ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT
ORGANISATION DE COOPÉRATION ET DE DÉVELOPPEMENT ÉCONOMIQUES
BETTER POLICIES FOR BETTER LIVES DES POLITIQUES MEILLEURES POUR UNE VIE MEILLEURE

OECD ENVIRONMENTAL OUTLOOK TO 2050:
The Consequences of Inaction

HIGHLIGHTS

Human endeavour has unleashed unprecedented economic growth in recent decades in the pursuit of higher living standards. However, the sheer scale of economic and population growth has overwhelmed progress in curbing environmental degradation. Providing for a further 2 billion people by 2050 will challenge our ability to manage and restore the natural assets on which all life depends.

The *OECD Environmental Outlook to 2050* projects demographic and economic trends over the next four decades, using joint modelling by the OECD and the PBL Netherlands Environmental Assessment Agency. It assesses the impacts of these trends on the environment if we do not introduce more ambitious policies to better manage natural assets. It then examines some of the policies that could change that picture for the better. This *Outlook* focuses on four urgent areas: climate change, biodiversity, water and the health impacts of pollution. It concludes that **urgent action is needed now to avoid significant costs of inaction, both in economic and human terms.**

Without new policies, progress in reducing environmental pressures will continue to be overwhelmed by the sheer scale of growth.

What could the environment look like in 2050?

By 2050, the Earth's population is expected to increase from 7 billion to over 9 billion and the **world economy is projected to nearly quadruple, with growing demand for energy and natural resources as a result**. While growth will still be high, average GDP growth rates are projected to slow in China and India. Africa could see the world's highest growth rates between 2030 and 2050. OECD countries are expected to have over a quarter of their population aged over 65 years in 2050, compared to 15% today. China and India are also likely to see significant population ageing, while more youthful populations in other parts of the world, especially Africa, are expected to grow rapidly. These demographic shifts and higher living standards imply evolving lifestyles and consumption patterns, all of which will have significant consequences for the environment. Nearly 70% of the world's population is projected to live in urban areas by 2050, exacerbating challenges such as air pollution, transport congestion, and waste management.

A world economy four times larger than today is projected to use 80% more energy in 2050. **Without more effective policies, the share of fossil-fuel based energy in the global energy mix will still remain at about 85%.** The emerging economies of Brazil, Russia, India, Indonesia, China and South Africa (the "BRIICS") are projected to become major energy users. To feed a growing population with changing dietary preferences, agricultural land is projected to expand globally in the next decade.

The "*Baseline*" scenario for this report reflects a combination of no new policies and continuing socioeconomic trends. Under the *Baseline*, pressures on the environment from population growth and rising living standards will outpace progress in pollution abatement and resource efficiency. **Continued degradation and erosion of natural environmental capital is expected to 2050, with the risk of irreversible changes that could endanger two centuries of rising living standards.**

The key environmental challenges identified in this *Outlook* are summarised using the "traffic light" system (Table 1). Despite some pockets of improvements, the overall outlook for the four themes is more alarming than in the previous edition of the *Outlook*.

Table 1. Key environmental challenges: Trends and projections without new policies

	Red Light	Yellow Light	Green Light
Climate change	• Growing GHG emissions (especially energy-related CO_2); growing atmospheric concentrations of GHGs. • Increasing evidence of a changing climate and its effects. • Copenhagen/Cancun pledges fall short of a cost-efficient 2 °C pathway.	• Declining GHG emissions per unit of GDP (relative decoupling) in OECD and BRIICS. • Declining CO_2 emissions from land use change (mainly deforestation) in OECD and BRIICS. • Adaptation strategies being developed in many countries but not yet widely implemented.	
Biodiversity	• Continued loss of biodiversity from growing pressures (*e.g.* land use change and climate change). • Steady decrease in primary (virgin) forest area. • Over-exploitation or depletion of fish stocks. • Invasion by alien species.	• Protected area expansion, but under-representation of certain biomes and marine protected areas. • Forest area expanding mainly due to afforestation (e.g. plantations); deforestation rates slowing but still high.	• Progress under the Convention on Biological Diversity in 2010 on the Strategic Plan for Biodiversity 2011-2020 and the Nagoya Protocol.
Water	• Increase in the number of people living in river basins under severe water stress. • Increase in groundwater pollution and depletion. • Deterioration of surface water quality in non-OECD countries; increase in nutrient loading globally and risk of eutrophication. • Urban dwellers increasing faster than people with connection to water services; large remaining number of people without access to safe water in both rural and urban areas; MDG on sanitation not achieved. • Increase in volume of wastewater returned to the environment untreated.	• Increase in water demand and competition among users, and need to reallocate water among users. • Increase in number of people at risk from floods.	• Decrease in point-source water pollution in OECD countries (from industry, municipalities). • MDG on access to an improved water source likely to be met in BRIICS.
Health and Environment	• Substantial increase in SO_2 and NO_x emissions in key emerging economies. • Increase in premature deaths linked to urban air pollution (particulates & ground-level ozone). • High burden of disease from exposure to hazardous chemicals, particularly in non-OECD countries.	• Decrease in child mortality from lack of access to safe water and improved sanitation. • Better, but still inadequate, information on exposure to and health impacts of hazardous chemicals in the environment, in products and from combined exposures. • Many OECD governments have changed, or are in the process of changing, legislation to expand regulatory coverage of chemicals, but enforcement still incomplete. • Decrease in premature deaths due to indoor air pollution from traditional solid fuels, but potential trade-offs if climate mitigation policies increase energy prices. • Decrease in premature mortality from malaria, despite climate change.	• Decrease in emissions of SO_2, NO_x and black carbon in OECD countries.

Notes: All trends are global, unless otherwise specified.

Green light = environmental issues which are being well managed, or for which there have been significant improvements in management in recent years but for which countries should remain vigilant.

Yellow light = environmental issues which remain a challenge but for which management is improving, or for which current state is uncertain, or which have been well managed in the past but are less so now.

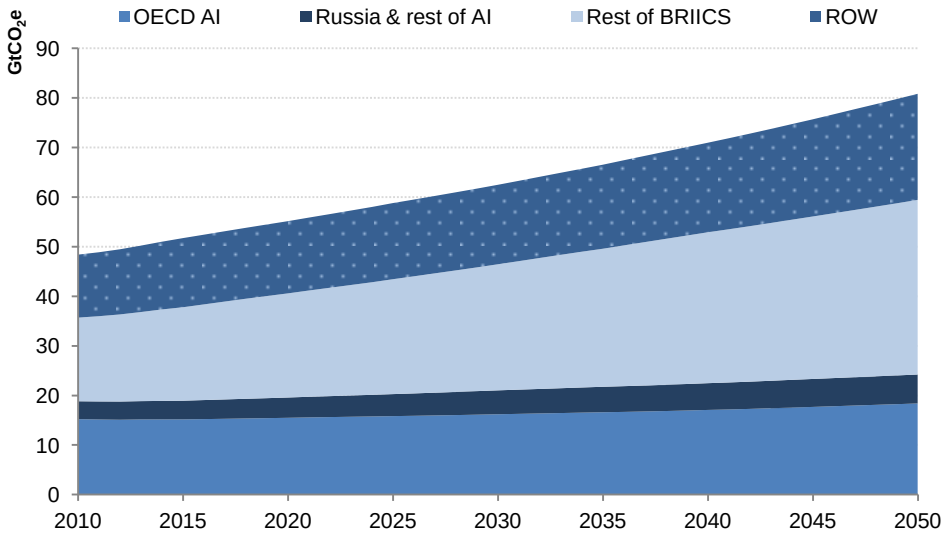
Red light = environmental issues which are not well managed, are in a bad or worsening state, and which require urgent attention.

OECD Environmental Outlook to 2050: The Consequences of Inaction - ISBN 978-92-64-122161 © OECD 2012

Without more ambitious policies, by 2050:

- **More disruptive climate change is likely to be locked in,** with global greenhouse gas (GHG) emissions projected to increase by 50%, primarily due to a 70% growth in energy-related CO_2 emissions (Figure 1). The atmospheric concentration of GHGs could reach 685 parts per million (ppm) by 2050. As a result, the global average temperature increase is projected to be 3° C to 6° C above pre-industrial levels by the end of the century, exceeding the internationally agreed goal of limiting it to 2° C. The GHG mitigation actions pledged by countries in the Cancún Agreements at the United Nations Climate Change Conference in 2010 will not be enough to prevent the global average temperature from exceeding the 2° C threshold, unless very rapid and costly emission reductions are realised after 2020. Surpassing the 2° C threshold would alter precipitation patterns, increase glacier and permafrost melt, drive sea-level rise, and worsen the intensity and frequency of extreme weather events. This will hamper the ability of people and ecosystems to adapt.

Figure 1. GHG emissions by region: Baseline, 2010-2050



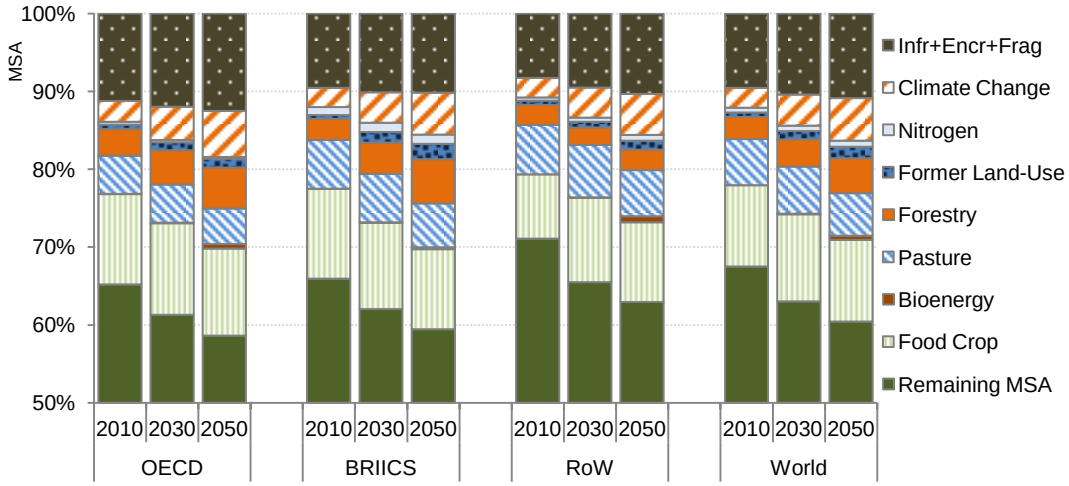
Notes: "OECD AI" stands for the group of OECD countries that are also part of Annex I of the Kyoto Protocol. RoW = rest of the world. $GtCO_2e$ = Giga tonnes of CO_2 equivalent

Source: OECD Environmental Outlook Baseline; output from OECD ENV-Linkages model.

- **Biodiversity loss is projected to continue**, especially in Asia, Europe and Southern Africa. Globally, terrestrial biodiversity (measured as mean species abundance – or MSA – an indicator of the intactness of a natural ecosystem) is projected to decrease by a further 10% by 2050 (Figure 2). Mature forests, which tend to be rich in biodiversity, are projected to shrink in area by 13%. The main pressures driving biodiversity loss include land-use change (*e.g.* agriculture), the expansion of commercial forestry, infrastructure development, human encroachment and fragmentation of natural habitats, as well as pollution and climate change. **Climate change is projected to become the fastest growing driver of biodiversity loss by 2050, followed by commercial forestry and, to a lesser extent, bioenergy croplands.** About one-third of global freshwater biodiversity has already been lost, and further loss is projected to 2050. Declining biodiversity threatens human welfare, especially for the rural poor and indigenous communities whose livelihoods often depend directly on biodiversity and ecosystems services. The aggregate loss of biodiversity and ecosystem service benefits associated with forest loss worldwide, for example, is estimated to be between USD 2 and 5 trillion per year, according to the Economics of Ecosystems and Biodiversity (TEEB) study.

OECD Environmental Outlook to 2050: The Consequences of Inaction - ISBN 978-92-64-122161 © OECD 2012

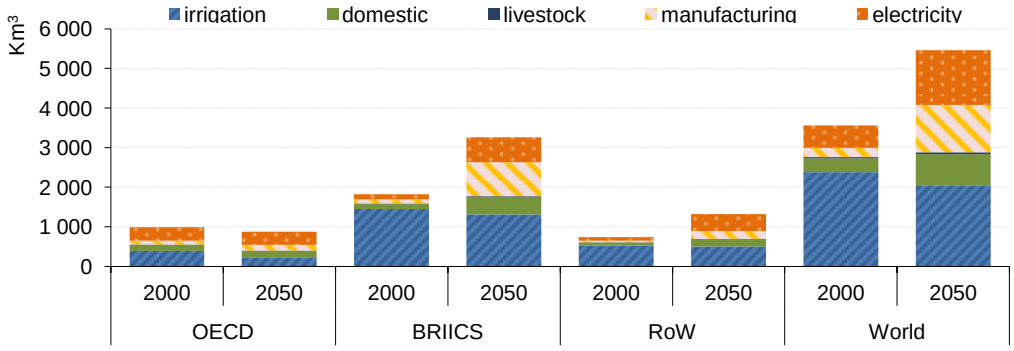
Figure 2. Effects of different pressures on terrestrial MSA: *Baseline*, 2010 to 2050



Notes: MSA of 100% is equivalent to the undisturbed state; See Chapter 3, Table 1 of the *Outlook* report for further explanations. RoW = rest of the world. Infra+Encr+Frag = infrastructure, encroachment and ecosystem fragmentation,
Source: OECD Environmental Outlook Baseline, output from IMAGE suite of models.

- **Freshwater availability will be further strained in many regions**, with 2.3 billion more people than today (in total over 40% of the global population) projected to be living in river basins experiencing severe water stress, especially in North and South Africa, and South and Central Asia. Global water demand is projected to increase by some 55%, due to growing demand from manufacturing (+400%), thermal electricity generation (+140%) and domestic use (+130%) (see Figure 3.) In the face of these competing demands, there is little scope for increasing irrigation water use under the *Baseline*. Environmental water flows will be contested, putting ecosystems at risks. Groundwater depletion may become the greatest threat to agriculture and urban water supplies in several regions. **Nutrient pollution from urban wastewater and agriculture is projected to worsen in most regions, intensifying eutrophication and damaging aquatic biodiversity.** The number of people with access to an *improved* water source (although not necessarily *safe* water for human consumption) is expected to increase, essentially in the BRIICS. However, globally more than 240 million people are expected to be without such access by 2050. Sub-Saharan Africa is unlikely to meet the Millennium Development Goal (MDG) of halving by 2015 the 1990 level of the population without access to an *improved* water source. The MDG for sanitation will not be met by 2015; by 2050 1.4 billion people are projected to be still without access to basic sanitation.

Figure 3. Global water demand: Baseline, 2000 and 2050

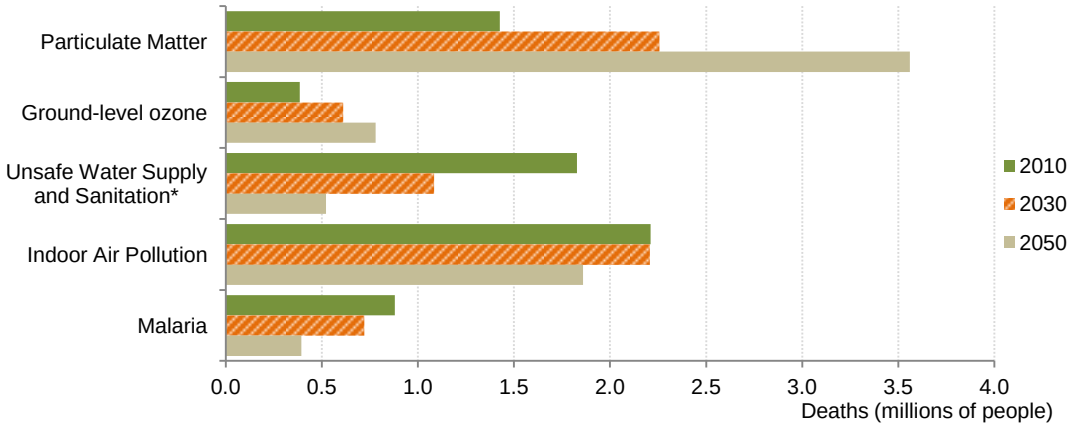


Notes: This graph only measures blue water demand (see Box 5.1 of the *Outlook* report) and does not consider rain-fed agriculture. RoW = rest of the world
Source: *OECD Environmental Outlook Baseline*; output from IMAGE suite of models.

OECD Environmental Outlook to 2050: The Consequences of Inaction - ISBN 978-92-64-122161 © OECD 2012

- **Air pollution is set to become the world's top environmental cause of premature mortality** under this scenario (see Figure 4.) Air pollution concentrations in some cities, particularly in Asia, already far exceed World Health Organization safe levels. By 2050, the number of premature deaths from exposure to particulate matter is projected to more than double to reach 3.6 million a year globally, with most deaths occurring in China and India. Because of their ageing and urbanised populations, OECD countries are likely to have one of the highest premature death rates from ground-level ozone, second only to India. **The burden of disease related to exposure to hazardous chemicals is significant worldwide**, but most severe in non-OECD countries where chemical safety measures are still insufficient. Yet, non-OECD countries are projected to greatly increase chemicals production, with the BRIICS overtaking the OECD in global sales by 2050 under the *Baseline*. While OECD governments are making progress in assessing human exposure to chemicals, knowledge of the health impacts is still limited.

Figure 4. Global premature deaths from selected environmental risks: Baseline, 2010 to 2050



** Note: Child mortality only*
Source: OECD Environmental Outlook Baseline; output from IMAGE suite of models.

Avoiding the consequences of inaction is affordable

These *Baseline* projections highlight the need for urgent action today to change the course of our future development. **Natural systems have "tipping points" beyond which damaging change becomes irreversible** (*e.g.* species loss, climate change, groundwater depletion, land degradation). However, these thresholds are in many cases not yet fully understood, nor are the environmental, social and economic consequences of crossing them. A key challenge is to strike a balance between giving clear policy signals to resource users and consumers, while leaving room for manoeuvre and for adaptation, given the uncertainties.

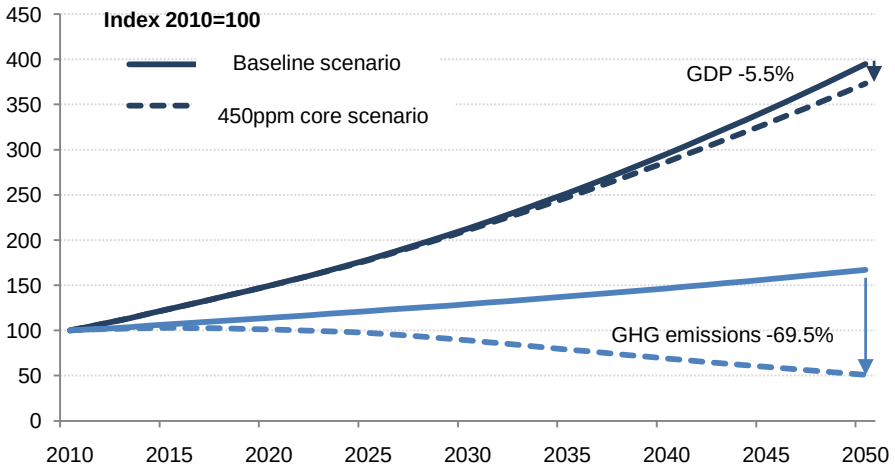
> ***What if…***
>
> …NO_x, SO_2 and black carbon emissions were cut by up to 25% by 2050? This *Air Pollution Reduction scenario* would result in an added benefit of a 5% reduction in global CO_2 emissions, but would not make much difference in preventing the expected doubling of premature deaths. Given that the pollution levels in many Asian cities in the Baseline scenario are already far above safe levels, pollution abatement goals would have to be even more ambitious to yield positive health impacts.

Acting now makes environmental *and* economic sense. For example, the *Outlook* suggests that if countries act now, there is still a chance – although it is receding – of global GHG emissions peaking before 2020 and limiting the world's average temperature increase to 2° C. The *Outlook* suggests that a global carbon price sufficient to lower GHG emissions by nearly 70% in 2050 compared to the *Baseline* and limit GHG concentrations to

OECD Environmental Outlook to 2050: The Consequences of Inaction - ISBN 978-92-64-122161 © OECD 2012

450 ppm would slow economic growth by only 0.2 percentage points per year on average. This would cost roughly 5.5% of global GDP in 2050 (see Figure 5). This pales alongside the potential cost of inaction on climate change, which some estimate could be as high as 14% of average world consumption per capita. The *Outlook* also suggests, for example, that the benefits of making further air pollution reductions in the BRIICS could outweigh the costs by 10 to 1 by 2050. Investing in safe water and sanitation in developing countries can yield benefit-to-cost ratios as high as 7 to 1 (see Chapter 5).

Figure 5. Climate change *450 Core* scenario: global emissions and cost of mitigation



Source: *OECD Environmental Outlook Baseline;* output from OECD ENV-Linkages model.

What policies can change this outlook?

Well-designed policies can reverse the trends projected in the *Outlook Baseline* scenario. Given the complexity of the environmental challenges, a wide array of policy instruments is needed, often in combination. This *Outlook* draws on a policy framework outlined in the OECD's *Green Growth Strategy*, which countries should tailor to their level of development, resource endowments and environmental pressures. But there are approaches that will be common to all:

- **Make pollution more costly than greener alternatives**; *e.g.* with environmental taxes and emissions trading schemes. Such market-based instruments can also generate much-needed fiscal revenues.

- **Value and price the natural assets and ecosystem services**; *e.g.* through water pricing which is an effective way of allocating scarce water, payments for ecosystem services, natural park entrance charges, etc.

- **Remove environmentally harmful subsidies**; an important step in pricing resources and pollution properly (e.g. to fossil fuels, to irrigation water). Support to fossil fuel production and use, for example, amounted to between USD 45-75 billion per annum in recent years in OECD countries. Developing and emerging economies provided over USD 400 billion in fossil fuel consumer subsidies in 2010 according to IEA estimates.

- **Devise effective regulations and standards**; *e.g.* to safeguard human health or environmental integrity, for promoting energy efficiency.

OECD Environmental Outlook to 2050: The Consequences of Inaction - ISBN 978-92-64-122161 © OECD 2012

- **Encourage green innovation**; *e.g.* by making polluting production and consumption modes more expensive, and investing in public support for basic R&D.

A mix of policies is needed because the different environmental issues are complex and closely linked. For example, climate change can affect hydrological cycles and exacerbate pressures on biodiversity and human health. Biodiversity and ecosystem services are intimately linked to water, climate and human health: marshlands purify water, mangroves protect against coastal flooding, forests contribute to climate regulation and genetic diversity provides for pharmaceutical discoveries. Policies must be carefully designed to account for these cross-cutting environmental functions and their wider economic and social implications.

Making reform happen and mainstreaming green growth

Making reform happen will depend on political leadership and widespread public acceptance that changes are both necessary and affordable. Not all of the solutions will be cheap, which is why seeking out the most cost-effective among them is so important. A key task is to improve understanding of the challenges and trade-offs that need to be made.

Integrating environmental objectives in economic and sectoral policies (*e.g.* energy, agriculture, transport) is vital, as the latter have greater impacts than environmental policies alone. Environmental challenges should be assessed in the context of other global challenges such as food and energy security and poverty alleviation.

Well-designed policies can maximise synergies and co-benefits on several fronts. Tackling local air pollution, for example, can cut GHG emissions while reducing the economic burden of health problems. Climate policy also helps protect biodiversity if emissions are reduced by avoiding deforestation.

Meanwhile **contradictory policies need to be carefully monitored and addressed**. For example, water infrastructure such as dams – intended to improve water and energy security – can disrupt wildlife habitats and ecosystems. Increasing the use of biofuels to meet climate goals could potentially have negative impacts on biodiversity by requiring more land for bioenergy crops.

> ***What if…***
> …climate mitigation options don't rely on expanding land use for biofuels? The Outlook suggests that such a scenario would cut cumulative deforestation emissions by 12.7 GtC and contribute to 7% of the required emission reduction to 2050. At the same time, biodiversity would be protected through a reduction in the extent of cropland by some 1.2 million km2 and 1 million km2 less land for animal grazing by 2050 relative to the *Baseline*.

As many of the environmental problems are global in nature (*e.g.* biodiversity loss, climate change) or linked to the trans-boundary effects of globalisation (*e.g.* trade, international investment), **international co-operation is indispensable to ensure effective action and an equitable sharing of the cost of action.** For example, while the world's mega-biodiverse areas are mainly located in developing countries, the burden of biodiversity conservation measures needs to be shared broadly as their benefits accrue globally. This calls for international financing to support such efforts. Similarly, international financing for low-carbon climate-resilient growth will need to be scaled up significantly. The *Outlook* suggests that it is possible to raise considerable

> ***What if…***
> …the emission reduction pledges that industrialised countries indicated in the Cancún Agreements were to be implemented through carbon taxes or cap-and-trade schemes with fully auctioned permits? The fiscal revenues could amount to over 0.6% of their GDP in 2020, *i.e.* more than USD 250 billion.

OECD Environmental Outlook to 2050: The Consequences of Inaction - ISBN 978-92-64-122161 © OECD 2012

revenues from market-based measures. Just a small part of such revenues could help finance climate action. International co-operation is also needed to channel financing for providing universal access to *safe* water and adequate sanitation.

Better information supports better policies, so our knowledge base needs to be improved. There are many areas where economic valuation of environmental impacts should be improved, including for understanding the full benefits of biodiversity and ecosystem services, and health costs associated with exposure to chemicals. This will help to measure and value those elements of improved human welfare and progress that cannot be captured by GDP alone. Better information on costs and benefits will help to improve our understanding of the costs of inaction, and make a strong case for green growth policy reforms.

This *Outlook* provides policy makers with actionable policy options for today that can help to put the world on a more sustainable path.

Contact: Kumi.Kitamori@oecd.org

The *OECD Environmental Outlook to 2050* (OECD, 2012) was prepared by a joint team from the OECD and the PBL Netherlands Environmental Assessment Agency. The *Outlook* includes chapters on: socioeconomic developments, climate change, biodiversity, water, and health and environment.

http://www.oecd.org/environment/outlookto2050

OECD Environmental Outlook to 2050: The Consequences of Inaction - ISBN 978-92-64-122161 © OECD 2012