-offs between higher growth and greener outcomes, and incorporating the economic values of services in policy decisions.

Chapter 6 explores why infrastructure is at the core of inclusive green growth policies, underscoring the high potential for both regret (given the tremendous inertia built into infrastructure investments) and benefits (given the need for massive increases in infrastructure services in developing countries).

Chapter 7 filters the key lessons through a political economy lens and provides a framework for building an inclusive green growth strategy—in light of the technical tools available, the need to maximize local and immediate benefits while minimizing lock-in, and the uncertainties about the future climate and technologies.

What are the overall messages of the report?

First, *inclusive green growth is necessary, efficient, and affordable.* It is necessary because sustainable development cannot be achieved without it. It is efficient in that addressing the market and governance failures that plague our economic systems will create plenty of scope for growing cleaner

without necessarily growing slower. The best example is the $1 trillion to $1.2 trillion currently being spent on environmentally harmful subsidies for fossil fuel, agriculture, water, and fisheries. Green growth is affordable because many green policies pay for themselves directly, and the others make economic sense once externalities are priced and ecosystem services are valued.

Second, *greening growth is constrained by social and political inertia and by a lack of financing instruments—not affordability, as is commonly believed.* Entrenched behavior, special interests, and the complicated political economy of reform explain why measures that amount to good growth policies have not yet been implemented. Also, many green growth measures require increased up-front capital. Yet the debate on financing remains focused on who pays what, rather than on how to finance economically (let alone socially) profitable investments.

Third, *greening growth should be carefully sequenced—not occur in one fell swoop—with priority going to what needs to be done in the next 5 to 10 years, both to avoid getting locked into unsustainable paths and to offer immediate, local benefits.* Those benefits will help to reduce the cost of the transition and facilitate the political economy of reform. Urban forms that are created today will affect city structures and housing and transport options for decades or even centuries. With urban populations in developing countries set to increase by 1.5 billion over the next 20 years, there is a window of opportunity to affect urban patterns at low cost.

Fourth, *the search for solutions needs to shift from a search for more financial resources (difficult anyway amid today's fiscal woes) to "getting smart"*:

- Smart about learning the lessons of complex reforms to tackle difficult political economy questions, given that many green policies trade immediate costs for later benefits or redistribute benefits from one group to another. Notable successes include trade reforms across the world, reform of fisheries in Namibia, reform of the Common Agricultural Policy in the European Union (EU), and progress on fossil fuel subsidies in the Islamic Republic of Iran, where care was taken to manage the losers and publicize the benefits.
- Smart about changing the behavior of consumers and firms and the view of societies about what constitutes social success and acceptable behavior. This entails combining economic incentives with well-framed information and the marketing techniques that public health specialists (or car salesmen) commonly use.
- Smart about developing the appropriate financing tools for the private sector, especially small firms, for local governments (China's cities are developing in a sprawling fashion in part because land sales at their peripheries are an important source of revenue for city governments; World Bank and DRC 2012), and for national governments, which are sometimes so fiscally constrained that they have to choose the investment with the lowest up-front cost (such as a thermal power plant) over one that may be less expensive in the medium term (such as a hydroelectric plant in a country with abundant water resources).

Fifth, *there is no single green growth model.* Inclusive green growth strategies will vary across countries, reflecting local contexts, preferences, and resources, but all countries—rich and poor—have opportunities to green their growth without slowing it.

Greening growth is necessary, efficient, and affordable

Necessary: Making development sustainable requires inclusive green growth

Growth—even measured with such an imperfect metric as gross domestic product (GDP)—is now recognized as a critical driver of poverty reduction (figure O.2, panel a; Ferreira and Ravallion 2009). It has resulted

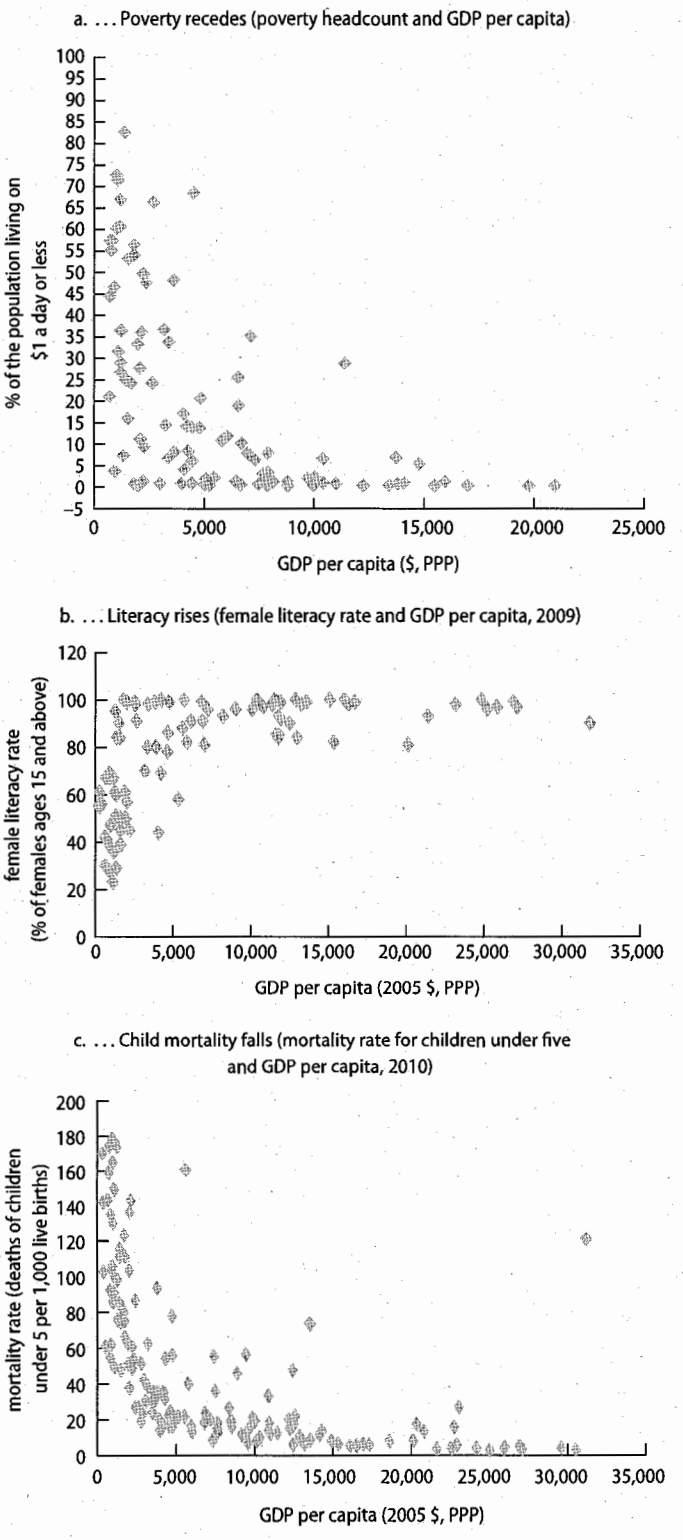
in an 80 percent increase in GDP per capita in developing countries over the past 20 years, despite substantial increases in population. Living standards have improved for many (figure O.2, panels b and c), with more than 660 million rising out of poverty and remarkable progress being made in literacy, education, life expectancy, malnutrition, and infant, child, and maternal mortality. And while China drove much of global poverty reduction, other countries that experienced growth also saw poverty decline rapidly. Ghana, for example, grew much faster than the African average and managed to reduce its poverty rate from 51 to 30 percent between 1990 and 2005 (World Bank 2011c).

Moreover, growth need not cause income inequality. The famous Kuznets curve argument, which posits that inequality first increases and then decreases with income, is not supported by the evidence. Inequality has increased substantially in recent decades in China, but also in the United States and most of Europe. And it has declined in much of Latin America (Milanovic 2010). Some countries reduce inequality as they grow; others let it increase. Policies matter.

Thus, the links between the economic and social pillars of sustainable development are generally self-reinforcing. But the story is not so simple when it comes to the economic and environmental pillars. Economic growth causes environmental degradation—or has for much of the past 250 years—driven by market failures and inefficient policies. As with inequality, overall environmental performance does not first get worse and then improve with income—no Kuznets curve here either. Of course, some local and visible environmental public goods do worsen at first and eventually improve with income—typically local air quality. But this is not true of local pollutants with invisible or long-term impacts (such as the accumulation of pesticides and toxic chemicals in land and water) or global pollutants (such as greenhouse gases in the atmosphere). These often get worse with higher income (figure O.3).

Against this backdrop, some observers, mostly in high-income countries, have argued

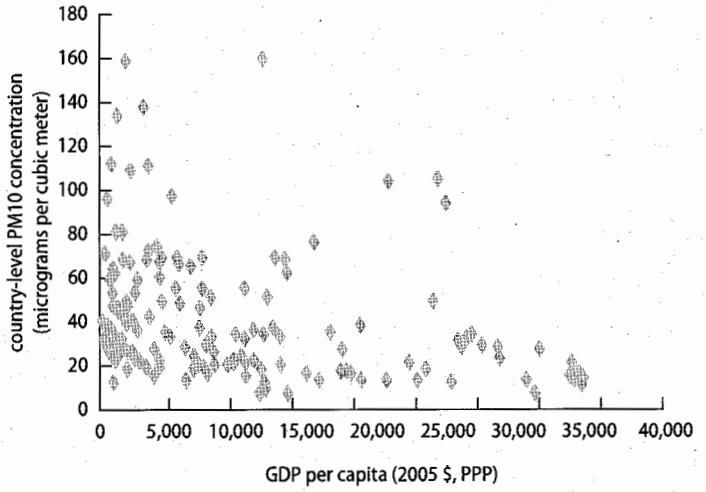
FIGURE O.2 As incomes increase . . .



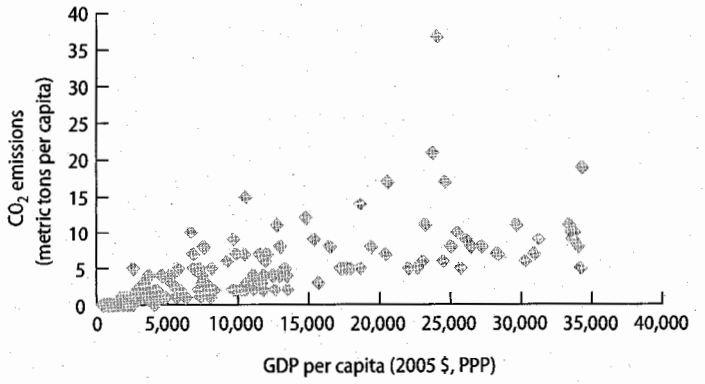
Source: For panel a, Ferreira and Ravallion 2009; for panels b and c, World Bank 2011c.

FIGURE O.3 As incomes increase . . .

a. . . . Local and visible pollutants tend to decline (PM10 concentration and income per capita, 2008)



b. . . . Global pollutants, such as CO_2 emissions, tend to increase (CO_2 emissions and income per capita, 2008)



Source: For both panels, World Bank 2011c.

against the need for more growth, suggesting that what is needed instead is a redistribution of wealth (Marglin 2010; Victor 2008). They point to the happiness literature, which suggests that above a country average of $10,000 to $15,000 per capita, further growth does not translate into greater well-being (Easterlin 1995; Layard 2005).

While this argument has value, it remains more relevant for high-income countries, where average annual incomes hover around $36,000. Developing countries—with average income of around $3,500 per capita—are still far from the point at which more wealth will bring decreasing returns to well-being. In fact, in low-income countries, average income is only about $500 (World Bank 2011c).[1] A redistribution of world income across rich and poor countries—even if it were politically feasible—would leave all with an income of about $8,000 per person per year.

Further, even after the rapid growth of the past decade, some 1.3 billion people do not have access to electricity, 900 million do not have access to clean water, 2.6 billion lack access to improved sanitation, and around 800 million rural dwellers do not have access to an all-weather road and are cut off from the world in the rainy season (Fay and others 2010; IEA 2011). Even with the rapid decline in the share of people living in poverty, close to 1 billion could still be living on $1.25 per day in 2015. With continued growth at about the same speed as during the past 20 years, developing countries would account for about half of the world's income and consumption (but close to 90 percent of the world population) by 2050.

Continued rapid population growth in several developing regions further complicates matters. Current projections are that the world will reach some 9 billion people by 2050. This implies that even more rapid growth is needed to tackle poverty, and more aggressive social policies are needed to ensure that children, especially girls, and mothers receive the care, nutrition, schooling, and employment opportunities they need. And, of course, this demographic challenge puts further stresses on the environment, particularly because much of the rapid population growth is happening in environmentally fragile locations, notably in Africa.

Thus, growth is a necessary, legitimate, and appropriate pursuit for the developing world, but so is a clean and safe environment. Without ambitious policies, growth will continue to degrade the environment and deplete resources critical to the welfare of current and future generations. And what about the argument that ambitious policies would be too costly and destroy jobs? The evidence reviewed in this report suggests that there is plenty of room to green growth without slowing it.

Efficient: Current patterns of growth are not only unsustainable, but also wasteful

There is mounting evidence that our patterns of growth and consumption are unsustainable at the scale required by our current and projected population. Much of this, however, is owing to inefficient production and consumption and poor management of natural resources.

Unsustainable

Population and income growth and the resulting increase in demand for food have driven the expansion of agricultural production around the world.[2] Intensification and productivity increases have helped to limit ecosystem loss in many countries, but poorly managed intensification has also exacerbated agrochemical and water pollution, soil exhaustion, and salinity. Extensive farming, driven by large-scale expansion in some regions and poverty-level subsistence agriculture in others, has contributed to land degradation and deforestation; forest losses averaged 5.2 million hectares annually between 2000 and 2010, mostly in tropical—and, hence, more intensely biologically diverse—regions (FAO 2010). By 2008 one quarter of the world's land surface was degraded as a result of soil erosion, salinization, nutrient depletion, and desertification (Bai and others 2008).

Income and population growth have also stretched water supplies. Water withdrawals have tripled in the past 50 years, leading to water scarcity and groundwater depletion (World Bank 2007b). Withdrawals are projected to increase in developing countries by another 50 percent by 2025, by which time roughly 5.5 billion people—two thirds of the projected global population—will live in areas facing moderate-to-severe water stress (UNESCO and WWAP 2006).

Growth has similarly strained ecosystems, with roughly 60 percent of ecosystem services now of lower quality than 50 years ago (MEA 2005). Additionally, the current rate of species extinction, stemming mainly from habitat loss and degradation, is 100 to 1,000 times higher than before humans walked the planet (Pimm and others 1995). In 2008, 875 species became extinct, and more than 17,000 others are at high risk (IUCN 2009).

Carbon dioxide emissions are accumulating in the atmosphere, approaching a level that will make it impossible to maintain global mean temperature below 2°C in excess of the preindustrial level, even though the probability of irreversible environmental changes is increasing with temperature (for example, rapid ice loss in Greenland and forest dieback in the Amazon). Carbon dioxide is also affecting the world's oceans. Because of global warming, we have already committed to high probabilities of coral bleaching and mortality by the late twenty-first century, which will significantly harm reef ecosystems (World Bank 2010d). The concurrent acidification of oceans, which absorb about one quarter of the excess carbon dioxide in the atmosphere, is threatening marine food webs and could undermine the global fishing industry and food security (Laffoley and Baxter 2009).

Lastly, energy prices are likely to be high in the future, because oil resources that are easy and cheap to extract and use have already been extracted, and the world is now turning toward fossil fuels that are more expensive—and more damaging to the environment—such as shale gas, tar sands, oil from deep offshore wells, or even liquefied coal. Without significant changes in energy policy, the amount of resources the world economy will have to dedicate to fossil fuel extraction and energy production is likely to increase substantially, making higher energy efficiency even more desirable in the future than it is today.

Wasteful

The environment can be thought of as natural capital that is often inefficiently managed, with many precious resources wasted. Investing in natural capital—just like investing in human or physical capital—is therefore good growth policy. The value of the services provided by well-managed ecosystems is illustrated by the impact of reforestation and watershed restoration

programs. In China's Loess plateau, such programs were associated with a near doubling of household incomes as a result of higher-value agricultural production as well as reduced frequency of landslides and flooding and increased resilience to drought (figure O.4; World Bank 2005b).

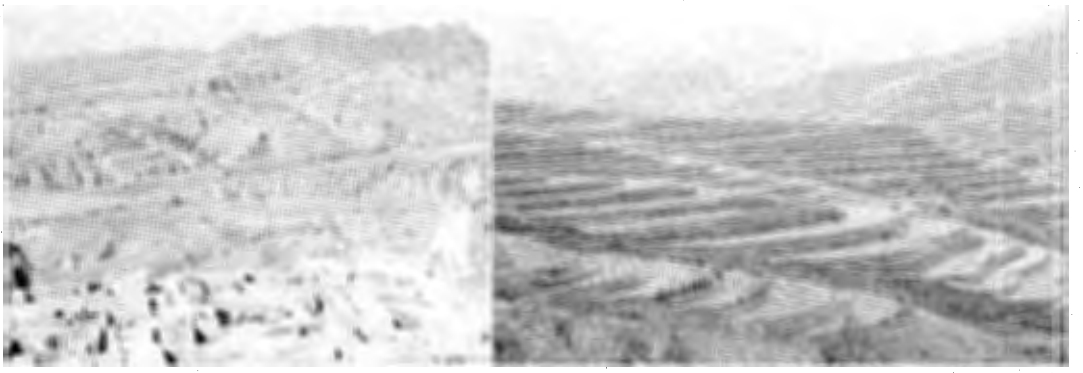
This inefficiency stems partly from the fact that many natural resources are common property, so consumption by one person precludes consumption by another, and it is hard to exclude potential users. Open-access regimes for common property create incentives to use up such resources as quickly as possible. Open access fisheries are a classic example in which catch per fisher and per vessel has been declining steadily because of overfishing, and continued depletion threatens the livelihood of more than 100 million people and the food security of many more.

Subsidies exacerbate common property problems, yet substantial resources are allocated to environmentally harmful price support schemes (box O.1). Global subsidies to fisheries are estimated at $10 billion to $30 billion and are partly to blame for the sixfold increase in the fleet capacity index between 1970 and 2005 (World Bank and FAO 2009).[3] In Mexico, subsidies for energy used in irrigation, amounting to around 1 percent of GDP, are exacerbating excessive groundwater withdrawals and the depletion of key aquifers. India suffers from the same problem in addition to spending some 2 percent of GDP on a fertilizer subsidy overly weighted in favor of nitrogen; the resulting use of fertilizer is causing serious pollution problems.

Production and consumption processes are often wasteful, too. This is particularly obvious in the energy sector. Existing energy efficiency technologies can cost-effectively reduce energy use in new buildings by at least 30 percent. In fact, making new buildings in China more energy efficient would reduce energy costs by more than 50 percent, while increasing construction costs by only 10 percent. Waste also plagues food production. Some 15 to 30 percent of food produced in developing countries is lost before it reaches the market due to poor storage and transport facilities. In high-income countries, meanwhile, one third of food is wasted through losses in supermarkets and homes and "plate-waste" (Foresight 2011).

The possibility of solving market and governance failures opens the way to policies that have both economic and environmental benefits and is at the heart of green growth strategies. (In that respect, greening growth is first and foremost based on good growth policies.) These market and governance failures have long been understood,

FIGURE O.4 The Loess plateau, before and after the watershed restoration program



Source: For the left-hand image, Till Niermann, March 25, 1987, http://en.wikipedia.org/wiki/File:Loess_landscape_china.jpg; for the right-hand image, http://digitalmedia.worldbank .org/slideshows/china1005/.

BOX O.1 What is the aggregate economic support to the (over)use of natural capital? $1 trillion to $1.2 trillion annually

A compilation of estimates by international organizations of aggregate support for the use of natural capital suggests an approximate total of $1 trillion to $1.2 trillion, consistent with McKinsey's estimate of $1.1 trillion (McKinsey and Company 2011). This support includes the following:

- *Fossil fuel subsidies: $455 billion–$485 billion.* This includes subsidies to fossil fuel production or use in Organisation for Economic Co-operation and Development (OECD) countries ($45 billion to $75 billion a year between 2005 and 2010) and consumption in developing economies ($409 billion in 2010; IEA 2011).
- *Water subsidies: $200 billion–$300 billion.* This represents subsidies to groundwater extraction or irrigation infrastructure—estimated as the difference between the market value of water and the part of costs covered by tariffs. Limited data are available, but Myers and Kent (2001) estimate water sector subsidies at $230 billion in 2000 and McKinsey (2011) cites estimates of $200 billion to $300 billion.
- *Fishery subsidies: $10 billion to $30 billion.* This encompasses a wide variety of instruments such as fuel price supports, grants, concessional credit and insurance, and direct payments to industry. Estimates range from $10 billion per year (World Bank and FAO 2009) to $27 billion per year (UNEP 2011).
- *Transfers to agriculture: $370 billion.* This represents total support to the agriculture sector in OECD countries (OECD 2011a) and includes different types of instruments, some environmentally harmful, such as market price supports, but some not, such as payments decoupled from production levels.

While these estimates suffer from errors of inclusion (some of the OECD countries' agricultural subsidies that were included are not environmentally harmful) and exclusion (they do not include developing countries' subsidies to agriculture, estimated by the OECD at about $200 billion for the few emerging economies for which data were available) and are therefore neither precise nor exhaustive, they do suggest that substantial resources go to environmentally harmful subsidies.

and their persistence suggests that the difficulty of correcting them should not be underestimated.

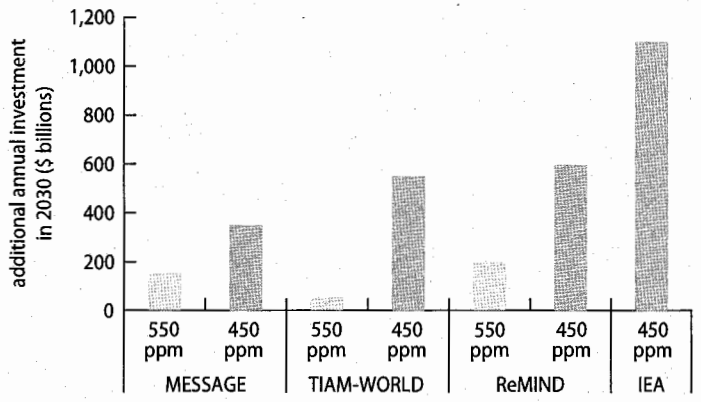
Affordable: Much of green growth pays for itself, and an innovative private sector keeps costs in check

Environmental policies should, in principle, improve social welfare and economic efficiency by reducing excessive pollution and other environmental bads. Nevertheless, such policies clearly have costs. They can hit taxpayers who have to pay the bill (for subsidies to renewable energy or public spending on green R&D) or producers and consumers if the policies mandate the use of more expensive or less productive technologies (such as renewable energy resources that are more costly than fossil fuel). Environmental policies alter relative prices and therefore change the structure of demand, requiring costly adjustments in the structure of production. Demand may decrease in sectors that have high capacity (coal production) and increase in sectors that have limited capacity (public transport). As a result, efficiency may fall, at least during an adjustment phase, jobs may be lost, and the poor may suffer if compensatory measures are not adopted.

Moreover, the up-front capital requirements are high. The energy investments needed globally to achieve greenhouse gas concentration of 450 parts per million (ppm) carbon dioxide equivalent (CO_2-eq; the level needed to maintain a 50 percent chance of not exceeding global warming of 2°C above preindustrial temperatures) could amount to

FIGURE O.5 Up-front investment costs for energy supply and energy efficiency could be substantial

(additional investment needed in the energy sector, both in energy supply and demand, in 2030 to reach a 450 ppm and a 550 ppm CO_2-eq objective, according to four global models)



Source: More information on these models can be found in the following sources: on MESSAGE, van Vliet and others 2012; on ReMIND, Luderer and others 2012; on TIAM-WORLD, Loulou and Labriet 2008; on IEA, IEA 2011.
Note: IEA (2011) does not provide estimates for a 550 ppm scenario.

between $350 billion and $1.1 trillion per year by 2030 (figure O.5). A 550 ppm target appears much easier to achieve, requiring some $50 billion–$200 billion of additional investments per year, but an additional $75 billion to $100 billion would still be needed to adapt to climate change (World Bank 2010d). Adding needed investments in water and land to energy, annual investments of $900 billion to $1,700 billion could be needed over and above business-as-usual requirements (McKinsey and Company 2011).

But many of these capital investments will be recouped through subsequent savings, so the net financial costs will be much lower. For example, the high capital cost of wind and solar energy or hydropower is offset by their low operating costs. Globally $1 spent on energy efficiency saves $2 through investments in new supply, with the savings even greater in developing countries (World Bank 2010d). As a result, the World Bank estimates that more than half the measures needed to decarbonize the energy systems of developing countries would eventually pay for themselves, bringing the financial costs down to between $140 billion and $175 billion per year in 2030 or perhaps half a percentage point of developing countries' GDP (World Bank 2010d). In East Asia, the estimated additional net financing required for a sustainable energy path is $80 billion, not much more than the $70 billion the region currently spends on fossil fuel subsidies (Wang and others 2010; IEA 2008).

Furthermore, determining affordability is about more than a financial ledger. Green policies can contribute to growth (box O.2) and boost a nation's overall wealth. And they help to reduce the damage done by environmental degradation, which is costly for an economy: equivalent to 8 percent of GDP across a sample of countries representing 40 percent of the developing world's population (figure O.6). As a result, benefits may well outweigh the costs (implying a negative net economic cost). $900 billion to $1,700 billion of green investments in land, water, and energy could yield economic returns of around $3 trillion per year, rising to $3.7 trillion with carbon at $30 per ton and no energy, agricultural, or water subsidies (McKinsey and Company 2011).

Thanks to such benefits, the net costs of greening growth appear manageable, although affordability will, of course, depend on the speed and ambition of the greening (as illustrated by the difference between the 450 ppm and 550 ppm targets) and on the design of policies. But the worse the environmental degradation and existing inefficiency, the greater the potential benefits to be obtained from green policies.

At the firm level, the cost of environmental regulation to firms is typically modest, with costs lower than expected thanks to the ability of firms to adapt and innovate (chapter 3). As a result, there is no evidence that environmental regulation systematically hurts profitability. While studies from the 1980s and 1990s found negative impacts, more recent papers find more positive results, partly because they allow a few years for firms to adapt and partly perhaps because we have become better at designing environmental regulations that promote efficiency gains

BOX O.2 The many ways in which green policies can contribute to growth

Green policies and practices can contribute to growth through three channels (see chapter 1). First, *they can help to increase the amount of natural, physical, and human capital available*: Better-managed soil is more productive. Well-managed natural risks result in lower capital losses from natural disasters (Hallegatte 2011). Healthier environments result in more productive workers: a recent California study shows a strong impact of air quality on the productivity of farm workers (Graff Zivin and Neidell 2011).

Second, *they can promote efficiency.* For instance, imposing environmental taxes (taxing "bads") and removing distortionary subsidies creates fiscal space for governments to lower labor taxes or subsidize green public "goods" such as public transport or renewable energy. In London, congestion taxes, besides reducing traffic, helped to finance investments in the aging public transport system, thereby increasing effectiveness of the price signal by reducing the costs or "disutility" associated with switching from single-car use to public transport (Transport for London 2008). And many firms—including large multinationals such as Hewlett Packard, Cisco, Clorox, and FedEx—are finding that embracing sustainability has improved the bottom line in part by promoting greater efficiency (Nidumolu and others 2009).

Third, *green policies stimulate innovation.* Study after study reports that well-designed environmental regulations stimulate innovation by firms, as measured by R&D spending or patents (see chapter 3). Surveys of firms in the European Union identify existing or future environmental regulation as the main driver for the adoption of incremental innovations. Similarly, international sustainability standards can help local firms to upgrade their environmental practices, a form of catch-up innovation. In developing countries, green policies can also encourage the adaptation and adoption of greener technologies that have been developed elsewhere.

Finally, *green policies also accrue non-growth gains to welfare.* They can reduce inequality through job creation and poverty alleviation, and they can reduce output volatility by increasing resilience to environmental and economic shocks, like natural disasters or spikes in commodity prices. A modeling exercise suggests that half of the cost of climate policies to limit greenhouse gas concentration at 550 ppm could be paid for by less vulnerability to oil scarcity (Rozenberg and others 2010).

(Ambec and others 2011). Further, where revenues from environmental taxes are used to reduce taxes on labor and income, the impact on GDP is likely to be neutral or positive, as found in an analysis of seven EU countries (Andersen and others 2007, cited in Ambec and others 2011).

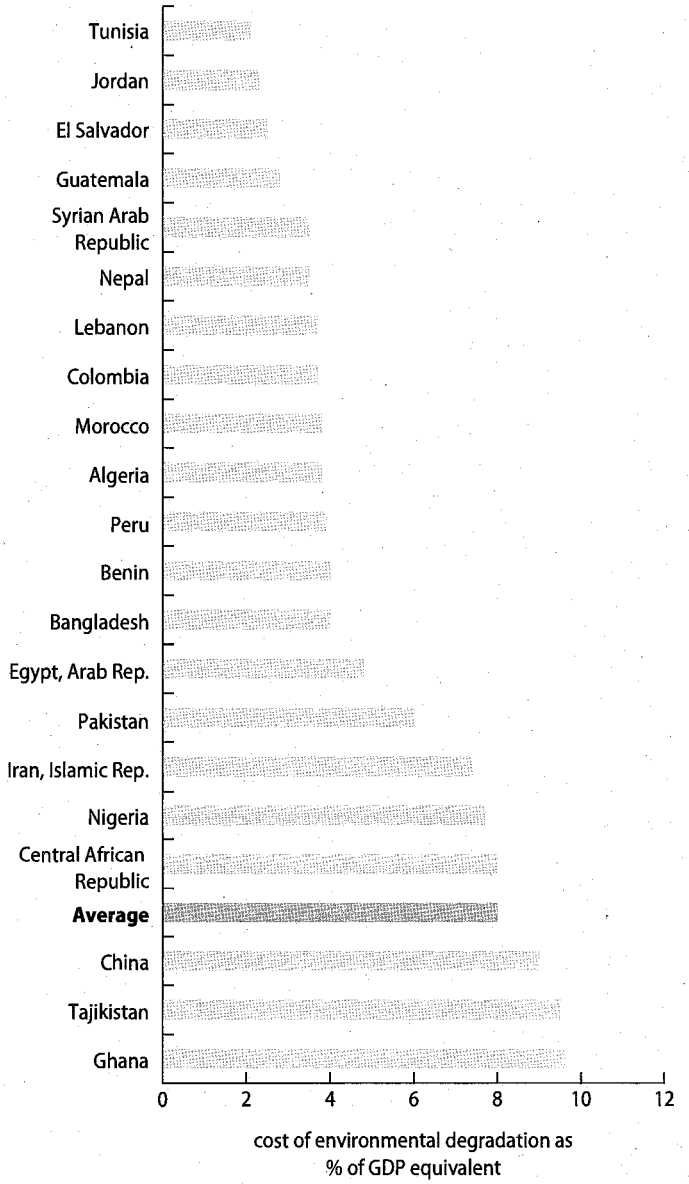
Other ex-post analyses confirm this conclusion. The EU Emissions Trading System has no negative impact on net imports in the aluminum, steel, and cement sectors (Ellerman and others 2010; Quirion 2011; Sartor 2012) or on the performance of German firms in general (Anger and Oberndorfer 2008). Meanwhile, the climate levy on U.K. firms seems to affect energy efficiency, but not economic performance and firm exit (Martin and others 2009).

Refineries located in Los Angeles significantly increased productivity in the late 1980s and early 1990s, a time of dramatically expanded regulation in California and decreasing refinery productivity in the rest of the United States. Interviews with plant managers suggest productivity increases resulted from a careful redesign of production processes to comply with the new regulations (Berman and Bui 2001 and others). Similarly, the productivity of the Mexican food-processing industry increased with stronger environmental regulations (Alpay and others 2002, cited in Ambec and others 2011).

Moreover, there is no evidence that environmental policies have led to an exodus of firms to "pollution havens" (locations with lax environmental policies). Tighter environmental regulation may cause firms to relocate, but they will choose locations that are more attractive overall, as pollution abatement costs represent a small share of production costs for most industries (Copeland

FIGURE O.6 Reducing environmental degradation would provide substantial economic benefits

(cost of enviromental degradation expressed as percentage of GDP equivalent)



Source: World Bank 2004, 2005a, 2006a, 2006b, 2006c, 2006d, 2006e, 2006f, 2007a, 2007b, 2007c, 2008, 2009, 2010a, 2010b, 2010c, 2011a, World Bank and DRC 2012.

2012). Factors such as availability of capital, labor abundance, location, institutions, and agglomeration effects are more important than environmental policy in determining the location choice and competitiveness of firms.

But obstacles are plentiful, and green growth is no substitute for good inclusive growth policies

If green growth is necessary, efficient, and affordable, what is impeding it? Across countries and income levels, a mix of governance and market failures, complex political economy, entrenched interests and behaviors, and financing constraints are significant obstacles. Further, despite much rhetoric to the effect, green growth is no panacea and will not substitute for a good business environment and the reforms that are needed to promote growth and protect the poor.

When first-best recommendations meet second-best situations

Much of green growth is about good growth policies—addressing market failures and "getting the price right" by introducing environmental taxation, pricing environmental externalities (such as carbon pricing), creating tradable property rights, and reducing inappropriate subsidies. These measures are critical for enabling the private sector to undertake needed investments and innovations and for getting consumers to internalize the true costs of their behavior. But as with all good economic policy making, textbook policy recommendations, however appropriate, must be applied with insights into behaviors, political economy, and governance and market failures. This is an enormous challenge for a variety of reasons.

First, *getting prices right may be difficult because of political or social acceptability issues.* The benefits are usually diffuse and uncertain, while the costs (the burden of the price increase) are immediate, visible, and often concentrated on a vocal minority. This is why price changes can be achieved only when political economy issues are managed with appropriate complementary policies.

Second, *getting prices right may not be sufficient because other market imperfections can prevent prices from being the silver bullet of environmental policies.* These market imperfections include the following:

- *Low price elasticity.* The ability of prices to trigger changes in behavior and technology is sometimes limited by substitution possibilities: the responsiveness of drivers to higher fuel prices is low in the absence of alternative means of transportation. The ability of firms in the renewable energy sector to respond to incentives will depend on whether transmission lines are built between centers of consumption and production. In these cases, price-based policies may have to be complemented with direct infrastructure investments (such as public transportation and transmission lines) and other policy actions, like changes in urban planning or in norms and regulations. But if substitution capacity is limited by alternatives, their provision may increase the economy's efficiency and boost income or promote economic growth, making the price increase more politically acceptable.
- *Missing markets or institutions.* Specific institutional measures may be required to transform the "right price" into the right incentive. Where tenants are paying energy bills, for instance, owners and developers have little incentive to "build right" or to invest in more energy-efficient appliances unless they can recoup their investments through higher rents or sales price. This "principal-agent" problem can be tackled through information (such as energy efficiency labels for homes), specific schemes to finance investments in energy efficiency, or norms (such as compulsory retrofit when homes are sold).
- *Lack of credibility and predictability of price signals.* Governments cannot commit to maintaining environmental price instruments over the long term, which puts them in a poor position to encourage firms to undertake long-term, risky investments (notably in R&D and long-lived infrastructure).
- *Coordination failures and knowledge externalities.* Prices are ill-suited to address the "classic" market failures usually invoked to justify innovation and industrial policies. Think about electric cars whose development requires coordination between electricity providers, city planners, battery producers, and car manufacturers.

Third, *inertia and biases in behavior are such that many efficiency measures that might pay for themselves are not implemented.* Household responses to higher energy prices are often disappointing, and firms do not always exploit all opportunities to improve efficiency (Gillingham and others 2009; Allcott and Mullainathan 2010). Energy savings of 20–25 percent could be achieved through improved industrial processes in high-income and emerging economies (World Bank 2010d).

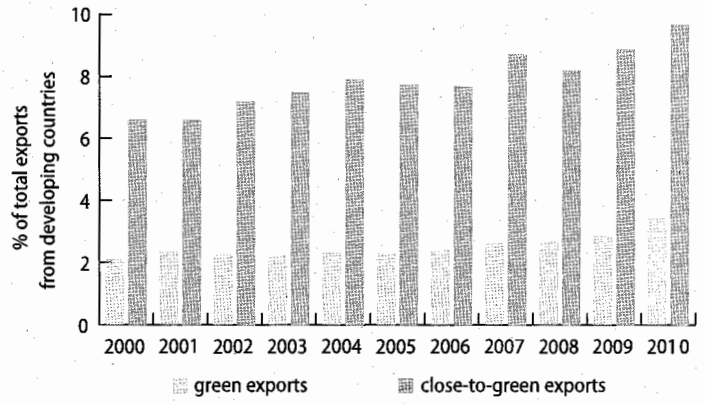
Fourth, *financing tools to tackle up-front investments are inadequate.* Take the case of solar, wind, or hydroelectric energy, which is characterized by much higher capital costs than fossil-based energy, but extremely low operating costs, or energy efficiency that requires up-front investments in new equipment or add-ons whose costs are then recouped over time through energy savings. Even with agriculture or fisheries, a shift to more sustainable practices typically results in lower returns and investments in early years that are then offset by higher returns in the future. The need for up-front financing can be a binding constraint for developing-country governments (especially local ones with limited access to capital markets and a small tax base) and the private sector (especially small and medium enterprises). Few countries have a well-developed banking sector, let alone energy service companies that specialize in financing investments in energy efficiency.

No substitute for good growth policy: The private sector needs an enabling environment

Green growth strategies are growth strategies with the additional goal of fostering a better environment. As such, they cannot substitute for good growth policies: environmental measures are unlikely to offset distorted labor markets, illiquid financial systems, or poor business environments.

FIGURE O.7 Developing countries may have substantial unexploited potential in green exports

(green and close-to-green exports as a share of total exports from developing countries, 2000–10)



Source: Dutz and Sharma 2012, based on data from the Commodity Trade Statistics database (COMTRADE) and a six-digit proximity matrix based on COMTRADE.
Note: Close-to-green exports are exports of goods that are not "green" but require similar skills—in the way growing apples requires the same set of skills as growing pears so that a country that is good at the former is likely to be good at the latter.

A case in point is "green jobs," a topic that has attracted substantial attention following the recent global financial crisis. Advocates stress that, in a situation of high unemployment, a green fiscal stimulus could effectively address recession-induced unemployment and set the stage for cleaner post-recession growth patterns. The argument is attractive: although green projects may not be the most labor intensive or "shovel ready," they have the added advantage of carrying environmental benefits. That said, a fiscal stimulus—green or not—is effective only if unemployment is linked to insufficient demand rather than to structural issues (such as lack of skilled workers or a poor investment climate).

Beyond stimulus effects, some countries—including Brazil, China, Germany, Japan, the Republic of Korea, and Morocco—are looking at green growth as a potential source of longer-term growth through which to create new markets. And even though not every country can become the world leader in solar panels or wind turbines, developing countries may have substantial unexploited potential in green exports (figure O.7). Many developing countries have natural endowments that create a potential comparative advantage in green activities (such as water resources and hydropower potential or insolation and solar power potential). Realizing this potential could generate jobs and exports, thereby boosting growth and output.

But green policies cannot address structural constraints to growth and employment creation, at least if deployed alone. They will not be effective at creating green jobs where labor markets are distorted and regulations discourage small business development. They will not offset an unattractive business environment. And where the labor force's skills are inappropriate for developing a competitive manufacturing sector, environmental policies can hardly replace education. Thus, a recent study of South Africa concludes that, while the idea of developing green industries (such as solar power) is appealing, it has little chance of succeeding unless structural problems such as regulatory obstacles to the creation of small enterprises and the lack of skilled workers are addressed (World Bank 2011b).

Skill shortages already appear to be impeding the greening of growth. In China and India, rural electrification programs are suffering from a lack of skilled workers. Reasons for these shortages include a scarcity of scientists and engineers, the poor reputation and limited attractiveness of some sectors important for the green transition such as waste management, and a limited number of teachers and trainers in environmental services (ILO and CEDEFOP 2011).

In countries where the business environment is not conducive to investment and growth, better economic policies must be the first step. Lessons from trade liberalization are telling: where labor mobility is limited by skills and regulations and where investments in the sectors that benefit from trade liberalization are impaired by inappropriate policies, both workers and the private sector take longer to adjust. The benefits from more trade take longer to materialize, and adjustment costs are much higher. Similarly, economic benefits from green policies are more likely to be large and immediate if economic

policies are conducive to change and favor the development of more environmentally friendly and more productive activities.

The poor and vulnerable need social protection

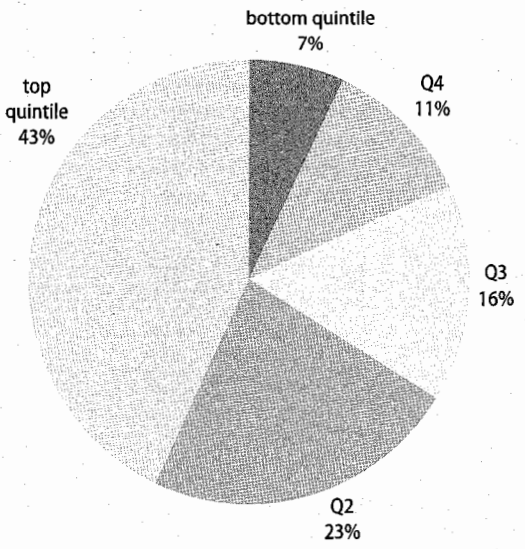
While there is a general presumption that the poor suffer most from environmental degradation and its impact, this need not imply that they would benefit automatically from green growth policies. For example, removing fossil fuel subsidies would clearly reduce the poor's purchasing power unless compensated for by other measures.

But subsidies are often regressive and can be replaced by better-targeted transfers at a fraction of the cost (figure O.8). By one estimate, the cost to the budget of transferring $1 to the poorest 20 percent of the population via gasoline subsidies is $33 (Arze del Granado and others 2010). Similarly, consumption subsidies for water and electricity can usefully be replaced by connection subsidies that are invariably better targeted, as the poor account for the majority of those without access to basic services.

In sum, hopes that green growth will single-handedly solve countries' employment, competitiveness, or poverty problems are probably as unfounded as the fear that environmental policies will lead to massive loss of jobs or competitiveness. Adjustment costs may vary across industries because some sectors are inherently more innovative than others and tend to adapt better. Better regulation—particularly if supported by training, R&D support, and the recycling of environmental taxes into other tax cuts—will help to minimize these adjustment costs and maximize benefits. Also needed are steps to protect the poor from the potential downsides of green policies and to ensure that they benefit fully from the likely upsides.

FIGURE O.8 Fossil fuel subsidies benefit primarily the rich

(fossil fuel subsidy allocation, by income quintile, average across 20 countries, various years)



Source: Arze del Granado and others 2010.

The way forward: Good and inclusive growth policies tailored to real-world challenges

So greening growth requires good growth policies adapted to political economy realities and entrenched behaviors. It entails reforms in the patterns of pricing, regulation, and public investment that trigger resistance. It requires complex changes in behaviors and social norms because, even with efficiency gains and new technology, it is unlikely that middle-class consumers (whether in rich or in poor countries) can stick to current consumption patterns. And it requires knowing when to go for the politically expedient rather than the economically optimal, carefully deploying social marketing tools and making financial tools available.

Complicating matters is the fact that opportunities to green growth at a manageable cost are not evenly distributed over time. This creates urgency for some, though not all, green policies and is one of several arguments for why "grow dirty and clean up later" is not a good option even for poor countries (box O.3).

What follows is a three-prong strategy for tackling entrenched interests and behaviors, financing constraints, and the risk of lock-in.

BOX O.3 Why "grow dirty and clean up later" is misleading

Many argue that poor countries should focus on satisfying human needs before attending to nature, especially given their relatively small environmental footprint. This argument is misleading for several reasons.

First, not all environmental goods are superior goods whose share in total consumption increases with income. Individuals who struggle to feed and house themselves may not see biodiversity protection and climate change mitigation as priorities, but local environmental goods affect their daily lives, with significant impact on income and welfare. The lack of solid waste disposal, for example, is not merely an environmental issue. By clogging drains, it leads to health hazards and flooding, with serious economic and human consequences:

- In Haiti, poor solid waste disposal is to blame for the resurgence of diseases such as dengue and for vulnerability to storms.
- In India, better solid waste disposal systems were a principal recommendation of the fact-finding committee established to investigate the causes of the 2005 Mumbai floods, which caused almost $2 billion in damages and killed an estimated 500 people.

Similarly, mismanaging water resources impairs people's ability to grow crops and feed their families. Where natural assets like soil quality, water, and standing forests serve as critical inputs into economic production, good environmental policies enhance income generation and poverty alleviation.

Second, it may be impossible or prohibitively expensive to clean up later. The loss of many environmental assets—most obviously biodiversity—is irreversible. This is also the case with climate. Because greenhouse gases reside in the atmosphere for a long time, each emitted molecule will influence the climate over decades (for methane), centuries (for CO_2), or longer. Irreversibility may also occur because of economic and technological lock-in. A lot of infrastructure is long lived, and today's choices will be hard to reverse. Urban forms are largely determined when city populations are increasing rapidly and most buildings and transport systems are being built. The consequences of development based on a low-density, individual-vehicle transportation model are largely irreversible, as evidenced by the current struggles of U.S. urban planners to densify and develop public transport systems.

Prong 1: Tailored strategies that maximize local and immediate benefits and avoid lock-in

Green growth policies require governments to do a better job of managing both market and governance failures. This is obvious in any discussion of green innovation or industrial policies, but also of the regulatory and market ("good growth") reforms that are needed, some of which are complex. Even sophisticated administrations may struggle with market-based instruments, as experience with the European Trading System has demonstrated (Betz and Sato 2006). Optimal solutions will differ across countries with varying degrees of institutional capacity, transparency, accountability, and civil society capacity. Therefore, green growth strategies need to be tailored to a country's circumstances, and "best practices" should be imported with caution.

Maximize local and immediate benefits. In addition to being tailored to local circumstances, strategies need to address the political economy of reform. Green growth strategies should aim to minimize transition costs by offsetting them to the extent possible, with visible and immediate benefits. This implies designing policies to maximize short-term, local benefits, such as increased efficiency and productivity, safety and resilience, job creation, and poverty alleviation.

Avoid lock-in. Governments cannot make all of the changes needed at once: they have limited resources and limited implementation capacity to devote to complex problems; they also have limited political capital to defend

TABLE O.1 Some guiding principles for establishing green growth strategies

Inertia and/or risk of lock-in and irreversibility	Local and immediate benefits: LOWER (Trade-offs exist between short-and long-term or local and global benefits)	Local and immediate benefits: HIGHER (Policies provide local and immediate benefits)
LOWER (action is less urgent)	• Lower-carbon, higher-cost energy supply • Carbon pricing • Stricter wastewater regulation	• Drinking water and sanitation, solid waste management • Lower-carbon, lower-cost energy supply • Loss reduction in electricity supply • Energy demand management • Small-scale multipurpose water reservoirs
HIGHER (action is urgent)	• Reduced deforestation • Coastal zone and natural area protection • Fisheries catch management	• Land use planning • Public urban transport • Family planning • Sustainable intensification in agriculture • Large-scale multipurpose water reservoirs

policies against interest groups and political opposition. A focus on the sectors and interventions that are most urgent—that is, those that can help to prevent irreversibility or reduce inertia—is thus called for.

Table O.1 illustrates the implications for priority setting of emphasizing local and immediate benefits and urgency. While lower-carbon energy from renewable sources is highly desirable, it is easier to build renewable plants later (even if this requires retiring thermal power plants) than to try and reverse poor land-use planning that has resulted in sprawling cities. Good land-use planning and urban public transport can provide short-term benefits—for instance, by reducing congestion and exposure to disasters and by favoring denser and more energy-efficient development. Table O.1 provides general statements on a few green policies; this analysis needs to be carried out at regional, national, and local scales to take into account specific contexts (see, for instance, an application to the Mediterranean countries in CMI 2012).

Developing countries (especially low-income countries) should prioritize policies that (a) have a negative or zero economic cost thanks to synergies with development (such as developing hydropower where appropriate, implementing effective urban plans, or scaling up family planning policies to manage population pressures and improve health and education outcomes), (b) have a positive economic cost but large direct welfare impacts (that is, when they target local environmental goods such as local air pollution or natural risks), or (c) are financed from external resources (including through carbon trading).

Actively manage the political economy of reform. Managing the political economy of reform also entails measures that target those segments of the population that would otherwise oppose reforms. For example, in 2010 the Islamic Republic of Iran increased domestic energy prices by up to 20 times, reducing fossil fuel subsidies by some $50 billion–$60 billion. It offset them with $30 billion in cash transfers that benefited 80 percent of its population, thereby addressing the fact that opposition to the reform of such subsidies usually comes from the middle class. The combination of cash transfers with a well-orchestrated public relations campaign was critical to the success of the reform (Guillaume and others 2011).

Understanding the sources of resistance to a reform helps to design the reform process in a way that minimizes this resistance (box O.4). Sound information about winners and

BOX O.4 Morocco: The importance of political economy

A sound understanding of the winners and losers of possible green growth strategies helps policy makers find ways to address tough economic reforms—as Morocco has recently learned in its quest to overhaul a universal subsidy system that rewards fossil fuel consumption. By gaining insights into the political economy of reform, Morocco is now poised to reform its energy subsidy, which would sharply reduce fiscal costs and facilitate a greener growth path.

The problems with the energy subsidy are multiple. Its fiscal impact reached 5.5 percent of GDP in 2011, absorbing roughly 17 percent of the total investment budget. It undercuts Morocco's ambitious mitigation goals by keeping the price of fossil-based energy products low, thus making renewable and efficiency investments less competitive. And it is regressive, with the wealthy benefitting the most.

So why has Morocco hesitated to reform the subsidy? A big reason is that the subsidy reform was believed to be unpopular, although the government had never done a survey to ascertain just how unpopular, among which segments of society, and whether alternatives could motivate changes. For that reason, the World Bank offered to conduct such a poll in 2010 using a nationally representative sample of 1,600 households.

The results are astonishing: more than 70 percent of the population was unaware of the existence of energy subsidies. Thus, the vast majority of buyers of 12 liter cooking gas bottles—a product as widespread as bread—did not know that the real market price was more than DH 100 ($14) instead of the standard retail price of DH 40 ($5.6). In addition, a large majority opposed the idea of reducing subsidies—although this majority decreased once offered a well-targeted social program, and fell even further when the program was explained in detail. In the end, it was the wealthy that remained the group most opposed to reform.

This simple exercise in revealing political awareness and preferences helped the previous government develop a communication strategy over the medium term, starting from informing the population of the existence of the subsidy system and explaining its disadvantages. A communication campaign ensued in the first months of 2011, and the government elected in November 2011 now has energy subsidy reform at the top of its agenda.

Box text contributed by Andrea Liverani.

losers enables an information campaign to be tailored to potential critics.

One way of improving public decisions and determining priorities is to inform decision makers of the value of the services provided by natural ecosystems, so that this value can be compared directly with the economic costs and benefits of their decisions. Indeed, most environmental assets do not have widely accepted prices either for their intrinsic value or for the services they provide (such as flood protection). As a result, decisions that involve a trade-off between economic interests and natural assets (such as building a road through a rain forest) are difficult to assess.

Green accounting extends beyond the valuation of natural assets and focuses on a country's stock of natural and other assets (its wealth) rather than on a flow measure like GDP. By doing so, it helps to identify situations in which economic growth does not create wealth (because natural assets are consumed more rapidly than other assets are created) and is not sustainable. For instance, a green accounting exercise suggests that China's growth would be much lower than its official GDP growth of nearly 10 percent a year if environmental depletion and degradation were included. Indeed, calculations put China's adjusted net national income growth at about 5.5 percent a year (World Bank and DRC 2012).

Prong 2: Measures that promote and incentivize smart decision making

Even though the information provided by green accounting can help inform and balance the debates on political choices and

public investments, it does not constitute an incentive for firms and individuals. To influence their behavior, additional measures are required, and it is here that governments can play a critical role by ensuring that market incentives promote green behavior on the part of firms and individuals.

Getting the prices right will influence consumer demand as well as firms' choice of production processes (for example, higher energy prices will make firms use more energy-efficient technologies to minimize their production costs) and products (to respond to consumer demand that changes with relative prices). But it will also make them innovate, develop, and implement new technologies and processes.

Getting prices right also has a central role in shaping the built-up structure of cities. Land developers respond to price signals so that higher land prices lead to higher density—enhancing productivity spillovers and the supply of affordable housing and managing demand for transport. When "official" land prices do not reflect demand and are depressed at the urban periphery, sprawl or suburbanization likely will be excessive.

But market incentives will not suffice. For green policies to succeed, governments will need all of the arrows in the public policy quiver.

Informing and nudging to influence individuals and address behavioral biases

Behavioral biases limit the impact of market incentives and complicate the design of environmental policies. For example, one explanation for the large unexploited potential that exists in energy efficiency springs from the "cognitive myopia" that prevents individuals from accurately weighing future benefits against immediate costs. Also, individuals measure gains and losses with respect to a reference point and weigh losses more than gains (Tversky and Kahneman 1992); as a result, they tend to consider the cost of new environmental policy as a loss and to disregard environmental damages avoided. People are biased toward the status quo, tend to choose the default option, and have an aversion to ambiguity, resulting in a tendency to delay decision making related to complex problems such as climate change (Tversky and Shafir 1992). At the same time, people like to "do the right thing" and are heavily influenced by social norms.

As a result, how messages are framed, what values are appealed to, and how the needed efforts are presented are critical. When given the choice of voluntarily paying for a carbon offset for an airline ticket, some 60 percent of Americans will do so regardless of political affiliation. When the offset is referred to as a carbon tax, support falls from 60 to 25 percent among Republicans (Hardisty and others 2010). More generally, framing green policies as a way to reach an ambitious and positive social goal (such as becoming carbon neutral by 2050 or becoming a leader in solar technologies) makes them more acceptable (and less prone to reversal at the next change of government) than if they are perceived as a constraint to economic development.

Another approach showing promising results is tweaking "choice architectures" to "nudge" people to make better decisions for the environment or other desirable outcomes without restricting their freedom of choice (Thaler and Sunstein 2008). To count as a nudge, the intervention must be easy and cheap, but not constitute a mandate. Changing the default options—without changing the options themselves—can be an efficient way to promote greener behaviors. In two cases where the default option offered by the electricity provider was a cleaner but more expensive one, fewer than 5 percent of customers requested a shift to a cheaper, but less green, source of electricity (Picherta and Katsikopoulos 2008).

Policies that unleash the power of the private sector

Firms have a major role to play in providing solutions to green growth. Through their capacity to innovate and adjust their production processes, firms are key to keeping the cost of green policy in check. This means that governments need to influence the behavior of firms by providing appropriate incentives and regulations in addition to the right economic incentives.

Use information. Besides prices, firms are subject to pressures from their customers, stakeholders, and investors, and this pressure can be used to green their behavior. Promoting transparency and access to information on environmental impacts can create social pressure to reduce these impacts. A 1996 amendment to the U.S. Safe Drinking Water Act requiring community drinking water systems to report regulatory violations publicly has been sufficient to reduce the incidence of subsequent violations, even in the absence of additional financial incentives.

In China, Indonesia, the Philippines, and Vietnam, performance evaluation and ratings programs that reported emissions data and assessed plants' environmental performance helped a large number of plants initially rated as "noncompliant" to rise to "compliant" (in contrast, plants rated as "flagrant violators" and "compliant" stayed in those categories). One reason these programs work is that they provide the information needed for civil society and legal and political systems to act to reduce pollution. But it also works because they attract the attention of managers to efficiency-increasing opportunities, which can be implemented at low or even negative cost.

Impose where it makes sense. Market and price instruments are sometimes difficult to implement or to enforce, they lack predictability and credibility over the long term, and they may be inefficient when economic actors do not take them fully into account, such as not fully valuing fuel economy when buying a car (Greene 2010). This is why it is sometimes easier to implement norms and regulations, as is done by Australia, Canada, China, the European Union, Japan, Korea, and the United States for car fuel efficiency standards (An and others 2007).

Use innovation and industrial policy, but with caution. Prices are notoriously limited instruments for transforming economies or triggering investments with long-term or uncertain payoffs. Since they depend on government actions, they have long-term credibility and predictability issues. They also cannot address the "classic" market failures that are usually invoked to justify innovation or industrial policies: increasing returns and knowledge externalities in new industries, information asymmetries, capital market imperfections, and the coordination needed across different sectors to permit a technological transition. As a result, most countries resort to some form of innovation and industrial policies in their growth strategies.

Such policies need to be used with care and tailored to the country context. Today, frontier innovation and basic R&D are highly concentrated in high-income countries and a few large emerging economies. High-income countries have a critical responsibility to step up their efforts on green innovation and its deployment as well as to take new technologies to scale through demand-side policies. Failure to do so will severely compromise the ability of developing countries to pursue green growth.

In lower-income countries, capacity is often not sufficient for frontier innovation; what is needed are policies to support the adaptation and dissemination of existing technologies. These technologies have been developed and tested in richer countries, making their support through trade, dissemination, and industrial policies less risky than the development of new technologies. The best way to accelerate technology diffusion is to reduce trade barriers. In China, photovoltaic panel fabrication technologies were introduced mainly through the import of manufacturing equipment from Europe. Also critical are policies to increase adaptation and adoption capacity through education and training as well as trade and industrial policies (such as local content requirements).

Moreover, several developing countries are pursuing green industrial policies—biofuels in Brazil and solar energy in China and Morocco. Lessons from past successes and failures of standard industrial policies are clear: governments should subject firms to competition, have clear sunset clauses, and focus on well-identified market failures, spillover, or latent comparative advantages (for example, solar potential in North Africa). But

most green industries will require some type of policy support, making a market test more complex to design (is a technology not competitive because the government is not pricing the externality correctly or because the technology is not the most competitive available?) and making it even more imperative for government to navigate carefully the twin risks of policy and market failures. Typically, environmental policy (such as a carbon tax) should address the environmental externality, while the standard tools of innovation and industrial policies are used to address knowledge externalities and other market failures such as economies of scale and coordination failures.

Prong 3: Innovative financing tools that tackle higher up-front financing needs

Even when environmental or green infrastructure policies and investments pay for themselves, they can involve significant up-front costs and require specific financial tools. Innovative financing is therefore urgently needed, especially where gains from better environmental management cannot immediately be monetized.

Resources are available but remain small relative to need, so they need to be leveraged. With respect to climate change mitigation, recent estimates suggest that a package of public sources (including a redirection of subsidies currently destined for fossil fuels), multilateral development bank flows, and carbon offset flows could leverage some $200 billion to $400 billion in 2020 in additional private flows (MDB Working Group on Climate Finance 2011). This is close to the expected investment needed to reach a 550 ppm CO_2-eq target, but about half of what is needed to reach a 450 ppm CO_2-eq target. As for the biodiversity market, offset and compensation programs officially amount to some $2.4 billion to $4 billion per year, but may be much bigger, given that most of the existing markets are not transparent or analyzed enough to estimate their size (Madsen and others 2011).

Increasing the role of the private sector is critical. Many of the needed investments could benefit from public-private partnerships. Private participation in infrastructure has grown at a steady pace (13 percent a year) over the past 20 years but remains concentrated in a few middle-income countries and a few sectors, namely, telecom and, to a lesser extent, energy (World Bank and PPIAF 2012). New investments in renewable energy are largely private (some $143 billion of the $211 billion invested in renewables in 2010), but 82 percent of private renewable energy investments that take place in developing countries occur in Brazil, China, and India (UNEP and Bloomberg New Energy Finance 2011). Yet the need for innovation, efficiency, and "smart investments" (smart grids, smart transportation, and smart houses) makes the role of the private sector even more critical in green growth policies than it already is in traditional infrastructure finance.

Three weaknesses hold back private financing of infrastructure—green or not (MDB Working Group on Infrastructure 2011):

- The scarcity of resources to prepare projects and bring them to a stage at which they are "bankable" (that is, attractive to private sectors). Developing-country governments—at least those with limited experience with public-private partnerships—are often reluctant to borrow to prepare uncertain projects, while private investors are unwilling to invest in preparing a project they may have to bid for and not win.
- The mismatch between the tenor of the funds available, with the preference of investors for short-term funds and the needs of infrastructure for long-term funds (15–25 years). Few countries have well-developed capital markets or banking institutions able to transform short-term deposits into long-term products, and not enough refinancing tool options are available.
- The challenge of cost recovery. The ability to charge at full cost is behind the massive expansion in telecom services, but few other infrastructure sectors are able to do so, although where they have, investors have come, as they did in Colombia's water sector. Solutions include measures to price

infrastructure services close to cost recovery, while ensuring affordability for low-income households.

Another weakness springs from the additional policy risk created by the fact that the profitability of green investments is often dependent on public policies (such as feed-in tariffs or environmental taxation). Thus, Spain's retroactive reductions in solar feed-in tariffs, Germany's and France's decisions to reduce the amount of support for future projects, and the lack of progress on a U.S. energy bill all combined to depress the private sector's appetite for renewable energy investments in 2010. As a result, clean energy share prices dipped, reflecting investor concerns, despite continued strong government support for renewable energy in China (UNEP and Bloomberg New Energy Finance 2011).

Renewable energy and energy efficiency illustrate the need for innovative public financing instruments (World Bank forthcoming b). Renewable energy is capital intensive with a long payback period and may face the technology risks associated with emerging technologies (such as concentrated solar) or unique resource risks (drilling for geothermal). Energy efficiency suffers from the fact that most local banks rely on balance sheet financing, rather than project-based financing that is based on the cash flow generated by the investments. The result is that the customers most in need of financing (small businesses and households) are typically deemed not creditworthy. And energy efficiency investments tend to be small, with high transaction costs, so that banks may not find them attractive in the absence of dedicated credit lines to increase confidence and capacity and instruments to aggregate small deals.

Furthermore, access to financing is particularly problematic for small and medium enterprises (SMEs), which account for a large share (60 percent in many countries) of pollution and resource use. Some 65 to 72 percent of all SMEs (between 240 million and 315 million firms) lack access to credit, with a particularly daunting picture in Asia and Africa (Global Partnership for Financial Inclusion 2011). Even in the more sophisticated markets, most firms find it tough to get credit for investments aimed at business activities other than expansion.

How can these obstacles to green investments be overcome? The public sector, international financial institutions (IFIs), and bilateral donors can help by providing funds for project preparation as well as concessional elements for pioneer investments. Such support can go a long way toward changing risk-return profiles and giving investors more confidence in the long-term viability of their projects.

More generally, well-designed public finance mechanisms help to mobilize private investments in energy efficiency and renewable energy (World Bank forthcoming b). In the case of renewable energy and energy efficiency, the following tends to have the greatest leverage:

- Credit lines or guarantee instruments to engage private banks. The experience of the International Finance Corporation is telling: between 1997 and 2011 some $65 million in concessional funding, primarily for risk-sharing facilities, generated $680 million in sustainable energy finance investments (IFC 2011).
- "Fund of funds" under which the government invests a relatively small amount of long-term capital in a range of private, professionally managed funds that then invest in clean energy or energy efficiency
- Public funds to reduce interest rates for consumer financing, typically through financial institutions or utilities.

In addition, energy service companies (ESCOs), which provide clients with energy auditing, propose energy-savings measures, and financing, can help consolidate multiple small transactions. ESCOs as an industry often require public support to establish: in China, it took more than a decade of support by the government and the World Bank before the ESCOs grew to a $1 billion industry in 2007 (World Bank 2010d).

TABLE O.2 Financing mechanisms need to be tailored to the maturity of the local financial sector

(context-dependent financing tools for clean energy in East Asia and the Pacific)

Indicator	Level of financial sector development		
	Low	Medium	High
Country income level	Low income (e.g., Lao PDR)	Middle income (e.g., Thailand)	Upper middle income (e.g., Malaysia)
Banking services	Basic banks	Full-range banks	Universal banks
Non-bank financial services	None	• Government bonds • Equity	• Government and corporate bonds • Equity • Alternatives (private equity, venture capital)
Interest rate	Administrative setting	Largely market based	Fully market based
Access to finance for SMEs	Limited	Partial	Readily available
Availability of long-term financing	Limited (up to 1 year)	Partial (up to 7 years)	Full (up to 15 years)
Risk management	Weak	Adequate	Robust
Appropriate clean energy financing instruments	• **Lines of credit (liquidity support)** • **Concessional financing** • **Dedicated debt funds**	• **Lines of credit (demonstration)** • **Partial risk guarantee**	• **Lines of credit (demonstration)** • **Partial risk guarantee** • **Equity funds** • **Consumer financing**

Source: World Bank forthcoming b.

Overall, the relevant mix of financing instruments will depend on the market barriers (access to credit, transaction cost, or perception of risk), market segments (SMEs, large developers, or polluters), and local context (such as the maturity of the local financial sector) in which they seek to operate (table O.2).

In addition, payments for environmental services (PES)—whereby farmers and landowners are compensated for maintaining their land's ability to provide ecosystem services (such as the regulation of water flows, water purification, control of soil erosion, and habitats for wildlife)—are promising, but underutilized. Fortunately, efforts to develop REDD+ are helping to develop PES schemes.[4] In addition, in developing countries, policy makers have tried to design PES programs to benefit the poor. But whether these schemes in fact benefit the poor depends on the nature of the scheme. Brazil appears to have been successful in this regard, building on its experience in developing social safety nets for the poor (box O.5).

Conclusions

In sum, this report approaches green growth from a pragmatic point of view. The current model is not just unsustainable, it is inefficient. Improving it is good economics, so let's fix market failures, internalize externalities, assign property rights, improve governance, and influence behaviors. But making green growth happen and ensuring it is inclusive will also require an acute understanding of political economy and social psychology.

As such, this report speaks primarily to those who fear that greening growth may be too expensive, may be too ambitious at an early stage of development, or should concern only high-income countries. To them, the report makes a clear case that greening growth is neither unaffordable nor technically out of reach, there are plenty of

BOX O.5 "Green" cash transfers are helping poor communities in the Brazilian Amazon

An innovative addition to the Brazilian *Bolsa Família* (family allowance) conditional cash transfer program—the world's largest and one of the best regarded in terms of coverage and targeting—is being implemented for communities living inside protected areas in the Amazon region.

The *Bolsa Floresta* (forest allowance) rewards traditional communities for their commitment to stop deforestation by distributing payments for ecosystem services to families, communities, and family associations. In order to be eligible to receive the grants, families must enroll their children in school, sign a zero deforestation commitment, and attend a two-day training program on environmental awareness. Each eligible family receives a monthly stipend of R$50 ($30), paid to the mother. Community associations can also be eligible to receive payments of up to R$4,000 ($2,500) to support sustainable income generation activities, such as honey production, fish farming, and sustainable forest management.

Investments for administrative support to community associations make up 10 percent of the total paid to families during the year. *Bolsa Floresta* is being implemented by the State Government of Amazonas and the Fundação Amazônia Sustentável (Sustainable Amazonia Foundation). The funds are generated by the interest on an endowment initially established with contributions from the state government and private donors. Deforestation is monitored on a yearly basis by the Amazonas State Secretariat for the Environment and Sustainable Development through satellite imagery analyzed by independent institutions. The program currently benefits 7,614 families in 15 protected areas, covering around 10 million hectares of forests. The State of Amazonas has succeeded in halving the deforestation rate over the past five years.

Box text contributed by Adriana Moreira.

BOX O.6 Joining forces: A common platform to move forward on greening our economies and growth processes

How does the World Bank's definition of green growth as economic growth that is environmentally sustainable compare to those advocated in recent major reports on green growth? The OECD defines green growth as "fostering economic growth and development, while ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies" (OECD 2011b). The United Nations Environment Programme (UNEP) defines a green economy as "one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities" (UNEP 2011). Like the approach promoted in this report, these definitions are consistent with sustainable development as an ultimate objective and with green growth or a green economy as a means to reconcile its economic and environmental pillars, without ignoring social aspects.

So while the three reports differ in their focus and target audience, they are fully consistent in their broad vision and policy advice. This common vision is being developed further in the context of the Green Growth Knowledge Platform (GGKP), a partnership of the three institutions and the Global Green Growth Institute. The GGKP—launched in January 2012—is a global network of researchers and development experts seeking to identify and address major knowledge gaps in green growth theory and practice. Through widespread consultation and world-class research, the GGKP aims to provide practitioners and policy makers with better tools to foster economic growth and implement sustainable development (http://www.greengrowthknowledge.org).

immediate benefits and a poor country can reap economic benefit from better environmental management. And although high-income countries, which still account for 75 percent of global consumption and a disproportionate share of environmental degradation, absolutely have to implement ambitious environmental measures, all countries will gain from starting early.

Greening growth need not entail slower growth and is affordable. However, achieving a green economy overnight probably is not. The costs of greening growth will depend on the degree of ambition. Rapidly and dramatically decreasing our impact on the planet would be quite costly. So, too, would delaying action for too long. Dramatic shifts would entail much slower growth at least in the medium run, and avoiding a brutal transition is the main incentive to start acting as early as possible.

This report adds to the chorus started by the Organisation for Economic Co-operation and Development and United Nations Environment Programme (UNEP) in recent reports supporting the idea that inclusive green growth is good economics and good development policy (box O.6). While we are still far from being able to price ecosystem services properly, they clearly are valuable. As such, neglecting natural capital, like neglecting human and physical capital, is simply bad management, bad economics, and bad for growth.

Notes

1. The equivalent amount using purchasing power parity (PPP) that allows for better cross-country comparisons of purchasing power is $6,000 PPP for all developing countries and $1,300 PPP in low-income countries.
2. This section is based on World Bank (forthcoming a).
3. The fleet capacity index is the relationship between the capacity of a fishing fleet to catch a particular quantity of fish and the quantity of fish that it actually catches.
4. Reducing Emissions from Deforestation and Forest Degradation (REDD) is an effort to create a financial value for the carbon stored in forests, offering incentives for developing countries to reduce emissions from forested lands and invest in low-carbon paths to sustainable development. REDD+ goes beyond deforestation and forest degradation and includes the role of conservation, sustainable management of forests, and enhancement of forest carbon stocks (http://www.un-redd.org/).

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