

# Highlights of the OECD Environmental Outlook



ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

## Preface

Just over three years ago, in 1997, OECD published a study entitled “The World in 2020 – Towards a New Global Age”. It gave a vision of the world economy in the year 2020, where governments and societies seize the challenge of realising global prosperity. In my preface to that Report I wrote that economic expansion of the kind envisaged by the New Global Age would bring the foreseen benefits only if pursued within the context of environmental sustainability. I pointed out that there was an urgent need to deal effectively with issues such as greenhouse gas emissions, hazardous waste production, megacity evolution, intensification of agriculture, timber and fisheries exploitation, and demands on freshwater. Following from this, it was only logical that Environment Ministers would ask the OECD for a forward-looking environmental strategy when they met in April 1998. And the OECD Environment Policy Committee wisely considered that such a strategy would only be credible if underpinned by a thorough analysis of how our use of natural resources and the quality of the environment may develop in the medium- to long-term future.

This OECD *Environmental Outlook* to 2020 provides the requested analysis. It presents an economy-based assessment of environmental pressures and conditions to 2020, indicates practical policy options to change the outlook in a more environmentally friendly direction, and analyses the potential economic and environmental consequences of implementing such policies. In preparing the *Environmental Outlook*, data collected throughout the OECD were used. The economic model was based on the one used in the 1997 study, and was combined with other models to provide projections on environmental pressures and conditions. Many OECD Directorates and affiliated agencies have contributed their experience and knowledge to the *Environmental Outlook*, ensuring that it is another good example of the unique ability of the OECD to provide high-quality cross-sectoral policy advice.

The *Outlook* also constitutes an important analytical background for the environmental pillar of the OECD-wide Initiative on Sustainable Development, and it has provided a substantial contribution to the Analytical Report and the Policy Report on Sustainable Development. The results of the *Outlook* are presented in such a way that a wide audience can find this study a worthwhile basis for thinking about the future of our environment.

In preparing for a New Global Age, it is becoming clearer that we don't own this world, but rather have borrowed it from our children and the generations that will follow them. We have responsibility to pass it on in a state which will allow them to fulfil ambitions similar to ours. Ambitions not only with respect to economic aspirations, but also in terms of living in good health and in a clean environment, without natural resources becoming scarce. The OECD *Environmental Outlook* provides a vision and a means for achieving these ambitions. However, the road to the future has more red and yellow lights than green ones. Were the late philosopher Lewis Mumford to review this *Outlook* he would likely repeat his famous observation of being “...optimistic about the possibilities; pessimistic about the probabilities”. I hope this *Outlook* will help to ring alarm bells in capitals around the world and inspire concrete policy implementation which will make us optimistic about both.

Donald J. Johnston

Secretary-General of the OECD



# 1. CONTEXT, VISION AND STRUCTURE OF THE REPORT

## Context

*OECD countries are taking stock of their environment.*

At the beginning of the 21st century, OECD countries are taking stock of their natural resources, the damage that is being done to the environment, and what actions they can take to ensure a clean, healthy and productive environment to pass on to future generations. This OECD *Environmental Outlook* provides an overview of developments in the economy to 2020, and examines how these will affect the environment, which policies can be used to address the environmental problems identified, and how the implementation of these policies would affect the economy.

*Developing an OECD Environmental Strategy,...*

In April 1998, OECD Environment Ministers adopted a set of Shared Goals for Action. This included an invitation to OECD “to develop a new environmental strategy for the next decade...”, a draft of which should be presented for consideration at their meeting in 2001. In order to support this exercise, the OECD Environment Policy Committee (EPOC) decided in November 1998 that the Strategy should be underpinned by an economy-based *Environmental Outlook* to 2020. As a basis for the identification of objectives to be outlined in the Environmental Strategy, the *Outlook* would also include an analysis of the policy options and potential policy packages that could be used to address the identified environmental problems and meet the objectives to be outlined in the Environmental Strategy.

*... requires an Environmental Outlook,...*

*... providing economy-based projections to 2020.*

While some outlooks have been produced by other international organisations (such as UNEP, 1997 and 2000; EEA, 1999; and UNCSD, 1997), the OECD *Environmental Outlook* is distinct in that it provides a detailed economy-based environmental outlook to 2020. It draws on the long experience and analysis by the OECD on economic and sectoral developments, and focuses on change in OECD regions, recognising that the OECD countries have a special responsibility for taking action on environmental problems and for achieving progress towards sustainable development. The *Outlook* contributes to the OECD work on sustainable development.

## The Outlook focuses on issues with high policy relevance

The *Outlook* does not exhaustively address all sectors and environmental issues of importance to OECD countries, but examines selected pressures and issues, focussing on those of highest policy relevance and for which information was available, both inside and outside the OECD.

The *Outlook* includes the following sections:

- *Section I:* Executive summary, context and structure
- *Section II:* Economic, social and technological drivers of environmental change
- *Section III:* Primary sectors and natural resources
- *Section IV:* Energy, climate change, transport and air quality

- *Section V:* Households, selected industries and waste
- *Section VI:* Selected cross-cutting issues
- *Section VII:* Institutional frameworks and policy packages for addressing environmental problems.

## Vision

*It starts from an economy-based vision of environmental issues,...*

The *Environmental Outlook* starts from an economy-based vision of environmental issues. It recognises that there are underlying economic, social and technological factors that drive the pressures on the environment and that most of these pressures arise from activities in specific economic sectors. In conjunction with high population pressures, the most significant drivers of environmental change over the next two decades will be continued economic growth (particularly in non-OECD countries), further globalisation of trade and investment, the use of new technologies (including information and communication technology) and changes in consumption patterns. Changes in these drivers could have both negative and positive effects on the environment, and policies will be needed to address the negative effects and encourage the positive effects.

*... in a period of changing policy context,...*

The broader context in which environmental policies operate has been changing in recent decades, and is expected to continue to evolve. Environmental problems that caused the greatest concern 20 to 30 years ago related to point-source pollution, with political interest being driven mainly by short-term public health concerns. The need for decisive political action was clear, and there tended to be more winners than losers from such policy actions. There was also relatively wide agreement on the policies that were needed (generally a ban on the offending pollutant or its containment), and progress was rapid. In effect, environmental policies were good by definition. The media coverage of environmental problems was extensive, but usually supportive, given the public health dimension of many of the underlying issues. There was also a general perception that existing institutions were capable of solving these problems. During this period, many of the most tractable environmental problems were “cherry-picked”, in the sense that the easiest issues were largely dealt with, leaving behind the more difficult (and more costly) questions to be faced in the future.

*... where attention has shifted from point-sources of pollution to non-point, or diffuse, sources.*

Attention has thus shifted from point-sources of pollution to non-point, or diffuse, sources, such as agriculture, motor vehicles and households. The number of actors with an effect on or interest in a given environmental problem has increased, complicating the policy task considerably. Awareness has also grown that environmental problems are very much part of a broader “system”, and cannot be viewed in isolation from that system. For example, deforestation is now seen as not just a forest management problem – it also increases erosion, alters flood risks, degrades water quality, and ruins fish habitat, as well as causing “rebound” effects on the economy by destroying the resource base. The diverse ecological services provided by the environment (as “sinks” for air and water pollutants, as habitats for commercial fisheries and wildlife, and as a fundamental source of life itself) have therefore gradually come to be recognised. Because of these more complex interactions, the urgency of some environmental problems seems less evident than in the past. After all, only few countries appear to be running out of water or land, and a key characteristic of many of the resource management problems is that they can be put off until later (“out of sight, out of mind”). As a result, there has often been a lack of a strong political constituency to lobby on behalf of these “new” environmental issues. Even where potential for lobbying exists, the issues involved are often so complex that they cannot be easily explained to the general public. As a consequence, media attention has declined in many countries.

*Environmental policies alone may not be sufficient.*

Climate change, biodiversity loss, acid rain and the thinning of the ozone layer all indicate that the world might be overexploiting the assimilative capacity of some of its natural resources. As these issues become broader and more complex, touching on every aspect of social and economic activity, it is becoming clear that environmental policies alone may not be sufficient to resolve them. Sectoral and economic affairs ministries, in particular, need to be actively engaged in the process of protecting the environment, together with the business community and environmental groups. In short, the focus has shifted away from simply “the environment” to “the environment in the context of sustainable development”.

*Environmental issues are likely to become increasingly complex,...*

As we look toward the future, environmental issues are likely to continue to become increasingly complex. The long-term nature of many environmental problems will become more apparent, as evidence grows of the accumulation of pollutants in ecosystems and of the gradual degradation of renewable resource stocks and quality. The role of these ecosystems in underpinning economic and social activity will become clearer, as will the need to examine the impacts of economic activities on ecosystems. Environmental “science” will therefore take on greater importance. On the other hand, the ability of science to deliver credible solutions to these problems is also likely to be called into question more often, and discussion about the need for “precaution” in dealing with environmental matters will probably intensify.

*... requiring integrated policy-making in a sustainable development context.*

We can also anticipate that decisions concerning environmental policy will increasingly have to be integrated with social and economic policy decisions in a sustainable development context. Two key messages will in particular need to be delivered to economic and social policy-makers. The first is the idea that the environment is a vital base upon which all economic and social activity ultimately depends. If this base is jeopardised, then these “derivative activities” will also be jeopardised. Second, it is no longer possible to completely separate economic and social policies from environmental needs, as if “someone else” were looking after the environment. In order to achieve full “policy integration”, policy-makers in the economic and social spheres will have to accept more environmental responsibilities (and *vice versa*).

### Sources of information and modelling

*The Outlook is structured using the PSR framework.*

The conceptual framework underlying the analysis and structure in the report is the OECD Pressure-State-Response framework (PSR). In this framework, “pressure” indicates pressures on the environment from human activities, “state” indicates changes in the state of the environment and its natural resources resulting from the pressures on the environment, and “response” indicates societal response to changes in the state of the environment.

*Projections are based on a macroeconomic model (JOBS), combined with the Polestar framework.*

The report examines the recent and projected future state of the environment to 2020 and the pressures exerted upon it. The projections to 2020 are developed using an OECD global, dynamic general equilibrium model (JOBS) to project economic developments in 12 regions and 26 different sectors, in combination with the Stockholm Environment Institute’s PoleStar framework to generate environmental projections. A Reference Scenario has been developed and is used throughout the report. Results of selected policy simulations are compared to the Reference Scenario.

*Data are drawn mainly from OECD sources.*

The quantitative data regarding recent past trends and the current state of the environment were primarily drawn from OECD environmental data and indicators, particularly the country data collected in the OECD *Environmental Data: Compendium 1999* (OECD, 1999). Data from outside sources (such as various UN bodies) were also used where in-house data were not available. The 1995 base year economic data used in the JOBS model were mostly taken from the GTAP (Global Trade Analysis Project) database developed at Purdue University.

*The modelling framework is used to analyse potential effects of policy packages.*

The Reference Scenario is based on current activities and recent trends. It does not take into account the adoption or implementation of new policies. The future population projections are based on UN median fertility projections, while the regional GDP assumptions are drawn from OECD Economic Department work. In addition to its application in developing the Reference Scenario, the modelling framework has also been used to examine the effects of particular environmental policies on economic and environmental conditions. While policy shocks were developed and analysed for particular sectoral pressures or environmental issues, and are described throughout the report, a “package of instruments” was also developed that combines some of the key policies for addressing the main environmental concerns of OECD countries in the next few decades.

## 2. KEY MESSAGES OF THE OECD ENVIRONMENTAL OUTLOOK

### The green, yellow and red lights

*The results of the analysis can be summarised using the symbols of traffic lights:*

Based on recent trends and the future outlooks described in the chapters, the report identifies the most pressing environmental concerns facing OECD countries over the next two decades, as well as some of the issues and pressures that are currently being addressed relatively well. The overall results of the analysis can be summarised in a general way using the symbols of traffic lights. More specific findings, including recent trends and projections to 2020 for economic sectors and environmental issues, are discussed in the chapters themselves.

*... the “green light”,...*



The “green light” signals pressures on the environment or environmental issues for which recent trends have been positive and are expected to continue in the future, or for which the recent trends have not been so positive, but are expected to improve. Green light responses have also been identified, signalling societal responses that help to alleviate environmental problems. For the “green lights”, current policy approaches in OECD countries thus seem adequate, but in most cases could be improved.

*... the “yellow light”,...*



The “yellow light” signals areas of uncertainty or potential problems. These relate primarily to environmental pressures and environmental issues for which current understanding is inadequate. “Yellow lights” are also attributed to societal responses that may help to alleviate the pressures on the environment, but for which there is uncertainty or concern regarding their effects (e.g. on human health or ecosystems). For the “yellow lights”, efforts should focus on better understanding the pressures and monitoring the state of the environment, and precaution is needed when addressing these issues or pressures.

*... and the “red light”.*



The “red light” signals pressures or environmental conditions for which the recent trends have been negative and are expected to continue, or for which the recent trends have been stable, but are expected to worsen in the future. The “red lights” need to be urgently addressed by OECD countries.

## Green lights: proceed with caution

*Some major improvements have been made or are expected,...*

*... including for some emissions to air,...*

*... point-source pollution from industries,...*

*... forest area and volume in OECD countries,...*

*... recycling of waste,...*

*... green purchasing and organic agriculture.*

For many years, OECD countries have been trying to tackle the environmental problems they face. For some of these problems, major improvements have been registered or are expected by 2020, such as decreasing emissions of some air pollutants, reversal of deforestation in OECD regions, and reductions in point source pollution from industry (see Table: Signals of the OECD *Environmental Outlook*). Thus, OECD countries have virtually eliminated lead emissions from petrol and their emissions of ozone depleting CFCs, and significantly decreased emissions of sulphur oxides, carbon monoxide and some particulate matter. Implementation of already agreed emission reduction targets in many OECD countries is expected to lead to further decreases in the emission of these pollutants to 2020.

The three industries examined in the *Outlook* – steel, pulp and paper, and chemicals – are examples of industries where increased efficiency and improved production methods are significantly reducing the intensity of resource use and the pollution and waste emitted per unit of product. In OECD countries, the introduction of efficient processes, pollution control systems and practises in these industries have contributed to the reduction of emissions and resource use per unit of production. With the further introduction of new technologies and increased efforts towards energy efficiency improvements in the steel, pulp and paper and chemicals industries, emissions to air and water, resource use and waste generation from production in these industries may not increase significantly in the period to 2020.

After centuries of deforestation, forested area and forest volume have begun to increase in most OECD countries over the last two decades, and are expected to remain stable in the OECD area to 2020, providing a large number of services to society, including economic benefits, environmental services and social benefits. In OECD countries, timber is increasingly being harvested from second growth and planted forests, reducing pressures on natural and old growth forests, and the areas of natural forest that are protected in national parks or reserves have expanded.

The share of waste that is diverted from landfill to recycling is continuing to increase. The further implementation of waste management policies is expected to lead to the reduction of the portion of municipal waste that is landfilled from 64% in 1997 to about 50% in 2020, while the recycling of municipal waste increase from 18% to 33%.

“Green” purchasing of environmentally friendly goods and services is gaining ground in many OECD countries, primarily as a result of increased consumer awareness and the use of information instruments, in combination with other measures, to stimulate environmentally friendly consumer decisions. Largely in response to health and environmental concerns, organic agriculture and other environmentally friendly farm practices are spreading rapidly in many OECD countries. Organic agriculture has been experiencing annual growth rates in excess of 20% in a number of OECD countries in recent years, although it still occupies less than 2% of total agricultural area in most of these countries.

## Yellow lights: require further investigation or additional action

*“Yellow lights”, signal uncertainty or potential problems, including,...*

Several environmental pressures and problems fall under “yellow lights”, which signal uncertainty or potential problems. One such issue is water use in OECD countries, which is continuing to increase in total, but has been declining per person in over half of the OECD countries since 1980, and is expected to continue to decline per unit of GDP to 2020. Similarly, while there have been significant improvements in surface water

quality in OECD regions, with many of the worst polluted water bodies having been cleaned up, few OECD countries satisfactorily meet basic water quality objectives.

*... ozone layer integrity,...*

Since the adoption of the Montreal Protocol in 1987, tremendous progress has been made in OECD countries in phasing out the production and consumption of substances that deplete the ozone layer. However, ozone-depleting substances are likely to remain in the stratosphere for a long time, and the ozone layer continues to become thinner as past emissions gradually reach the stratosphere and as emissions from some non-OECD countries increase.

*...and modern biotechnology.*

For many environmental concerns, available data or scientific understanding are inadequate. Effects on human health and ecosystem functions due to toxic and hazardous emissions from industry and other sectors are still uncertain and poorly understood. Furthermore, data on hazardous waste generation in OECD countries have not been reliably collected, so recent trends are difficult to discern, although there are some indications that hazardous waste generation has been increasing. Similarly, with respect to many aspects of modern biotechnology, the potential effects on both human and ecological health are still unclear (see Box 1).

While both aquaculture and plantation forests can help to alleviate pressures from increased demand for fish and forest products on the natural resource base (e.g. marine capture fisheries and old growth forests) through intensive production, both have potentially negative effects on local ecosystem quality.

#### Box 1. New technologies

Technological responses have lessened a number of environmental pressures in the past, and they can be expected to alleviate many – though certainly not all – of the expected future pressures. Most of the technological developments have been in the form of energy or resource efficiency improvements, practices or technologies to increase the level of renewable resources production (e.g. intensive forestry and agriculture, use of biotechnologies), or to reduce or eliminate the release of pollutants to environmental media.

In many fields, there have been new technological breakthroughs recently, and others are expected to occur in the period to 2020. These include new energy technologies, such as fuel cell technology, that can contribute to improving energy efficiency and reducing pressures on the environment.

Modern biotechnology, including genetically modified organisms (GMOs), have the potential to reduce the amount of damaging inputs (pesticides, fertilisers) used in natural resource sectors (agriculture, forestry, fisheries), and increase production levels to meet human needs. However, there may be negative effects on human health and on ecosystems; coping with these potential threats will require more research and improvements in risk management regimes.

### Red lights: need to be addressed urgently

*“Red lights” need to be addressed urgently.*

A number of environmental pressures and conditions are given a “red light” in the *Outlook*, signalling recent trends which have been negative and are expected to continue to 2020, or recent trends which have been more stable, but are expected to worsen. These are the major problem areas, and need to be addressed urgently.

*They include global environmental problems such as overfishing,...*

Many of the “red lights” relate to global issues – the state of environmental resources or sinks of global significance – for which OECD countries are only some of the users or polluters. Over-fishing is a clear example of a “red light” issue of global importance: one-quarter of the world’s marine fisheries are already either exhausted, over-fished, or recovering from over-fishing. All or most of the increases in demand for fish to 2020 will need

to be supplied through aquaculture, since marine capture fisheries show no signs of increasing yield. Instead, their yields are likely to remain stable or even decline.

... *biodiversity loss, tropical deforestation,...*

Global deforestation is another serious problem, as is biodiversity loss. Efforts in OECD countries to improve conditions at home – such as through afforestation programmes and the expansion of protected areas – are steps in the right direction, but insufficient to dominate the global trends, with non-OECD regions expected to lose almost a further 10% of their forested area by 2020.

Table: **Signals of the OECD Environmental Outlook**

			
<b>PRESSURES ON THE ENVIRONMENT</b>	<ul style="list-style-type: none"> <li>• Industrial point source pollution</li> <li>• Some air pollutants (lead, CFCs, CO, SO<sub>x</sub>)</li> </ul>	<ul style="list-style-type: none"> <li>• Water use</li> <li>• Toxic emissions from industry</li> <li>• Hazardous waste generation</li> <li>• Energy production and use</li> </ul>	<ul style="list-style-type: none"> <li>• Agricultural pollution</li> <li>• Over-fishing</li> <li>• Greenhouse gas emissions</li> <li>• Motor vehicle and aviation air pollution emissions</li> <li>• Municipal waste generation</li> </ul>
<b>STATE OF THE ENVIRONMENT</b>	<ul style="list-style-type: none"> <li>• Forest coverage in OECD regions</li> </ul>	<ul style="list-style-type: none"> <li>• Surface water quality</li> <li>• Forest quality in OECD regions</li> <li>• Ozone layer integrity</li> </ul>	<ul style="list-style-type: none"> <li>• Biodiversity</li> <li>• Tropical forest coverage</li> <li>• Fish stocks</li> <li>• Groundwater quality</li> <li>• Urban air quality</li> <li>• Climate change</li> <li>• Chemicals in the environment</li> </ul>
<b>RESPONSES</b>	<ul style="list-style-type: none"> <li>• “Green” purchasing</li> <li>• “Green” agriculture</li> <li>• Protected areas</li> <li>• Resource efficiency</li> <li>• Energy efficiency</li> </ul>	<ul style="list-style-type: none"> <li>• Biotechnology</li> <li>• Forest plantations</li> <li>• Aquaculture</li> <li>• Energy and transport technologies</li> <li>• Waste management</li> </ul>	

*... climate change,...*

Climate change as a result of greenhouse gas emissions is, arguably, one of the most important “red light” issues faced by OECD countries. Despite commitments by Annex I countries<sup>1</sup> to reduce emissions, the release of total greenhouse gases in OECD countries is expected to continue to increase to 2020, with emissions from non-OECD countries also growing rapidly, leading to increases in global mean temperatures and a rise in sea levels. Under current policies, OECD countries are likely to increase CO<sub>2</sub> emissions by a further one-third to 2020, far from the overall Kyoto Protocol target for Annex I countries of a 5% reduction of greenhouse gas emissions from 1990 levels to 2008-2012. Meeting Kyoto targets will require reducing greenhouse gas emissions in OECD countries by roughly 20% to 40% compared to the Reference Scenario projections. Stronger policies are urgently required if the worst effects of climate change are to be averted.

*... and urban air pollution,...*

Despite progress in reducing air pollution emissions in OECD countries, serious air quality and related human health problems persist in heavily industrialised and densely populated urban areas. Air quality standards for nitrogen dioxide, tropospheric ozone and fine particulate matter, as well as critical loads for acid rain and eutrophication depositions, are still exceeded in many OECD countries, and it is projected that this will continue to 2020.

*... to which energy use and transport are the main contributors.*

Energy use and transportation are the main contributors to greenhouse gas emissions, as well as to various air pollutants that lead to urban air pollution. If current policy patterns continue, the impacts on climate change of these activities are likely to continue in OECD countries and worldwide to 2020, with motor vehicle kilometres travelled in OECD countries expected to increase by 40% from 1997 to 2020, and passenger air kilometres expected to triple. Meanwhile, energy use in OECD regions is expected to increase by 35% to 2020.

*Groundwater pollution,...*

While groundwater pollution has not been a major concern for OECD countries in the past, it is increasingly becoming one now. Most OECD countries have been experiencing difficulties with the protection of groundwater quality, especially from non-point source pollution such as agricultural run-off. Thus, nitrate concentrations in excess of WHO drinking water guidelines are now widespread in aquifers in many OECD countries, and available evidence suggests that there is a trend towards a worsening of aquifer water quality in OECD regions. As human populations draw more and more upon groundwater sources for drinking water and other uses, the build-up of nitrates and other pollutants in these sources will pose a growing problem.

*... primarily from agricultural run-off,...*

Despite significant progress in recent decades, agriculture continues to be a major source of pollution to water, air and soil. Agricultural intensification has led to a higher energy intensity of agricultural production, pollution of ground and surface water by pesticides, fertilisers, and nutrients, increased soil erosion, and reduced habitat provision in OECD countries. In the period to 2020, total water use by agriculture in OECD countries is projected to increase by 15%, nitrogen and biochemical oxygen demand (BOD) loading to waterways from agriculture is projected to increase by more than 25% and methane emissions could increase almost 9% from current levels.

*... chemicals in environment,...*

Even though emissions from the production of chemicals have been reduced, releases of chemicals from the consumption and use of products will continue to result in

1. Under the UN Framework Convention on Climate Change (UNFCCC), Annex I (industrialised) countries have agreed to aim to limit their greenhouse gas emissions. Annex B of the Kyoto Protocol establishes legally binding greenhouse gas limitation commitments for almost all Annex I countries.

their widespread presence in the environment. Persistent and toxic chemicals could cause serious effects on the environment and human health over the next 20 years (see Box 2). Major efforts will be needed to test, assess and, where needed, manage the risks of endocrine disruptors.

*... and municipal waste generation are also “red lights”.*

The generation of municipal waste in OECD countries increased by around 40% between 1980 and 1997, amounting to about 540 tonnes in 1997. While the average growth rate seems to have slowed down in recent years, municipal waste generation is expected to keep growing in OECD countries over the next two decades, reaching an estimated 770 million tonnes annually by 2020.

### **Integrity of ecosystems**

*The integrity of ecosystems is threatened.*

Many renewable resources are used in unsustainable ways, threatening the integrity of ecosystems. As indicated by the “red lights”, there are now concerns that current fishing practices and levels are not sustainable in the long run, and that the diversity and catch of the world’s oceans may decrease to 2020. Human induced climate change is evident, and the effects on ecosystems are expected to be severe, including rising temperatures and rising levels of the world’s oceans. Biodiversity is threatened in OECD and non-OECD countries, and tropical forests are continuing to diminish. Furthermore, freshwater scarcity is becoming a problem in some regions and desertification, land degradation, and soil erosion are also threatening the health of ecosystems.

With the world’s population expected to increase by one-quarter to 2020, and economic growth and globalisation continuing steadily, human pressures on the environment are not expected to ease unless strong policy actions are taken to protect ecosystems and maintain the essential services they provide. In order to ensure ecosystem integrity over the long term, policies will be needed to secure detoxification of the substances released to the environment, decarbonisation of energy supply, conservation of biological diversity and the sustainable use of renewable natural resources.

### **De-coupling environmental degradation from economic growth**

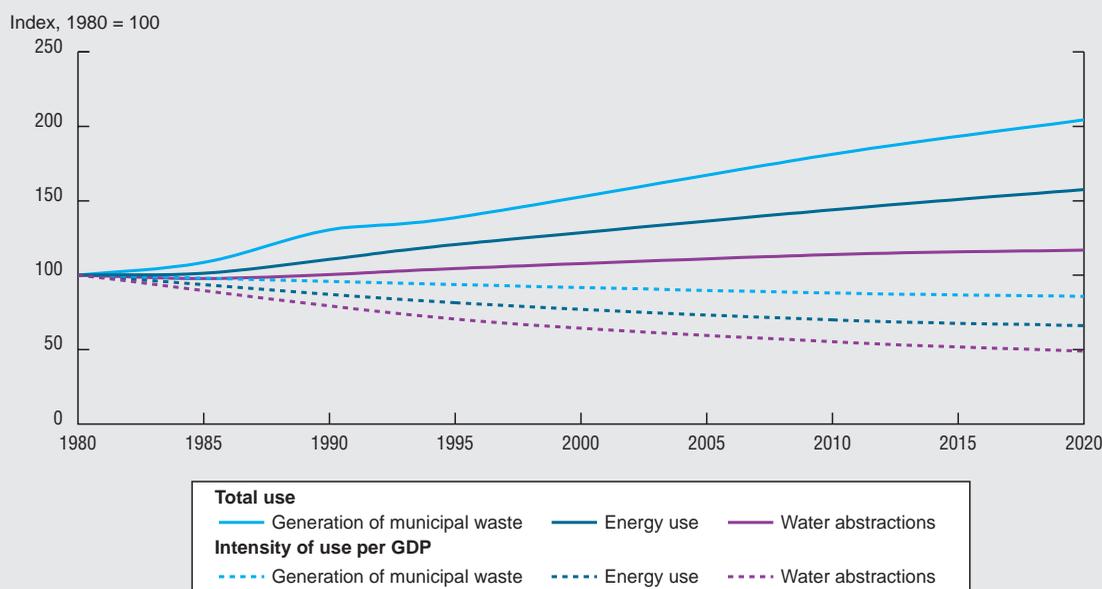
*Some de-coupling of environmental degradation from economic growth is expected,...*

In general, environmental degradation has increased at a slightly slower rate than economic growth. The use of energy and other resources, like agricultural inputs, water and metals, now appears to be increasing at a slower rate than GDP in many OECD countries, and the pollution intensity of output is growing even more slowly. These trends suggest a potential for de-coupling environmental degradation from continued economic growth. In some cases, reductions in resource intensity have been large enough to lead to absolute, rather than just relative, environmental improvements by offsetting the overall effects of growth in per capita incomes and population.

*... but will not be enough to outweigh the volume effects.*

However, overall environmental degradation has persisted in most areas, despite improvements in resource efficiency, as the volume effects of total increases in production and consumption have outweighed the resource efficiency gains per unit of product. Thus, following recent trends, OECD countries are expected to reduce the energy intensity of their economies by 20% to 2020, while increasing total energy use by 35% (see Figure 1). Even with the use of new, more efficient, energy and transport technologies, it is unlikely that total emissions from these sources will decrease much over the next two decades. OECD countries will need to achieve more significant changes in the fuel mix than are currently foreseen, with greater substitution of the more polluting fossil fuels by renewable resources and cleaner fuels.

Figure 1. Resource and material intensity of OECD economies, total use and intensity of use relative to GDP, 1980-2020



Sources: OECD (1999) and Reference Scenario.

## Addressing the social and environmental interface

*The social and environmental interface needs to be addressed.*

Perhaps some of the most significant effects of environmental degradation from a social and economic perspective are the effects on human health (see Box 2). Furthermore, it is often the poorest regions of the world and the poor communities in society that are particularly exposed to these effects, and that are the least able to access the benefits, resources and services that the environment provides.

### Box 2. Environment and human health

Environmental degradation can have a significant impact on human health, for example through increased asthma and respiratory diseases from urban smog, skin cancer from a thinner ozone layer, and poisoning through chemicals in the environment. Estimates of the share of environment-related human health loss are as high as 5% for high-income OECD countries, 8% for middle-income OECD countries and 13% for non-OECD countries. In total, environmental damage may be responsible for up to 6% of the total burden of disease in OECD countries. Air pollution and exposure to hazardous chemicals are important causes of the environment-related burden of disease in OECD countries. The transport and energy sectors are major contributors to air pollution, while important sources of chemical pollution are agriculture, industry, and waste disposal and incineration. In the period to 2020, the effects on human health of the widespread release of chemicals to the environment and of reduced air quality may worsen. At the same time, new environmentally related human health threats may emerge in OECD countries. The possible effects of climate change are a widely recognised future threat to human health, although their exact impact is not yet well understood.

Opportunities for reducing environment-related human health risks are considerable. The benefits of many environmental policies in terms of reduced health care costs and increased productivity significantly exceed the costs of implementing these policies.

Policies that are developed to protect the environment and manage natural resources should consider the distributive effects of environmental quality and access to natural resources and, of course, ensure that they do not further exacerbate these effects. Strategies for addressing distributive issues in environmental policy design are discussed in the *Outlook*, including measures to reduce any potentially regressive effects of environmental taxes or charges (*i.e.* where lower-income groups spend a larger proportion of their incomes on the tax or charge than higher-income groups).

In addition, the availability of and access to environmental information, opportunities for public participation and partnerships in environmental decision-making, and access to courts on environmental matters, is essential for enhancing public awareness of environmental issues and the implementation of widely supported environmental policies.

### 3. POLICY PACKAGES FOR ADDRESSING ENVIRONMENTAL PROBLEMS

#### Policy action: learning from the past

*What can policy-makers do to tackle these environmental problems?*

What can policy-makers do to tackle these environmental problems? For a start, they need to look at examples of where improvements have already taken place or are starting to happen. Improvements have often been linked to pricing incentives or regulatory intervention. Government regulations and restrictions have been particularly successful in reducing industrial pollution, cleaning up the worst polluted surface waters, and reducing the levels of some air pollutants.

Many of the issues identified as “red lights” are problems of sharing the use of global resources or sinks, such as biodiversity loss, over-fishing and the release of greenhouse gases. While unilateral action can help to alleviate some of the pressures on these resources, strong internationally co-ordinated policies will be required. A number of the other “red lights” are the result of diffuse sources of pollution – *e.g.* poor urban air quality, the dispersion of chemicals in the environment, and groundwater pollution – which are difficult to tackle because they come from large numbers of dispersed or mobile sources (cars, farms, consumers). In many cases it is difficult to identify the particular source of the pollution, and thus to design regulations or policies to directly address the problem. Increasing the availability of and access to environmental information, as well as increased public participation in environmental decision-making processes, can help to improve understanding of environmental issues and increase support for environmental policy development.

*Comprehensive packages of policy instruments will need to be adopted in OECD countries.*

Comprehensive packages of policy instruments will need to be adopted in OECD countries to successfully address the “red lights” identified throughout the *Outlook* – *i.e.* the environmental pressures and conditions that most urgently need attention by OECD countries. Because of the complexity of many of the most urgent pressures on the environment, their often inter-connected nature, and the limited understanding of some of their causes and effects, single policy instruments will seldom be sufficient to effectively resolve these problems. Instead, combinations of policy instruments will be required which target the range of actors affecting the environment, draw on synergies for realising the different environmental policy objectives and avoid policy conflicts, and which address any social or competitiveness concerns about the policy instruments.

*The Outlook outlines “policy packages” to tackle the most pressing problems.*

The *Outlook* outlines “policy packages” or combinations of instruments – regulatory, economic, and others – that can be used to tackle many of the most pressing environmental problems. The policy mix suggested here involves the combination of a robust regulatory framework with a variety of other instruments, such as stronger pricing mechanisms to influence the behaviour of consumers and producers, voluntary agreements, tradable permits, eco-labels and information-based incentives, land use regulations and infrastructure provision. In particular, the *Outlook* recommends the removal of environmentally harmful subsidies and a more systematic use of environmental taxes, charges and other economic instruments to get the prices right.

*The policy packages required will include a combination of policies.*

The appropriate policy packages will need to be carefully designed in order to achieve the desired environmental objectives in the most cost-effective manner. Policies will be needed which deal with intervention failures, such as inefficient subsidies or poorly designed regulations, and with market failures that stem from the non-internalisation of environmental costs in the market or the lack of markets for particular resources or environmental services, such as biological diversity. The policy packages required to address the identified “red light” problems will in general include a combination of:

- *economic instruments* – taxes, charges and fees, the reform of environmentally damaging subsidies, transferable permits;
- *regulatory instruments* – standards, licenses, permits, regulations, restrictions;
- *voluntary approaches* – negotiated agreements, unilateral commitments, public voluntary commitments;
- *incentives for technological development and diffusion*; appropriate pricing signals, regulations, support for research and development;
- *information-based instruments* – data collection and dissemination, indicators, information provision, valuation, education and training, eco-labelling; and
- *other policies* – zoning and land-use planning, infrastructure provision.

*Many of these would need to be implemented outside environment ministries.*

These packages are not limited to only those policy instruments that are available to environment ministries. Many of the instruments discussed here would need to be implemented either by, or in co-operation with, authorities outside environment ministries. The co-operation of finance authorities is needed to implement environmental taxes, as is the co-operation of sectoral authorities to implement policies which affect these sectors, particularly agriculture, fisheries, forestry, energy, transport, and selected industries.

### **A policy package for the primary sectors and selected natural resource issues**

*A policy package for primary sectors and selected natural resource issues,...*

The *Outlook* presents a package of policies OECD countries could adopt to help address the most pressing environmental issues relating to primary sectors and natural resource use – in particular, agricultural pollution, the contamination of groundwater resources, overfishing of the world’s marine fish stocks, tropical deforestation, and global biodiversity loss.

A simulation was undertaken in the *Outlook* modelling framework to indicate the potential effects of removing subsidies to primary sectors and the use of natural resources in OECD countries. All the subsidies to the agriculture, forestry, fisheries, and water supply sectors, and to the use of products from these sectors, were removed in the simula-

tion.<sup>2</sup> Despite the large levels of support that are listed as going to the sectors, the database used still does not reflect all the support to these sectors and natural resource use. Given the underestimation of total subsidy levels in the model, the results of the policy simulation should be considered only as an indication of the direction, and rough minimum level, of the effects that might be obtained from subsidy removal in the sectors concerned.

*... could lead to significantly lower water use and nitrogen loading.*

The effects of the subsidy removal are estimated to be positive for the environment in OECD regions. Thus, total irrigation water use in OECD countries would be expected to be about 11% lower in volume terms in 2020 compared with the Reference Scenario projections, while nitrogen loading to waterways from agriculture (through fertiliser use and livestock waste) would be about 6% lower. Methane emissions (both from rice and livestock production) are also estimated to be lower in 2020 than projected in the Reference Scenario, but only marginally.

*Introducing a tax on chemicals used by agriculture, in addition to the subsidy removal, would have strong effects.*

Another model simulation was made reflecting the introduction of a tax on chemical inputs used by agriculture (e.g. fertilisers, pesticides), in addition to the subsidy removal described above. The tax was set as an *ad valorem* tax on chemical inputs to agriculture in OECD regions that increases by 2 percentage points each year, such that it would be equal to a 50% tax on these inputs by 2020. This simulation led to particularly strong effects in the emissions of nitrogen from crop production in OECD regions, indicating that such a tax might lead to significant decreases in nitrogen-loading of waterways from agricultural run-off and nitrous oxide (N<sub>2</sub>O) emissions (a greenhouse gas) from agricultural soils. Although not quantified in the modelling framework, one can assume that such a tax would also lead to reductions in pesticide use. The estimated effect on real GDP in OECD regions of removing the primary sector subsidies as described above and adding this tax was negligible.

### **A policy package for climate change, air pollution, and the energy and transport sectors**

*Dealing with these “red lights” will require a comprehensive policy package.*

Moving the sectors and issues of energy, climate change, transport and air pollution out of the “red lights” category will require a comprehensive policy package. Such a package should include a combination of economic instruments (subsidy and tax reform, introduction of new taxes or charges, and wider use of tradable permits systems), a strong regulatory framework (particularly for setting air quality targets or standards), the promotion of voluntary or negotiated agreements, and the use of information-based policy tools to encourage more sustainable energy consumption and production patterns.

Again, because of the limited estimates of energy and transport subsidies reflected in the model, the effects of a policy simulation to remove these subsidies was understandably also small. However, previous OECD analysis has shown that a targeted reform of energy and transport subsidies in OECD countries could significantly reduce greenhouse gas emissions without increasing overall economic and social costs (OECD, 1998). OECD case studies indicate that energy subsidy reform could reduce CO<sub>2</sub> emissions in the range of 1-8% of energy-related emissions at the national level, while also improving economic performance (OECD, 1997). Case studies also indicated that transport subsidy reform could reduce emissions from that sector by 10-15%.

2. These correspond to subsidies listed in national accounts, as summarised in the GTAP database (Version 4) used in the JOBS model. Because of a lack of disaggregation of the subsidies in the database, it was not possible to simulate the results of removing environmentally damaging subsidies alone. Instead, all the subsidies listed were removed for the exercise.

***Subsidy reform is needed.***

At a minimum, subsidies that support the use of fossil fuels over other, less environmentally damaging, fuels should be reformed to “level the playing field”. As the share of nuclear fuel in the fuel mix of OECD countries is expected to decrease over the coming decades, actions will need to be taken to ensure that this is replaced with environmentally sound alternatives.

***Removing subsidies and introducing a tax on fuel use would reduce emissions significantly.***

A model simulation was undertaken reflecting the removal of the subsidies to energy and transport listed in the modelling database, combined with the application of a yearly increasing *ad valorem* tax on fuel use in OECD countries whose increase is linked to the carbon content of the fuels. The tax was thus set to increase by 2, 1.6 and 1.2 percentage points per annum for coal, crude oil and natural gas respectively. The tax rate thus reached the level of 50%, 40% and 30% of pre-tax prices respectively in 2020.<sup>3</sup> According to this simulation, implementing the combined subsidy removal and fuel tax policy package in OECD countries would reduce CO<sub>2</sub> and SO<sub>x</sub> emissions in OECD regions in 2020 by as much as 25% each compared with the Reference Scenario. The simulation indicated only a small leakage effect of emissions to non-OECD countries, with resulting worldwide CO<sub>2</sub> emissions 11% lower and SO<sub>x</sub> emissions 9% lower in 2020 compared with the Reference Scenario.

### **A policy package for households, selected industries and waste**

***Waste generation and chemicals in the environment need to be addressed urgently.***

Many of the pressures and issues examined in the chapters of the *Outlook* on households, selected industries and waste are “green lights” or “yellow lights”. However, two “red light” pressures remain from these issues and sectors – municipal waste generation and the widespread release of persistent and toxic chemicals to the environment. Decoupling waste generation from economic growth will be a major challenge. To a large extent, addressing this problem will require policies that address both production processes (particularly packaging practices), and consumer behaviour. Tackling the problem of persistent and toxic chemicals in the environment will require a comprehensive package of policies that provides the right incentives for the various down-stream actors to reduce their release of chemicals.

Economic instruments, such as user charges on municipal solid waste collection and treatment, are already widely used in OECD countries but their rates are, in general, too low to influence consumer behaviour. Economic instruments for addressing problems of toxic and persistent chemicals in the environment are less widely used in OECD countries, and their potential applications are more limited.

***A tax on chemicals use, combined with removal of subsidies, would lead to noticeable effects.***

While it was not possible in the modelling framework to apply a tax on waste generation or a tax on the use of toxic or persistent chemicals only, a simulation was undertaken to examine the effects of a tax applied across all chemicals use, combined with the removal of all subsidies to the manufacturing sectors. The environmental benefits of this policy package are most noticeable in the chemicals industry, but they would affect the other manufacturing industries as well. Water use by the pulp and paper industry would be expected to be 3% lower in 2020 than under the Reference Scenario, while CO<sub>2</sub> and SO<sub>x</sub> emissions would be 4-5% lower for both the steel and pulp and paper industries in OECD countries. A more significant reduction (roughly 22-24%) is expected for the chemicals industry for the pressures under the policy simulation, including energy use, CO<sub>2</sub> and SO<sub>x</sub> emissions, and water use.

3. For technical reasons, the policy simulation is related to the pre-tax prices of the fuels, and not directly to the carbon content of each fuel, and so does not, strictly speaking, reflect a “carbon tax”.

### Assessment of a combined policy package to address all the “red lights”

*A combined policy package, with subsidy removal and taxes on fuel use and chemicals use,...*

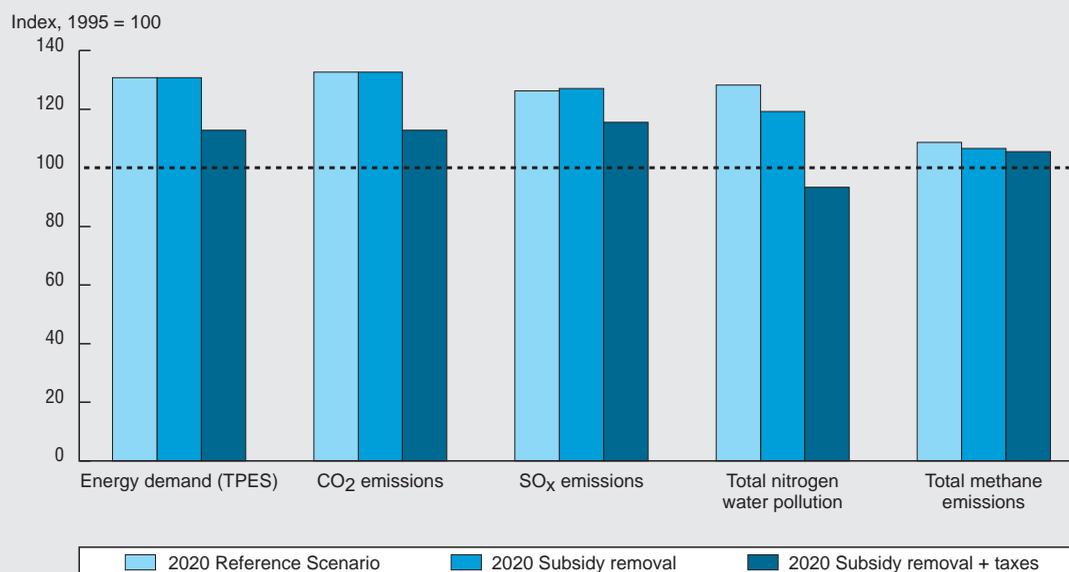
A combination of economic incentives, a strong regulatory framework, increased technological development and diffusion, and voluntary and information-based policies will be required to address all the “red lights” identified in the *Outlook*. A range of policies that could be included in such a policy mix are outlined in the report, and the potential environmental and economic effects are assessed where information was available. And what would be the net effects of adopting the full package of policies? A policy simulation was undertaken to examine the net impact of adopting the main economic incentives described above for the specific sectors, applied in two stages through a combination of:

1. removing all subsidies (as listed in the modelling framework) to production and consumption across OECD regions; and then
2. applying an *ad valorem* tax on fuel use in OECD regions that increases annually by 2, 1.6 and 1.2 percentage points respectively for coal, oil and natural gas use; and applying an *ad valorem* tax on chemical use in all sectors of OECD economies that increases by 2 percentage points per year.

*... would be cost-effective and lead to significant environmental improvements.*

As a result of implementing this policy mix, CO<sub>2</sub> emissions from OECD countries are expected to be 15% lower in 2020 compared with the Reference Scenario, SO<sub>x</sub> emissions would be 9% lower, and methane emissions 3% lower (see Figure 2). Largely because of the effect of the chemical tax on fertiliser use in agriculture, nitrogen loading to waterways would be almost 30% lower in 2020 compared with the Reference Scenario. With this policy package, the economic costs of achieving these environmental benefits

Figure 2. Effects in 2020 of removing subsidies, applying a fuel tax and a chemical use tax in OECD regions, index: 1995 = 100



*Note:* The subsidy removal scenario simulated the removal of all subsidies in OECD countries listed in the model, and a proxy for the removal of Market Price Support to agriculture in OECD countries. The subsidy removal taxes scenario add an *ad valorem* tax on fuel use in OECD countries that increases by 2, 1.6 and 1.2 percentage points *per annum* respectively for coal, oil and natural gas, and an *ad valorem* tax on all chemical use which increases by 2 percentage points *per annum*.

*Source:* Reference Scenario and policy simulations.

were estimated to be marginal – resulting in less than a 1% lower level of GDP for OECD regions overall in 2020 than in the Reference Scenario. Hence, from 1995 to 2020 GDP in OECD regions overall is projected to grow by 61% in the Reference Scenario and by approximately 60% with the policy package. Thus, implementing such a policy package would be cost-effective and would lead to significant environmental improvements by 2020.

### Implementing the combined policy package

*Implementation is the weak link in the environmental policy cycle.*

As shown throughout the *Outlook*, OECD countries have already implemented, or are starting to implement, policies to address some of the “red lights” identified. However, their use is still limited in most countries. Particular efforts need now to be devoted to the implementation of policies that have already been agreed, as well as to the adoption of new policies to ensure comprehensive policy packages for addressing these urgent issues. As is shown over and over again in the *Outlook*, implementation of environmental policies is often the weak link in the environmental policy cycle.

*Measures that address potentially adverse social effects need to be developed.*

To ensure successful policy implementation at the national level, measures that address potentially adverse social effects of some environmental policies (*e.g.* on incomes or employment) or sectoral competitiveness effects will need to be developed. In many cases, the implementation gap is the result of concerns that applying a given environmental policy will result in hardships for a particular region, sector, or for particular income groups. Thus, large exemptions are often in place for fuel taxes, with the aim of protecting energy-intensive industries from adverse effects on competitiveness at the international level. Similarly, environmentally damaging support to coal production, agriculture, and fisheries is often difficult to remove because of the potential effects on employment in the regions concerned, and again because of the fear of a loss of competitiveness in the world market for sectors where support is common practice. In such cases, stronger international co-operation can be the key to reforming the environmentally damaging policies. Finally, an implementation gap for environmental policies often persists where there is a lack of scientific, technical, or institutional capacity to support the design, implementation and enforcement of appropriate policies.

*Successful implementation requires setting objectives and targets, using indicators, collecting data, involving stakeholders,...*

Successful implementation of environmental policies and policy packages will require consideration of the following issues. First, the setting of clear and realistic objectives and targets that can be checked against a set of reliable indicators is essential to record the progress that is being made in policy implementation. Strengthened data collection and indicator development and use will be essential for both the development of the appropriate environmental policies, and monitoring the progress of these policies in reaching the environmental objectives and targets that are set. Second, to achieve these objectives, support will often have to be secured not only from the public at large, but also from the main stakeholders who are part of the implementation process. One way to secure such support is to inform and consult the various stakeholders early in the decision-making process, while facilitating public access to environmental information and reporting regularly on the progress being made in implementation. Third, care should be taken to limit potential negative social effects arising from implementation of environmental measures, such as employment loss or additional burdens imposed on low-income groups of the population. Where the policies may lead to negative social effects, careful use of temporary compensation measures, such as direct income payments to affected workers or retraining schemes, can help to smooth the transition. Finally, effective compliance and enforcement mechanisms at the national and international levels will need to be adopted.

*... and adopting effective compliance and enforcement mechanisms.*

*Increased international co-operation is needed.*

Because a large number of the “red light” environmental pressures or conditions identified are of global concern (e.g. climate change, biodiversity), increased and more effective international co-operation will be needed to successfully address them in the future. In addition to concluding and ratifying existing and any new international or regional agreements to deal with these issues, mechanisms are needed to ensure their enforcement and provide incentives to encourage compliance. Increased international co-ordination will also help to address concerns of industry with respect to potential loss of competitiveness due to unilateral action taken by one country.

*Institutions need to increasingly address these issues within the framework of sustainable development.*

In the future, it is likely that the institutions that support environmental policies will need to increasingly address these issues within the broader framework of sustainable development (encompassing economic, social and environmental objectives). More decentralised and co-operative policy decision-making and implementation (i.e. working with the business community and non-governmental organisations, greater public accountability) will be needed, and greater commitment to internationally agreed targets for addressing global and regional environmental concerns. While some of the institutions and the capacity to face these growing challenges are in place, adaptations will need to be made in most national governments, as well as in the international institutions that directly deal with environmental concerns or have an impact on the environment.

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