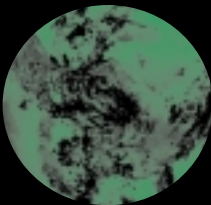
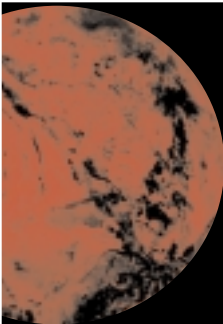
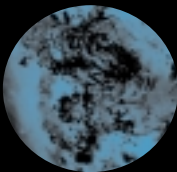
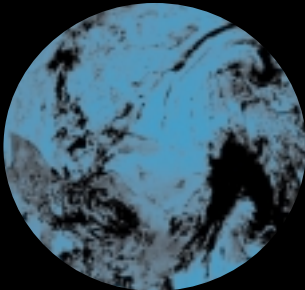
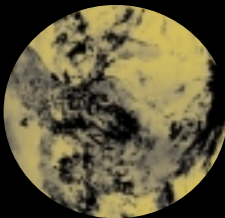
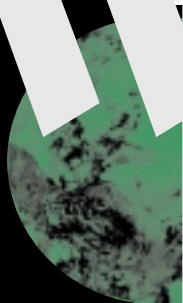


# Policies to Enhance Sustainable Development

SUSTAINABLE DEVELOPMENT



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# **Policies to Enhance Sustainable Development**



ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

## ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

Pursuant to Article 1 of the Convention signed in Paris on 14th December 1960, and which came into force on 30th September 1961, the Organisation for Economic Co-operation and Development (OECD) shall promote policies designed:

- to achieve the highest sustainable economic growth and employment and a rising standard of living in Member countries, while maintaining financial stability, and thus to contribute to the development of the world economy;
- to contribute to sound economic expansion in Member as well as non-member countries in the process of economic development; and
- to contribute to the expansion of world trade on a multilateral, non-discriminatory basis in accordance with international obligations.

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## Preface

In May 1998, OECD Ministers agreed "... that the achievement of sustainable development is a key priority for OECD countries. They encouraged the elaboration of a strategy ... in the areas of climate change, technological development, sustainability indicators, and the environmental impact of subsidies". They also agreed "... to interpret the term 'sustainable' as including social and environmental, as well as economic, considerations", and in a context of "... integrating economic, environmental and social policies to enhance welfare". Finally, they "... stressed the importance of promoting effective integration of environmental considerations in the multilateral system". A report, including policy recommendations, was anticipated in 2001.

This report responds to that mandate. It draws mainly on recent work done by the OECD and its affiliate Organisations\* on various themes related to sustainable development. It also uses other appropriate sources to complete the discussion of these themes. Consistent with the mandate for the project, the report makes no attempt to be comprehensive in its treatment of sustainable development. Rather, it focuses on policy options available to OECD countries to improve the integration of environmental considerations into the working of the economic system, and to address some of the social consequences of better integration. While many of these policy options are well-known, their actual implementation in Member countries has often fallen short of what is desired. This report stresses that high priority needs to be put on building stronger support within governments, and society more broadly, for comprehensive implementation of sustainable development policies, both domestically and internationally.

A range of government agencies, international organisations and groups in civil society are active in promoting the sustainable development agenda. What the OECD brings to these efforts is its *economic perspective* and its *multidisciplinary expertise*. Implementing policies in practice that promote sustainable development requires the strong involvement of both economic and other policy communities, as well as ongoing efforts to build bridges among these communities.

Policies specifically aimed at securing sustained economic growth, a healthy environment or an inclusive social development are important in their own right

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\* International Energy Agency (IEA); OECD Nuclear Energy Agency (NEA); the European Conference of Ministers of Transport (ECMT); and the OECD Development Centre.

for sustainable development. Although these policies are not extensively discussed in this report, related OECD documents on economic growth (OECD, 2001*g*), on an environmental strategy for the next decade (OECD, 2001*i*), and on guidelines for poverty reduction in developing countries (OECD, 2001*a*) contribute to the analysis of policies in these areas. These reports are also highly relevant for the broader discussion on sustainable development.

This report builds upon, and is complemented by, a more detailed analytical report on sustainable development (OECD, 2001*m*). It is provided as background for the OECD Council Ministerial Meeting in May 2001, and is published under my responsibility. Other related publications generated during the course of the OECD Project on Sustainable Development are listed below.

Donald J. Johnston  
Secretary-General of the OECD



**Other OECD publications released in the context of the three-year project on sustainable development**

- OECD (2001), *Sustainable Development: Critical Issues*, Paris, forthcoming.
- OECD (2001), *OECD Environmental Outlook*, Paris.
- OECD (2001), *The Well-being of Nations: The Role of Human and Social Capital*, Paris.
- OECD (2001), *International Science and Technology Co-operation. Towards Sustainable Development*, Paris.
- OECD (2000), "Special Issue on Sustainable Development", *Science, Technology and Industry Review*, No. 25, Paris.
- OECD (2000), *Frameworks to Measure Sustainable Development: An OECD Expert Workshop*, Paris.
- OECD (2000), *Towards Sustainable Development: Indicators to Measure Progress*, Proceedings of the OECD Rome Conference, Paris.
- OECD (2000), *Governance for Sustainable Development: Case Studies of Canada, Germany, Japan, the Netherlands and United Kingdom*, Paris.
- OECD (2000), *Transition to Responsible Fisheries: Economic and Policy Implication*, Paris.
- OECD (1999), *Action Against Climate Change: The Kyoto Protocol and Beyond*, Paris.
- OECD (1999), *National Climate Policies and the Kyoto Protocol*, Paris.
- OECD (1999), *Technology and Environment: Towards Policy Integration*, Paris.
- OECD (1999), *Framework to Measure Sustainable Development*, Paris.
- IEA (1999), *World Energy Outlook – 1999, Insights: Looking at Energy Subsidies: Getting the Prices Right*, Paris.
- NEA (2000), *Nuclear Energy in a Sustainable Development Perspective*, Paris.

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## Key Challenges and Policy Responses

### Introduction

OECD countries routinely refer to economic growth as a measure of increasing human welfare. That economic growth is used as a proxy for welfare is not surprising. After all, consumption possibilities are a major component of welfare as the public understands it. But that same public is also aware that economic growth alone cannot fully describe its needs and wants. It is reminded of this by some of the negative consequences of economic activity – health risks from transport emissions and ozone depletion, declining bio-diversity from loss of habitat, and new forms of inequality associated with changes in technologies and production patterns. This is the context in which the concept of *sustainable development* has taken root – *i.e.* that of linking the economic, social and environmental objectives of societies in a balanced way. The Brundtland Commission defined sustainable development as development that “meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987).

Concern for the interests of future generations will, for many people, be reason enough to look beyond economic growth as an indicator of welfare. But there are other reasons as well. The long-term sustainability of economic growth itself depends on maintaining basic ecosystem services, a healthy environment and cohesive societies. Balancing these elements will require stronger co-operation with developing and transition countries – which already represent over 80% of the world population, and which will account for virtually all of its future increase – because risks of disintegration and exclusion affect all countries, as do opportunities to benefit from participation in a growing global economy. Hence the importance of taking a broader view of what welfare entails, a longer-term view about the consequences of today's activities, and of greater emphasis on international co-operation to reach viable solutions. Ten years after the Rio Conference on the Environment and Development,<sup>1</sup> the concept of sustainable development is firmly rooted in standard economic analysis (Box 1). But for all the work at the conceptual level, its implementation in practice remains muted and uneven. Given the urgency with which the case for sustainability is often made, why have concrete actions lagged behind?

Box 1. Key concepts

Sustainable development can be interpreted in economic terms as “development that lasts” (Pearce and Barbier, 2000) – *i.e.* a path along which the *maximisation of human well-being for today's generations does not lead to declines in future well-being*. This report interprets human well-being as including not only the satisfaction of economic needs, but also aspirations for a clean and healthy environment, and preferences in terms of social development. Types of capital that sustain well being – because of their levels and distribution – include man-made, natural, human and social capital (OECD 2001*m*). Their “adequacy” to support well-being depends on the interaction among them, as well as on the size of the population, its characteristics and preferences. Different types of capital provide one of the main mechanisms through which generations are connected to each other – as their stocks are influenced by current investment decisions, but their lives span several generations.

A key issue for sustainable development is the extent to which different types of capital can be substituted for each other. When substitution at the margin is possible, depletion of one type of capital is consistent with sustainability if it can be offset by an increase in other types. However, substitution between different types of capital is not always possible. For example, in the presence of critical thresholds for some resources, the cost of further degradation may escalate rapidly, calling for policies that maintain the quality and resilience of these resources. In the case of resources where critical thresholds can be defined, more stringent criteria for sustainability will apply (Box 2).

This report identifies some of the key challenges and barriers – conceptual and practical – that stand in the way of progress, and some of the areas where concrete government actions in Member countries would allow better integration of environmental, economic and social goals. The agenda that sustainable development espouses is both complex and broad. Hence the importance of focusing on only *some* of the key areas – those where the risks of non-sustainability are highest. This report concentrates on risks of irreversible depletion and degradation of a range of natural and environmental resources, and suggests a comprehensive set of measures to respond to those risks. Although opportunities to contribute to long-term sustainability via economic and social policies are clearly important, comprehensive sets of policies in these two domains are – at least in OECD countries – relatively well established.<sup>2</sup> So are the linkages between economic<sup>3</sup> and social policies.<sup>4</sup> In contrast, environmental policies, and their linkages with both economic and social policies, are generally less well understood. These linkages need to be strengthened to support sustainable development. Because of these considerations, much of the focus of this report is on the environment-economy link, partly because the stakes in this area are

especially high, and partly because less is known about the environmental-social connection. Improving the coherence between economic and environmental policies would contribute to removing those inappropriate incentives that are leading towards unsustainable resource depletion and environmental degradation.

The measures described in this report cover four broad areas for action:

- The use of the price system to encourage individual agents to take the full costs of environmental degradation into account in their decisions.
- The reform of governments' decision making processes to allow more integrative approaches to the full range of consequences of their policies.
- The use of technology policies to help de-couple environmental degradation from economic growth.
- The strengthening of the contribution of the international trade and investment systems to sustainable development world-wide.

Recommendations in each of these areas are presented at the end of this chapter, and are supported by more detailed analysis in the full report. These cross-cutting recommendations are then applied to two specific issues – climate change and natural resource management – where the risks of non sustainability appear to be particularly high. In addressing these areas for action, policy-makers need to take into account a number of important elements that can contribute to the design and implementation of sustainable development policies (Box 2).

#### Box 2. **Important elements of sustainable development policies**

The discussion presented in this report highlights the importance of a number of cross-cutting elements to guide policies towards sustainable development. These include:

*Long-term planning horizons.* In the absence of an adequate framework for assessing the impact of policies on different types of resources, measures targeted at short-term objectives may be selected even if they have negative long-term impacts. While trade-offs between different goals may prevail in the short-term, in the long-term man-made, natural, human and social capital will complement each other in supporting welfare improvements.

*Pricing.* For markets to support sustainable outcomes, prices should reflect the full costs and benefits to societies of the goods and services being produced. This may require the elimination of incentives to over-use natural resources and to degrade the environment, or the introduction of new incentives to improve the environment.

Box 2. **Important elements of sustainable development policies** (cont.)

*Delivery of public goods.* Many of the benefits from government interventions needed to promote sustainable development have the characteristics of public goods (basic research, information, health and education). Also, many of these public goods are global, as they will benefit several countries (e.g. information on the state of global ecosystems). Effective delivery of these public goods requires overcoming obstacles to co-ordination, through burden-sharing rules that recognise the different responsibilities and response capacities of individual countries.

*Cost-effectiveness.* Policies should aim at minimising their economic cost. This will require ensuring that the costs of each extra resource spent are equal across the range of possible interventions. Cost-effectiveness allows the minimisation of aggregate costs and the setting of more ambitious targets in the future.

*Environmental-effectiveness.* Policies should secure: i) *regeneration* – i.e. renewable resources should be used efficiently and their use should not be permitted to exceed their long-term rates of natural regeneration; ii) *substitutability* – i.e. non renewable resources should be used efficiently, and their use limited to levels that can be offset by renewable resources or other forms of capital; iii) *assimilation* – i.e. releases of hazardous or polluting substances to the environment should not exceed its assimilative capacity, and concentrations should be kept below established critical levels necessary for the protection of human health and the environment. When assimilative capacity is effectively zero, effectively a zero release of such substances is required to avoid their accumulation in the environment; iv) *avoiding irreversibility* – i.e. irreversible adverse effects of human activities on ecosystems and on bio-geochemical and hydrological cycles should be avoided. The natural processes capable of maintaining or restoring the integrity of ecosystems should be safeguarded from adverse impacts of human activities. The differing levels of resilience and carrying capacity of ecosystems should be considered, in order to conserve their populations of threatened, endangered and critical species.

*Policy integration.* Unsustainable practices may result from incoherent policies in different domains. Sectoral policies, in particular, are often introduced without due regard for the externalities being targeted by environmental policies, leading to inconsistencies and spill-over effects. Improving policy coherence requires better integration of economic, environmental, and social goals in different policies.

*Precaution.* Threats of exceeding critical thresholds in the regenerative capacity of the environment are subject to uncertainty. Accordingly, when designing policies for sustainable development, countries should apply precaution as appropriate in situations where there is lack of scientific certainty.

*International co-operation.* With deepening international interdependency, spill-overs become more pervasive. A narrow focus on national self-interest is not viable when countries are confronted with a range of environmental and social threats that have global implications.

*Transparency and accountability.* A participatory approach is important to successfully meeting the challenge of sustainable development, as the criteria for sustainability cannot be defined in purely technical terms. This requires that the process through which decisions are reached is informed by the full range of possible consequences, and is accountable to the public.

## De-coupling environmental pressures from economic growth: key challenges

Are we on a sustainable path? Not without considerable changes aimed at de-coupling a range of environmental pressures from economic growth, so as to ensure that continued economic growth does not result in further environmental degradation. The interaction between economic growth and the natural environment that supports it lies at the core of sustainable development. Economic growth contributes to higher levels of human well-being, and provides the resources to address a range of environmental objectives. However, economic growth can also lead to excessive degradation of environmental and natural resources – when incentives to their use are inappropriate, and external effects are not internalised. Historically, economic growth has meant transforming much of societies' stocks of natural resources into other forms of capital. Today, maintaining functioning ecosystems that can support economic and social development is recognised as crucial for development to last, especially when no substitutes are available.

Economic and demographic projections heighten the importance of more ambitious policies to respond to the challenge of de-coupling. The volume of world GDP is projected to expand by 75% in the 1995-2020 period, with two-thirds of this increase in OECD countries. Over the same period, world energy demand could increase by 57% (IEA, 2000*b*), and motor vehicle kilometres travelled by around 80% (OECD, 2001*h*) – with, respectively, around three fourths and two thirds of this increase occurring in non-OECD countries.<sup>5</sup> On the demographic side, the global population, having tripled in the past 50 years, is expected to increase over the next 50 years by another 20-75% – according to different UN assumptions on fertility and mortality rates – with much of this increase occurring in metropolitan areas of less-developed countries. The increased economic weight of non-OECD countries<sup>6</sup> implies that these countries will play a progressively larger role in shaping global environmental conditions. Consumption patterns prevailing in OECD countries are already imposing a large burden on the global environment, through demands for food and other natural resources.<sup>7</sup> The prospect of increased competition for scarce resources, and of greater pressures on the environment that would follow from the extension of these consumption patterns to the world population, underscores the importance of achieving more sustainable patterns of consumption world-wide.

*Human interference with the climate system* is one area where de-coupling is particularly important. There are no alternatives to many of the climate services provided by nature, and several of the changes prompted by increasing concentrations of greenhouse gases in the atmosphere may prove to be irreversible. Human activities have contributed to higher concentrations of greenhouse gases via the burning of fossil fuels (which account for about 85% of global emissions) and

a range of other economic activities. New scientific evidence suggests that most of the warming observed over the past half-century is attributable to human activities (IPCC, 2001*a*). A continuation of these trends could double concentrations of greenhouse gases by the end of the century, increase temperatures, alter precipitation patterns, raise sea levels, and interfere with atmospheric and oceanic circulation. Effects could also include inundation of coastal areas, loss of forests and coral reefs, endangerment of species, reduction in crop yields, impacts on irrigation, higher levels of air pollution, health impacts of heat waves, and the spread of infectious diseases (IPCC, 2001*b*). In the short-term, most OECD countries have committed themselves to significantly reducing their emissions of greenhouse gases (Figure 1). In the long-term, participation of developing countries in the abatement effort will be essential to limit climate change. Even if OECD countries were to reduce their emissions to zero, further increases in the global concentration of greenhouse gases will occur unless growth in emissions elsewhere are not reduced. The divergence between past responsibilities for greenhouse gas emissions (mainly in industrialised countries), future pressures (which include some large non-OECD countries), and vulnerability to climate impacts (in some of the poorer developing countries) makes issues of equity between countries central for climate policies.

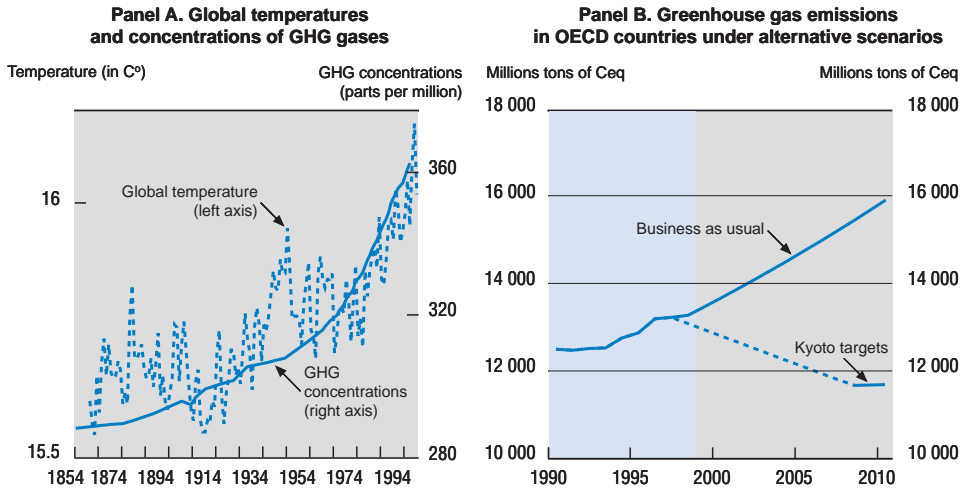
Risks that current patterns of production and consumption could compromise the life-supporting services on which human well-being depends also extend to other aspects of the global ecosystem. Resource management in OECD countries has traditionally focused on the market-based values of natural resources while largely ignoring values that are not captured by markets. Sustainable development requires considering all ecosystem services, which are a function of both the quantity (total stock) and the quality (resilience) of the resources involved. Management systems in place in most countries are gradually starting to recognise this broader perspective, in particular in the areas of biodiversity, farmland, forests, water and living marine resources. The international community has introduced several conventions and treaties over the past two decades aimed at addressing these challenges. Non-ratification, however, has often undermined the credibility of this treaty process.<sup>8</sup>

It is difficult to measure the significance of changes in ecosystems, but analysis of selected vertebrate species living in forests, freshwater and marine ecosystems suggests that their numbers may have declined by about one-third over the last thirty years.<sup>9</sup> Marine resources are exposed to especially large pressures. Around one-quarter of major fish stocks were over-exploited in 1996; while they are now recovering in some areas, they will not return to levels consistent with their single-species maximum sustainable yields<sup>10</sup> without further reductions in fishing activity (OECD, 2001*h*). More generally, biodiversity reduction is driven by over-exploitation of native species, impairment of their habitat, and introduction

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<sup>14</sup>

Figure 1. Global temperatures and emissions of greenhouse gases in OECD countries



*Note:* Data on GHG concentrations are based on records from ice-core data up to 1960, and from observations at the Mona Loa Observatory, Hawaii, since 1960.

*Sources:* Panel A: GHG concentrations are from C.D. Keeling and T.P. Whorf, Scripps Institution of Oceanography, University of California, United States, for measurements taken at Mauna Loa Observatory, Hawaii; and Atmospheric Environment Service, Environment Canada for records from Alert, NWT, Canada. Global temperatures are from Jones *et al.* (1999) and Parker *et al.* (1995). Panel B: GHG emissions include emissions of carbon dioxide, methane and nitrous oxide and are for the OECD GREEN model.

and spread of invasive species. Since the extinction of an individual species is irreversible, actions taken to prevent extinction should be regarded as insurance against the loss of resources that could be valuable in the future – either on their own or because of the raw material they could provide in such areas as pharmaceutical, agricultural, and industrial processes.

Similar concerns are justified by the rate at which water resources are being used and degraded. Human activities have increased water withdrawals and pollution of water bodies. While freshwater resources are still globally abundant, they are unevenly distributed across and within countries. One in five people in the world does not have access to safe and affordable drinking water, and half do not have access to adequate sanitation. About one-third of the world's population is estimated to be living in countries suffering medium-high to high water stress,<sup>11</sup> and the proportion is projected to double by 2025.



Many of these trends are compromising the ability of nature to support future well-being. They are also imposing a large burden on the well-being of today's generation because of their impacts on human health. Environmental damage may already be responsible for 2% to 6% of the total burden of disease in OECD countries, and for 8% to 13% in non-OECD countries (OECD, 2001<sup>16</sup>). The health effect of environmental degradation is a critical component of the social-environment interface.<sup>12</sup> Better understanding and quantification of the burden that environmental hazards impose on today's well-being could prove crucial to adopting more ambitious environmental policies over the long-term.

### **The social dimension of sustainable development**

A coherent approach is required to address these environmental threats in a manner that is consistent with the development and social priorities of different countries. It is particularly important in the light of the global nature of many of the challenges described above. In some cases, such as climate change, countries cannot individually reverse adverse trends. In others, such as biodiversity and water shortages, consequences of continued degradation spill over national borders. Globalisation of economic activity and changes in countries' relative economic weights have also shifted policy priorities from the local and national levels to the regional and global ones. As a result, national policies in many areas have become less effective on their own, prompting calls for new multilateral responses. International co-operation, however, requires shared priorities for action and criteria for sharing its costs. It is difficult to reach agreement on these priorities when large disparities exist in economic conditions among countries.

This result is all the more likely when a large number of people – mainly in developing countries – cannot satisfy their fundamental needs because of poverty, malnutrition, illiteracy and inadequate access to basic services. The consequences of poverty often persist over time, and spread across countries in the form of conflicts, migration and disease.<sup>13</sup> Poverty reduction is therefore integral to the pursuit of sustainable development world-wide. Stronger efforts from governments, business, civil society, and the community of donor countries are required to meet this goal. Building on resolutions from a number of UN conferences in the 1990s, donor countries have agreed to focus on seven international development goals that, if achieved over the next 15 years, would improve the lives of millions of poor people in developing countries.<sup>14</sup>

There are also important synergies between the goals of poverty reduction and better environmental protection. Rural populations, for instance, depend directly on their surrounding ecosystems – pastures, forests, wetlands and coastal fisheries – to meet their needs for food, fuel, shelter, fodder and medical plants.

<sup>16</sup>

And in both rural and urban areas, the importance of environmental factors for the health status of those living in developing countries is similar to that for malnutrition and other preventable risk factors (World Bank, 2000b). More generally, environmental sustainability can only be achieved within a broad development strategy, encompassing sustained economic growth, financial solvency, institutional development, improved governance, effective investment in education and health, and poverty reduction.

OECD countries can play an important role in helping developing countries achieve these goals, by providing increased access to needed investment flows and to their own markets. Liberalisation of international trade and investment helps developing countries enhance their economic growth and has the potential to lift large numbers of people out of poverty. It can also improve environmental protection in developing countries through the diffusion and implementation of cleaner technologies, co-operation to develop good governance systems, and assistance to producers in developing countries meet consumers' demands for goods produced in a sustainable manner. However, globalisation will not deliver its full potential benefits if new technologies, capital and export markets only benefit those countries where the conditions to effectively exploit these opportunities are present, while marginalising those countries where these conditions do not yet exist. Development co-operation contributes by helping developing countries, especially the poorest ones, build their capacity to take full advantage of globalisation's potential to reduce poverty.

Social considerations are also important for the pursuit of sustainable development in OECD countries. Most OECD countries have made significant progress in establishing extensive safety nets, education and health systems, alongside well-developed governmental, legal and institutional apparatus for delivering these services to their citizens. Social policy in OECD countries has long been motivated by concerns about equity and the social externalities of poverty, unemployment, inadequate skills or ill health. Policies in these areas need to adapt to changing circumstances and are continuously under review, but a framework already exists for addressing a broad range of social needs. Such policies testify to an on-going concern about current needs and future prospects, even if this concern is not always phrased in sustainable development terms. Social protection systems, however, may need to adjust so as to contribute to creating the necessary conditions for more determined action to preserve long-term "environmental commons", and to address the structural adjustment that policy reforms entail.

The level of wealth, institutional infrastructure and social safety-nets in place in OECD countries may appear to make the goal of environmental sustainability a more attainable one in those countries. However, recent experience has demonstrated that the required changes in policies and behaviour may be difficult to

achieve in the face of ignorance, inertia, and vested interests. In recent years, the notion of “social capital” has gained prominence to describe those features of societies and communities that facilitate collective action and, in particular, the kinds of difficult changes that will be needed to ensure environmental sustainability (Box 3).

### Box 3. Social capital

Social capital, according to the preferred OECD definition, refers to networks, shared norms, values and understandings that facilitate co-operation within and among groups. Communities or societies with high social capital are thought to be characterised by higher levels of mutual trust, reciprocity, unwritten and unspoken agreement about societal rules, and social cohesion. Such societies may also be more effective at achieving collective goals – including those for environmental protection. In developing countries, where the role of formal institutions is less developed, informal arrangements provided by families, friends and local communities may be crucial in ensuring well-being and, indeed, survival. While the notion of social capital is relevant for both developed and developing countries, it seems especially important in the context of development and poverty eradication, and has been given much prominence in recent World Bank work.

In practice, the concept of social capital is difficult to make operational and to measure. Putnam (2001) has developed proxy measures based on statistics of: *i*) the amount of involvement in community and organisational life; *ii*) public engagement (*e.g.* voting); *iii*) volunteer community activities; *iv*) informal sociability (*e.g.* visiting friends); and *v*) reported levels of interpersonal trust. A number of studies suggest that social connectedness is correlated with physical and emotional health, lower crime rates, and performance of government institutions.

It is not always clear how policy can foster the accumulation of social capital, as it is mainly an attribute of communities. Government support for voluntary initiatives and community organisations has been suggested as one option, but the effectiveness of such measures in enhancing social capital is less obvious than, for example, increasing access to higher education for enhancing human capital. Whether social sustainability depends on the amount and composition of social capital is impossible to judge at this stage of development of the concept and its measurement.

An OECD study on the role of human and social capital for sustained growth and development (OECD, 2001*n*) reviews the origins of the concept, its relation to human capital, its measurement and impacts on well-being.

## Inadequate responses: knowledge and implementation gaps

Policies in place have so far failed to match the urgency of the challenges described above. This gap reflects both knowledge and implementation problems. Lack of knowledge often accounts for the difficulties in valuing external effects, or in decisions about the supply of public goods. For example, important gaps exist in understanding the pressures exercised by human activities on terrestrial and marine ecosystems, in valuing a range of ecosystem services, and in quantifying the health implications of various environmental hazards. Risks of serious or irreversible damage call for precaution<sup>15</sup> in policy making, yet inadequate information on the size of the risks involved – or on the point where critical thresholds are reached – has often complicated decisions about how much “insurance” (in an economic sense) is justified. Filling in these gaps is crucial for designing more credible policy targets, and for gaining broad support for their implementation. OECD governments, *via* their extensive research capabilities, have important responsibilities in this regard.

The difficulty in providing comprehensive and concise information about sustainable development is also part of this knowledge gap. Gross domestic product

### Box 4. Measuring sustainable development

Much recent work on measuring progress towards sustainable development has addressed specific issues, such as measuring climate change or the environmental and social impacts of particular sectors (*e.g.* agriculture, energy and transport). Measuring sustainable development at an aggregate level, however, requires a broad integration of indicators of economic, environmental, and social changes.

One way to achieve this integration is to extend the traditional framework used for measuring economic activity – the National Accounts. Extensions of the National Accounts to the environmental area are currently underway. These extensions are aimed at recording changes in environmental assets, and at highlighting environment-related transactions (*e.g.* pollution abatement and control expenditure). Extensions to the social area may also allow the linking of accounts measuring employment, human capital, and the distribution of household income and consumption among various socio-economic groups. Measuring natural and human capital requires both monetary and physical data. While work in these fields has progressed,<sup>1</sup> the application of a fully extended National Accounts framework remains a medium- to long-term objective. In the shorter term, complementary approaches to achieve such integration are required.

## Box 4. Measuring sustainable development (cont.)

Since indicators in each of the three dimensions of sustainable development are well developed, one approach is to select a small set of indicators pertaining to each of these dimensions to capture key sustainable development trends. Some OECD countries already use this approach. A preliminary set of such indicators for OECD countries is described in OECD (2001*m*). These are grouped as *resource indicators* (measuring levels and changes in economic, environmental and social assets<sup>2</sup>); and *outcome indicators* (covering the quantity and quality of development across a broad range of perspectives, including income distribution, health and environmental quality<sup>3</sup>). This list provides an illustration of this approach, based on available indicators for most OECD countries, that could be used in OECD work (including in performance reviews). It is not meant to be a prescriptive, definitive, set to be applied in each country, but as a basis for further work.

A limited set of indicators can complement single measures based on aggregation of indicators. Some aggregate indicators use physical or subjective weights to combine trends in different variables (*e.g.* the *Living Planet Index*, WWF *et al.*, 2000). Others rely on monetary valuation of different assets and flows, and are closely linked to the national accounting framework. Examples of the latter include measures of “green GDP” and “genuine savings” (OECD, 2001*f*). Genuine savings deduct from the traditional definition of savings the estimated costs of depletion and degradation of a range of environmental assets, and add on estimates of investment in human capital. One advantage of the genuine savings approach is that persistently negative values can be interpreted as evidence of unsustainable trends. However, this approach suffers from the difficulty of attaching monetary value to the depletion and degradation of a range of resources.

1. The OECD and other agencies are co-operating to the preparation of a revised manual for the compilation of *System of Economic and Environmental Accounting*, to be released in 2001.
2. The *resource indicators* selected in OECD (2001*m*) cover change in air quality (changes in emissions of CO<sub>2</sub> or GHG, NO<sub>x</sub> and SO<sub>x</sub>); changes in water resources (intensity of water use); changes in land and ecosystems (changes in land use); changes in biodiversity (protected areas); changes in use of energy resources (growth in consumption of energy resources); net changes in produced assets (change in value of the net capital stock); net changes in financial assets (current account balance to GDP ratio); technological change (multi-factor productivity growth rate); changes in the stock of human capital (changes in the proportion of the population with upper secondary/tertiary qualifications); investment in human capital (growth in expenditure on education); and depreciation of human capital (standardised unemployment rates).
3. The *outcome indicators* selected in OECD (2001*m*) cover consumption (household final consumption expenditure per capita); sustainable consumption (waste generation intensities); income distribution (D9/D1 decile ratio/Gini coefficient); health (life expectancy/ disability free life expectancy, environment related health expenditure); work status/employment (employment to population ratio); education (enrolment rates).

(GDP) is today recognised as only a partial measure of human well-being, as some of the activities that contribute to GDP lower well-being (*e.g.* pollution), while others may reduce resources beyond their reproduction limits – if they are not managed in a sustainable manner. This recognition, however, has not yet translated into the establishment of comprehensive measures combining information on different types of assets and income flows. While a range of approaches and indicators has been developed (Box 4), an authoritative set of data that combines these different strands of work does not yet exist. Its development and use in the context of peer-review process are key priorities for increasing awareness in the general public, and to identify critical pressure points.

In many areas enough information is already available to serve as the basis for policies. However, action remains inadequate. Several factors contribute to these *implementation gaps*:

- For common resources – such as climate, biodiversity, marine resources and (in some cases) freshwater resources – there may be little incentive for any one country to take unilateral action, as the costs would be borne by the country involved, while the benefits would accrue to all. Co-operation across countries, according to their common but differentiated responsibilities, is therefore required for effective implementation.
- Concerns about the short-term consequences of policies to protect the environment on the distribution of household income (*i.e.* the possibility they may disproportionately affect those with lower income), on employment (in particular when employment losses are locally concentrated), and on the competitiveness of individual firms and sectors, have also delayed implementation. Practical options to deal with these problems are presented in this report. These concerns are not unique to policies addressing challenges to sustainability. As in other areas, the structural adjustment that these policies imply will be easier to implement in countries that have been most successful in addressing pressing social needs.
- Governments are not always well-equipped to deal with the cross-cutting and long-term nature of many of these challenges. Sustainable development policies typically involve the responsibility of several ministries, implying the need for better integration of economic, social and environmental objectives (*e.g.* in specific sectors depending on natural resources). The long-term nature of some of the threats to sustainable development also requires reflecting possible irreversible effects (*e.g.* disposal of toxic waste, species extinction, etc.) and extreme events (*e.g.* floods, storms) in policy decisions. Risk assessment and risk management are important to the design of policies leading to sustainable development.

- Although OECD governments have important responsibilities in promoting sustainable development, progress will be enhanced by participation and support from the general public, consumers, business, and civil society. Business can play an important role in adopting and diffusing sustainable practices world-wide, and in many instances appear to be ahead of governments in implementation. Organised groups in civil society can also play a role in identifying key challenges and in facilitating adaptation. Providing consumers with information about the environmental characteristics of the goods and services they buy, and making them aware of the consequences of their decisions, will facilitate change in consumption patterns. Governments have an important responsibility in setting up the conditions necessary to encourage changes in behaviour that favour sustainable development, and in providing access to the information needed for effective participation.

### **A framework for sustainable development policies: key policy responses**

A comprehensive strategy is needed to overcome these knowledge and implementation gaps. OECD governments need to show leadership. In particular, they need to make their policy tool-kit more market-oriented, more integrative, and more inclusive of developing-country interests. Progress also requires a focused agenda, with special priority given to areas where the risks of non-sustainable patterns of development are highest – such as climate change and the management of other natural resources. Recommendations to improve the effectiveness of policy interventions are provided below, and developed in more detail throughout the remainder of the report. Not all of the recommendations apply to all OECD countries, nor in all circumstances. Different priorities and institutional conditions will need to be taken into account when considering their effective implementation. Nevertheless, when comprehensively applied, these recommendations provide a practical framework for progress towards sustainable development.

Responsibility for implementation clearly rests with Member countries. However, the OECD itself can play an important role in supporting these efforts. The OECD provides a forum for “without prejudice” discussions, where common positions among Members can be developed outside negotiating fora. It can also assist in tracking progress towards sustainable development; in collecting comparable information in key areas, such as indicators of subsidies and their effects; in developing recommendations on the characteristics of sustainable development policies; in analysing the socio-economic and environmental effects of different measures; and in periodically reviewing progress in the implementation of domestic policies, via its peer-review system.

### ***Making markets work for sustainable development***

There is significant scope throughout the OECD area to expand the use of market-based instruments and to reform support programmes so as to make price signals more coherent with the goal of de-coupling environmental pressures from economic growth. Several environmental objectives could be achieved in a more cost-effective way using market-based instruments. This would include removing externalities and market failures through greater use of environment-related taxes and tradable permit systems, and addressing policy failures by reforming environmentally damaging subsidies. Obstacles to these reforms can be overcome by improved international co-ordination; by targeted interventions, such as compensating those most affected by reforms in a way that does not undermine the environmental effectiveness of market-based instruments; and by general measures, such as phasing-in reforms and programmes to build public acceptance. In practice, market-based instruments will need to be combined with other interventions such as regulations, voluntary agreements, and information. Opportunities exist to increase the effectiveness of all these tools.

- Take account of externalities and market failures through greater use of environment-related taxes and tradable permits. While the choice and design of instrument will vary depending on national circumstances and on the problem being addressed, this implies:
  - Setting tax rates that are consistent with environmental targets, *e.g.* by introducing new taxes on some products and processes (especially those that are currently tax-exempt), and by better targeting existing taxes.
  - Expanding the use of tradable permit systems to address global (*e.g.* climate change), regional (*e.g.* eutrophication), or domestic (*e.g.* local air pollution) concerns.
  - Reducing exemptions to environmental taxes and restrictions to tradable permit systems that undermine their effectiveness.
  - Using the revenues from these instruments in line with national priorities. This could include policies to facilitate adjustment and to gain public support for these instruments, giving priority to reducing other more distortionary taxes. If these revenues are used to finance specific environmental programmes, review these arrangements periodically to ensure that they do not distort spending priorities. Similarly, limit the grandfathering of tradable permits in time, in order to minimise distortions to competition.



- Correct policy failures through reforms of environmentally damaging support programmes by:
  - Phasing-out subsidies that are environmentally damaging, and making the remaining ones consistent with specific improvements in environmental performance.
  - Ensuring that benefits from support payments for environmental services meet the cost of provision, and making the valuation of the costs and benefits transparent.
- Improve the effectiveness of other measures by:
  - Considering all economic, environmental and social benefits and costs expected from proposed regulations.
  - Strengthening the environmental effectiveness of voluntary arrangements, through provisions for follow-up, verification, and control.
  - Educating and informing producers and consumers to increase awareness of the environmental and social consequences of their choices, taking care to avoid creating unintended trade effects.
- Address the possible effects of more ambitious environmental policies on employment and income distribution, and assist the redeployment of workers affected by these policy reforms through labour market measures (*e.g.* income-support, job-search assistance and retraining) and other interventions that increase flexibility and well-functioning labour markets.

### ***Strengthening decision making***

Governments also need to “lead by example” in promoting sustainable development. Governments should therefore focus their internal policy design and implementation processes on more effectively integrating the three dimensions of sustainable development (economic, environmental, and social); improving their own capacity to support sustainable development; and developing transparent and productive mechanisms for interacting with civil society.

- Improve the capacity for policy integration at all levels of government by:
  - Ensuring that key economic, environmental and social considerations are integrated into sectoral policy analysis, design and implementation, before decisions are taken, using tools such as environmental, social and regulatory impact assessments, as well as cost-benefit analysis.
  - Ensuring that the best scientific advice on sustainability issues is co-ordinated at the highest possible level within government, and communicated in a timely manner to decision-makers.

- Co-operating internationally to develop common approaches for making economic, environmental and social policies mutually supportive.
- Assessing the coherence of their international engagements, to improve international policy-making processes.
- Clearly identifying sustainable development policy targets and timetables and conducting regular reviews of progress (including through peer review).
- Develop the capacity within government to use information and communication technology to co-ordinate effectively across government.
- Improve transparency and public participation at all levels of government by:
  - Enabling effective participation of firms, workers, consumers and non-government organisations in policy discussions on production and consumption patterns, thereby facilitating the transition to sustainable development.
  - Providing the public with access to information and to effective means of challenge (*e.g.* judicial processes).

### **Harnessing science and technology**

Scientific progress and technological development are major forces underlying improvements of productivity and living standards. New technologies offer considerable promise for de-coupling economic growth from long-term environmental degradation. But there is no guarantee that innovations will appear when and where they are most needed, or at a price that reflects all environmental and social externalities associated with their deployment. Governments need to create a policy environment that provides the right signals to innovators and users of technology processes, both domestically and internationally; to fund basic research; and to support private initiatives in an appropriate manner.

- Provide permanent incentives to innovate and diffuse technologies that support sustainable development objectives, by expanding the use of market-based approaches in environmental policy. When market-based instruments are not appropriate, use performance standards in preference to measures that prescribe and support specific technologies.
- Support long-term basic research through funding and efforts to build capacity (*e.g.* development of centres of excellence). Increase research on ecosystems, the value of the services they provide, the long-term impact of human activity on the environment, and the employment effects of new technologies.
- Address unintended environmental and social consequences of technology, by separating technology *promotion* responsibilities from those on health, safety, and environmental *protection* within governments.

- Support applied research activities when they are clearly in the public interest (*e.g.* protection of public health and environment) and unlikely to be provided by the private sector by:
  - Co-operating with the private sector to develop and diffuse new technologies.
  - Facilitating public-private and inter-firm collaboration with the innovators of cleaner technologies and practices.
  - Seeking out opportunities for greater international collaboration on research, especially on issues critical for sustainable development.
  - Allowing competition among technologies that can meet the same policy objective, and equal access to “learning opportunities” (*e.g.* protected niche markets and similar schemes) by foreign as well as domestic investors.

### ***Managing linkages with the global economy***

International trade and capital flows contribute to long-term economic growth and development, and provide a foundation for achieving environmental and social goals. When trade and investment policies and environmental and social policies are mutually supportive, the contribution of each to sustainable development is enhanced. OECD countries should reinforce this coherence, both in their domestic arrangements and in international negotiations. To grow in a way that is environmentally and socially sustainable, developing countries need improved access to OECD markets and active support from OECD countries for their capacity building efforts.

- Strengthen coherence among trade, investment, environmental, and social policies by:
  - Reforming domestic policies that are both trade-distorting and environmentally-damaging.
  - Assessing the environmental and social impacts of trade and investment liberalisation and of incentive measures aimed at attracting foreign direct investment, and developing or refining suitable methodologies to this end.
  - Developing practical approaches for ensuring that trade and investment disciplines and environmental and social policy instruments remain mutually supportive.
  - Encouraging the use of environmental and social codes of conduct in the private sector; providing a supportive regulatory and institutional framework for private sector activity; and promoting awareness and effective implementation of OECD instruments dealing with multinational enterprises, corporate governance, and bribery.

- Support opportunities and capacities for developing countries to grow in a way that reinforces environmental protection and social development by:
  - Increasing market access for developing countries, especially in sectors where sustainable development is likely to benefit most from economic liberalisation.
  - Reviewing economic and environmental policies from the perspective of the goal of poverty reduction.
  - Promoting implementation of the international development goals reflected in the DAC Report “Shaping the 21st Century: The Contribution of Development Co-operation”. In working toward these goals, most OECD countries are guided by the widely accepted target of 0.7% of GNP as an appropriate objective for ODA levels.
  - Continuing to help the poorest countries improve their capacity to participate in the sustainable development of the global economy. This includes establishing the policy and institutional frameworks needed to attract private capital flows to those countries, while minimising adverse environmental or social impacts associated with such flows, and providing appropriate support for technology co-operation.
  - Where development co-operation resources are used to support the provision of global public goods (*e.g.* climate change), focusing on those activities that have clear local benefits, and which also generate ancillary benefits at the regional and global levels.

### **Responding to climate change**

Addressing climate change is a particularly urgent challenge, requiring strong international co-operation as well as leadership from OECD countries to act rapidly to achieve the mitigation levels envisaged under the Kyoto Protocol. OECD countries need to better align their domestic policies with climate change objectives. They also need to introduce market-based measures, such as emission trading systems, carbon taxes and subsidy reforms, and to combine these policies with focused programmes for technology development and diffusion (*e.g.* low carbon-emissions energy sources). And finally, they need to develop long-term mitigation policies and to strengthen their partnerships with developing countries, in order to stabilise concentrations at levels that avoid dangerous interference with the climate system.

- Use a comprehensive approach to climate mitigation by:
  - Extending mitigation to all sources of greenhouse gases and carbon removal through sinks.

- Incorporating into climate policies both the ancillary benefits of mitigation policies, and the climate benefits of other policies (*e.g.* energy efficiency and diversification).
- Reforming subsidies that increase emissions or reduce uptake by sinks, especially in transport, energy and agriculture, and consider measures to ease adjustment.
- Assessing and reporting on the implications for emissions of greenhouse gases of assistance provided by Export Credit Agencies.
- Supporting research and technology projects that remove barriers to the uptake of more energy-efficient technologies and less carbon-intensive energy sources, as well as research on the social adjustments likely to arise from policy changes.
- Developing consistent approaches for monitoring and tracking emissions, to enable transparent reporting, verification and review, and to enhance compliance.
- Developing adaptation strategies to reduce exposure to risks of climate change and to facilitate the transition to patterns of living that are less vulnerable to climate impacts.
- Raising awareness of climate change, its impacts, costs and the benefits of policy actions, through information and dialogue with the communities and sectors most affected, so as to facilitate the transition to new forms of work and consumption.
- Develop policies to guide mitigation over the long-term, for stabilising concentrations at levels that avoid dangerous interference with the climate system by:
  - Identifying and evaluating emission limits consistent with the objectives of the Framework Convention on Climate Change.
  - Encouraging participation of developing countries in mitigation policies – an essential step for reducing climate change over the longer term.
  - Using various forms of financial and technical support to assist developing countries to enhance their capacity to implement climate mitigation and adaptation policies.

### ***Managing natural resources***

Natural resources provide the raw materials necessary for economic activity, as well as the foundations for life itself. However, many of the ecosystem services provided by natural resources cannot easily be reflected in market prices. Sustainable management of natural resources requires getting their prices right, by taking fully into account both their use and non-use values. Governments should

examine current policies with a view to making markets better serve conservation aims and to strengthening their research, monitoring and enforcement capabilities. They should also increase their efforts to help developing countries improve their capacity to manage their own natural resources in a sustainable manner.

- Improve the knowledge base for decision making by:
  - Promoting research on environmental thresholds for renewable resources, on methods for measuring non-market values of natural resources, and on technologies that more efficiently use or recycle natural resources.
  - Developing indicators and techniques for assessing the state of natural resources; their use and the variables bearing on it (*e.g.* prices and subsidies); threats to ecosystems, such as invasive species; the relationships between natural resources and the people who directly depend on them; and the socio-economic impacts of policy reform.
- Make markets better serve conservation aims by:
  - Making greater use of environment-related taxes, tradable permits and other market-based approaches to managing natural resources.
  - Developing improved methods to take ecosystem services into account when making policy decisions affecting natural resources.
  - Encouraging the creation of markets for goods and services produced in a sustainable manner (*e.g.* eco-tourism), by clarifying property rights, disseminating information, and establishing institutions to enforce contracts.
  - Reforming subsidies that encourage the over-exploitation of natural resources, and making cross-subsidies explicit. When considering support for environment-related services from natural resources, clarify the public benefit involved, and make the basis for this support explicit.
  - When planning investments in natural resource infrastructure (*e.g.* irrigation works and public water supplies), use cost-benefit analysis for project appraisal, taking into account the most important impacts, and make full-cost recovery of private benefits a long-term goal.
  - Addressing adverse social impacts from changes in resource management policies – such as impacts on income distribution, employment in specific industries – in a way that facilitates structural adjustment. When pricing natural resources, provide direct income support to poorer users rather than cross-subsidies or reduced fees as a means to achieve social objectives.
- Reduce waste flows, for example by raising public awareness of ways to reduce household waste; promoting product innovations (*e.g.* through prizes) that reduce waste or increase recycling rates; shifting government procurement

towards products that generate less waste; setting fees for waste disposal to reflect full costs; and reducing barriers to the development of markets for recycled goods.

- Increase co-operation with developing countries in building their capacity to manage natural resources by helping them to:
  - Finance training and the acquisition of technologies needed for the sustainable management of natural resources.
  - Clarify property and tenure rights over natural resources, including those of indigenous communities.
  - Identify ways to ensure that the poorest members of society have equitable access to natural resources or to the benefits derived from them.
  - Develop equitable rules for sharing the benefits arising out of the utilisation of genetic resources.

## Making Markets Work for Sustainable Development

### Establishing the right policy framework

Historically, OECD governments have relied primarily on regulations to meet their environmental goals – bans, emission caps, technical norms, and other quantitative limits. Regulations work best when addressing sources of pollution that can be easily identified and monitored. However, they are often complex to administer and, if not well-designed, may cost more and reduce incentives to innovate. Sector-specific regulations are also less cost-effective than instruments applied to the whole economy, since they require improved performance in specific sectors, even though it may be less costly to abate in others. In contrast, market-based instruments are more efficient in achieving environmental goals when polluting emissions can be easily monitored (*e.g.* sulphur dioxide emissions by large stationary sources), or when they can be estimated based on direct links among the product being used and the associated emissions (*e.g.* carbon dioxide emissions from fuels). In these situations, and in the presence of different marginal abatement costs between emitters, market-based instruments allow agents the flexibility to minimise their compliance costs. They are also more efficient over time, as they provide permanent incentives for technical innovation (see Chapter 4). Although market-based instruments are a useful way of integrating economic and environmental values into the price system,<sup>16</sup> support granted to particular activities can produce the opposite result. Government support is usually granted for economic or social purposes, but it can encourage over-use of natural resources and pollution in some circumstances. Other forms of support are sometimes granted for specific environmental purposes, but with the risk that they could cost more than alternative instruments designed to deliver the same goals.

Improving the co-ordination of these various instruments is a key requirement to establishing a policy framework that supports sustainable development. Policy reform implies more than merely replacing one instrument with another. In practice, a mix of instrument will be appropriate under most circumstances. Different instruments are also typically used in combination with each other, and reforms will need to consider the signals provided by the entire range of interventions. A broad



approach to improving the coherence of these instruments is therefore required, in order to meet the challenge of sustainable development in the most effective way.

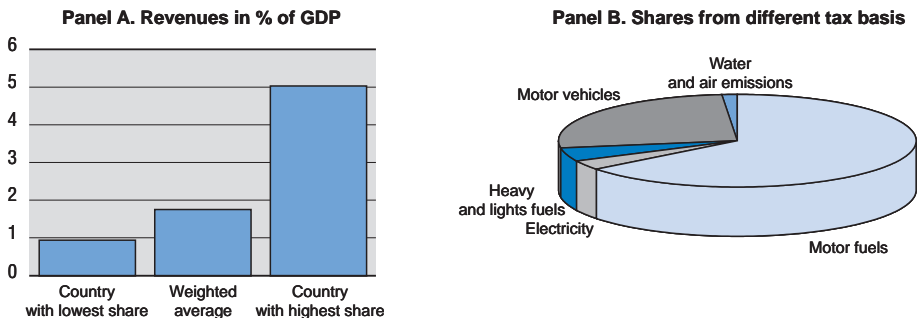
### Using market-based instruments to provide the right signals

#### Environment-related taxes<sup>17</sup>

Taxes provide incentives to change behaviour in ways that can promote sustainable development. Evidence of their effectiveness is given, for example, by the higher responsiveness of energy demand to changes in energy prices in the longer than in the shorter run, which implies that consistent implementation of environment-related taxes could reduce energy consumption. Several countries have recently introduced measures to “green” their tax system, either by introducing new environment-related taxes,<sup>18</sup> or in the context of comprehensive tax reforms aimed at reducing economic distortions. In some of these countries, revenues from environmental taxes have been “earmarked” for environmental support programmes. Earmarking, however, may not be the most effective use of the additional revenue, because it can make it more difficult to subsequently alter spending decisions in the light of changed government priorities.

Despite recent increases in the use of environment-related taxes, revenues from them in OECD countries still amounted to less than 2% of GDP on average – and 7% of total revenues – in 1998, only marginally above the level recorded five years earlier, and with large variations across countries (Figure 2). These taxes are

Figure 2. Environmental taxes in OECD countries in 1998



Note: Countries with the lowest and highest share refers, respectively, to the United States and Denmark.  
 Source: OECD Database on environment-related taxes ([www.oecd.org/env/policies/taxes/index.htm](http://www.oecd.org/env/policies/taxes/index.htm)).

also heavily concentrated on motor fuels and vehicles, with revenues from these sources contributing more than 90% of the total. Only a small share of this revenue is raised through taxes on the heavy fuels typically used in industry, while other industrial pollutants, such as those associated with coal and coke, are often not taxed at all. In any case, revenue is not in itself a good measure of the role played by environmental taxes, since a successful tax may significantly reduce the polluting activity, and the revenue it generates, over time. Major gains in the efficiency and effectiveness of environmental policies could follow from better targeting of these taxes, and by expanding the range of their application.

#### *Improving the targeting of environmental taxes and expanding their application*

One factor limiting wider application of environmental taxes has been the difficulty in measuring the amount of the externality generated (or of the resource used) that the tax is supposed to control. As a result, most taxes to curb pollutants are levied on the products associated with pollution, rather than on the volume of pollution being generated. In some cases there are good proxies for the externality (*e.g.* sulphur or carbon content of fuels), but this is not always the case (*e.g.* automobile emissions of carbon monoxide, volatile hydrocarbons, and nitrogen oxides). However, new monitoring technologies (*e.g.* smart cards and satellite technologies), and greater understanding of the underlying processes, are changing the ways these taxes are applied, and will enable better targeting in the future.

In some cases, improved targeting may require moving from a single tax on a given product (*e.g.* petrol taxes) towards a combination of taxes applied to the various externalities involved. In the case of road transport, for example, externalities and social costs arising from congestion, the use of public infrastructure, traffic noise, and exhaust emissions could be more efficiently dealt with through more specific instruments – by charging for the use of a road according to the type of vehicle, stretch of road, or time of day. Restructuring existing taxes on the basis of environmental parameters – such as the carbon or sulphur content of fuels, or nutrient loading from manure and fertilisers – could also lead to substitution towards less-polluting inputs.<sup>19</sup>

The taxation of transport activities highlights a more general challenge with the current application of environment-related taxes – their uneven application. Although petrol used in private cars is subject to taxes that are as high as 400% when converted to an *ad valorem* equivalent, dirtier fuels (such as coal and heavy fuel oil) are usually subject to no (or very little) tax. Differentiation also exists between sectors. Increased transparency about these differences and about the distortions they create is important for their reform. In particular, differences in tax rates that do not reflect differences in the environmental impacts of goods that are close substitutes need to be examined. Tax differentiation is also generally ineffi-

cient when applied to particular agents, since it loads the main burden of pollution reduction on a narrow base, while giving other agents little incentive to reduce their emissions. Increased transparency about these exemptions, and about the distortions they create, is important for the reform process. Extending the base of environmental taxes could be achieved by introducing new taxes on emissions (*e.g.* atmospheric or water pollutants), or on products. The latter are currently more common, and several OECD countries have recently introduced taxes (or deposit and refund mechanisms) on items such as batteries, chemical solvents, lubricants, tyres, razors and disposable cameras.

Opportunities also exist to increase revenues from economic rents generated from natural resources controlled or owned by the public sector, notably from companies that mine, graze, or log public lands. Some governments also provide special tax incentives – in the form of resource allowances, or flow-through share provisions – to mining and forestry operations that accelerate the depletion of natural capital and the generation of waste streams from these operations. Ensuring that the full rents from exploiting these resources accrue to the public would provide signals that are more consistent with the sustainable use of these resources (see Chapter 7).

#### *Opportunities for tax shifting*

Taxing environmental externalities would improve economic efficiency, as these taxes provide incentives to reduce activities that diminish welfare. It is sometimes argued that shifting the tax burden towards environmental taxes would also yield a “double dividend”: more cost-effective environmental protection, and a higher level of employment (and lower economic inefficiencies) related to the phasing-out of distortionary taxes. In fact, most OECD countries that have introduced environmental taxes in recent years have done so in the context of reforms that shifted the tax burden from labour to pollution, and have used the double dividend argument to support these reforms.

While this argument may increase the political acceptability of environmental taxes, *ex-post* evaluations of the employment effects are inconclusive. For one thing, the size of new environmental taxes may be too small to have discernible effects on employment. Moreover, the size of any employment effect would depend on the specific characteristics of labour and product markets in each country. Most empirical studies (OECD, 2001*m* and Majocchi, 2001) have therefore indicated a real employment effect from “green” tax reforms, but suggest that the effect is small – especially in countries with flexible labour and product markets. Finally, any positive employment effect would reflect the indirect influence of reforms on income distribution (*i.e.* by shifting the tax burden to non-labour sources), and other ways of achieving this same result will usually exist. Overall, therefore, the

main rationale in favour of environmental taxes seems likely to rest on the environmental benefits they deliver, rather than potential effects on employment.

### **Tradable permits**

Another approach to reducing market failures is to set up conditions for market transactions in tradable permits. Environmental taxes and tradable permit systems are most appropriate in similar conditions (see above), but also have some important differences. Environmental taxes lead to greater certainty in the prices of the externality being addressed, but the behavioural response of the consumers and producers who are affected by the tax will be less certain. Tradable permits, in contrast, set a target level for emissions (or natural resource use) and, after distributing shares in that quota,<sup>20</sup> let trading in those permits determine their price. Therefore, they provide more certainty about the environmental outcome, but not about the price at which that target will be achieved.

Tradable permit systems are already in use, or are being considered, in a number of OECD countries to control air pollution, to manage natural resources (*e.g.* fish and fresh water), or to influence environmental outcomes indirectly (*e.g.* by granting quotas on the numbers of livestock, to limit over-grazing or manure production, or for renewable electricity). Examples of some important and successful trading schemes in the United States are described in Box 5.

Several factors account for the limited use of tradable permit systems in OECD countries to date. One challenge is the complexity of establishing a functioning market in the permits.<sup>21</sup> Another is gaining agreement on the way in which the

#### **Box 5. Examples of emission trading schemes in the United States**

A trading scheme for sulphur dioxide (which is one of the pollutant responsible for acid rain) has been in place in the United States since 1992. The scheme, which aims at halving emissions from power generation from their 1980 levels, has proved successful in reducing them significantly below-target, and at permit-prices lower than originally anticipated. While it is more difficult to deal with nitrogen oxides (responsible for smog and atmospheric pollution) through trading – as the link between fuel combusted and emissions is weaker – a trading scheme with similar properties has been in place since 1999, for electricity utilities in a number of states. Despite early volatility in permit-prices, this scheme also reduced emissions where they were less costly.

Source: OECD (2000), *Economic Surveys, United States*, Paris.

permits will initially be allocated. In particular, free allocation of permits to existing polluters or users (“grandfathering”) limit the extent to which the polluter pays for the environmental damage caused by his/her activities. Grandfathering also foregoes revenue that would otherwise arise from auctioning the permits, thereby missing an opportunity to lower other tax distortions. It may also give existing firms a competitive advantage over new entrants to the market, lowering the pace of technological innovation. These arguments suggest that, while free allocation may sometimes improve the political acceptability of tradable permits, grandfathered permits should – from an economic perspective – be regarded as transitional, and should be phased out over time. When the allocation of permits is free, it should also be combined with taxes on the windfall gains when permits are sold.

Another obstacle to greater use of tradable permits in the context of managing natural resources (*e.g.* fish) is linked to concerns about their effect on local communities. Many small fishing communities worry about the possibility that their fishing rights may be purchased by companies operating out of a larger port, or based in a different region. Countries have often responded to these concerns by limiting trading, even when direct income support would have achieved the same social objective without undermining the environmental effectiveness of the tradable permit system.<sup>22</sup> Despite these obstacles, tradable permit systems are being introduced domestically in an increasing number of contexts, and are being considered internationally for addressing key challenges, such as climate change (see Chapter 6).

### ***Reforming sectoral support programmes***

Subsidy programmes in OECD countries are often used to support selected economic activities or communities in specific areas, and to protect these activities from competitive pressures. To the extent that these policies change relative prices, however, they also alter production practices, sometimes increasing pollution and encouraging more use of environmental resources. Other support programmes aim at delivering positive effects for the environment although, in practice, information to distinguish among the various environmental impacts of these programmes, and among the private and public benefits arising from them, are often lacking. Policy-makers therefore need to consider the extent to which reforms of both types of support programmes might better achieve their sustainable development objectives in ways that avoid unintended effects elsewhere.

Reliable and up-to-date estimates of *support* are limited to a few sectors – agriculture, coal mining, and marine fishing – and, even for these sectors, their coverage varies. Support to these particular sectors at the end of the 1990s approached USD 375 billion for the OECD as a whole, or 1.6% of GDP, of which agriculture is by far the largest recipient in absolute terms, accounting on average for around USD 340 billion in 1998-2000 (see Chapter 5 in OECD, 2001*m*). But in some

countries, support to other industries is also high, especially when measured as a share of value-added. This is the case, for example, for certain segments of transport – notably passenger rail and maritime shipping, air transport and aircraft manufacture – as well as metal smelting, logging and inland barge transport. Support to these latter industries is typically provided through government-guaranteed or subsidised loans, cheap energy and water, or preferential access to publicly-owned infrastructure or natural resources.

In general, the support measures that create both the largest economic distortions and environmental impacts per dollar spent are those coupled with levels of current production or input use – *i.e.* trade barriers, market-price support, production and input subsidies (Box 6). Over-fishing, expansion of agriculture onto marginal lands, and greater energy production and emissions of carbon dioxide are some of the consequences. Often, these support programmes lock-in particular combinations of inputs (*e.g.* water) or processes (*e.g.* irrigation), and reduce incentives to develop and use cleaner technologies.<sup>23</sup> Reforming these support programmes would contribute to reducing emissions of carbon dioxide<sup>24</sup> as well as those of methane, excessive water used in irrigation, and nitrogen loading of waterways from fertilisers and livestock waste.<sup>25</sup>

#### Box 6. A classification of agricultural support

Support takes many forms, both on- and off-budget. Grouped according to the way in which they are provided, they include market-price support, payments for production and input use, and income payments. *Market-price support* include transfers provided from consumers to producers via policies that keep domestic market prices higher than world-prices, generally by means of import barriers, export subsidies and other export enhancement measures. *Payments for production* are budget-financed, and include deficiency payments that raise domestic producer prices; and payments based on area and animal numbers. *Input subsidies* are typically provided via refunds on inputs purchased at market prices (*e.g.* fertiliser), exemptions from product taxes (*e.g.* on diesel fuel), inputs in-kind (*e.g.* seeds), under-priced resources (*e.g.* electricity or water), grants for the purchase of capital equipment, and subsidised loans (if tied to capital purchases). *Income payments* provide support to those farmers with low or fluctuating incomes. Some payments and input subsidies are paid on the condition that farmers adopt farming practices that improve environmental performance (for the provision of environmental services or to avoid environmental damage).

Source: OECD (2000). *Agricultural Policies in OECD Countries – Monitoring and Evaluation*, Paris.

Support programmes (*e.g.* agriculture) are often justified by governments in terms of the need to maintain the incomes and assets of small producers. Yet – the bulk of support in most OECD countries is linked to outputs, inputs or land – those producers who are best able to expand their operations end up capturing most of the benefits.<sup>26</sup> Moreover, much of this support leaks to unintended recipients (*e.g.* those providing inputs to the protected sector). The combined result of these effects has often been the expansion of large-scale producers at the expense of smaller ones (who benefit little from the support programmes), thereby conflicting with the stated purpose of these programmes. In some countries this outcome has been used to justify additional government support, to ensure the continued survival of small producers. The protection of domestic industries through higher prices also generates regressive effects on consumers, especially those in poorer households who spend a large share of their income on food and energy, and penalises potentially competitive suppliers in developing countries.

However, not all support programmes have generated negative environmental effects. Some subsidies generate environmental benefits as well. For example, subsidies to technology research can lead to more environmentally-friendly technologies being used (see Chapter 4). Explicit financial support of environmental goals is another way in which positive environmental outcomes may be produced. For example, support can be used to reward payments for flood-control services, protection of landscape and wildlife habitat, and the creation of marine reserves. In the short-term, the incentive effects of payments for pollution abatement or more effective natural resource management may be similar to those of taxes or permits. However, they differ from other market-based instruments in some important respects. First, they are often tied to particular abatement technologies rather than to emission reductions *per se*, which risks retarding innovation. Second, even when they are equivalent to other economic instruments in internalising negative externalities, the budgetary revenues required for their financing risk introducing additional economic distortions (unlike environmental taxes and permits, which raise additional budgetary revenues). For these reasons, provision of support for public goods should be targeted to the most efficient providers, minimise market distortions, and avoid permanently subsidising the costs of meeting environmental standards.

Obstacles to the reform of sectoral support programmes are pervasive. One obstacle is that the benefits from support programmes may become capitalised into the price of land and other capital assets over time (because support becomes perceived as an entitlement, reform becomes more difficult). Moreover, information on the supply and demand for public goods is often poor, so designing support measures that will contribute to the provision of public goods, while avoiding economic distortions, is difficult. In part because of these problems, progress in the reform of support programmes in most OECD countries has been

slow. Priority areas for reform are: i) phasing-out environmentally-harmful subsidies and making remaining ones conditional on the achievement of specific environmental aims; ii) reducing discrepancies in domestic support that are not justified by the public goods that different sectors may provide; iii) better identifying and quantifying different types of subsidies and their effects; iv) helping those adversely affected by reform through transitional measures to smooth their employment adjustment and to upgrade their skills and employability; and v) encouraging the creation of efficient markets to provide environmental services. While unilateral subsidy reform may yield benefits for the country that undertakes it, there are also political advantages from international co-ordination. For example, removing subsidies that are both trade-distorting and environmentally-damaging would help to advance the reform process (see Chapter 5).

### **Overcoming obstacles to market-based policy reform**

While changes in government policies are generally justified by their effect on general welfare, not all firms and individuals will benefit from them. How to deal with groups that lose as a result of policy reforms aimed at better protecting the environment is therefore a key challenge for overcoming obstacles to policy reforms. Often, the benefits from market-based policy reforms will be more widely-spread than the losses, leading to a disproportionate influence on the policy decision by the “losers”. Most obstacles to the establishment of more effective policies for environmental protection reflect concerns about their adverse effects on the competitiveness of specific firms, on the viability of particular communities, and on the distribution of resources among individuals.

These concerns have affected the design of most market-based policy instruments. For example, the extensive exemptions in the application of existing environmental-related taxes most often reflect the way in which governments have reacted to concerns that these taxes might increase the compliance burden faced by domestic producers, compared with their competitors abroad. In the case of policies addressing global or regional externalities, these concerns are heightened by fears of a production transfer towards countries with less-stringent environmental standards, leading to an increase in emissions internationally (“leakage”). In other circumstances, concerns about the use of market-based instruments relate to possible adverse effects on the distribution of household income, due to differences in the structure of household consumption at different income levels, or to structural factors determining the point of final incidence of the tax (market structure, the exchange rate regime). While these concerns may be invoked irrespective of the instrument used, they are raised more strongly in the case of market-based instruments because of the higher visibility of changes in market prices relative to the less-visible costs associated with regulations. Paradoxically then,



the higher visibility and transparency of the effects of market-based instruments may be an important obstacle to their increased use.

The significance of each of these effects is an empirical question, and will depend on the nature of the environmental problem being addressed, on the characteristics of the sectors considered, and on the situation of individual firms and households.<sup>27</sup> What is often neglected in discussions concerning the increased use of market-based instruments for environmental policy is that *any* measure will generate competitiveness and distributive effects. For a given environmental target, however, economic instruments usually represent the least-cost option for achieving that target, because they allow affected parties flexibility in their response to the change in relative prices – firms, for example, may change the mix of inputs used, make investments in lower energy- or material-intensive technologies, or reduce production. The choice among these options depends on individual circumstances and costs. Competitiveness and distributive effects from the use of market-based instruments will therefore be less than if other instruments had been used to achieve the same target. In addition, when competitiveness is considered at the macro economic level, losses in the competitiveness of one firm may be more than offset by gains for others. Hence these concerns are overstated: there is only weak evidence of significant reductions in the competitiveness of individual sectors, or of significant regressive effects associated with environmental taxes.

Even when these effects prove to be significant, exemptions granted to specific industries and groups risk undermining the effectiveness of market-based instruments, and increasing costs. Exempted agents are often those with the greatest scope for switching their input mix and for making energy-efficient investments. Exempting heavy (polluting) industries from the application of market-based instruments will increase the overall costs of dealing with the environmental problem. It also imposes a larger abatement burden on other domestic industries and consumers that have lower scope for adjustment. While it might be argued that the final incidence of the tax will ultimately fall on consumers, whatever the policy design, concentrating interventions onto final consumption means foregoing opportunities for input substitution or for technical changes in production. Several more preferable approaches exist for reducing these effects in a way that is compatible with enhancing sustainable development:

- *International co-ordination.* Co-ordinated implementation is appropriate in cases where unilateral domestic environmental taxes could be easily evaded. Co-ordination may be applied both globally and regionally (*e.g.* among countries with high levels of trade integration). Governments could therefore participate in international discussions to share information, experiences and best practices regarding opportunities for expanding the application of market-based instruments. Countries concerned with the competitiveness implications of market-based instruments could also dis-

cuss possible co-ordinated options, to be decided and implemented at the national level. For example, neighbouring countries could seek ways to reverse the environmentally-harmful tax preference that is currently given to diesel fuel, compared with gasoline. More global participation would also probably be required to reach agreement on reducing exemptions granted in most countries to industries that burn coal.

- *Complementary social measures.* Countries unilaterally introducing market-based instruments may use other measures to soften their income effect for both households and firms. Most OECD countries have well-developed safety nets to address unintended effects of market-based instruments on household income distribution. Other specific interventions – such as compensation schemes independent of emissions, tax credits, free minima allocations of resources (*e.g.* water), or social funds to help those for whom financing would be difficult – will reduce negative income effects of a market-based instrument, without diminishing incentives to substitute towards inputs or products that are less environmentally-damaging.
- *Time-phased implementation.* In those circumstances where the environmental problem being addressed makes a gradual approach possible, stepwise implementation – *e.g.* establishing a credible timetable to gradually increase an initially low tax rate, or to phase out free allocations of emission permits – will provide agents with time to adapt, while preserving incentives to substitute towards less environmentally-damaging goods or processes.
- *Measures to increase public acceptance of these instruments.* Better use of the revenues generated by market-based instruments (for example by reducing other more distortionary taxes in the context of comprehensive reforms) and by re-cycling revenue to particular industries, would facilitate adjustment. Consultations with stakeholders and communication to the public of the objectives and expected effects of reforms would also contribute to higher public acceptance of reforms.

## Enhancing the effectiveness of other instruments

### Regulatory reform

Regulatory reform can lower the compliance burden imposed on agents and increase economic efficiency. However, in the absence of complementary policies to internalise environmental externalities, the net effects of regulatory reform on the environment may be mixed. On the one hand, regulatory reform may lower economic costs of existing regulations or increase their environmental effectiveness. It may also increase the effectiveness of market-based instruments used in environmental policy by increasing competition in product and labour markets

and agents' responses to market signals. On the other hand, lower prices in markets that do not fully price existing externalities (*e.g.* energy) may increase demand and associated emissions. Regulatory reform may also lead to losses in the market shares of cleaner, but more expensive, sources (see Chapter 6). Complementary measures may therefore be required to ensure that these reforms benefit both the environment and the economy. Reforms should consider both the benefits and costs – environmental and economic – of existing regulatory systems, as well as the distributive consequences of reforms.

### **Multi-stakeholder initiatives**

Initiatives undertaken by firms, often in collaboration with other groups in civil society, are important for diffusing improved economic, environmental and social practices. Multinational enterprises, in particular, often have access to the best environmental technologies, management, and labour practices. Increased attention by firms to their environmental and social performance often reflects the importance of market pressure (Box 7). Through effective public information campaigns (aided by the Internet), public opinion is increasingly able to “target” firms that do not conduct their affairs in a manner deemed to be environmentally and socially acceptable. This may lead to product boycotts, reduced profits, and share values. Corporations are therefore increasingly aware of the benefits of linking their economic, environmental, and social performance via the “triple bottom-line” concept.<sup>28</sup>

Multi-stakeholder initiatives differ in the degree in which they depend on specific government policies:

- *Corporate codes of conduct* have emerged within many firms and industries for sensitising employees, suppliers, and contractors to management's expectations concerning the environmental and social performance of the enterprise. While these codes of conduct may sometimes simply form part of a firm's public relations strategy, in many cases they have spread an ethic of continuous improvement in environmental and social performance. Firms that have adopted such codes are increasingly focusing on their integration into internal management and control systems, the build-up of institutional capacity to pool the costs of these systems, and more reliance on certification and verification.
- *Negotiated agreements* can involve either voluntary adherence to a public programme, or a negotiated commitment for specific improvements in environmental and social performance (Box 8). The latter are often signed at the national level between an industry sector and a public authority, although agreements with individual firms also occur. Use of negotiated agreements between business and other interested parties, aimed at addressing problems related to sustainable development, has grown throughout the OECD

### Box 7. The role of financial and insurance markets for sustainable development

Robust and dynamic financial markets that are subject to effective supervision and regulation make a vital contribution to resource allocation and capital accumulation. They may also contribute to environmental protection by lowering risks and discount rates for projects with a long planning horizon. Recent shifts in financial markets away from bank inter-mediation have increased the power of share-holders and their scrutiny of the way companies are run, exposing companies that do not adhere to social and environmental standards to reputational risks and attendant negative impacts on the value of the company. Financial markets are also beginning to respond to the needs of sustainability in more direct ways, for example through the growth of “green” mutual funds and of pension funds with long-term horizons. These funds provide opportunities to firms that adopt the best social and environmental practices, by lowering their risks of survival and facilitating their financing.<sup>1</sup>

Insurance companies also contribute to sustainable development by assisting other firms to prevent and manage environmental damage. They can promote the prevention of environmental damage by developing specific policies (*e.g.* environmental impairment liability) that enable activities that would not be undertaken without cover; by developing techniques and comprehensive data sets to better assess and manage environmental risks; by reducing the risks of environmental damage on their clients (*e.g.* through requirements to install specific equipment, regular maintenance, advice and discount on insurance premia); and by promoting socially responsible behaviour through their own investment policies.

1. For example, the Dow Jones Sustainability Index tracks the price and total returns of over 200 companies that have adopted corporate responsibility principles; as of end-July 2000, the market capitalisation of these firms exceeded USD 5 trillion.

Source: OECD (2001), “Financial Markets and Sustainable Development”, Paris; and OECD (2001), “The Role of Insurance in Sustainable Development”, Paris.

region.<sup>29</sup> Since these agreements are typically self-monitoring and non-binding, concerns are often expressed about their effectiveness. Indeed, these agreements often suffer from weak controls, free-riding, high transaction costs, and regulatory capture (OECD, 1999j). On the other hand, they may deliver “softer” benefits such as raising awareness and disseminating information. Over the long-term, these instruments – if made more efficient – could help to change business perspectives about sustainable development.

Box 8. **Examples of negotiated agreements**

- *Agreements that form part of the regulatory system.* Negotiated agreements for pollution abatement in The Netherlands are known as “covenants”. As of 1996, 107 of these covenants were in place, covering all major polluting industries. Covenants have the status of a contract under civil law. They typically define pollution abatement targets for each industrial site, and include a corporate environmental plan aimed at achieving them. Once these elements are in place, permits are issued by the public authorities. Individual monitoring of performance is followed up within the permit system itself.
- *Voluntary adherence by business to a public programme.* Beginning in the 1980s, the US Government began encouraging firms to voluntarily work toward reducing their releases of toxic chemicals to the environment. The objective was to cut these emissions one-third by 1992, and one-half by 1995 (the initiative therefore became known as the 33/50 Programme). The Environmental Protection Agency reports that all goals have been achieved.
- *Agreements negotiated between a business and an NGO.* Under the terms of an agreement signed in 1996, a large US aluminium company agreed to build new water-treatment facilities at one of its plants – to protect a downstream shrimp fishery from pollution – against the promise of a local NGO not to challenge the company’s application to renew its federal water pollution permit, and not to encourage others to do so.
- *Negotiated agreements combining environmental and social objectives.* In 1992, a Swedish trade union group developed criteria to screen the performance of enterprises in six areas (ecology, emissions, efficiency, economy, energy, and ergonomics). Monitoring and follow-up procedures form part of the process. Companies that agreed to submit to this screening are entitled to use the “6E” label in their marketing. As of 1999, 28 companies were participating in the Programme.

Source: OECD (1999), *Voluntary Approaches for Environmental Policy: An Assessment*, Paris.

Several opportunities exist for OECD governments to work with the private sector to promote sustainable development. For example, governments should support the use of corporate codes of conduct related to sustainable development, in particular by small- and medium-sized enterprises (SMEs) and by those sectors and industries that are the most environmentally- and socially-sensitive. Internationally, priority should be given to the effective implementation of the *OECD Guidelines for Multinational Enterprises* (OECD, 2000e), which already include provisions to advance the goal of sustainable development. New forms of public-

private partnership could also be developed to accelerate the pace of investment in infrastructure with important environmental and social implications, especially in those areas (such as municipal water supply and treatment) where the private and public sectors already share responsibilities. Finally, the effectiveness of voluntary approaches should be increased, in particular through credible monitoring, third-party participation in the setting of targets, and credible incentives to reduce non-compliance.

### ***Information programmes***

Achieving sustainable development also requires business practices and government policies that broaden the range of choices open to consumers to make environmentally-sound decisions. Information programmes can play a role to increase awareness and action by consumers to reduce the environmental impact of their consumption patterns. These may include eco-labeling and other certification schemes about the environmental characteristics of goods (when designed to avoid trade-distorting effects). Education and learning initiatives can also support the goal of sustainable development. These schemes, however, are rarely effective on their own, and need to be accompanied by incentives to change behaviour and to put the new information to effective use (OECD, 1999*d*).

## Chapter 3

# Strengthening Decision Making

### Introduction

How governments organise their own activities related to sustainable development sends strong signals about the priority they attach to it. At all levels of government, meeting the challenge of sustainable development requires clear processes for identifying integrated environmental, social, and economic goals, and for implementing these goals efficiently across all responsibility areas. Success also depends on commitment at the highest political level. Policies affecting sustainable development are typically cross-cutting – several ministries are responsible for different portfolios relating to them, but none is usually responsible for their entirety. Policy design, decision making, and implementation processes therefore need to be integrated both vertically (international,<sup>30</sup> national, sub-national) and horizontally (intra- and inter-sectoral). Making managers accountable for their performance in attaining integrated objectives is also a necessary component of effective implementation. Finally, transparency in government processes is needed to provide opportunities for active participation of citizens in policy debates about sustainable development, and to build consensus on necessary reforms.

### Policy integration

OECD governments, at all levels, engage in strategic processes in one form or another – typically at the beginning of the electoral cycle, and then annually when they set their strategic targets for the government as a whole. These processes provide an opportunity for governments to make their sustainable development goals transparent, and to incorporate these goals in a consistent manner within sectoral responsibilities. They provide also an opportunity to incorporate a longer-term perspective into policies. It is at this stage that the potential effects of environmental uncertainties on policy should be explicitly considered.

The main tool used by governments to implement its policy goals is the annual budget process. Some OECD countries have undertaken initiatives aimed at integrating environmental objectives into this process. One example is Denmark,

### Box 9. Strategic environmental assessment of the budget process in Denmark

In the Danish experience, the Strategic Environmental Assessment of the Budget includes a macroeconomic analysis, and a presentation of progress against environmental indicators. Assessments have been made of: the status of the government's environmentally-related expenditure; the use of environmental taxes and subsidies; the development of regulations; use by parliament of environmental assessments of proposed legislation; proposed use of mandatory environmental assessments of large projects; and the scope for green procurement in central government. Sectors assessed have included transport, chemicals, agriculture, waste management, energy consumption, carbon dioxide emissions and the aquatic environment. Lessons from the Danish experience with this tool include:

- It has proved easier to focus on the economic efficiency of environmental policies, rather than to make economic policies more environmentally-sensitive.
- The wide scope of the environmental problems examined in such assessments (*e.g.* the transport sector, material flows, the agriculture sector) has facilitated the study of a range of interactions between the environment and the macro-economy. As a result, the environmental implications of economic policies have also been *de facto* examined in the assessment process.
- Several opportunities have been found for improving the cost-effectiveness of environmental policies that would increase economic performance with no decline in environmental quality.
- The assessment process has examined the contributions of both macroeconomic and sectoral policies to the efficient achievement of environmental objectives. In general, macroeconomic policies have been found to play only a *minor* role in this process; sectoral policies *occasionally* play a significant role; and environmental policies always play a *major* role.
- The requirement to prepare the budget assessment has forced a useful exchange of information among the departments concerned. This promotes better integration and spreads the use of common analytical tools (such as cost-benefit methods and general equilibrium models).

The assessment process has changed some key policies to reach environmental goals in a more efficient way (*e.g.* changing Denmark's CO<sub>2</sub> targets towards greater emphasis on national targets, rather than on reaching specific targets in individual sectors, like transport). The assessments have also clarified the Danish environmental agenda to a broader range of decision-makers, and focussed the debate on how best to achieve environmental goals.

Source: Danish Ministry of Finance.



where an annual Strategic Environmental Assessment (SEA) of the Finance Bill has been prepared since 1997. The objective of this assessment is to encourage the ministries responsible for economic policies to take environmental pressures into account; and conversely, to encourage the Environment Ministry to take economic efficiency concerns into account (Box 9). Such assessment covers all expenditures that are wholly or partly motivated by environmental goals.

The capacity of governments to address longer-term issues in an effective way depends heavily on their ability to assess future trends and emerging issues. Governments are increasingly facing policy challenges in areas where scientific evidence is incomplete and where there are risks of serious or irreversible damage. Such challenges tend to be inter-sectoral, and usually involve relationships between different levels of government, the science community, and the public-at-large. They also tend to require a strong response from governments at particular points in time. Governments should therefore consider how best to strengthen both their research capabilities in sectors where there is a lack of knowledge, as well as the science-policy interface – for example by establishing specific procedures (co-ordination points, or guidelines for the use of scientific advice in the policy processes).<sup>31</sup> Such arrangements would facilitate internal discussions before key policy decisions are taken – on the implications, risks, and precautions that are needed. They would also encourage interdepartmental and intergovernmental co-ordination, facilitate the wider circulation of knowledge from the scientific community to decision-makers, and provide a clear locus for engaging civil society. Partnerships among governments, the private sector and academia – based on a coherent research strategy – would increase the ability of governments to acquire the necessary scientific information on which to base decisions.

### ***Sectoral policy integration***

The institutional arrangements prevailing in most OECD governments are organised along sectoral lines. Sustainable development implies improving the overall coherence of policies at all levels of government and spatially (Box 10). Coherence with other government objectives is particularly important in the case of agriculture, transport, and energy policies, mainly because the economic, social, and environmental impacts of these sectors are large. Important policy integration issues also arise at the sub-national level. For example, spatial planning that allows low-density developments on the margins of cities may be inconsistent with policies to protect productive agricultural land, or with measures that favour the efficient evolution of public transport and water infrastructure in urban areas.

### ***Policy integration between levels of government***

Sub-national governments are often important for the effective implementation of policies developed at the national level. Local public services, such as town

**Box 10. Policy integration issues for sustainable development in selected sectors**

*Agriculture.* Agriculture receives many subsidies that have the effect of increasing either outputs (*e.g.* crops) or the use of inputs (*e.g.* water). Both of these results may generate negative environmental externalities. In addition, agriculture is often exempted from policies aimed at addressing these environmental externalities. For example, agriculture often receives exemptions from water prices in the very locations where water is scarce. Similarly, taxes on fertiliser sometimes apply only to households – not to the agriculture sector.

*Transport.* The scale of transport activity has increased rapidly in recent years, and is likely to continue to do so in the future. This provides additional mobility, and helps to limit the economic costs of transportation. However, it represents a significant challenge for environmental policy-makers, mainly because the environmental externalities associated with transport (*e.g.* air pollution, climate change, noise and biodiversity loss) are often not taken into account when transport decisions are made. The large number of producers and consumers of transport services also limits the effectiveness of environmental regulations. Other challenges occur at sub-national levels of government, when the relationship between transport and land use are not fully considered in decision making. Nevertheless, opportunities exist for increasing the coherence between transport and environmental policies, as well as between economic and social ones. For example, fuel taxes could be combined with other instruments (*e.g.* “smart” cards, satellite technologies), in order to better relate the total costs faced by road users (especially trucks) to the specific environmental and social effects of their journeys.

*Energy.* The economic aspects of energy production and use have historically dominated energy policy decisions. However, the social (*e.g.* energy security) and environmental (*e.g.* air pollution, climate change) aspects are increasingly recognised as important priorities. In OECD countries, a main challenge is to reduce the total use of energy, and to de-carbonise the supply mix. Subsidies to the most carbon-intensive sectors (*e.g.* coal), and exemptions from energy taxes, are largely inconsistent with these goals. Policies aimed at enhancing the clean and efficient use of fossil fuels (especially in electricity and transport), further diversification of energy sources, and improving energy efficiency and conservation are therefore the highest priorities. Strong support for research and development and for the diffusion of clean energy technologies underlies these priorities. In developing countries, the main challenge is to support development that uses energy in an efficient and flexible manner (*e.g.* by extending access to energy services based on renewable sources).

planning, local transport, waste management and water supply, are often directly relevant for sustainable development. Sub-national governments therefore need to be active participants in the setting of consistent strategic goals, assessing the territorial impacts of sectoral policies and agreeing on implementation modalities.

Decentralisation of public-sector decision making increase the need for policy integration at the sub-national level. In Germany, some states (*Länder*) have integrated sustainability principles and goals into spatial planning (*e.g.* Berlin, Brandenburg) or into state laws (*e.g.* Saxony-Anhalt, OECD 2001*d*). The need for coherence between levels of government is also becoming more important for successful policy implementation, for example where sub-national jurisdictions are responsible for implementing national greenhouse gas reduction, *e.g.* through transport decisions. In general, one level of government should not impose responsibilities on another, unless the latter has been consulted in making the decision, and unless the latter is provided with the means to carry out its new responsibilities.

A wide range of approaches are being used in OECD countries to respond to the need for better local integration. For example, the newly established sub-national governments in the Territory of Nunavut (Canada) and the Welsh Assembly (United Kingdom) have been given specific responsibilities for sustainable development (OECD, 2001*m*). In Mexico, the central and sub-national levels of government participate jointly in the planning, implementation, evaluation, and monitoring of natural resource management activities. Some countries (*e.g.* the Netherlands, Denmark and Ireland) have also established plans to guide territorial development towards sustainability goals, along with legally binding mechanisms to ensure that local decisions are consistent with national objectives. In Sweden, a multi-stakeholder co-operative group monitors Agenda 21 action across levels of government.<sup>32</sup> Other territorial governments are increasingly developing strategies and indicators for sustainability.

### **Strengthening the machinery of government**

Once agreed, policy priorities need to be acted upon. Because of the cross-cutting nature of sustainable development, implementation will need to involve senior-level commitments within government. These requirements go beyond the need for information to flow from one agency to another, and include the broader need for integrated policy advice and decisions. OECD governments have approached this need in various ways. Box 11 summarises the approach currently used in the United Kingdom.

Switzerland follows a different approach to improving the coherent implementation of cross-cutting policies. Guidelines have been developed to avoid inconsistencies between foreign aid, trade, environmental, agricultural, labour market, and immigration policies. After possible inconsistencies have been iden-

**Box 11. The “whole-of-government” approach to policy integration in the United Kingdom**

The government of the United Kingdom has committed itself to a *sustainable development strategy* which provides a framework for annual policy reviews against a set of headline indicators. A website allows for continuous reporting on progress, as well as for discussion, debate and exchange of information.

Each government department has its own Green Minister, responsible for promoting sustainable development and environmental matters within that Department. Green Ministers work collectively to:

- Promote the integration of sustainable development goals across government policies and the wider public sector.
- Encourage the use of environmental appraisal as an integral part of policy making.
- Improve the environmental performance of departments in managing their buildings and facilities (*i.e.* “green operations”).

The Cabinet Committee on the Environment, chaired by the Deputy Prime Minister, brings the Green Ministers together to consider environmental policies, and to co-ordinate policies on sustainable development more generally. The Performance and Innovation Unit – which reports directly to the Prime Minister through the Head of the Civil Service – acts as a resource for the whole of government, tackling issues that cross public-sector boundaries on a project basis, and promoting innovation in policy development and delivery. Finally, the Parliamentary Environmental Audit Committee also monitors the work of the Green Ministers, via an annual inquiry.

Experience with this “whole-of-government” approach suggests that it is starting to make a difference in the functioning of inter-Ministerial co-ordination. For example, a sustainable development perspective has been incorporated into recent reviews of policies in the aviation, defence, procurement, and energy fields.

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Source: UK Department of the Environment, Transport and the Regions, *Greening Government: The First and Second Annual Reports of the Green Ministers Committee 1998/99 and 2000*, HMSO, London.

tified, the government then decides whether to address them directly, or to accept them and make the trade-offs explicit.

With levels of urbanisation in OECD countries approaching 80%, the internal capacity of city governments to integrate policies in support of sustainable development also needs to be strengthened. In urban areas, the social and environmental

consequences of economic decisions and technological change appear quickly, and affect large number of individuals. OECD experience with the reform of metropolitan governance systems shows that urban government structures are often outdated and not adapted to solving problems such as sprawl, congestion, redevelopment, and pollution – all of which directly affect sustainable development (OECD, 2000a).

Coherent implementation also requires sufficient technical and managerial competence at all levels of government. The role of information and communication technology (ICT) for communications across ministries and between levels of government will play an increasingly important role in enhancing policy integration. Raising both the awareness and the skills of government officials (*e.g.* via training, mobility, sharing of best practices, and benchmarking) are therefore important for sustainable development. For example, the municipal government in Heidelberg (Germany)<sup>33</sup> sets specific goals related to sustainable development for its employees, and then assesses performance against these goals. The awareness-raising involved in this process may be as important as the goals themselves.

Progress towards sustainable development will also be strengthened by improving the way national governments engage in international policy-making processes. This problem has received less attention than it deserves. Nation-states are the decision-makers in international institutions, which means that successful policy integration depends on their efforts. Periodic assessment of the coherence of international engagements made by individual OECD countries, would therefore be useful. A related priority is to strengthen relationships with developing countries on sustainable development. This could include strengthening the capacity of developing countries to address sustainability issues, via better co-ordination in their own domestic policies, and by sharing information on experiences and policy solutions (OECD, 2001*m*).

Parliaments and the judiciary also play significant roles in supporting sustainable development, although their role varies from country to country. For example, parliaments can promote policy coherence through their oversight of commissions and advisory bodies, their provision of information to citizens, and their role (in some countries) in the ratification of international agreements related to sustainable development. The judiciary also plays a role in reviewing compliance with sustainable development, for example in shaping the behaviour of polluters. New bodies, such as Round Tables and Commissions on sustainable development, are also playing an increasing role in advice, advocacy, awareness-raising, and information-sharing. All these institutions are strengthening government processes for achieving policy coherence in support of sustainable development.

## Accountability

*Ex post* monitoring of performance is an important step in any internal management system. Monitoring provides valuable feedback on progress towards goals, and facilitates policy adjustments needed to ensure that implementation remains on target. It is also an important element of accountability. In turn, accountability processes rely on good information and analysis, and a willingness to alter priorities in the face of changed circumstances. Transparency in reporting the results of that monitoring is therefore important, as are incentives to encourage participants to improve their performance. Such incentives also help to convince third parties of the credibility of the system itself. Inadequacies at any one of these levels will raise public concerns about the effectiveness of government policies.

Accountability systems need to be specifically designed to improve integrated decision making, because no single department has responsibility for sustainable development goals in their entirety. Requiring regular reports on progress toward sustainability goals is most likely to foster the cross-departmental (or inter-governmental) interaction that is needed. In Canada, for example, the Commissioner of the Environment and Sustainable Development reviews departmental strategies for sustainable development, audits the Federal Government's management of sustainable development issues, and undertakes studies aimed at strengthening management practices. Independent scrutiny plays an important role in identifying the gap between goals and actions, in raising awareness, and in providing recommendations to the departments concerned (OECD, 2000b).

Public reporting of the results of *ex-post* reviews of performance on matters related to sustainable development can also provide support for accountability. Many OECD countries and international organisations already carry out such reviews (Box 12). Most often, however, these reviews assess only one aspect of sustainable development (*e.g.* environmental performance, or the economic efficiency of environmental and social policies). More integrated evaluations are desirable, to encourage higher levels of performance across departments, and to promote the development of appropriate indicators for quantifying changes in performance over time.

## Transparency and participation

Well-designed consultation and participation processes are important to democratic governance in general. These processes are especially important for sustainable development because of the cross-cutting nature of the problem, and because non-public entities are increasingly becoming involved in the implementation of goals in the environmental and social area. Informed public debate contributes to the transparent discussion of the full range of policy options that have different impacts on society generally and on specific sectors. Business, trade unions,

**Box 12. Environmentally-sustainable growth  
in the OECD Economic Review process**

The Economic Development Review Committee (ERDC) of the OECD, comprising members from economic and finance ministries, meets regularly to review the economic performance and policies in Member countries. Each review has a “special issue” chapter, selected by agreement with the country in question, and based on an evolving menu of topics. These have ranged from tax reform and labour market policy, to ageing, education, and health.

Eight reviews of national policies to enhance environmentally-sustainable growth have been conducted in these OECD Economic Surveys. Five more will be completed in 2001. These country reviews look at the interface between environmental, economic and sectoral policies, asking questions such as: do economic and sectoral policies pay sufficient attention to environmental externalities? Is appropriate use made of economic incentives in environmental policy? Are environmental policies cost-effective? The focus of these reviews is on a small number of environmental and natural resource policy issues, where lessons drawn have more general implications.

Specific lessons from these ERDC reviews include the need for increased use of market-based policies, and reform of subsidies so that their primary objectives can be achieved without undermining environmental goals (see Chapter 2). These reviews note that concerns about competitiveness and distributive effects of environmental policies are often used inappropriately to limit the application, and hence the effectiveness, of market-based instruments.

Mechanisms to improve policy analysis and coherence of government policies are also discussed in the reviews. These reviews suggest that environmental impact assessments of specific projects are used in most OECD countries; and that strategic environmental assessments of policies and regulatory impact assessment of the costs of regulations are beginning to be used. Cost benefit frameworks, however, are used much less. Such frameworks, even without full quantification, would improve decisions about where government attention and resources are best directed, especially when used alongside other instruments.

other non-governmental organisations (NGOs), consumers, and the public-at-large are increasingly active in policy debates about sustainable development. These groups have much to contribute to policy development, and their active engagement can also build better understanding and support for the government’s sustainable development strategies. It enables important information about the possible impacts of policy change to feed back to decision-makers, so these impacts may be considered and acted upon.

Transparency in government promotes trust – essential for the institutional stability that will facilitate sustainable development over the long-term. This calls for measures to enhance the legitimacy of government actions, including a commitment to integrity and to fight against corruption. The demands for more transparency and more ethical behaviour are increased by greater NGO involvement and increasing expectations of citizens. Transparency implies adequate information – and access to it – about the long-term environmental, social, and economic implications of government policies. This, in turn, requires an active communication and consultation strategy. Several international declarations and instruments support these two objectives – including the *Rio Declaration on Environment and Development*, the (Aarhus) *Convention on Access to Information, Public Participation in Decision Making and Access to Justice in Environmental Matters*, and the 1998 *OECD Council Recommendation on Environmental Information*.

OECD countries have different traditions of civic involvement in policy debates, but most have recently taken action to increase that involvement. For example, the extent to which countries are equipped with mechanisms for public consultation and participation varies (OECD, 2001*b*). Consultation is more common in the environment, health, and social domains than it is in the economic one. Although traditional tools for interacting with civil society (conferences, public meetings, written comments) still predominate, the use of information and communication technologies is developing (*e.g.* electronic discussion groups). *GeoConnections* and the *Sustainable Community Indicators Program* in Canada are examples of how Internet and Web based tools can enable communities to develop capacity to manage their development in a more sustainable way.

Concerns are sometimes expressed about the democratic representation of individual groups wishing to be heard by governments. Asking groups that represent broad constituencies (geographically, financially, etc.) to take responsibility for arranging the participation of other groups, and then for consolidating and transmitting opinions from these groups, can be an effective solution to these concerns. For example, representatives of business, trade unions and NGOs – selected by their peers, rather than by governments – participated actively in debates leading up to the revision of the *OECD Guidelines for Multinational Enterprises* and publicly-supported the outcome of that process. Developing a coherent internal strategy for consultation and participation (especially deciding at what stage consultation should occur), and then setting clear guidelines for those processes – including a common understanding on the inputs expected, the procedures to be followed by each participant, and how the outcomes will be used – will help promote the quality of consultation processes.



## Chapter 4

# Harnessing Science and Technology

### Introduction

Advances in scientific knowledge and technology are necessary conditions for achieving sustainable development. Examples of their importance abound. Over the last century, progress in agriculture and medicine have been instrumental in improving nutrition, in reducing child mortality, and in enhancing the quality of life. New technologies have enabled more ore to be recovered from mining waste, wastewater to be purified to a higher standard, and cleaner substitutes for fossil fuels to emerge. Higher productivity associated with process innovation has allowed real incomes to increase, and the creation of new products and services has fuelled economic growth.<sup>34</sup>

Scientific discovery and technological innovation exhibit important spill-overs of a public nature. Knowledge generated by research and development (R&D) eventually diffuses throughout the economy and across borders. Scientific enquiry, along with education, is also essential for maintaining society's capacity to deal intelligently with the environmental and social impacts of technological change. These society-wide benefits are often ignored by the private sector and provide one of the rationales for public intervention to support basic research and innovations.

The environmental and social effects of technologies are not always positive, however, and are hard to predict. The replacement of one technology by another often creates new employment opportunities, while making other skills and jobs redundant. Some innovations help to conserve and protect natural capital; others to accelerate its exploitation. Even where the consequences of a technological advance are positive in relative terms (*e.g.* a reduction in the per-kilometre emissions from automobiles), the additional demands resulting from lower prices can sometimes lead to increased absolute pressures on the environment. In any case, new technologies should not be seen as substitutes for needed policy reforms. Even those technologies developed explicitly in response to an environmental need usually comprise only a small subset of a much wider spectrum of changes – technological and otherwise – that could potentially achieve the same result.

Governments play an important role in harnessing science and technology to promote sustainable development: by establishing appropriate environmental

policies, by supporting basic research, and by providing the means, such as patents, through which firms or individuals who invest in private R&D can profit from their investments. Sound management of the economy also plays a part in stimulating private R&D, by improving the investment climate for risk capital. If environmental externalities were being fully internalised, there would be little reason to use other instruments to steer the development and adoption of technologies in any particular direction. Environmental and economic (“framework”) policies – largely technology-neutral (*i.e.*, not favouring one technology over another) – would be sufficient to ensure outcomes that were socially optimal. However, in actual practice, many environmental policies are introduced gradually, or grant exemptions to existing polluters. Therefore, other policies may be needed to increase the *rate* at which technological change occurs. And because the coverage of environmental policies remains incomplete in many areas, institutions may need to be strengthened to ensure that the *direction* of technological change is consistent with sustainable development objectives.

### **Providing the right framework conditions**

#### ***Addressing the potential risks of technological change***

Technological developments have often spurred economic growth, but some have had unintended social, economic or environmental consequences. Even technologies designed specifically to address particular issues related to pollution, public health or worker safety have not been immune from such problems.<sup>35</sup> Public acceptance of new technologies has occasionally suffered as a result.

Governments often have to take decisions relating to new technologies in the absence of sufficient information to properly evaluate their benefits and associated risks. That underscores the importance of ensuring that their own experts are up-to-date on new scientific and technological developments, and of keeping open channels of information with experts from outside government. Governments may also need to sponsor research targeted at better understanding and forecasting the potential benefits and risks of new technologies, including employment impacts. To prevent potential conflicts-of-interest from arising, they should ensure that the government agencies responsible for protecting the public interest on health, safety, and environmental matters are capable of assessing technologies, and where necessary regulating their use, independently from those parts of government responsible for promoting those same technologies.

#### ***Using environmental policy instruments to guide technological change***

Getting the price signals right – by making polluters pay for their environmental damage, by reducing subsidies to activities that give rise to that damage, and by reducing or removing market barriers to the spread of new technologies – could

make many new, cleaner technologies profitable immediately. When polluters are required to internalise the externalities generated by their activities they may respond in various ways. Some may simply cut back the activity, others may install commercially available equipment to reduce the externality. Larger firms, in particular, may find more innovative solutions, such as a new use for a former waste product, or even an entirely new process or technology. Where conditions in markets are favourable (which may mean opening them up to greater competition), substitution toward more environmentally friendly technologies begins to take place.

The actual response of firms and individuals to environmental policy will depend in part on the instrument(s) being applied. Generally, instruments that are the least prescriptive as to the specific technologies that may be used to achieve a given environmental objective provide the strongest and most enduring stimulus for innovation, though not necessarily for technological change itself in the short run (Box 13).

In order to influence private decisions regarding technologies, signals from economic instruments have to be transmitted from the source of the environmental damage back upstream through consumption choices, production processes, and research and development activities. Thus the strength of the technology signal emerging from environmental policies will depend upon factors such as market structure and adjustment lags. Over time, as environmental policy has expanded from purely regulatory

### Box 13. Environmental policy instruments and innovation

Emission taxes and tradable permits provide a continuous incentive to reduce pollution at all levels of emission. They encourage processes that avoid the damage altogether – not just bring it down to the allowable limit. General performance standards, which are not directed at particular technologies, provide firms with stronger incentives to innovate than technical (or technology-based) standards, but less than with market-based instruments. Prohibitions on the manufacture and use of dangerous substances encourage the development of substitutes, though not necessarily a shift to the cleanest alternative. And, in contrast with market-based instruments, their effects on innovation may be once-and-for-all unless regulators later revise the standard. Negotiated agreements usually set a global limit on emissions or inputs, without specifying the actual means by which participating firms will meet it. If the degree of compulsion involved is close to that of a mandatory instrument, the stimulus to technological innovation will be similar to that of a performance standard. However, experience with community-based groups in agriculture (OECD, 1998a) suggests a possible benefit of voluntary collective action: producers become more willing to share information about their own innovative responses to specific environmental problems, thereby spreading technologies farther and faster than would otherwise have been the case.

towards more-flexible instruments, and as firms have begun to respond to environmental requirements when developing new products and plants, technologies have correspondingly become more diverse. Pollution-control devices attached to the tail-pipes and smoke stacks of older technologies are gradually being replaced by technologies that are cleaner by design. Examples of some technologies with the potential to substantially improve the efficiency with which resources are used, or to produce fewer or less dangerous emissions or waste products, are listed in Box 14.

The processes that lead to new technologies are to some extent random, and their outcomes difficult to predict. Most of the technological innovations listed in Box 14, for example, have been influenced only indirectly by environmentally-directed policies. Over the long-run, advances in information technology may play a greater role in de-coupling environmental degradation from economic growth than

#### Box 14. Examples of emerging technologies

- Advanced sensors are increasingly used to monitor air quality and traffic, as well as changes in the global climate, stratospheric ozone layer, marine environment, and other ecosystems. Greater use of global information systems could aid precision farming, saving resources while maximising output.
- Biotechnology could reduce resource inputs, pollutants, and wastes from manufacturing. Provided proper safeguards are applied, agro-genetics could reduce the need for pesticides and other agro-chemicals, and increase crop yields.
- Cleaner cars will feature alternative sources of energy, lightweight materials, direct injection engines, and enhanced recyclability.
- New materials could facilitate recycling of consumer goods and manufacturing inputs, and reduce pressure on scarce natural resources.
- Photovoltaic arrays installed on buildings, automobiles and decentralised power units, and using energy from sunlight, could reduce the need for more-polluting power sources.
- Improved power storage technology and combined conversion systems could increase the reliability of electricity generated from renewable sources (*e.g.* the sun, wind, and biomass).
- New membrane technologies and biological treatments could purify wastewater by removing organic compounds, and lead to community or home-based water treatment units. New enzymes, catalysts, and other advanced techniques, such as transmutation, could reduce municipal waste, clean up hazardous waste, and treat nuclear waste.

Source: Adapted from Y. Fukasaku (1999), "Environment Technology Foresight", in *Technology Foresight and Sustainable Development – Proceedings of the Budapest Workshop*, OECD, Paris.

pollution-control technologies themselves. That makes attempts by governments to “pick winners” in the technological race quite risky. Well-designed government R&D policies avoid this problem.

### ***Ensuring that priorities for sustainable development are reflected in basic research***

Public funding of basic research is warranted for many reasons, not just environmental protection. These include the diffuse benefits that new knowledge generates for all aspects of human welfare (*e.g.* economic growth). Support for research should therefore generally be broad-based. However, as long as there are environmental externalities that are not being internalised, there is a strong chance that sustainable development objectives will not be adequately reflected in research programmes.<sup>36</sup> Moreover, because of the long delay between scientific discoveries and their commercial application, decisions taken today on how much scientific research to fund, and where and how to fund it, will have a large bearing on the technologies that become available a full generation from now.

Basic and applied research clearly benefits private production and consumption. It also assists governments in carrying out their own responsibilities in relation, for example, to public health, environmental protection and the economy. As stressed throughout this report, there are gaps in our knowledge of the behaviour of biological, physical and economic systems that need to be filled in order to strengthen the ability of policy-makers to deal with environmental externalities, to husband natural resources, to ensure adequate provision of public goods, and to improve social conditions. Translating this knowledge into a form accessible to policy-makers also requires tools and indicators that allow better integration of environmental, economic, and social objectives. Governments should review their current funding priorities to determine whether sufficient resources are being devoted to research in these areas.

Involving experts from different research and private-sector communities in the priority-setting process for research can encourage an inter-disciplinary perspective, which is important when attempting to identify science and technology fields that may nurture new knowledge and innovations with the potential to generate large benefits for society. Many countries are extending this “partnership approach” to research priority-setting so as to involve policy makers, representatives from business and civil society, as well as scientists. Tools such as “technology foresight” have proven to be useful for integrating the numerous viewpoints that are generated by these exercises (OECD, 1999i).

Much research of an applied nature, including research that contributes to sustainable development, is undertaken by private firms and individuals. A vital role of government is to provide legal protection for the intellectual property rights that enable the private sector to profit from its innovations. Providing institutional and market conditions conducive to innovation may also require correct-

ing policies that inadvertently create obstacles to it. Many countries, for example, are reforming regulations relating to the commercialisation of results from publicly financed research at universities, with a view to giving researchers greater autonomy and more competitive and performance-based funding. Reforms in other areas, such as financial markets and competition, could also improve the climate for innovation. Finally, governments can reduce one element of the risk of investing in new technologies by making their policy intentions regarding sustainable development more consistent and predictable.

Over the last several decades, many OECD governments have gone beyond merely facilitating private-sector R&D. Most provide direct grants or tax credits to support R&D carried out by business, for example. Such support is often justified by the benefits to society of additional knowledge spill-overs.<sup>37</sup>

Governments are also promoting co-operative approaches among firms, and between firms and research institutions, with a view to creating synergies. Their involvement ranges from helping firms find network partners to fostering the formation of industry clusters, which can include manufacturers of technologies used in natural-resource-based industries or for the control of pollution (Box 15).

#### Box 15. **Fostering clusters**

Much innovation in today's economy occurs through the interaction of firms – firms in related industries, specialised suppliers, service providers – and associated universities and research institutes within geographic clusters. Clusters tend to emerge where there is an entrepreneurial business climate, readily available risk capital and a business-friendly academic infrastructure. They thrive because they provide a pool of skilled labour and opportunities for frequent exchange of ideas, products and technologies.

In 1997 Finland launched an *Environmental Cluster Research Programme* which targets the emerging environmental goods and services industry, one of the country's fastest-growing sectors. The Government provides seed-funding for research on new environmental technologies to be carried out by consortia of producers and suppliers, universities and institutes. Collaborative projects enhance networking among researchers and users. The initial focus of research is on improving eco-efficiency through the application of life-cycle techniques in agriculture, forestry, basic metals and water management. The Ministry of the Environment co-ordinates the programme together with the Ministry of Trade and Industry, the Technology Development Centre (TEKES) and the Academy of Finland.

*Source:* OECD Committee for Scientific and Technological Policy, National Innovation Systems project.

### Box 16. Examples of environmental technology partnerships

*Canada – Technology Partnerships Canada.* Provides repayable contributions for research on clean cars and transportation systems, and technologies for controlling air pollution, mitigating climate change, treating water and wastewater, and recycling.

*Germany – Research for the Environment.* Supports scientific initiatives aimed at developing new environmental technologies and new concepts of environmental engineering and use.

*Japan – Research Institute of Innovative Technology for the Earth (RITE).* Develops technologies for reducing greenhouse gas emissions, biotechnologies used in production processes, substitutes for ozone-depleting substances, and monitoring techniques for air, water and soil pollution.

*United Kingdom – Foresight Vehicle Programme.* Aims to develop a clean, efficient, lightweight, intelligent vehicle that will satisfy stringent environmental requirements while meeting mass-market expectations for safety, performance, cost and desirability.

*United States – Industries of the Future Initiative.* Aims to develop competitive technologies that fully integrate energy and environmental considerations through a collaborative effort between the Department of Energy and seven energy-intensive industries (steel, aluminium, metal casting, glass, chemicals, petroleum refining and forest products).

*Source:* OECD (1999), "Technology and Environment: Towards Policy Integration", Document No. DSTI/STP(99)/FINAL, Paris. [www.oecd.org/dsti/sti/s\\_t/index.htm](http://www.oecd.org/dsti/sti/s_t/index.htm).

Governments are also themselves forming partnerships with private firms, partly as a way to spread risks in long-term ventures. Box 16 provides some examples of public/private partnership programmes set up specifically to develop environmental technologies. The partnership concept is also being extended to other stages in the R&D process, and in many areas public/private co-funding of research projects is becoming the norm. These public-private partnerships are important for leveraging private investments towards critical public research needs. However, governments must take care to retain sufficient independence within these partnerships so that the public interest is adequately protected.

### Encouraging the development and diffusion of cleaner technologies

Policies to explicitly encourage the development and diffusion of cleaner technologies is needed – in addition to the framework measures described above –

in order to overcome particular market failures. Arguments for such policies fall into two categories. First, potential users may be unaware of (or find difficult to understand) the advantages of the new technology, or they may require proof that the technology has been successfully employed by others before using it themselves. Second, before the benefits to society from deploying a new technology may be realised, the market may have to be expanded so as to exploit economies-of-scale, and opportunities may have to be created for “learning-by-doing”.<sup>38</sup> If the up-front investment during the pre-commercial period is not too large, private investors may accept initial losses if they expect bigger profits later.<sup>39</sup> Such investments are risky, however, and innovators may find it difficult to obtain adequate financing if capital markets are underdeveloped. Justification for government intervention to correct these market imperfections is strongest in the case of sectors that generate large negative environmental externalities – *e.g.* energy transformation and consumption – or produce outputs with strong characteristics of a public good.

Many cleaner technologies exist but are not used because necessary information about them does not reach firms, or because they must be adapted to local conditions. Such information barriers for small-scale and low-risk technologies can often be overcome through programmes to inform, educate and facilitate communication between experts, suppliers and adopters of innovations. Eco-labelling schemes, for example, can increase the chance that product innovations will be rewarded in the market-place. Technical assistance programmes can provide hands-on advice in diagnosing environmental problems and recommending responses. Publicly-sponsored advice, training and demonstration programmes may persuade farmers to change their agricultural practices and technologies. Benchmarking schemes, which enable firms to compare their environmental performance with that of others, can focus greater attention on environmental performance within industries. Work-force training and advice on managerial and organisational changes within firms can improve their ability to assess and adapt cleaner technologies.

More selective types of programmes entail risks, especially if they involve substantial transfers from governments. The history of government support to new technologies, particularly energy technologies, suggests a number of potential hazards that need to be avoided. Technology-specific programmes can develop powerful constituencies with an interest in perpetuating government support long after the social returns to further public expenditure have disappeared. They can lead to the creation of firms that depend on support, making the cessation of “temporary” support programmes all the more difficult. Emphasis on technological solutions can bias the search for least-cost policies in favour of particular domestic industries (*e.g.* automobile manufacturing) and lead to matching subsidies in other countries, as each country attempts to give its industry a “first-mover” advantage. This can create trade frictions, and adversely affect markets for private risk capital.<sup>40</sup>



Governments need to mobilise private capital during the deployment stage, while avoiding the temptation to promote one acceptable technology over another, or to let innovation and deployment policies discriminate in favour of a domestic industry. Innovation and deployment policies should allow competition among technologies that can meet the same policy objective (*e.g.* generate emission-free electricity, rather than electricity from one particular energy source). They should also allow equal access to “learning opportunities” – protected niche markets and similar schemes – by foreign as well as domestic investors. The market for some new technologies – *e.g.* for renewable-energy-based power generation – is potentially huge. Facilitating international competition in their development is therefore important, both to minimise unnecessary duplication and to avoid possible trade frictions.

The need to spread the risks of uncertain technological trajectories where capital is long-lived – and where the technologies concerned can be locked into service for many years – has led most OECD countries to support R&D across a portfolio of new technologies, and encourage learning opportunities among them. For example, several OECD countries are today requiring electricity generators to meet a certain share of their production from emission-free sources – through their own generating plants or purchase of tradable certificates (Box 17) – rather than supporting specific technology solutions.

**Box 17. A new tradable permit system for renewable-energy based electricity in Australia**

In December 2000 the Australian Parliament passed the Renewable Energy (Electricity) Bill 2000. The new law aims to increase the share of renewable energy sources in Australia's electricity mix to 12.7%, or 25 500 GWh per year, by 2010. Starting 1 April 2001, wholesale energy purchasers – with no exceptions – have had to buy increasing amounts of electricity generated from renewable sources. In order to discharge their liability, they must periodically surrender Renewable Energy Certificates to the Renewable Energy Regulator. One Renewable Energy Certificate can be created for each megawatt-hour of electricity generated from a new eligible renewable energy source. These certificates may be traded through a market separate from the market for physical energy. Renewable energy sources eligible for certification will be defined by regulations. They are likely to include both grid-connected and stand-alone plants running on geothermal energy, biofuels, specified wastes, solar-heated water, and pumped storage hydro-electricity, as well as biomass co-fired with fossil fuels, and fuel cells using a renewable fuel.

Source: Australian Greenhouse Office (2001), *Mandatory Renewable Energy Target*. [www.greenhouse.gov.au/markets/2percent\\_ren](http://www.greenhouse.gov.au/markets/2percent_ren).

Many technologies based on non-exhaustible or renewable energy sources that hold promise for generating electricity with lower emissions are in their early stages of deployment, and are still expensive compared with conventional power plants. Their profitability will depend partly on whether they (and the technologies with which they will have to compete) are required to internalise the environmental costs of using them. Where internalisation policies are in place, the break-even point for these new technologies arrives sooner, and the need for government support is less.

## Managing Linkages with the Global Economy

### Impacts of trade and investment on sustainable development

International trade and investment promote economic growth and competition. In so doing, they contribute directly to poverty reduction, thereby enhancing long-term development opportunities in poorer countries. They also stimulate technology development and diffusion, and promote the structural changes necessary to make more efficient use of natural and environmental resources. Thus, trade and investment have the potential to contribute to all three dimensions of sustainable development.

It is well-established that international trade and investment contribute to economic growth. For example, the gains from trade liberalisation under the Uruguay Round Agreement have been estimated at USD 258-510 billion (OECD, 2001*m*). Over the past decade, countries that have maintained open trade and investment regimes have also experienced rates of economic growth twice as large as those of countries that have not (OECD, 1998*b*). Open trade and investment regimes also increase opportunities for multinational firms to expand the rate of technological change in host countries, both by bringing new technologies into use themselves, and by encouraging domestic firms to change their own practices. This effect is particularly important for developing countries, where long-term development prospects depend heavily on access to modern technology.

However, market openness is only a necessary – not a sufficient – condition for economic growth. Just as important are sound macroeconomic policies, and stable institutional and social conditions (Rodrik, 1999). For example, 15 of the world's poorest countries have been involved in some form of armed conflict during the past 20 years. Conversely, developing countries that have experienced both macroeconomic stability and no armed conflicts have generally recorded higher-than-average per capita growth rates (World Bank, 2000*a*). Preventing bribery and corruption is another important part of the institutional context. Corruption acts as a serious obstacle to the efficient operation of investment processes in some countries. The OECD *Convention on Combating Bribery of Foreign Officials in International Business Transactions* is an important instrument for addressing this problem.

Most of the expected environmental effects<sup>41</sup> of trade and investment activity are associated with an expansion of economic output (scale effects), a reallocation of production and consumption (structural effects), or effects on technological development and diffusion (technology effects). A key environmental concern is the possibility that expanding outputs associated with trade and investment will exacerbate environmental problems, although there is some evidence suggesting that, as incomes rise, both the demand for higher environmental quality and the ability of the economy to pay for that higher quality also increase. Conversely, although the structural and technology effects of trade and investment on the environment are often expected to be positive (*e.g.* via improved operating processes), there may be specific situations where it is not the case (*e.g.* introduction of invasive species as a result of structural economic reforms).

There is also disagreement about how liberalisation of trade and investment may affect environmental regulations, either by encouraging existing standards to be reduced (leading to the creation of “pollution havens”) or by limiting the likelihood that these standards will be increased (leading to a “regulatory chill” effect). Evidence in support of the pollution haven hypothesis is not strong, at least at the national level (OECD, 1998*b*; Adams, 1997), but it may be more problematic for specific resource-using sectors of the economy, where environmental costs are sometimes an important share of total costs. On the other hand, there is some evidence that governments are sometimes reluctant to raise their environmental standards in the face of competitiveness concerns facing domestic industry (Maybey and McNally, 1999; Oman, 1999).

Most of the expected social effects<sup>42</sup> of trade and investment relate to problems either with labour markets (*e.g.* employment effects), or with income distribution and competitiveness. Trade and investment are generally expected to increase total employment and per capita incomes (Sachs and Warner, 1995; Rodriguez and Rodrik, 1999), although this may not be true for specific sectors or regions, especially in the short-term.

As with environmental regulations, concerns are also sometimes expressed about the effects of trade and investment on social regulations, either by encouraging a lowering of local standards or by reducing the scope for those standards to increase. Available evidence here suggests that, although some governments do compete to attract foreign direct investment (FDI) by reducing the effectiveness of local social standards (*e.g.* in some export processing zones), there is little general evidence of a “race to the bottom” of this type (OECD, 2001*m*).

There is similarly little evidence to suggest that reducing core labour standards is an effective way of attracting foreign investment. On the contrary, countries that rely heavily on child labour generally have a harder time attracting foreign capital. Similarly, countries that strengthen their core labour standards are

likely to increase their opportunities for economic growth – by raising skill levels in the work-force, and by creating a working environment that encourages innovation and productivity improvements.

Concerning the possibility that trade and investment might increase income disparities, it is noteworthy that the large increase in these activities over the past 50 years has been accompanied by a decline in the share of the world's population living in extreme poverty, from 29% to 24%.

The general conclusion is that neither the size, nor the direction, of the direct effects of trade and investment on environmental or social conditions can be predicted with certainty. Similarly, the evidence is mixed with regard to the indirect effects on environmental and social regulations. What does seem clear, however, is that the most-efficient way of reducing any negative impacts (or of increasing any positive ones) will usually be to adjust environmental and social policies first, rather than relying on trade and investment policies to do the job. Taking the latter approach could unnecessarily constrain the capacity of trade and investment to contribute positively to both economic growth and poverty reduction, thereby constraining opportunities to move toward sustainable development as quickly as might otherwise be the case. Trade and investment can, under certain conditions, be vehicles by which environmental and social problems are spread throughout the economy, but the root source of these problems is normally inadequate environmental and social policies themselves.

Although the best approach will generally involve adjusting environmental and social policies first, sustainable development will be enhanced if the coherence among environmental, social, trade, and investment policies can be increased. This means implementing environmental and social policies in such a way that they actively support trade and investment policy goals. Similarly, it means ensuring that trade and investment policies actively support environmental and social policy objectives. In general, therefore, one set of policies should provide “flanking support” for the other. The remainder of this Chapter focuses on areas where such support is especially important, both domestically and internationally.

### **National policy responses**

A key area of concern for both trade and environmental policies is that of environmentally-damaging subsidies. Some subsidies have the effect of encouraging higher levels of production or consumption than can be justified by sustainable development. These subsidies often exert pressure on the environment, by distorting decisions on resource allocation and on international trade and investment. The net result is that subsidy reform will often be both environmentally-beneficial and trade-enhancing. One specific area where large improvement in both economic efficiency and environmental conditions is possible is that of subsidies to fossil fuels

(*e.g.* coal). Possible adverse social effects of subsidy reforms in these areas can often be mitigated by de-linking the subsidies provided from outputs or inputs. This would facilitate the required social adjustments, but without generating either environmental damages or trade and investment distortions (see Chapter 2).

Environmental Impact Assessment procedures (EIAs) have been part of the OECD policy landscape for decades. The role of EIAs as a backdrop to the global expansion of trade and investment activity is also becoming more visible. For example, it is increasingly seen to be important that Export Credit Agency assistance takes into account the environmental and social implications of that assistance (see Chapter 6). Similarly, EIAs are increasingly seen as a vital part of the background in which trade negotiations take place. Many OECD countries are also committed to undertake environmental (sustainability) reviews of WTO and regional/bilateral trade agreements. However, the methodologies used to do these assessments are still at an early stage of development, and need to be further strengthened.

Consumers are also increasingly concerned about the environmental and social impacts of individual products, leading to new demands for information about these impacts. Domestic policies related to the labelling of products according to their environmental characteristics (*e.g.* eco-labelling), to public procurement (*e.g.* green public purchasing), and to life-cycle responsibility for products (*e.g.* extended producer responsibility) are therefore becoming more common. However, these policies often have trade implications. They therefore need to be designed in a way that minimises these implications, without jeopardising the underlying environmental objective. OECD reviews of policies in each of these areas suggest that it is possible, especially when transparency, credible information, and open access are featured in the design of these programmes (OECD, 1999*h*).

Under the Generalised Systems of Preferences (GSP) schemes currently in place in most OECD countries, certain developing countries benefit from preferential access to specific OECD markets. Two of these schemes (in the European Union and the United States) currently incorporate clauses linking market access to compliance with labour and environmental standards. However, such clauses have given rise to some concerns, both because they entail a risk of trade protectionism, and because they imply external monitoring of social standards in the developing countries involved. Nevertheless, the GSP approach does seem to have been used effectively on a selective basis to promote sustainable development objectives and, in the context of dialogue with developing countries, it offers some promise for the future (OECD, 2001*m*).

### **International responses: trade and investment policy**

Although individual WTO agreements do not aim directly at achieving environmental objectives, environmental considerations are included in some of them (Box 18).

### Box 18. WTO and the environment

- The Preamble to the WTO Agreement refers to the objective of sustainable development, and to the need to protect and preserve the environment, in a manner consistent with countries' needs and levels of economic development.
- The Agreement on Technical Barriers to Trade and the Agreement on Phytosanitary Measures consider the use by governments of measures to protect human, animal and plant life, and the health of the environment.
- The Agreement on Agriculture exempts from WTO subsidy disciplines certain forms of support provided within the context of agri-environmental programmes.
- The Agreement on Subsidies and Countervailing Measures treats as "non-actionable" 20% of any government subsidy to the cost of adapting existing facilities to new environmental legislation.
- Both the Trade Related Aspects of Intellectual Property Rights Agreement and the General Agreement on Trade in Services contain provisions related to environment objectives.
- More generally, trade rules allow for discrimination on the basis of product characteristics, many of which have environmental implications.

Source: World Trade Organisation (2001), *Introduction: Environmental Issues in the WTO*. [www.wto.org/english/tratop\\_e/envir\\_e/backgr\\_e.htm](http://www.wto.org/english/tratop_e/envir_e/backgr_e.htm)

WTO agreements can also have indirect positive effects on the environment. For example, the Agreement on Trade Related Investment Measures removes local-content restrictions which could be supporting inefficient production processes and overuse of environmental resources. The WTO Committee on Trade and Environment was established to further explore the links between international trade and the environment.

Linkages between international trade tools and environmental goals are also developing at the bilateral and regional levels. For example, the North American Free Trade Agreement (NAFTA) contains side agreements dealing with both the environment and labour co-operation. In contrast, environmental and social issues are not generally addressed in bilateral investment treaties (BITs), although there are exceptions.

Investment agreements are not designed to achieve environmental objectives either, but some do occasionally include environmental considerations. Similar to

trade, the core principle of non-discrimination embodied in investment agreements calls on host governments to treat foreign investors no less favourably than domestic investors, and no less favourably than other foreign ones – the National Treatment (NT) and Most-Favoured Nation (MFN) Principles.

The OECD Code of Liberalisation of Capital Movements, while calling for the progressive liberalisation of all capital movements, permits OECD countries to limit capital flows when they consider it necessary to protect public health and safety. Some developing countries have also adopted regional integration agreements related to investment, some of which include environmental provisions. For example, the 1998 Framework Agreement on the ASEAN Investment Area embodies a general exception for public health and environmental protection, so long as measures do not unduly restrict investment flows.

Current trade and investment disciplines thus leave ample room for countries to take the measures they deem appropriate for the protection of human, animal, plant life or health. In some cases, however, it is unclear how these disciplines affect a government's ability to apply national environmental or social measures. Four issues have generated particular debate in recent years.

First, countries have adopted a variety of regulations to mitigate the negative environmental impacts of processes and production methods (PPMs). However, measures that address environmental problems at the production stage raise complex trade issues. Some WTO agreements (such as those dealing with trade-related intellectual property rights and subsidies) explicitly provide for certain distinctions among products based on non-product-related characteristics. Overall, however, the GATT regime for trade in goods requires that “like products” receive “like treatment” – *i.e.* that foreign producers should not be discriminated against, unless certain exceptions apply. Developing a better understanding of these exceptions (and their practical application) would improve opportunities for trade and environment policies to support each other.

Second, similar opportunities for improved understanding exist in the area of precaution. In recent years, discussion about the use of precautionary measures against possible environmental damage has intensified. Several multilateral environmental agreements (MEAs) and other international instruments, as well as some national legislation, explicitly envisage the use of precaution. However, where countries take different approaches to valuing the potential risks involved, the implementation of precaution in practice may be viewed by affected countries as introducing unwarranted trade distortions. OECD countries could contribute to reducing this tension by examining opportunities for making the application of precaution in environmental policy more consistent with trade disciplines.

Third, the principles of NT and MFN present a policy challenge when environmental or social policies affect foreign investors differently from domestic investors.



Governments often have legitimate reasons for treating particular investments, or investors, differently from each other. However, it is not always clear in practice how to distinguish between “discrimination” and “differential treatment”. As with the trade case, a better understanding of these distinctions (and their practical application) would improve opportunities for investment and environment policies to support each other.

Finally, the application of the principles of NT and MFN does not prevent a host country from lowering its environmental or social standards in order to create *more* favourable conditions for foreign investors. Some countries have therefore included “not lowering standards” clauses in the BITs in which they are involved. Further work to clarify the conditions under which competition for investments would be regarded as compatible with sustainable development would therefore also be useful.

The private sector plays a vital role in generating sustainable economic growth, and is increasingly seeking to contribute to sustainable development more broadly. OECD countries have therefore become more active in promoting corporate performance that supports this goal. The OECD *Principles of Corporate Governance* and the OECD *Guidelines for Multinational Enterprises* are recent examples of international initiatives in this area. These instruments provide benchmarks against which corporate performance can be assessed, primarily within the corporations themselves. Many corporations have also developed internal policy statements (*e.g.* codes of conduct) which outline their basic commitment to the goal of sustainable development, as well as their own expectations concerning how to achieve further progress.

Despite recent successes in liberalising world trade, considerable scope remains for further liberalisation to benefit developing countries. While average tariffs in OECD countries have declined, tariffs remain high in six sectors that are vital for developing countries: major agricultural staple foods products; fruit, vegetables, fish; processed food; textiles and clothing; footwear, leather and travel goods; and automotive and other transport, and high technology goods. Tariff escalation also remains an issue for a number of raw material-based products. Although imports of basic commodities often face a zero tariff, intermediate and processed products face successively higher tariffs. In addition, these same products often face several non-tariff barriers. Both tariff and non-tariff barriers make it difficult for developing countries to export manufactured goods. The World Bank (2000*b*) has estimated that OECD tariffs and other distortions, such as farm subsidies, cause annual welfare losses of almost USD 20 billion for developing countries – equivalent to about 40% of the total Official Development Assistance (ODA) given to those countries.

### **International responses: environment policy**

The relationship between MEAs and trade and investment policies has been the subject of much on-going discussion. Trade measures are sometimes used in

Box 19. Trade measures and MEAs

Trade measures can be an appropriate policy measure to use in MEAs, for example, when:

- countries have agreed to manage collectively international trade as part of the environmental problem;
- trade itself contributes to the environmental problem, as with invasive species;
- trade controls are needed in order to make regulatory systems comprehensive in their coverage; or
- discouraging free-riding is necessary in order to reduce barriers to effective international co-operation.

Source: OECD (2000), *Trade Measures in Multilateral Environmental Agreements*, Paris.

MEAs to encourage broader participation, or to resolve particular environmental problems that have trade dimensions. The goal is not to limit trade *per se*. Recent OECD assessments of the use of trade measures in the Convention on International Trade in Endangered Species (CITES), the Montreal Protocol on Substances that Deplete the Ozone Layer, and the Basel Convention on Hazardous Waste (Box 19) suggest that trade measures have been quite successful in contributing to the goals of these particular MEAs. However, these measures need to be carefully designed and targeted to the environmental and economic objectives at hand. They are also most effective when used as part of a larger package of mechanisms for addressing environmental problems, and when complemented with resources aimed at building implementation capacity, especially in developing countries.

Concerns are also sometimes expressed that the provisions of one international legal regime could take precedence over the provisions of another, in the event of a direct conflict between the two. One recent example of this concern from an environmental perspective arose during negotiation of the Cartagena Protocol on Biosafety.<sup>43</sup> Potential trade issues arising from climate change abatement commitments made under the Kyoto Protocol have also been discussed in this context. However, despite the possibility of this type of conflict in principle, no formal disputes have yet occurred. Rather than presume any particular outcome in this regard, it would be better to engage in systematic dialogue among the various policy communities, with a view toward limiting the potential for future problems.

## Development co-operation

There are important links between the development priorities of developing countries – especially those involving poverty reduction – and many of the trade, investment, environmental, and social policy challenges that underlie sustainable development.<sup>44</sup> Most developing countries have committed themselves – under the Rio Conventions – to preserving the global environment, on the basis of common but differentiated responsibilities. For many developing countries, however, there are important trade-offs between domestic development priorities and global environmental protection objectives. The Global Environmental Facility (GEF) was established partly to assist developing countries in overcoming these trade-offs.

At the same time, there is considerable scope for local and global policy objectives to support each other. For example, measures to improve health by controlling local air pollution can also contribute to reducing greenhouse gas emissions. Similarly, efforts to reduce land degradation (*e.g.* by preventing deforestation) can improve food security, as well as preserve global biodiversity. Exploiting these synergies is vital for achieving sustainable development in both developing and developed countries.

The OECD has developed a framework for co-operation with developing countries toward the goal of sustainable development (OECD, 1996). This framework is focused around a series of International Development Goals, six of which are quantified and time-bound (see Chapter 1), and recognises the need for development co-operation to build upon, rather than to substitute for, national efforts. In particular, co-operation should be provided within the framework of local development strategies, and emerge from a transparent dialogue between governments, business and civil society.

National Sustainable Development Strategies provide a framework for elaborating coherent, long-term approaches to tackle the trade-offs involved in achieving sustainable development. While the focus of these strategies will vary across countries, poverty reduction will be a central objective for many of the poorest ones (OECD, 2001l).

Although development co-operation is one of the main instruments through which OECD countries can help the poorest countries, several other policies – notably trade and investment – also have important impacts in developing countries. The need for these policies to be mutually consistent is increasingly recognised. For example, the *Reference Checklist on Policy Coherence for Poverty Reduction*, compiled by the OECD Development Assistance Committee (DAC), provides useful guidance on ways of improving the coherence of OECD policies towards developing countries.

Official Development Assistance (ODA) has traditionally played an important role in development co-operation. However, a growing portion of available ODA

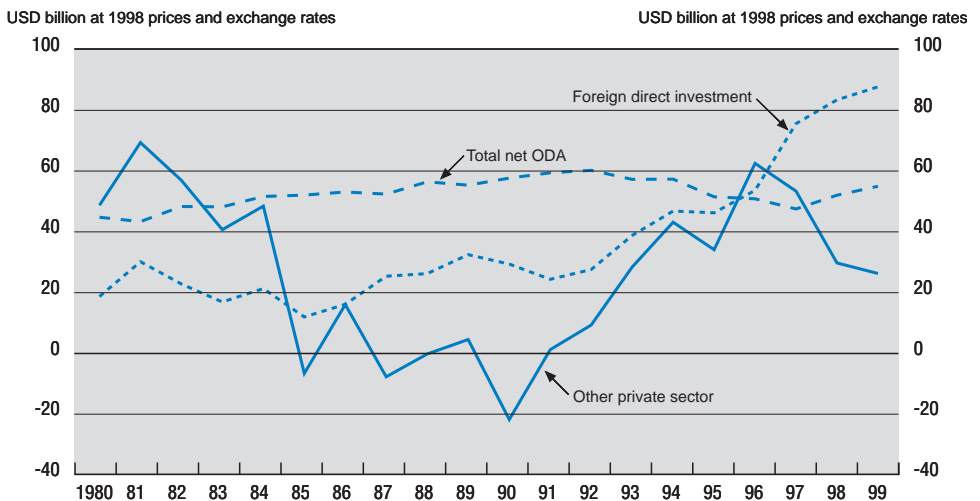
resources has been devoted to humanitarian needs and debt relief in recent years, placing some strain on the “development” portion of aid budgets.

Recent liberalisation efforts in many countries have also led to significant increases in FDI flows, with the result that the ratio of ODA transfers to FDI has declined (Figure 3). Absolute levels of ODA have also declined in some countries. The net result is that only four of the DAC’s 21 Member countries consistently meet the widely accepted volume target of 0.7% of GNP as an appropriate level for ODA.

The aggregate data illustrated in Figure 3 mask an important fact about private investment: most of it flows to a small number of countries, generally those with the healthiest economies. For example, of this total, 45% went to the largest and strongest developing economies, such as Brazil. More generally, only 20% of global FDI went to developing countries in 1998. Private flows also tend to be concentrated in a limited number of economic sectors (such as energy production), while only limited flows accrue to sectors (such as health and education) with important social implications.

In many developing countries, ODA remains a critical source of public finances. Often, FDI levels are low because the institutional capacity and macro-economic stability needed to support FDI are insufficient. Even in countries where

**Figure 3. Selected long-term flows from OECD to developing countries, 1980-99**



Note: ODA figures exclude forgiveness of non-ODA debt for the years 1990 to 1992.  
 Source: OECD, DAC.

FDI flows are already significant, ODA may complement private sector investment, for example by helping governments to finance local public goods, or by helping to attract FDI flows that promote sustainable development.

For example, ODA could play an important role in infrastructure development in urban areas. Developing countries already have an urban population that is more than double that of Europe, North America, and Japan combined. Most of the world's largest cities are in the developing world, and environmental pressures are often high in these cities. ODA can make a difference to many areas of urban management, especially access to clean water.

Economic growth in developing countries (supported by trade and investment) will contribute most to sustainable development if the local environmental and social policies are set at adequate levels, and are effectively implemented. Development co-operation plays an important role in helping countries build their capacity to improve these institutional responses, and to take full advantage of the opportunities afforded by globalisation. Several developing and transition economies are now moving in this direction, but development co-operation can help accelerate this change. In particular, it can help by improving the capacity of governance systems in place in developing countries to support sustainable development goals. Capacity development is a long-term process, requiring an effort that extends well beyond the normal planning horizon (3-5 years) of most co-operation programmes. Its results also have to be accepted by all parts of the societies in which it is carried out.

Achieving sustainable development will also require that developing countries avoid some of the stages of technology experimentation and diffusion that the developed countries have previously undergone. Although many existing technologies could promote sustainable development in developing countries, their use is often hampered by their high cost, and by the lack of skills and infrastructure necessary to adapt foreign technologies to local circumstances.

Effective dissemination of cleaner technologies begins with creating an awareness of the causes and possible impacts of unsustainable activities. It also requires developing scientific, technological, and managerial capacities at the local level, to allow managers to properly evaluate the advantages of competing technologies. And often, it requires assistance to developing countries in building the infrastructure (*e.g.* energy, transportation, and telecommunication networks) necessary for efficiently assimilating and harnessing technological change. Key lessons learned from the experience of aid donors on technology co-operation are summarised in Box 20.

Box 20. **Co-operation on “clean technologies”**

Lessons from donor country experiences with “clean” technologies include:

- *Promote capacity-building, not only hardware.* The main constraint to diffusion of clean technologies is the lack of institutional, technical, and managerial capacities needed to manage changes in production methods.
- *Support the financing of cleaner production.* In many developing and transition countries, access to credit is an important factor limiting the development of cleaner technologies.
- *Support improved framework conditions for cleaner production.* A strong legislative framework is needed for environmental protection, regulation, and enforcement.
- *Raise public awareness of the impact of environmental degradation.* Improving public knowledge of the health and other impacts of environmental degradation can create demand for improved environmental performance.
- *Support cleaner production centres.* The promotion of better management practices in enterprises requires access to trained professionals with good technical knowledge at the local level. Staff should also generally be composed of local experts.
- *Improve co-ordination.* External and domestic actors need to co-ordinate their activities, so that conflicting advice, overlaps and duplication are avoided. Co-operation, led by the host country, facilitates the sharing of experience and the dissemination of best practices.

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Source: OECD (1995), *Promoting Cleaner Production in Developing Countries: The Role of Development Co-operation*, Paris.

## Responding to Climate Change

### Introduction

Human interference with the climate system is a key challenge for sustainable development, as it risks irreversibly altering eco-systems, as well as affecting social, political and economic systems around the world. New evidence suggests that most of the observed warming over the last fifty years is attributable to human activities (IPCC, 2001*a*); and that precipitation patterns are changing, sea levels are increasing, glaciers are retreating, Arctic sea ice thinning, and extreme weather events are becoming more frequent and intense (Watson 2000). Climate change is expected to impact on human settlements, food production and distribution, water availability, and to contribute to the spread of diseases. Despite the urgency that the international community has accorded to climate change, concrete actions to mitigate emissions are still lagging. Few OECD countries are on track to meet the objectives of the UN Framework Convention on Climate Change (UNFCCC) and associated Kyoto Protocol. Evidence of concrete action by OECD countries would help to secure participation by other countries – especially the developing countries – in the much deeper cuts in emissions that will be necessary in the longer-term. Limiting climate change requires political commitment and global co-operation across all economic activities, sectors and actors. It requires policies to change production and consumption patterns, to facilitate investment in clean technologies, and to balance economic efficiency, environmental effectiveness and social development in policy design.

Opportunities to respond effectively to climate change are available, but are not yet sufficiently exploited. An extensive array of policies and technologies in energy, agriculture and forestry already exists for dealing with climate change. In the shorter-term, action is required to reduce emissions from existing sources. In the longer-term, policies will need to favour investments that transform energy and transport infrastructure towards less carbon-intensive sources, as well as to facilitate cost-effective adaptation to a changing climate. In addition, the uneven distribution of costs and benefits of climate change is likely to lead to political tensions concerning the sharing of responsibility for action. The poorest countries

and regions of the world will be both the most vulnerable to the impacts of climate change, and the least capable of responding.

### **Features of the Kyoto Protocol**

Were it to enter into force, the Kyoto Protocol would set binding emission reduction targets for industrialised (and transition) countries over the 2008-2012 period, from 1990-levels. Compared with a “business as usual” scenario, these targets imply emission reductions of 20-30% for most OECD countries, should they tackle the targets unilaterally. Features critical for its implementation are the treatment of sinks (carbon uptake by plants, trees and soil),<sup>45</sup> rules and modalities to implement the Kyoto flexibility mechanisms, and programmes to assist developing countries in responding to climate change.<sup>46</sup>

Institutional capacity – especially international guidance for consistent emission monitoring and tracking systems, credible methods for determining emission baselines, transparent reporting and review, and an efficient compliance system that encourages good performance – will be important for the effective implementation of the Kyoto Protocol. National “cap and trade” systems would also need to be backed by domestic laws and enforcement actions, in order to provide incentives to firms and other entities to comply with agreed emission limits. Monitoring emissions, and assessing the effects of projects and programmes would also require significant administrative support from governments. More efforts to share national experiences in this area would allow the identification of best practices, and provide a platform for building capacity in emission monitoring and project assessment among interested countries (OECD, 1999*f*). Strong international co-operation and leadership by OECD countries is needed to achieve institutional changes adapted to wide variety of national circumstances.

### **Domestic policies**

Appropriate domestic policies are needed in the short-term to guide the transition to a lower carbon economy. Early interventions could reduce transition costs and avoid the premature scrapping of technology and infrastructure that would follow from more radical measures at a later stage. OECD countries have started to implement a mix of domestic measures to reduce emissions by improving energy efficiency, diversifying energy sources (towards less carbon-intensive ones) and reducing energy consumption.<sup>47</sup> CO<sub>2</sub> taxes have already been introduced in several European countries, and are being considered in others. In addition, some OECD countries have adopted (or are considering) CO<sub>2</sub> trading systems, mainly between private entities, but occasionally between governments (IEA, 2000*a*). Several others are using trading systems for electricity produced from renewable sources that – while introduced for other reasons – deliver carbon reductions (see Chapter 4). The



private sector is also engaged in carbon mitigation through a range of voluntary measures (IEA, 2000a). Further progress is needed to extend the use of such measures and to apply them to all relevant sectors. For example, exemptions granted to energy-intensive industries for competitiveness fears have significantly limited the effects of the domestic carbon taxes that have so far been applied.

Several types of *subsidies* contribute to higher greenhouse gas emissions, and their reform would contribute significantly to achieving emission targets. Lower tax rates granted to energy-intensive sectors, as well as preferential tax exemptions on company cars and driving-to-work rebates, lead to higher emissions than would occur with uniform tax treatments. Similarly, indirect subsidies to private transport (including support to highway infrastructure in urban areas and free parking) increase dependency on fossil-fuel-intensive activities. Local governments' land-use decisions can also exacerbate these effects. It is estimated that subsidy reform could reduce CO<sub>2</sub> emissions from transport by 10-15%, while improving economic welfare more generally (OECD, 1997a). Some subsidies to agricultural production (*e.g.* livestock) can also increase the intensity and level of production, leading to higher emissions of methane and nitrous oxide (see Chapter 2). While subsidies exist for a number of reasons, de-linking support from specific outputs could deliver important climate benefits.

Climate policies may help to achieve other benefits as well, such as avoiding loss of human life or illness due to air pollution, and eco-system benefits. Conservative estimates of these *ancillary benefits* of greenhouse gas abatement suggest that these may offset one-third of the estimated costs of domestic mitigation in OECD countries (O'Connor, 2000). In developing countries, where local air quality is generally poorer and carbon abatement costs lower, these ancillary benefits could be even larger. Ancillary benefits are important for designing climate policies because of their immediacy, compared with the long-term nature of direct benefits from climate mitigation. They can reduce the cost of achieving climate objectives, thereby making climate policies more politically acceptable.

There are also important opportunities to capture benefits in terms of greenhouse gas mitigation from sectoral policies aimed at objectives other than climate change. For example, changes in the fuel mix (for energy-security reasons) and improvements in energy efficiency (for economic reasons) can also deliver significant climate benefits. In the transport field, increasing competition among operators, and improving labour flexibility in protected transport markets (*e.g.* freight), could facilitate changes in transport mixes towards less carbon-intensive modes. Regulatory reforms of electricity markets could increase the share of natural gas and renewable sources in the energy mix, contributing to both reduced carbon emissions and improved local and regional air quality, if the right price signals and policies are in place (IEA, 2001a). Investment in infrastructure and equipment that accelerate the uptake of low-emission technologies and practices would also ease

the cost of long-term transition to a less carbon-intensive economy. In addition, programmes that divert land from cultivation for farm management reasons enhance sink capacity, by increasing biomass density and soil carbon storage.

National Export Credit Agencies (ECA) can also contribute to achieving climate objectives. Support provided by OECD-based ECA is large, and a significant portion of this support is concentrated in the transport and energy sectors.<sup>48</sup> Given the long life-span of energy and transport infrastructure – typically ranging between 30 and 50 years – support from ECA risks locking-in carbon-intensive modes of production in countries that are recipients of export credits. This underscores the importance of considering the climate change implications when assessing the environmental impacts of projects seeking ECA support. The development of common international approaches for integrating export credit assistance with environmental goals would also reduce concerns related to competitiveness losses associated with domestic action.

In the longer term, policies will be essential to help accelerate the development of technology solutions that can break the link between the growing demand for energy and transport services, and greenhouse gas emissions. This acceleration would also be promoted by providing incentives for private-sector R&D and by helping to achieve economies of scale in their production. In some countries, government support to carbon-free renewable technologies has played an important role in favouring their diffusion world-wide, although these interventions have not always been cost-effective from a domestic perspective. While such policies need to be carefully designed and administered, in order to avoid creating market distortions and trade barriers, they can boost investment in carbon-free technologies and reduce the costs of abatement (Box 21).

Irrespective of the success of *mitigation* policies, *adaptation* policies will also be needed to deal with the impacts of changes in the climate system that will occur in any case. Adaptation measures could include the construction of protective infrastructure (*e.g.* against flood control), the resettlement of populations and the identification and development of more adaptable plants and animals that can produce food in a different type of climate. To promote adaptation, governments at all levels need to provide the right market signals to technology innovation and research, to educate producers, consumers and workers about the changes in behaviour that are likely to be necessary, and to reform land use planning systems to reduce vulnerability. Policies will also be needed to facilitate labour market adjustments.

### **Reducing the costs of mitigation**

International measures will be needed to minimise the costs of domestic policies. The Kyoto Protocol offers opportunities for Annex B countries to lower mitigation costs through the use of three “flexibility mechanisms”: joint implementation

### Box 21. Carbon-free energy and climate change

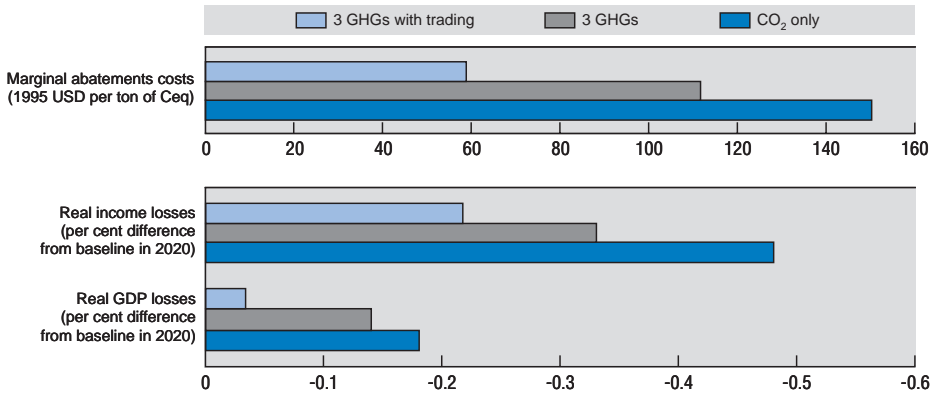
Policies towards carbon-free energy sources, such as nuclear energy, renewable energy or hydrogen, will shape the costs of meeting emission targets over the near and long term. For example, OECD countries that currently depend on nuclear power for electricity generation and are planning to phase it out, will face *coeteris paribus* a higher carbon abatement requirement than they currently have. The opposite will occur in countries planning to expand their use of carbon-free energy options.

Nuclear power currently provides 7% of the world's energy supply, although this contribution may decline to 5% by 2020. Nuclear power interacts positively and negatively with the economy, environment and society, but OECD countries differ in their assessments of its potential contribution to sustainable development, depending on their values, preferences and circumstances. It has an ample resource base, is essentially carbon-free, produces no significant amounts of air pollutants, generates spin-offs in other fields (*e.g.* medicine and physics), and (under normal operation) radiation releases are a small fraction of natural background levels. Existing plants are economically competitive, but new plants generally cost more than alternatives (at discount rates currently prevailing in liberalised energy markets) – although capital costs may decline in the future as a result of on-going R&D. There are also concerns related to the transport and disposal of long-lived (but concentrated) waste, plant accidents, and the illegal diversion of nuclear technologies or material to weapons use – as well as, in some cases, to the localised effects of waste heat from low thermal efficiency.

Renewable sources provide 5% of today's world energy supply – a share that is projected to remain stable over the next 20 years. Despite strong growth in non-hydroelectric sources, their share is expected to grow only marginally – from 2% today to 3% by 2020 – and to offset a decline in the share of hydroelectricity. Renewable sources can reduce emissions of greenhouse gases and other pollutants while increasing diversity of energy supplies and replacing diminishing fossil fuel resources over the long-run. Although the costs of renewable sources are falling, many of the technologies used to exploit them are still at an early stage of development, and face technical and costs-barriers. Three technologies – hydroelectric-power, biomass (from wood fuel and digester-liquors) and geothermal energy – are commercial now and are already well-integrated into the energy supply infrastructure of many countries. Land-based wind turbines are also an important source of electricity in several countries, and off-shore wind turbines are beginning to be deployed. With further development and increased production, other energy sources (such as small-scale hydroelectricity, energy from wastes, forests and crops, photovoltaics, and – in the longer term – hydrogen) could also become cost-effective and more widely deployed, particularly if environmental externalities were reflected in the price of carbon-based energy options. While all these sources could reduce climate impacts, these positive effects will have to be balanced against possible negative site-specific impacts, such as visual intrusion, degradation of ecosystems, and effects on aquatic life.

Source: NEA (2000), *Nuclear Energy in a Sustainable Development Perspective*, OECD, Paris; and Chapter 11 in OECD (2001), *Sustainable Development: Critical Issues*, Paris.

**Figure 4. Costs of implementing the Kyoto targets, 2010**  
Alternative assumptions on the use of Annex 1 trading  
and on the greenhouse gases subject to mitigation



*Note:* Marginal abatement costs are expressed in 1995 dollars per ton of carbon equivalent. Real GDP and income losses are expressed in terms of billions of 1995 dollars. In the scenario labelled “3GHG with trading”, abatement costs are equalised among Annex 1 countries. The other two scenarios correspond to cost-effective implementation by individual Annex 1 countries of CO<sub>2</sub> abatement only, and of CO<sub>2</sub> plus two others greenhouse gases.

*Source:* Burniaux J.M. (2000), “A Multi-gas Assessment of the Kyoto Protocol”, OECD Economics Department Working Papers No. 270, Paris.

and emission trading, between Annex B countries; and projects funded under the Clean Development Mechanism, with other countries. These international mechanisms are especially suited to the problem of reducing greenhouse gas emissions because the environmental effects of greenhouse gas emissions are independent of where they occur. International mechanisms also reduce the competitiveness effects of unilateral domestic action. According to OECD analysis (Figure 4), trading between Annex B countries can significantly reduce economic costs – whether measured in terms of marginal abatement costs, or of reductions in the growth of real income and GDP incurred by Annex B countries.<sup>49</sup>

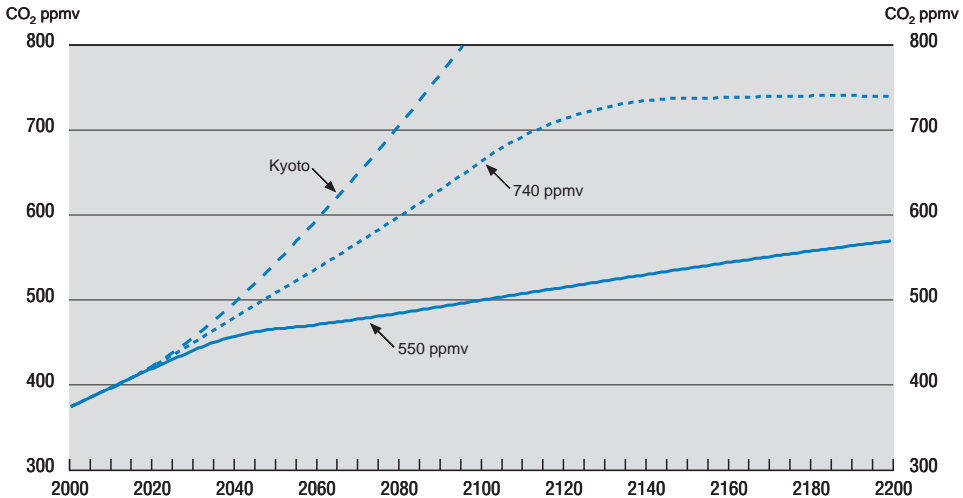
Extending mitigation beyond carbon dioxide emissions to include all the greenhouse gases covered by the Kyoto Protocol reduces further the estimated economic costs of abatement. For example, including methane and nitrous oxide lowers estimates of marginal abatement costs by approximately one-third, compared with mitigation limited to carbon dioxide alone (Figure 4). However, adjustment costs – linked to rigidity in labour, product and capital markets – could increase the total costs of any mitigation. Policies to facilitate labour-market adjustment in a timely way are therefore also needed.

## The long-term challenge: encouraging participation of developing countries

The attainment of Kyoto targets would only be the beginning of a sustained effort necessary over many decades to stabilise atmospheric concentrations of greenhouse gases at levels consistent with the objectives of the UN Framework Convention on Climate Change. Extending in time the current Kyoto commitments of Annex B countries would only delay by a few years the time when greenhouse gas concentrations double from pre-industrial levels (Figure 5, top line, for concentrations limited to CO<sub>2</sub>). Achieving more ambitious stabilisation targets would require significant mitigation in all major emitting countries. This is because, even if OECD countries were to reduce their emissions to zero, emissions growth in other countries would still increase concentrations world-wide. Participation of developing countries will therefore be essential for the success of policies to reduce climate change over the longer-term.

Equitable burden-sharing arrangements will need to be developed in order to assure the participation of developing countries. In the context of any future *global* emission trading system, for example, distribution of emission permits in a way that results in significant resource flows to developing countries could raise the

Figure 5. **Alternative concentration paths for carbon dioxide**



Note: ppmv = parts per million by volume. These paths are derived from assumed emissions using the model of Wigley T.M.L. (1993), "Balancing the global carbon budget. Implications for projections of future carbon dioxide concentration changes", *Tellus*, Vol. 45. Coefficients are based on Ha-Duong, M., M.J. Grubb and J.C. Hourcade (1997), "Influence of socio-economic inertia and uncertainty on optimal CO<sub>2</sub> emission abatement", *Nature*, Vol. 390. Source: OECD (1999), *Action Against Climate Change*, Paris.

*average* real income of developing countries above the levels that would have prevailed in the absence of climate policies, thereby increasing their incentive to participate in the abatement effort.<sup>50</sup>

Climate change is closely linked to a range of other challenges in developing countries, such as desertification and deforestation, which will influence the availability of natural resources to support their economic development. Hence opportunities exist to better-integrate climate change goals with the domestic development priorities of these countries. OECD countries can play a key role in enhancing developing countries' capacity to respond to these threats. Multilateral mechanisms for financial transfers, such as the Clean Development Mechanism and the Global Environmental Facility, can help advance technology transfer and capacity-building related to climate change. Official Development Assistance may also be used to build the capacity of developing countries, to develop the skills, knowledge and technical know-how required to adopt climate-friendly technologies; to identify priorities for sectoral reform; to design market incentives; and to develop the institutions necessary for the formulation of national climate plans, emissions monitoring, mitigation assessment and adaptation options. Strengthening these mechanisms will be critical for building consensus at the international level, and to encourage broader participation in mitigation efforts.

## Managing Natural Resources

### Introduction

Natural resources provide the raw materials necessary for economic activity, as well as the foundations of life itself. They include all of nature's endowment: air, water, minerals, plants and animals, and the ecosystems in which they form a part. A development strategy that depletes natural resources without providing secure, long-term substitutes for the goods and services that they provide is unlikely to be sustainable. Given the expected pressures on natural resources that will occur over the next century, establishing sound management practices now is critical.

Some natural resources are intrinsically more important for certain aspects of sustainable development than others. For example, petroleum and mineral resources underpin much economic activity, but their environmental role prior to extraction is insignificant compared with that of renewable ecosystem resources, such as marine estuaries and tropical rain forests. On the other hand, the rents created through the exploitation of resources provides an important source of capital that must be invested wisely if the total value of society's assets is to be maintained. Millions of people are employed in the mining and harvesting of natural resources, and many of them live in communities that have strong economic and cultural ties to those resources.

Potential supplies of most non-renewable resources, such as minerals and oil, are not in immediate danger of exhaustion.<sup>51</sup> Depletion drives up current prices, which spurs exploration and resource-saving innovations. This occurs alongside the long-term materials-saving bias of technological change (Radetzki, 2001). Few non-market values are embodied in minerals and hydrocarbons while they remain in the ground, although their extraction may well disrupt surrounding ecosystems.<sup>52</sup> There is considerable scope for substitution *among* natural resources and for increasing their productivity. What matters most for sustainable development is not the absolute quantity of resources, but whether human ingenuity can keep combining different forms of capital in ways that enable both human and ecosystem needs to be met.

A comprehensive approach to managing natural resources requires taking into account ecosystem services – and, more broadly, non-market values – flowing from them, particularly renewable resources, and not just their value in the marketplace. Sound management also includes the control of invasive (exotic) species that spread through the movement of goods and people. Some OECD countries have made progress in these directions, for example by adopting legislation that requires the maintenance of minimum in-stream flows in order to protect aquatic species. Most have generally recognised that forests need to be harvested on a sustainable yield basis, while providing space for wild flora and fauna.

### **Improving the knowledge base for decision making**

Although the commercial values of natural resources are usually reflected in market prices (except when subsidies are provided), many other values are not. To ensure socially optimal outcomes, these non-market values should be taken into account when making policy – by creating markets where they are feasible, and by estimating non-market values where they are not. Formal methods for estimating non-market values continue to improve, but still lack universal acceptance (Box 22). While waiting for these methods to develop, governments should continue to explore a range of different valuation methodologies while co-operating internationally on ways to reduce the subjectivity of the information (OECD, 2000i).

### **Making markets better serve conservation objectives**

#### ***Reforming subsidies***

Government subsidies have historically supported a range of activities that affect natural resources. The OECD regularly measures support to agriculture, fishing and coal mining arising from policies, and has examined support to water consumption. Support for some forest products, minerals, and energy products can also be significant (see Chapter 2). Subsidies affecting natural resource use can take the form of direct transfers, preferential tax structures, subsidised prices, and preferential access. Reducing harmful subsidies can encourage sustainable natural resource management in three basic ways: by reducing pressure to use resources in the current period; by encouraging the development of resource-conserving technologies, products, and practices over the long-term; and by releasing resources so that they can be used to provide public goods. Not all government expenditure is harmful: some is necessary for carrying out research, monitoring resource use and enforcing laws. Several countries that have combined subsidy reforms with improvements in management measures have found that they can improve their resource management by doing so (Box 23). Nonetheless, many of the adverse effects of subsidies can be avoided if adequate management systems are in place.



### Box 22. Overcoming information gaps

OECD Member countries have made significant progress in collecting information on important aspects of natural resources and in making that information public. State-of-the-environment reports are now common, and often are available via the Internet. Many corporations report environmental information related to natural resources used in their operations. Environmental groups are also increasingly active in this area. The World Resource Institute, for example, has set up Global Forest Watch – a system for monitoring the activities of logging companies that combines satellite imagery, global positioning system devices, mapping software, the Internet and on-the-ground observation. Another example is the Global Coral Reef Monitoring Network, established by the International Coral Reef Initiative. The GCRMN functions through 15 independent networks in six regions around the world, all collaborating to monitor coral reefs and share data. As remote-sensing technologies and systems mature, and fall in cost, they could enable substantial improvements in environmental data collection to take place.

However, knowledge about the environmental services provided by natural resources, and the threshold points at which damage to them risks becoming irreversible, is still inadequate. More research is needed. Moreover, the tools that have been developed to evaluate the (non-market) values people attach to these services, such as contingent valuation (a survey technique that requires respondents to specify their preferences for different goods or services and how much they would pay to obtain them) are time-consuming, costly, and require expert understanding and interpretation to be applied correctly. Yet without such information, assigning non-market values, and defining an optimal strategy for avoiding thresholds must necessarily involve methods that yield approximate results.

Many subsidies to industries based on natural resources, or to consumers of natural resources, are provided through under-charging for the use of infrastructure. For example, an estimated USD 2.5 billion is spent each year by OECD governments on infrastructure related to marine capture fisheries – 40% of total government financial transfers to the industry (OECD, 2000*h*). Public investment in water infrastructure, particularly for irrigation, involves even larger sums. User charges for both kinds of infrastructure rarely cover operations and maintenance cost, or (even more rarely) the depreciation of invested capital (OECD, 1999*g*).

In the case of water, farmers usually pay the lowest charges. This price differential can only partly be explained by differences in quality and conveyance costs. It is quite common for governments to set charges for the agricultural use of water on the basis of socio-economic criteria, such as farm income or ability to pay (Dinar, 1998; OECD, 1999*g*). In the absence of other constraints, low charges encourage waste: using traditional techniques only about one-third of the water

**Box 23. The reform of Norway's subsidies to fishing**

"The period of support reduction has been characterised by improved stability in the sector. The variability in catch levels, value and value-added have all decreased since 1993. At first sight there seems to be a clear correspondence between the removal of support and the improvement in the health of key fish stocks. Between 1981 and 1996, support to the sector fell by 85%. At the same time, there have been remarkable improvements in the size of cod and herring fish stocks, up 110% and 1 040%, respectively. However, in the same period more-effective measures were introduced for managing the most important fish stocks. It is therefore difficult to isolate the relationship between reduction in transfers and the improvement of fish stocks."

Source: OECD (2000), *Transition to Responsible Fisheries: Economic and Policy Implications*, Paris, pp. 147.

withdrawn for irrigation actually reaches the crop. By contrast, drip irrigation – a technique that delivers water to crops directly – can sometimes cut water requirements in half. Nevertheless, although drip irrigation increased 28-fold between the mid-1970s and the early 1990s, it was still being used in less than 1% of the world's irrigated areas (Postel, 1993). Greater emphasis should be placed on encouraging farmers to adopt water-efficient irrigation technologies and techniques in order to mitigate future water scarcities and avoid further damage to aquatic ecosystems.

Under-pricing of industry-specific infrastructure raises three basic issues. First, it induces additional investment in related capital, either in the public or the private sector – *e.g.* extra fishing vessels or on-farm irrigation works. Second, where the resource is rationed, under-pricing penalises the most-efficient users. Third, it passes the cost of replacing worn-out infrastructure onto future generations.

Those replacement costs could be huge. Global investment in water services today – excluding investments made directly by industry – is estimated at USD 70-80 billion a year (Table 1). The annual rate of investment will need to more than double over the next 25 years. The situation is most serious in the developing countries, especially those undergoing rapid urbanisation. But considerable investments will be required in many OECD countries as well.

Several OECD countries are moving toward more complete recovery of infrastructure costs from users, though implementation has been slow. Greater transparency in the level of implicit subsidies (including cross-subsidies between

Table 1. Annual world-wide investment requirements for water resources

| Area                        | Billions of US dollars |                   | Share (%) |                   |
|-----------------------------|------------------------|-------------------|-----------|-------------------|
|                             | 1995                   | 2025 <sup>1</sup> | 1995      | 2025 <sup>1</sup> |
| Agriculture                 | 30-35                  | 30                | 43-50     | 17                |
| Environment and industry    | 10-15                  | 75                | 13-21     | 41                |
| Water supply and sanitation | 30                     | 75                | 38-43     | 42                |
| Total                       | 70-80                  | 180               | 100       | 100               |

1. Estimate.

Source: Cosgrove, W.J. and F.R. Rijsberman (2000), *World Water Vision: Making Water Everybody's Business*, Earthscan Publications for the World Water Council, London, <http://www.watervision.org/>.

users) provided through under-charging for the use of infrastructure could help to build up momentum for further reforms.

### Creating new markets

Clearly-defined and secure property rights are necessary, though not always sufficient, conditions for ensuring that natural resources are exploited by those users who can put them to their highest-valued use. The specification of property rights helps to clarify who is responsible for the negative environmental consequences of resource-use or pollution, as well as who should be rewarded for enhancing those resources. Without adequate property rights, users may have little incentive to protect a resource, or may even have an incentive to degrade it (Box 24).

There are, however, several limitations to natural resource management approaches based on the trading of property rights. For example, it is difficult to establish secure rights to resources that cannot be clearly defined (*e.g.* bio-diversity), or are mobile (*e.g.* migratory birds). Trading systems also require strong institutional support, and are not always popular with local communities because of the distributive effects associated with the explicit assignment of rights. Nevertheless, the use of property-rights-based approaches in some natural resource management contexts is already occurring (OECD, 1999c and 1999e), and opportunities exist to expand their use into other areas.

One such area is water. Several OECD countries have introduced limited schemes for the trading of rights to consume or divert specified volumes of water. These schemes are most common within the agriculture sector, especially in semi-arid regions and where the institutional support necessary to administer the trading programme already exists. Australia and the United States have also experimented with tradable permits for inputs to water quality. Though trading water or water-pollution rights is not always simple to implement, and needs to be assessed on a case-by-case basis (in particular when inter-basin bulk movements of water are contemplated), it should be more extensively used.

Box 24. **Property rights and fisheries**

Access to fisheries resources has traditionally been managed in “open-access” regimes, where there are no constraints on any actor’s ability to harvest the resource. Under such regimes, no individual fisher has an incentive to leave fish in the sea to grow and reproduce, because each fisher can gain from harvesting the fish but would have to share the benefits of restraint with others. Competition then tends to drive fish stocks below optimum levels (*i.e.* the stock that would yield the maximum returns for the group as a whole).

In responding to this problem, most OECD governments over the last several decades have introduced input controls, such as limited licenses, and output controls, such as a total allowable catch (TAC) limits (and frequently both) to manage their marine fisheries. In addition, several countries have divided their TACs between vessel groups and individual vessels. To be effective, any management system must ensure that a sufficient number of fish are left in the sea to grow and, by spawning, to replenish those that are taken out of it. Too often, however, governments have set TACs at levels higher than those proposed on the basis of scientific advice, resulting in fishing mortality rates in excess of precautionary levels (see, *e.g.*, CEC, 2001).

As an alternative to direct regulation, a few countries have developed “rights-based” systems, such as individual tradable quotas (ITQs), to manage some or all of their commercial fisheries. These systems have helped to reduce fishing pressure on stocks, while providing economic incentives for responsible behaviour. ITQs work best when they are complemented by other measures to regulate fishing, such as limits on mesh-size that protect juvenile fish. On the other hand, an ITQ is neither the only nor always the best tool for every situation. For example, community-based management of coastal fishery stocks (*e.g.* lobster fisheries) has been shown to work well in some cases (OECD, 1997b).

**Ensuring an adequate supply of environmental services**

Many environmental values associated with privately-owned natural resources are actually public goods. For example, private farmland may provide habitat for wildlife, and sinks for atmospheric carbon (OECD, 2001f). The values of these services typically cannot be appropriated by individual landowners, though compensating producers for them should be considered only where there is a problem of under-supply. If under-supply is a problem, and payments or other financial incentives are warranted, they should be clearly related to the public benefits being provided, and should avoid weakening the intrinsic motivation of people to behave in an environmentally responsible manner (Frey, 1997). The basis for the incentive, the

### Box 25. Payments for environmental services: forestry and agriculture

Payments to compensate forest owners for conserving biologically rich habitat exist in many OECD countries. In Finland, for example, the Act on Financing Sustainable Forestry came into force in 1998. At the EU level, the *Natura 2000* Directive provides for payments to forest owners (although the level of these payments has not yet been determined). In New Zealand, some indigenous people are compensated for not harvesting wood in natural forests that they own. In the United States, one-time payments may be granted to forest owners under various contractual and easement programmes.

Policy-makers are also paying increasing attention to environmental amenities in agriculture. These include habitat for symbiotic plants and animals that depend on agricultural land for food or shelter, as well as landscape and recreational opportunities and flood control. Research is also helping to identify low-cost practices that can increase biodiversity without unduly reducing crop and livestock production. As in forestry, many countries now compensate farmers for income losses resulting from application of these practices.

OECD (1999), *Handbook on Incentive Measures for Biodiversity: Design and Implementation*, Paris.

compliance criteria, and the conditions for extending the contract, should also be made explicit.

To protect certain rich or endangered ecosystems, it may also be necessary to set-aside specific areas, rather than to regulate their use. Governments may therefore decide to keep or purchase title to such land, as they have been doing for decades. However, outright purchase can be expensive. As an alternative, several countries are compensating private landowners for giving up particular rights to development (*e.g.* agreeing to leave wooded areas on their properties intact for the benefit of wildlife). Such conservation easements offer governments – and charitable land trusts – a way to secure ecosystem services at lower cost than outright purchase, although monitoring and enforcement costs may still have to be incurred (Box 25).

### Dealing with adjustment problems

The transition from one natural resource management regime to another often meets resistance, usually from those who are reluctant to give up a rent that had been previously established. The transition process is further complicated by the long history of some of the industries involved, and by the complex web of

laws, traditions and property rights that have evolved around them. For example, inappropriate subsidies, repeatedly granted over an extended period of time, create expectations about their continuation. These expectations can be difficult to change.

An estimated 40 million workers (including 32 million farmers) are directly employed in primary industries in OECD countries. Many of these workers have specialised skills, but low levels of formal education. Because the activities of primary industries tend to be carried out in rural areas, alternative local employment opportunities for their workers may be limited. OECD work on agriculture (OECD, 1994) and fisheries (OECD, 2000<sup>h</sup>) has stressed the importance of re-deployment measures and training for redundant workers; of ending policies that encourage young people to seek employment in industries that lack a sufficient resource-base to sustain them; and of developing new economic activities based on enhancing local environmental amenities. Re-deploying displaced workers to environmental restoration projects (as is happening in fisheries and uranium mining) can ease adjustment problems, and improve the environment at the same time. However, to avoid creating a dependency on short-term measures, countries need to have programmes in place that can help people move into more permanent employment elsewhere.

### **Improving resource efficiency and reducing waste**

An important objective for sustainable development is to de-couple economic growth from environmental pressures associated with that growth. More comprehensive approaches to natural resource management, involving such practices as life-cycle management, recycling, and material flow analysis, can contribute to that goal.

The most critical problem relating to materials nowadays occurs at the back end of the cycle rather than the front. As the volume of waste generated by society has increased, and the costs of disposal have risen, governments have looked for various ways to prevent – or better control – the generation of waste, and to isolate its most hazardous forms from the environment. These interventions are aimed mainly at reducing waste flows, rather than pressures on the primary production of natural resources *per se*. Their effect, nonetheless, is to moderate the demand for raw materials, as well as the pollution and habitat disruption associated with their extraction, transformation, and disposal.

Governments are encouraging the recycling of materials through various measures: by shifting the composition of their own procurement towards products that generate less waste; by raising public awareness of ways to reduce household waste; by encouraging manufacturers and retailers to dispense with excess packaging; and by facilitating recycling. Market forces can also be harnessed in the

### Box 26. Reducing material flows in Japan

In 2000, Japan enacted a Basic Law for Establishing the Recycling-Based Society. This Law adopts a comprehensive view of the waste management problem – restricting the generation of waste, and then promoting the reuse, recycling, and appropriate disposal of products. The Law also envisages a society-wide effort toward reducing the throughputs of natural resources; national and local governments, business, the public-at-large, non-governmental organisations, and educators all contribute to the effort. Finally, the Law also supports the notion of “extended producer responsibility”. Other, complementary, laws have also been revised. For example, the “Law for the Promotion of Utilization of Resources” now requires business enterprises to actively look for ways to reduce waste and enable re-use or recycling at the initial stages of product design and manufacturing.

service of waste reduction, for example by setting fees for waste disposal that reflect full costs, including externalities. Provided the incentive structure is right, many current waste streams could become useful industrial inputs, in some cases through voluntary arrangements between firms. The development of chicken-litter power stations in the United Kingdom, and of the Kalundborg, Denmark industrial park, are just two examples (Desrochers, 2000). However, not all industrial waste can be dealt with in this way, and some countries have tried other approaches to minimise waste flows – *e.g.* by holding businesses responsible for taking back certain waste products for recycling when consumers are finished with them (Box 26).

Policies to encourage recycling (and composting of organic material) among the public at large have proved most successful in cities and countries with dense settlement patterns and limited waste disposal options. Many cities provide infrastructure to encourage voluntary recycling (*e.g.* glass and aluminium containers); some have even earmarked revenues from the collected material for popular causes, such as cancer research. Before considering implementing mandatory recycling, however, governments should carefully analyse the likely material and energy flows, and markets for recycled products, to ensure that its benefit/cost ratio is greater than that of a comparable voluntary programme.

### Helping developing countries to better manage their own natural resources

Managing natural resources effectively requires, at a minimum, educated people and sufficient funds for research, monitoring, and enforcement. Many developing countries, although richly-endowed in natural resources, do not have

the capacity to ensure that those resources are used properly, much less protected from over-exploitation. OECD countries can play an important role in developing or enhancing that capacity in many ways, for example by helping them to: finance training and the acquisition of technologies needed for effective management;<sup>53</sup> diversify their economies, notably in rural areas; clarify property and tenure rights over natural resources, including those of indigenous communities; and develop fair and equitable rules for the sharing of the benefits arising out of the utilisation of natural resources, including genetic resources. Such improvements are important for the developing countries themselves, but also for the developed world, particularly as the consequences of poor resource management in regions with vulnerable ecosystems could trigger broader environmental problems that would ultimately be more costly to deal with than to prevent.



## Notes

1. The Rio Conference on the Environment and Development (UNCED) in 1992 – which approved Agenda 21, the Rio Declaration and a number of conventions – provided much of the impetus to work on sustainable development at the international, national, and local levels. Responses included the adoption of sustainable development strategies in several countries, and the establishment of the UN Commission on Sustainable Development to follow-up progress in the implementation of the Rio Commitments.
2. For example, policies to establish a robust and dynamic financial system – subject to effective supervision and regulation – make a vital contribution to sustainable development, by contributing to improved economic results and enabling economies to deal with structural problems. See OECD, 2001*d*.
3. For example, human capital has been shown to be a significant determinant of economic growth, with one additional year of schooling leading to about 6% higher GDP in the long run. Policies to adapt educational and training systems to changing skill requirements, as well as measures to re-organise work within firms, are also essential for countries to take advantage of the growth potential of the “new economy” (OECD, 2001*g*).
4. Social policies which give priority to integrating transfer recipients into employment – through investment in their capacities to participate in a modern economy – provide one example of policies to increase the coherence between social and economic goals.
5. In non-OECD countries, energy demand and distance travelled by motor vehicles are expected to increase by 113% and 240%, respectively.
6. Over the period 2000 to 2020, the share of non-OECD countries in world GDP (at market exchange rates) is expected to increase from less than 20% to 25% (OECD, 2001*b*).
7. The “ecological footprint” index of WWF *et al.* (2000) measures the hectares of the biologically-productive area required to produce the food and wood people consume, to give room for infrastructure, and to absorb the carbon dioxide emitted from burning fossil fuels. By this measure, the ecological footprint of OECD countries, per person, is almost 4 times larger than in non-OECD ones.
8. For example, several international agreements relating to living marine resources, such as the *Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas*, have not yet come into force (see OECD, 2000*h*). Similarly, the *Agreement for the Implementation of the Provisions of the Convention relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks*, which forms an integral part of the FAO Code of Conduct for Responsible Fisheries, has so far been ratified by only 19 countries; 25 ratifications are needed for the agreement to enter into force.

9. The “Living Planet Index” – developed by WWF, UNEP and other agencies – is a simple average of three indexes measuring changes in the population of animal species in forest, freshwater and marine ecosystems (WWF *et al.*, 2000).
10. This is the maximum amount of a renewable resource that can be harvested over an indefinite period without causing its stock to be depleted, assuming that removals and natural mortality are balanced by stable reproduction and growth.
11. Water stress is considered to be medium-high (or high) when the ratio of water withdrawals, minus water returns, to the stock of renewable water resources exceeds 20% (or 40%) (OECD, 2001*h*).
12. Environmental hazards to human health have traditionally been linked to household access to clean water, community sanitation, maternal conditions and nutritional deficiencies. Current health risks are also associated with industrial and agricultural emissions to water, air and food, which can lead to respiratory and cardiovascular diseases, cancers and other maladies.
13. Infectious diseases are already imposing a devastating toll on some of the poorest countries. Life expectancy at birth in the 29 African countries most affected by HIV is projected to decline from above 50 years in the early 1980s to 47 in 2000-2005, 9 years less than would have been expected in its absence ([www.popin.org/pop1998/6.htm](http://www.popin.org/pop1998/6.htm)).
14. These goals cover economic well being, social development and environmental regeneration. Goals are formulated for halving the proportion of individuals living on less than USD 1 per day by 2015; for securing universal primary enrolment of children by 2015; for eliminating gender disparities in primary and secondary education by 2005; for reducing by two-thirds infant and child mortality by 2015; for lowering by three-fourths maternal mortality by 2015; for providing universal access to reproductive health services by 2015; and for implementing national sustainable development strategies by 2005, so as to reverse loss of environmental resources by 2015 (IMF *et al.*, 2000).
15. The idea of “precaution” is already referenced in several instruments at the international level. Different terms have arisen in the negotiation of these texts to give effect to this idea (*e.g.* “precautionary principle”, “precautionary approaches”, etc.).
16. Market-based instruments include an array on measures, such as environment-related taxes, tradable permits, charges, performance bonds, non-compliance-fees, performance bonds, liability payments, and natural resource pricing (see OECD, 2001*m*, chapter 5). The discussion below focuses on the first two types of instruments because the potential for their use seems largest. Natural resource pricing is further discussed in Chapter 7 of this Report.
17. For further elaboration of these points, see OECD, 2001*c*.
18. Environment-related taxes are defined as payments to *general government* that are *compulsory* and *unrequited* (*i.e.* benefits to taxpayers are not proportional to their payments). In co-operation with the European Commission and the IEA, the OECD has developed an online database of environmentally-related taxes in OECD countries. This database, which provides information on tax rates applied to more than 1750 tax bases, and on more than 850 exemptions and refund mechanisms, includes all energy and transport taxes of major relevance to environmental protection.
19. In several countries, taxes differentiated according to environmental criteria on gasoline (between leaded and unleaded) and diesel fuels (between ordinary and ultra-low sulphur) have led to a reduction in the use of the most-polluting fuels. However, the existing differential treatment between gasoline and diesel is usually harmful for the

environment, as diesel fuel (which is more lightly taxed) causes more local air pollution than gasoline. Other countries have introduced differentiated vehicle taxation, adjusted to specific vehicle characteristics.

20. This characterisation applies to so-called “cap-and-trade” systems. Under “emission-reduction-credit” systems, in contrast, credits are earned for emission reduction in excess of firm-specific baselines.
21. Practical guidelines for the implementation of domestic tradable permit schemes are provided in OECD, 2001*k*.
22. For example, in the fisheries sector, most governments have limited the trading of fishing rights within national borders, while others have imposed restrictions on the total amount of permits that could be transferred outside the affected community.
23. Many of these observations, however, are based on partial equilibrium studies. Better models for quantifying the environmental effects of subsidies from a general equilibrium perspective are still needed.
24. Simulation results suggests that eliminating energy subsidies in 8 major non-OECD countries could reduce their energy consumption and CO<sub>2</sub> emissions by 12% and 16%, respectively (IEA, 1999).
25. Model simulations of the effects of agricultural subsidy removal in OECD countries suggest a decrease in the volume of irrigation water of about 10%, a fall in agricultural nitrogen loading of waterways of some 6%, and small reductions in methane emissions (OECD, 2001*h*).
26. For example, it has been estimated that, in the United States, over one-quarter of federal farm subsidies paid over the period 1985 to 1994 accrued to the top 2% of producers (Cook *et al.*, 1995).
27. For example, “leakage” may be a problem in the case of global environmental problems when the countries to which production is transferred are not participating in mitigation agreements. In the case of climate change, OECD analysis based on general equilibrium models suggests a rate of “carbon leakage” in a range between 20% and 2%. However, loss of competitiveness of energy intensive industries is found to be much less important than what would happen in international energy markets (see Chapter 7 in OECD, 2001*m*).
28. For example, the Global Reporting Initiative (GRI), established in 1997, is an international multi-stakeholder effort to create a common framework for the voluntary reporting of the economic, environmental and social impact of corporations, and (eventually) for any business, governmental, or non-governmental organisation. The GRI goal is to increase the comparability and credibility of sustainability reporting practices.
29. For example, the number of pollution-control agreements (by industry sector) in Japan increased from 1 990 in 1995 to 30 961 just a year later (OECD, 1999*f*).
30. Institutional processes to achieve policy integration at the international level are not dealt with at length in this report, although they are partly taken up in Chapter 5.
31. For example, in the United Kingdom, the government has issued such guidelines through its Chief Scientific Adviser, with the endorsement of Ministers across government.
32. The Association for Agenda 21 and Sustainable Development is a non-governmental organisation comprising partners from municipalities, the business sector, NGOs and other public authorities.
33. See [www.heidelberg.de](http://www.heidelberg.de).

34. See, for example, OECD (2001*g*).
35. For example, catalytic converters have been mandated on automobiles in some countries, in order to reduce tail-pipe emissions of carbon monoxide, volatile hydrocarbons, and nitrogen oxides. Yet these devices generate some nitrous oxide (N<sub>2</sub>O) – a powerful greenhouse gas – and impose an energy penalty on engines. As with many technologies, however, the benefits of the catalytic converters may still outweigh their unintended consequences.
36. Surveys of OECD government expenditure on research directed explicitly at the environment suggests that it accounts for about 2% of total government R&D budgets – 5% of the total when environment-related research in fields such as energy, agriculture and the atmosphere are included. These numbers are imperfect indicators of actual expenditure related to sustainable development, given the breadth of the objectives it encompasses. Greater detail in the reporting of publicly financed R&D could improve evaluations of its consistency with sustainable development objectives.
37. Evidence from OECD countries suggests that the positive effects of this type of support may only increase up to a subsidisation rate of 13% of total business R&D expenditure, and decline beyond that point. Above a subsidisation rate of 25% additional public expenditure appears merely to substitute for private funding (Guellec and Pottelsbergh, 2000).
38. For example, the unit cost of generating electricity from wind turbines, which have been developing rapidly over the last 20 years, has fallen by over 80% (IEA, 2000*b*).
39. There may also be positive, knowledge-based, externalities generated by the learning process itself, but these are not considered here.
40. It is sometimes hard to tell whether government support is motivated by the objective of encouraging cleaner production methods, or to boost production in another domestic industry that will itself be a customer for the new technology. For example, many of the coal technology demonstration programmes initiated by coal-producing OECD countries in the early 1990s were designed to use domestic solid fuel as feed-stocks, rather than cleaner, and often cheaper, imported coal (Steenblik and Coroyannakis, 1995).
41. For an overview of the environmental issues discussed in this section, see OECD (1998*b*).
42. For an overview of the social issues discussed in this section, see OECD (2000*c*) and Brown (2001).
43. The Preamble to that Protocol notes: “i) Recognising that trade and environment agreements should be mutually supportive with a view to achieving sustainable development; ii) Emphasising that this Protocol shall not be interpreted as implying a change in the rights and obligations of a Party under any existing international agreements; iii) Understanding that the above recital should not be interpreted to subordinate this Protocol to other international agreements.” (See [www.biodiv.org/biosafe/protocol/protocol.htm](http://www.biodiv.org/biosafe/protocol/protocol.htm)).
44. Current work at the World Bank stresses the need to “... integrate environmental concerns into poverty alleviation and economic development strategies. ... Real, lasting poverty reduction is only possible if the environment is able to provide the services people depend on, and if natural resources are used in a manner that does not undermine long-term development.” (See [www.worldbank.org/environment/strategy](http://www.worldbank.org/environment/strategy)).
45. The Kyoto Protocol allows for some sinks to be used against Annex B mitigation commitments. Discussions are underway to clarify the coverage and extent of use in

Annex B countries, as well as possible coverage of sinks in other countries through the Clean Development Mechanism.

46. The countries listed in Annex B of the Kyoto Protocol are those with quantified emissions targets. They consist of OECD countries (except Turkey, Mexico and Korea); other Central and Eastern European countries; and Russia, Belarus and Ukraine.
47. The “Statement on Sustainable Development”, agreed by the IEA Governing Board in April 2001, stresses the importance of changing current energy trends through measures aimed at: *i*) safeguarding energy supplies; *ii*) promoting improvements in energy efficiency and development of non-fossil fuel technologies; *iii*) eliminating distortions in energy markets; *iv*) creating a stable framework for decision making; *v*) continuing to liberalise energy markets with appropriate protection for the environment and social welfare; *vi*) encouraging the systematic use of best technologies where energy investment is made; *vii*) participating in global efforts to extend electricity services in developing countries; *viii*) ensuring high safety standards; and *ix*) sponsoring R&D, information exchange and dissemination, to encourage commercial application and changes in consumer behaviour, as well as wider stakeholder involvement.
48. The value of outstanding medium- and long-term ECAs support from OECD countries was around USD 300 billion in the first half of 1999. More than 75% of the long-term credits went to transport and energy.
49. Marginal abatement costs are a measure of the USD price per tonne of carbon equivalent required to meet the Kyoto targets. Aggregate abatement costs can be expressed in terms of either changes in real income or of changes in real GDP; terms-of-trade effects account for the difference between these two estimates.
50. For example, with emission trading and an “egalitarian” distribution of permits – *i.e.* gradual convergence to equal emissions per capita – the real income of non-Annex 1 countries could be around 1% higher, on average, than under a “business as usual” scenario – when concentrations are stabilised at around twice the level prevailing in pre-industrial times (and 50% higher than the one observed today). However, even under this scenario, transfer payments from OECD countries could still be needed to compensate those individual developing countries that would be worse off after undertaking abatement policies (OECD, 1999*a*).
51. However, heavy reliance on a particular natural resource – especially one in which supplies are geographically concentrated – can put whole economies at risk unless safeguards against such disruptions are maintained. Oil is the pre-eminent vulnerable natural resource; most OECD countries have therefore sought to reduce their exposure to oil-supply disruptions.
52. Commonly, governments require mining and petroleum companies to post bonds in order to guarantee that sufficient funds are available to restore sites to near-original condition after extraction ceases.
53. Support to international agricultural research is of particular importance, and should focus on improved seeds and farming systems and on the needs and constraints of poor farmers in ecologically fragile or drought-prone areas, which tend to be neglected by private firms. It should build on the efforts of the Consultative Group on International Agricultural Research (CGIAR) co-sponsored by the Food and Agricultural Organization of the United Nations (FAO), and the United Nations Development Programme (UNDP) the International Bank for Reconstruction and Development (IBRD) and its network of agricultural research centres.

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