Making the Green Recovery work for jobs, income and growth

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This Policy Brief focuses on how countries can create opportunities for a green and inclusive economic recovery from the COVID-19 pandemic. A green recovery will significantly enhance the resilience of economies and societies in the face of both the severe recession and accelerating environmental challenges. The Brief also undertakes a preliminary review of announced recovery and stimulus policies in OECD and Key Partner countries. While many countries are focusing on measures that can drive sustainability while boosting jobs, income and growth, a number of countries are proposing measures that support environmentally damaging activities. Measuring and evaluating the environmental impacts of recovery policies over time is crucial, and a set of indicators, covering a broad array of critical environmental dimensions, is proposed for this purpose. This brief was first published on 14 September 2020. This is a revised version that incorporates a correction on page 8. Fossil fuel subsidies amounted to USD 478 billion in 2019 and not to USD 582 billion.

Introduction

The COVID-19 pandemic has evolved from a major public health crisis to become also a major economic and jobs crisis, the full extent of which is still unfolding. The economic impact is enormous, as we are facing the most severe recession in nearly a century, with long-lasting repercussions for people, firms and governments. The pandemic is also inextricably intertwined with global environmental issues such as biodiversity loss, climate change, air and water pollution, and waste management, both in terms of its origin and the implications for environmental outcomes and the future well-being of societies around the world.

The economic stimulus packages and recovery plans that governments are now putting in place have the potential to create a recovery that is both green and inclusive. Such a recovery can be defined by its potential to create opportunities for income, jobs and growth, and at the same time accelerate action on medium and long-term environmental goals, both national and global. Such action will significantly enhance the resilience of economies and societies in the face of accelerating environmental challenges due to strengthening feedback loops and the increasing likelihood of cascading tipping points. Importantly, putting people at the centre of green recovery plans can lay the foundations for sustainable well-being[1].

The environmental consequences of COVID-19

The short-term environmental impacts of the pandemic, both positive and negative, have been significant. Many of these consequences are likely to be temporary, while some may endure in the form of longer-term structural or behavioural changes:

- **Global CO_2 emissions** are expected to decline overall by 8% in 2020, to levels of 10 years ago.[2] However, this one-off expected decline will not have any long-term impact on the CO_2 levels in the atmosphere as the atmospheric concentration of CO_2 (the primary driver of climate change) continues to climb rapidly.[3] This will continue to be the case unless structural changes lead to emissions staying consistently below pre-pandemic levels.
- **Air pollution** also declined temporarily as industrial activity, ground transport and air travel were heavily curtailed for several months, but a number of countries have since reported a rapid return to rising levels of air pollution.[4] The pandemic highlighted the important link between air pollution and mortality from COVID-19, with higher levels of indoor and outdoor air pollution exacerbating the health impacts of the pandemic. A number of studies have demonstrated that a small increase in particulate matter ($PM_{2.5}$) is associated with an increase in the COVID-19 death rate of 8-16%, depending on the region.[5] In addition, there is growing evidence that the airborne transmission of SARS-CoV-2 is exacerbated by air pollution.[6] As evidence indicates that socially disadvantaged groups are already more exposed and vulnerable to air pollution, this makes them potentially more vulnerable to adverse cardiovascular and respiratory impacts.

- The reduction in economic activity led to an improvement in **water quality** in a number of waterways and coastal zones, with a number of countries and regions reporting reduced concentrations of suspended particulate matter and other water pollutants. However, this will also be a temporary phenomenon as water pollution is expected to increase once economic activity resumes. The impacts on the most vulnerable segments of society need to be taken into account, especially those exposed to contaminated sites and inadequate housing conditions.
- **Waste management** challenges have increased significantly as a result of the pandemic as governments deal with major increases in medical waste (due mostly to disposable personal protective equipment), increased demand for single-use plastics (for groceries, food delivery, health care and e-commerce packaging), and reduced recycling capacity and a collapse of the market price for recycled plastics. With many governments now mandating masks for large segments of the general population, the use of disposable medical masks has skyrocketed, creating significant waste management and environmental challenges.
- The pandemic has also highlighted the **significance of human interference with biodiversity** in helping to create the conditions for pathogens to leap from animals to humans. Deforestation, habitat degradation and fragmentation, agriculture intensification, wildlife trade and climate change have all played a role in zoonotic diseases. Along with COVID-19, many deadly pathogens in recent memory – Ebola, HIV, dengue, SARS, MERS, Zika, West Nile – have taken this interspecies leap. In addition, there have been reports of increased poaching and illegal resource extraction in some countries, which links to the loss of rural livelihoods and the reduced capacity for monitoring and enforcement.

The pandemic and the ensuing economic crisis have underscored the importance of environmental health and resilience as a critical complement to public health. Better air quality, improved water quality, effective waste management, and enhanced biodiversity protection will not only reduce the vulnerability of communities to pandemics, but will also improve overall societal well-being and resilience. Good air quality generates wider benefits for public health and well-being along with significant economic benefits as a result of fewer air pollution-related illnesses and reduced impact on work productivity. Similarly, improving access to safely managed drinking water and sanitation services will bring important benefits to the most disadvantaged in both OECD and non-OECD countries. In OECD countries, improved access can significantly enhance inclusiveness for under-privileged groups (such as people with health conditions, groups in substandard housing, migrants, and homeless people). In many developing countries, women and girls, in particular, are often responsible for collecting water and suffer most from inadequate access to sanitation. Biodiversity conservation and sustainable use is also key as biodiversity and ecosystem services provide benefits of USD 125-140 trillion per year (i.e. more than one and a half times the size of global GDP). Effective biodiversity conservation and sustainable use, including the need to address deforestation, will limit the risk of zoonotic transfer while also helping to maintain the existing ecosystem services.[7]

Tracking recovery measures

Against this background, it is clear that addressing global issues such as climate change, air and water pollution, biodiversity loss, ocean degradation, and inefficient resource use has become even more important as countries seek to rebuild their economies and enhance resilience against future shocks. Surveys suggest that despite the widespread economic suffering, the pandemic has increased public consciousness of the fragility of natural systems and their importance for human well-being. In this light, integrating environmental and inclusiveness aspects into recovery and stimulus measures is a mutually beneficial strategy, as it allows governments to progress towards meeting environmental goals and commitments while at the same time boosting economic activity in the shorter term, and reducing inequalities. When well designed and implemented, green stimulus measures can generate income, create jobs, improve well-being for all and build resilience. This was one of the key lessons emerging from a review of the measures implemented in the aftermath of the 2008 global financial crisis.[8] Integrating environmental sustainability and socioeconomic equity together in policy packages is also important to mitigate regressive impacts of environmental policies and ensuring equal opportunities for all to contribute to and benefit from economic growth.[9]

Many governments have included "green" recovery measures in their policy packages designed to address the short- and medium-term socio-economic impacts of the pandemic. There are also a number of measures that are not targeted at green sectors or activities, but may nevertheless have an impact on environmental outcomes positively or negatively. Some governments have also planned or implemented measures that will have a negative impact on the environment (such as support for fossil fuel-based industries).

According to preliminary analysis conducted by the OECD Secretariat in August 2020, **at least 30 OECD and Key Partner countries[10] have included measures directed at supporting the transition to greener economies as part of their recovery programmes or strategies** (see box on p.6). Such measures include:

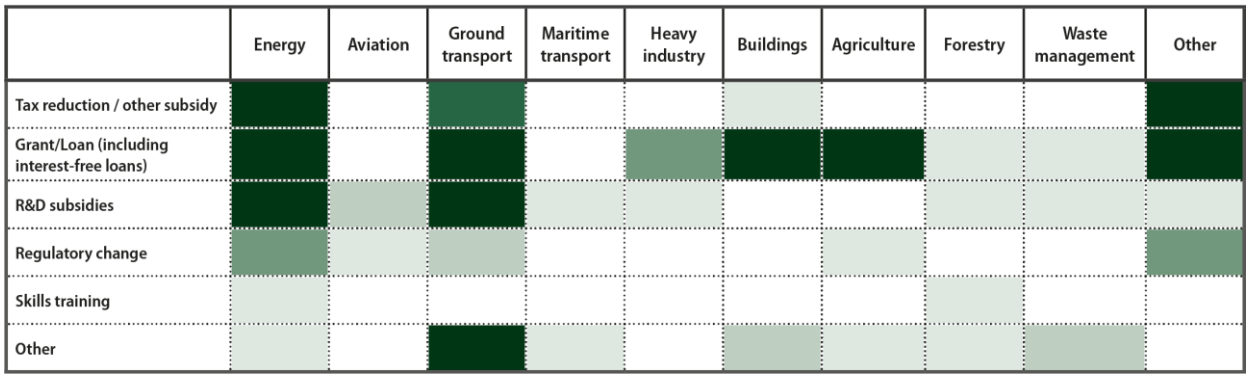
- grants, loans and tax relief directed towards green transport, circular economy and clean energy research, development and deployment;
- financial support to households and businesses for energy efficiency improvements and renewable energy installations;
- new funding and programmes to create jobs and stimulate economic activity through ecosystem restoration;
- control of invasive alien species and forest conservation.

The initial analysis suggests that governments have so far concentrated their green measures in the energy and surface transport sectors (see table on p.5). Other sectors important for a green and resilient recovery, such as industry, agriculture, forestry and waste management, have so far been less targeted. In terms of types of support measure used, tax reduction and grants/loans are the most commonly used, followed by subsidies to Research and Development (R&D). Few measures are so far dedicated to skills training.

In the case of urban transport, for example, some countries are scaling up efforts and funding to re-allocate car space to more sustainable modes (walking, cycling, micro-mobility, public transport) and to other urban functions. Some countries have also stipulated environmental conditionality for recovery support offered to firms in

key sectors, for example in aviation, and through linking automotive industry support to the promotion of cleaner vehicle technologies.

Number of recovery measures with positive environmental implications, by sector and type



Note: Colour shading represents the total number of measures with a clear expected positive environmental impact, tracked across OECD and Key Partner countries in August 2020.

Box 1. The time for green deals

The **European Green Deal**, as proposed by the European Commission (EC) at the end of 2019, is a new growth strategy that aims to transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy where there are no net emissions of greenhouse gases in 2050 and where economic growth is decoupled from resource use.

The European Green Deal is at the heart of the EU's strategy to drive the economic recovery from the COVID-19 pandemic, in particular through Next Generation EU, the EC €750 billion recovery instrument announced in May 2020. Additionally, EU Member States have begun announcing national recovery plans that go beyond the contributions of the EU, some of which have substantial green components.

Reaching the targets of the European Green Deal will require action across all sectors of the economy, including:

- Decarbonising the energy sector through renewable energy projects, especially wind and solar, and kick-starting a clean hydrogen economy.
- Investing in environmentally-friendly technologies.
- Supporting industry to innovate.
- Rolling out cleaner, cheaper and healthier forms of private and public transport.
- Ensuring buildings are more energy efficient and supporting the circular economy.
- Working with international partners to improve global environmental standards.

The EU will also provide financial support and technical assistance to help those who are most affected by the move towards the green economy, through the Just Transition Mechanism.

South Korea's Green New Deal of July 2020 is part of a wide national strategy to create 659 000 jobs and help the country overcome the economic crisis while addressing climate and environmental challenges.

South Korea will commit approximately USD 61 billion in five years (2020-25) to boost renewable energy capacity to 42.7 GW by 2025 from 12.7 GW in 2019 and expand the green mobility fleet to 1.33 million electric and hydrogen-powered vehicles. The plan also promises refurbishment of public rental housing and schools to make them zero-energy, and transformation of urban areas into smart green cities.

Sources: EC (2020), A European Green Deal website, https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en; https://www.forbes.com/sites/donaldkirk/2020/07/14/koreas-reveals-new-deal-designed-to-boost-jobs-revive-sagging-economy/#7b17f8423250.

At the same time, the OECD's initial country-level analysis also indicated that **24 national governments have announced measures that are likely to have a direct or indirect negative impact on environmental outcomes**. These include plans to roll back existing environmental regulations (including on water quality, air pollution emissions, and single-use plastics), reductions or waivers of environmentally-related taxes, fees and charges, unconditional bailouts of emissions-intensive industries or companies (such as airlines or fossil-fuel extractive industries), and increased subsidies to fossil-fuel intensive infrastructure (including road transport) and electricity consumers. On the consumer side, many

countries have implemented measures to support households through easing payment terms (longer grace period, no disconnection etc.), and reducing or directly subsidising electricity bills. Although some of these measures may be temporary as part of emergency rescue and support plans, others risk having longer-term environmental, economic and social implications.

Unfortunately, the balance between green and non-green spending is so far not favourable in terms of the volume of support towards positive environmental outcomes. According to a number of studies, the amount of funding directed towards green measures is outweighed by the funding for non-green measures. In the case of the energy sector, for example, the International Institute for Sustainable Development (IISD) estimates that G20 countries are providing support to different energy types through new or amended policies with 47% of this directed to support fossil fuels and 39% to clean energy.[11] More generally, a "Greenness of Stimulus Index" developed by Vivid Economics has identified stimulus measures across 17 countries that will pump approximately USD 3.5 trillion into sectors that have a large and lasting impact on nature, with potentially damaging flows outweighing those supporting nature in 14 of the 17 countries considered.[12] A study by Rhodium Group, taking a relatively narrow definition of stimulus spending across major economies, found that while the EU has allocated around 20% of spending to green, climate-related priorities, the percentage is much lower elsewhere.[13]

Opportunities of the green recovery

The current crisis presents governments with challenges in ensuring that the recovery and stimulus measures enhance, and do not adversely affect, environmental sustainability and well-being. Ultimately, however, the recovery is an opportunity to "build back better", combining an emphasis on restoring growth and creating jobs with the achievement of environmental goals and objectives.

Overcoming inertia and rebound effects. Governments' imperative is to get economies recovering quickly. This will often be based on known investments, technologies and investment plans, reflecting a certain amount of inertia in the system, a lack of understanding on the factors behind unsustainable growth, and a lack of information on alternative, sustainable options. Experience from recovery measures that followed previous economic downturns indicates that negative effects on the environment can be significant, with potential for environmental impacts to increase to levels that were even higher than prior to the downturn. Ensuring that emergency response measures do not relax environmental standards and regulation, and ultimately exacerbate existing environmental challenges, requires a whole of government approach to assessing the impact of recovery and stimulus measures.

Supporting sector restructuring towards fairer, greener economies. The green recovery is an opportunity to undertake wider reaching and fundamental restructuring of critical sectors and activities in order to support the transition to low-emission climate-resilient and resource-efficient economies in socially inclusive ways and to enhance the resilience of their economies. Not only would this be in line with national and international commitments made under the Paris Agreement, Sustainable Development Goals and other international environmental agreements, such as the Aichi Biodiversity Targets, but they would also support improving the well-being of communities and societies over the near and medium

to longer term. Social investments are also needed to avoid communities being left behind by the green transition, including targeted measures to strengthen social dialogue and protection. In addition, social security guarantees and entitlements may need to be adapted in the context of transition to new employment and types of work.

Accelerating existing plans. The OECD's initial country analysis of green recovery measures indicates that a number of governments are using the post-COVID measures to accelerate actions that were already envisaged under existing environmental plans and proposals. To capitalise on this effect, it will be important that plans are accompanied by clear strategic and regulatory frameworks pertaining to the long-term transition to a low-carbon economy, beyond the specific recovery programmes announced. One key example of accelerated efforts is investment in renewable energy, which has been a focus of ramped up government support in some countries, especially in areas where the use of fossil-fuel energy is being phased out. Another example is accelerating programmes to improve energy efficiency in the existing building stock. Such projects tend to be relatively labour-intensive and are easy and quick to scale up with relatively low demands on skills from workers. It is important to note, however, that if retrofits are of low-quality, their environmental benefit over the medium to longer term will be limited. The economic crisis has also accentuated the importance of providing appropriate support to communities adversely affected by the transition to a low-carbon economy, for example through providing retraining and reskilling as well as measures to enhance mobility and support the development and establishment of alternative industries in those regions.

Implementing fossil-fuel subsidy reform and carbon pricing, with due consideration of distributional impacts. Low fossil-fuel energy prices provide weaker incentives for investment in low-carbon and energy efficiency technology at all stages, from research and development to commercial diffusion.[14] The potential for an extended period of high uncertainty and substantially lower fossil-fuel prices than previously expected, raises the urgent need to introduce effective incentives for firms to invest in energy-efficient technologies. The role of carbon pricing and fossil-fuel subsidy reform is key in this regard.

A period of relatively low oil prices offers an ideal opportunity to continue efforts to scale up the introduction or extension of carbon pricing. Lowering taxes on labour and capital, in favour of taxing environmentally harmful consumption and production, can stimulate job creation and investment, improving economic efficiency. It is crucial that energy tax reforms are designed to avoid increasing the share of "energy poor" and rising inequalities, as adequate access to energy services is essential for ensuring decent standards of living. The distributional implications of other pricing instruments, such as those introduced to discourage vehicle and fuel use should be also addressed. Similarly, reform of fossil-fuel subsidies, which amounted to USD 478 billion in 2019 according to OECD and IEA data, is best accomplished in a low oil price environment and should be accompanied by targeted and time-limited transition support for industries, communities, regions and vulnerable consumers.

Avoiding locking-in unsustainable infrastructure and resource extraction. The OECD has shown the critical role of infrastructure in driving the transition and avoiding lock-in to high-emission and polluting industries. The significant amounts of money being focused on infrastructure as part of the stimulus packages highlight the opportunity to invest in better alignment of infrastructure plans with longer-term

goals on climate, biodiversity, water and waste management, and resource efficiency. This is particularly the case for investments in major transport-related infrastructure, such as road systems, public transport, railways, and ports, as these will have major implications for future environmental outcomes.

The green recovery poses a particular challenge for developing countries rich in non-renewable resources, notably fossil fuels and minerals. For fossil fuel-exporting countries, low demand of fuel sources, in combination with policy pressure to reduce GHG emissions, would increase the urgency to diversify exports away from fossil fuels toward cleaner energy forms. For mineral-rich developing countries, the abatement of emissions from this sector could contribute significantly to overall emissions reductions. To achieve such objectives, countries rich in non-renewable resources will need to develop targeted policies in areas including fiscal and tax policy, financial, energy, and mining sector regulation, and low-carbon technology, while keeping a strong focus on equity aspects of the transition.

Achieving more sustainable and resilient agriculture. The agricultural and food sector, which is among the most vulnerable to climate change, is an important contributor of GHG emissions, a major water user, and an important source of pollution. While OECD and emerging economies provide USD 536 billion of support to producers annually, more than half (USD 345 billion) runs counter to improving the sector's sustainability, while most of the rest does little to help. Only USD 26 billion is used to support agricultural knowledge and innovation systems. The green recovery provides an opportunity to improve long-term productivity, sustainability, and resilience of global food systems by removing price-inflating and trade-distorting measures that discourage production changes, encourage an overuse of natural resources, potentially increase GHG emissions and slow climate change adaptation. Public funds can be redirected towards investments in innovation, in sustainable use of land, water and biodiversity resources, in climate change mitigation and adaptation, and farm household resilience. This could encompass, in particular, a broader use of targeted payments to encourage improved farm management practices.

Unleashing innovation. The creation and diffusion of new products, processes and methods is fundamental to creating new businesses and jobs, increase productivity and drive progress towards the green recovery. There are major opportunities for green innovations, which include, among others, technologies for renewable energy, energy storage, heating and cooling in buildings, electric, hybrid and fuel-efficient vehicles, and carbon capture, storage and use technologies. Despite some progress, the current level of innovation is not sufficient to reach ambitious climate and environmental objectives. Stimulus measures represent an important opportunity to bolster funding for innovation, though government involvement in innovation goes well beyond public funding for R&D. Typical innovation barriers include financing, information asymmetries, uncertainty of future policy strategies, and trade barriers.[15]

Job creation in the green recovery

Addressing the impact of the pandemic on employment has been a major factor in government measures for recovery and stimulus to date. It is clear that green recovery measures will also need to address as a top priority the issue of jobs, both directly and indirectly. There is mixed evidence on the macroeconomic

impact of green growth on overall employment[16]. However, sectoral and regional impacts can be significant for particular industries and measures to facilitate worker re-allocation need to consider types and transferability of skills as well as quality of jobs.

Various "green" sectors and activities offer significant prospects for job creation. For example, renewable energy, notably solar PV, employs more people per unit of investment and energy than fossil-fuel generation.[17] The International Renewable Energy Agency (IRENA) estimates that renewable energy could employ more than 40 million people by 2050 and that total energy sector employment can reach 100 million by 2050, up from around 58 million today, should the international community utilise its full renewable energy potential. Energy efficiency also offers significant opportunities for rapid job creation, with the IEA estimating potential of up to 2.5 million new jobs per year as part of recovery efforts. However, there are considerable regional disparities in job creation in the energy sector with job gains in some parts of the world outpacing losses in others. In addition, some population groups, notably ethnic minorities and women, do not benefit from job creation to the same extent as others. The identification of policies that balance the impact of the transition while maximising socioeconomic opportunities is key for a more inclusive transition that supports the most vulnerable groups of society.

Nature-related jobs are also an important potential source of employment in the green recovery. Ecosystem restoration in the US provides direct employment for 126 000 workers and generates USD 9.5 billion in economic output annually. It creates a further 95 000 indirect jobs and USD 15 billion in household spending. Another study found that around 11 jobs were directly attributable per USD 1 million investment in ecosystem restoration projects, while total direct and indirect restoration jobs generated by USD 1 million investment, reached 31.5.[18]

Additionally, organic agriculture offers potential for job creation. A number of studies have found that labour requirements per hectare on organic farms are higher than their conventional counterparts given that they have more labour-intensive production activities (e.g. complex rotation systems, mixed farming); that there is a higher share of labour-intensive crops (e.g. fruit and vegetables), less mechanisation, more on-farm processing and trading, and higher requirements for information. It has been argued, however, that labour needs in organic farming vary according to industry and country characteristics. For example, organic horticulture farms need considerably more labour, while organic, cereal-livestock and dairy farms might not require any more labour than their conventional counterparts.[19] In addition, there are important trade-offs which need to be taken into account. For example, organic farming is land-intensive and GHG emissions per unit of production can be higher than conventional agriculture. Moreover, yields per hectare are lower and fixed costs per unit of production are in general higher in organic agriculture.

The transition to a greener economy also requires new skills, both for newly emerging jobs and for existing jobs that are evolving. Without a suitably trained workforce the transition will be impossible. Skills gaps and shortages are already recognised as a major bottleneck in a number of sectors, such as renewable energy, energy and resource efficiency, renovation of buildings, construction, environmental services and manufacturing. Skills gaps related to the low-carbon transition are particularly pronounced in developing countries. The availability of workers and enterprises with the right skills for green jobs plays not only a critical

role in initiating the transition to a green economy, but also in enabling a just transition that ensures social inclusion and decent work. As all households and individuals need to have equal opportunities to adjust and gain from the green transition, investment in their skills and education should be an integral part of recovery plans. Comprehensive measures for vocational training and reskilling can improve transferability across firms and sectors, thus enhancing ability to successfully relocate as needed. While the energy transformation is likely to have an overall net-positive impact on employment, millions of fossil-fuel workers will need to find new jobs[20]. Policies for a just transition can also facilitate the process of retraining fossil-fuel workers at risk. Partnerships between governments and industry can be built to finance reskilling and to ensure that training content meets the evolving needs of the sector.

The role of sustainable finance

Governments have committed substantial public resources to supporting a green recovery, at least USD 312 billion according to a preliminary estimate from OECD country-by-country analysis (subject to further refinement and elaboration in coming months). If the full package of measures proposed by the EU is also included, this figure rises to over USD 1 trillion (noting that there may be double counting with already-announced totals from EU countries). However, as noted above, greater resources have so far been allocated towards less sustainable drivers of economic recovery, such as facilitation of fossil-fuel investments. A green and jobs-rich recovery needs additional financial resources.

To fully fund the low-carbon transition, public resources committed to green measures must be used strategically to mobilise capital from private sources. To facilitate this, the financial system should correctly value and incorporate climate and biodiversity-related risk. Financial markets also need to be transparent and efficient in order to ensure market integrity and investor confidence, which in turn contributes to market resilience. In recent years, trillions of dollars in capital have flowed into investments that are assessed using environmental, social and governance (ESG) criteria. In the COVID-19 context, greater attention to non-financial ESG risks is more important than ever before, both for sustainability and as a competitive factor to win market share and investment. ESG criteria have helped raise awareness and strengthen corporate and investor commitments, but more work is urgently needed to ensure that ESG ratings are fit for purpose. Today's ESG markets contain a huge variety – and at times a divergence – in methodologies, performance metrics and product structures. Forthcoming OECD research on these ratings finds, for example, that a high rating under the "Environmental" pillar of an ESG criteria does not necessarily translate into lower carbon emissions.[21] New OECD work will help address these challenges, through a framework and policy guidance for effective ESG practices.

Leveraging private investment for infrastructure is a critical pillar of the low-carbon transition, as reflected by the OECD-wide initiative on sustainable infrastructure. Around USD 6.3 trillion of annual investment in infrastructure is needed until 2030 in energy, transport, water and telecommunications infrastructure, to sustain growth and increase well-being. Only 10% more, USD 0.6 trillion per year, would be required to align new infrastructure with a well-below 2°C climate goal. [22] Sustainable infrastructure investment is also an important

opportunity for the green recovery, given that 60% of the urban infrastructure to exist by 2030 is yet to be built. Infrastructure investment was an important component of fiscal stimuli following the 2007-08 financial crisis, ranging from 21% in advanced economies and 40% in other countries.[23]

In recent years, bond issuances have become increasingly important as a means to mobilise private finance for low-emission infrastructure projects, totalling nearly USD 800 billion. Despite the crisis, demand for responsible investment has continued to drive green bond issuance in 2020, with USD 77.7 billion issued, albeit 13% lower than the same period in 2019.[24] While significant progress has been made to establish standards for green bonds, there continues to be a risk of "green washing", whereby the use of proceeds is invested in less sustainable outcomes.

A further challenge to mobilising private investment as part of the green recovery is the lack of sufficient "investment-grade" infrastructure projects. Greater certainty over a pipeline of potential projects would allow investors to take calculated risks, invest in capacity building and help foster a market for infrastructure investment. To facilitate this, governments can support the creation of such project pipelines, including through partnerships between investors and governments and through providing more precise and consistent definitions of which investments are "green". A common understanding of criteria for 'green' and 'sustainable' infrastructure would accelerate investment flows by simplifying due diligence and enabling a 'plug and play' architecture. The EU taxonomy for sustainable finance is an important development in this regard.[25]

Multilateral development banks and development finance institutions have played a key role in supporting governments' response to the pandemic. As the response shifts from providing emergency liquidity to financing the recovery, development finance providers should prioritise sustainability and seek to mobilise private capital for a green recovery through strategic risk sharing.

The importance of global co-operation in the green recovery

COVID-19 has triggered a global health and economic crisis that calls for greater international co-operation across a number of areas, from the development of vaccines and treatments, to strengthening the robustness and resilience of supply chains, to the co-ordination of fiscal and monetary policies and support to developing countries.

The most pressing environmental problems are also largely transnational in nature, so meeting global environmental challenges requires multilateral co-operation, especially to achieve the needed transformative action at least cost. This is critical to strengthen resilience and well-being – including to shore up defences against future pandemics – as well as to realise the potential of green sectors for job creation, income and growth. The green recovery is central in this regard, at both the national and international levels. Much of the current policy focus is on national measures, supported by international efforts to track progress, such as the "Platform for Redesign 2020", led by Japan and supported by the UNFCCC.[26] However, smoother international trade in environmental goods and services, enhanced co-operation on innovation, and increased flows of sustainable finance and technical support between developed and developing countries will also be key. These cannot be achieved without increased global co-operation. Importantly, the upcoming round of major international negotiations in 2021 on

climate, biodiversity and chemicals will be critical waypoints in driving multilateral action and reaching globally agreed environmental goals.

As it has done in the past, the OECD will be supporting these efforts through its evidence, data and analysis of best practices. In coming months, the OECD will be enhancing and refining the monitoring of green recovery measures in Member countries and Key Partners, and will continue to develop analysis to support the forthcoming major international negotiations on climate and biodiversity in 2021. The OECD is also planning a major horizontal project in 2021-22 on climate and economic resilience that will address the policy challenges confronting economies and societies in meeting climate and related environmental challenges in an era of economic and technological disruption.

Monitoring and evaluating the green recovery: key indicators

Monitoring the impact of recovery and stimulus measures on environmental outcomes through measurable, comparable and timely indicators is key to ensuring that the green recovery is well-targeted and effective in its execution. In addition, when designing and implementing green recovery measures, countries should systematically develop evaluation frameworks with clear criteria and robust methodologies in order to assess the environmental effectiveness and economic efficiency of stimulus measures. Such evaluation will also allow governments to adjust programmes and policies in response to changing circumstances or new evidence and data.

Analysis conducted on stimulus packages introduced in response to the 2008 global financial crisis[27] showed that very few countries had conducted ex post assessments of national green stimulus measures. The distributional consequences of such measures should also be explicitly considered in such evaluations. This is a key part of the ongoing discussion on how measuring economic growth might be improved to include environmental degradation, non-market activities, and inequality of income, among other factors, and how countries need an indicators framework to measure, monitor and evaluate progress towards the green recovery.

To contribute to this effort, the OECD has identified a list of 13 headline environmental indicators derived from its set of Green Growth Indicators and Core Set of Environmental Indicators (see the Environment at a Glance online platform). The indicators were selected according to their relevance for monitoring progress towards green growth and environmental objectives, and they will be essential in tracking the environmental success of recovery packages over time, alongside economic, employment and other social indicators. Some indicators track outcomes, while others relate to policy measures that governments directly control.

The following criteria were used to select the indicators:

- Capacity to capture the interface between the environment and the economy
- Capacity to monitor key environmental trends
- Measurability and comparability across countries and over time

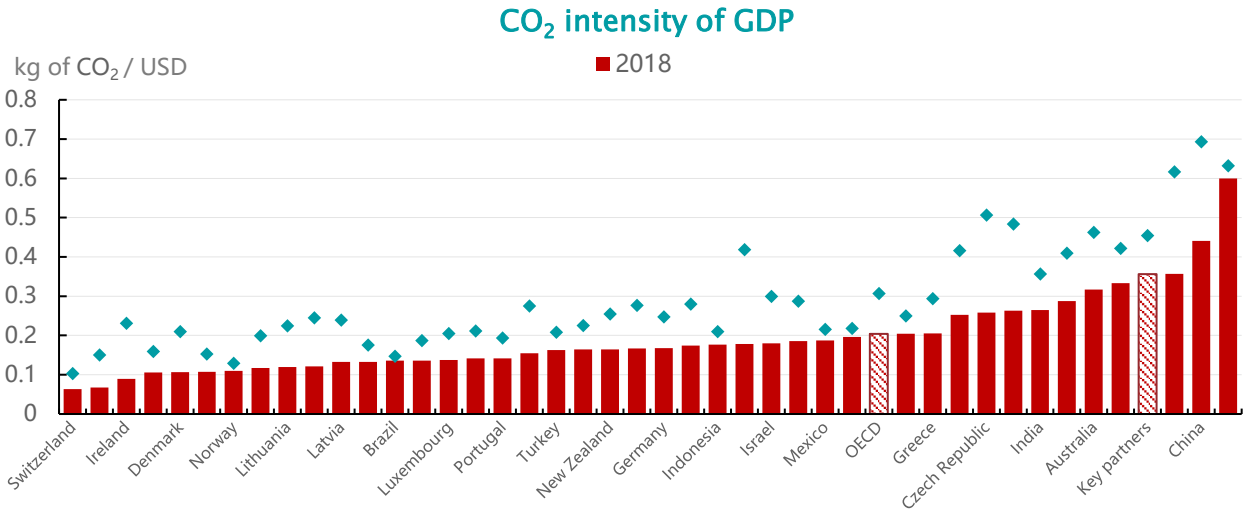
Environmental indicators for a green recovery

	Outcome indicators	Policy indicators
Climate	1. Carbon intensity 2. Renewable energy in the energy mix	3. Effective carbon rates 4. Fossil-fuel support
Biodiversity	5. Land cover change	6. Protected areas 7. Economic instruments relevant for biodiversity
Other environment dimensions	8. Exposure to air pollution 9. Material productivity 10. Water stress	11. Research and Development 12. Environmentally related tax revenue 13. Environmental Official Development Assistance

Climate

Carbon intensity

Progress towards green growth can be evaluated against trends in carbon dioxide (CO_2) intensity of GDP, as CO_2 emissions are the primary driver of climate change. The carbon intensity of all OECD and Key Partner economies has decreased since 2000 showing that CO_2 emissions increased at a lower rate than real GDP, thus achieving relative decoupling. Beyond decreases in economic activity, this reflects shifts in industrial structure and the energy supply mix, and improved energy efficiency. Still, global CO_2 emissions continue to grow, mainly due to increases in emissions in the transport and energy sectors. The level of decoupling between CO_2 emissions and economic growth is far from sufficient to achieve the aims of the 2015 Paris Agreement, which would require steep reductions in total global emissions.

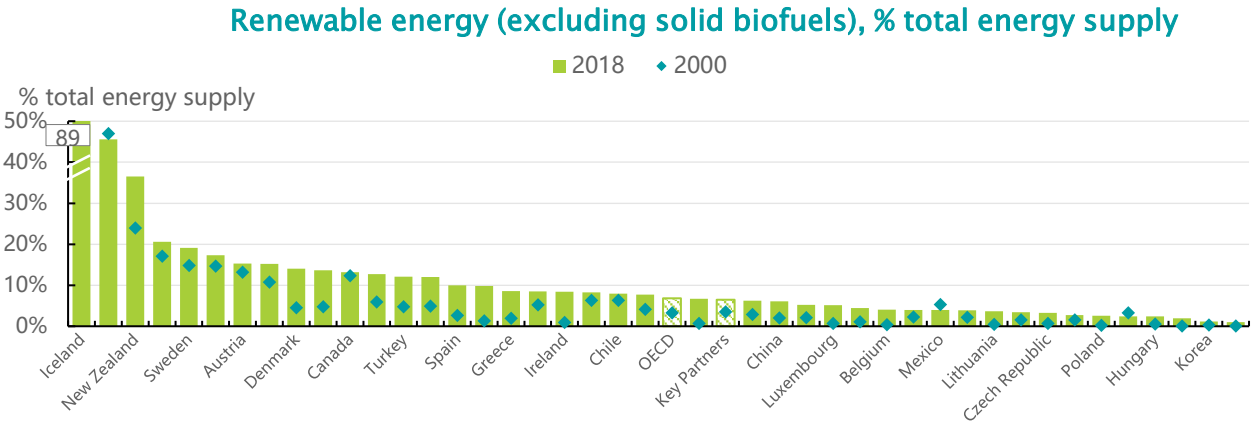


Note: CO_2 emissions refer to gross direct emissions of CO_2 from fossil-fuel combustion, i.e. from burning oil, coal, natural gas and other fuels for energy use. Intensities are expressed as kg of CO_2 emitted per unit of GDP (kg/USD). GDP is expressed at constant 2015 USD using purchasing power parities (PPPs). CO_2 emissions account for roughly two thirds of total greenhouse gas (GHG) emissions. This indicator should be read alongside total GHG emissions, energy productivity and efficiency, renewable energy sources, energy prices and taxes, and carbon pricing. Consumption-based emissions metrics can also provide an important complement (i.e the total carbon footprint of goods and services consumed within a country, regardless of where they were produced)

Source: IEA (2020), IEA *CO_2* Emissions from Fuel Combustion Statis*tics (database).*

Renewable energy in the energy mix

Increasing the share of renewable energy sources in the energy mix (as well as other low-carbon fuel technologies) is an important factor in addressing climate change. Fossil-based energy is a major source of greenhouse gas emissions and local and regional air pollution, and also affects water quality and land use. While several OECD countries have made progress in increasing renewable energy, in particular for electricity, the overall share of renewables has increased modestly over the last two decades. The fastest increases in renewables penetration were mainly for electricity, due to government policies supporting deployment of new renewable generation capacity. Since 2000, improvement rates have been mixed across countries, with generally stronger increases in the OECD area.



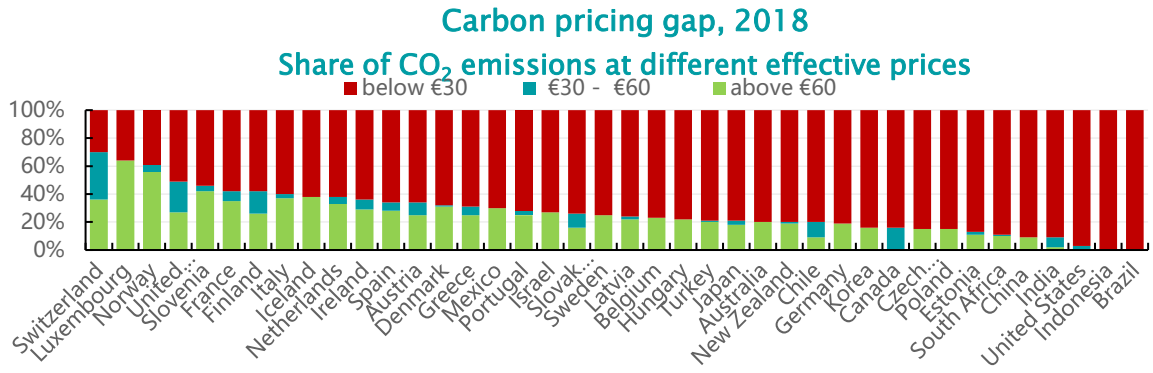
Note: Renewables include hydro, geothermal, solar (thermal and PV), wind and tide/wave/ocean energy, as well as combustible renewables (liquid biomass, biogas) and waste (renewable municipal waste). The indicator excludes solid biomass (primary solid biofuels and charcoal) to avoid distortions due to t he traditional use of biomass for cooking and due to the potential environmental risks associated to its unsustainable sourcing.

A country's energy profile can be assessed by more than the supply from renewable energy sources. Other considerations include economic structure (e.g. presence of large energy-consuming industries), country size (influencing demand from the transport sector), local climate (affecting demand for heating or cooling) and outsourcing of goods produced by energy-intensive industries. Cross-country comparisons also need to consider countries' endowment in energy resources.

Source: IEA (2020), "Extended world energy balances", IEA World Energy Statistics and Balances (database)

Effective carbon rates

Carbon prices are an essential element to decarbonise the economy, indispensable to induce cost-effective abatement, to steer investment towards low-carbon infrastructure technologies and to discourage carbon-intensive production and consumption. Globally, countries are far from exploiting the full potential of emissions pricing policies, as reflected in the effective carbon rates for OECD and partner countries. "Effective carbon rates" measure the actual carbon price paid across the economy, combining for example energy taxes and specific carbon pricing measures. This allows calculation of a carbon price "gap", i.e. the difference between the average effective carbon rate and a benchmark level. Most emissions across OECD and Key Partners are not priced at all, and 90% of emissions are priced at less than EUR 30 per tonne of CO_2, the low-end estimate of the social damage that carbon emissions cause. The current effective carbon prices do not provide stable and sufficient economic incentives for firms to reduce the costs of future mitigation. Nor do they provide incentives for investments that take account of rising climate risks and support climate-compatible economic growth.



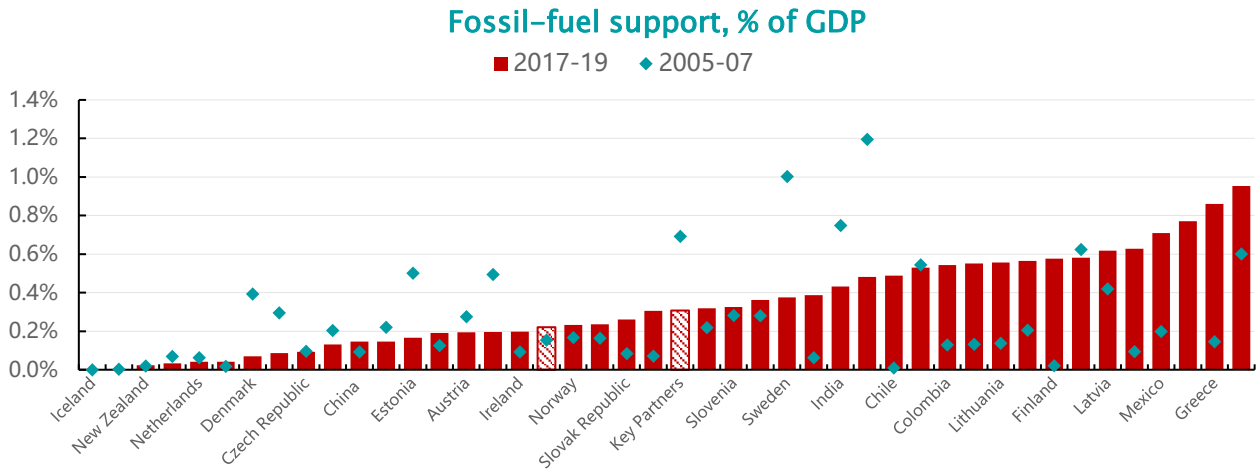
Note: The carbon pricing gap is a summary measure of the difference between the actual (or effective) price applied to CO_2 emissions from energy use and the benchmark rates[28] of EUR 30 and EUR 60 per tonne of CO_2. For example, for Switzerland the gap to a €30 benchmark is 27%, whereas for Brazil its 94%. Effective carbon rates include carbon taxes, specific taxes on energy use (primarily excise taxes), and tradable emission permit prices, representing the opportunity cost of emitting an extra unit of CO_2.

Effective carbon rates do not account for differentiated value added tax rates or production and consumption subsidies on energy products within the different countries. Such differentiated rates alter relative prices and should complement the indicators on effective carbon rates. In addition, these benchmark rates are expressed irrespective of external costs additional to those of CO_2 emissions. For example, excise taxes can also serve as (imprecise) instruments to internalise congestion, noise and air pollution costs. Ideally, these benchmark rates would include the full array of external costs caused by fossil-fuel consumption.

Source: OECD (2018), Effective Carbon Rates 2018: Pricing Carbon Emissions Through Taxes and Emissions Trading, OECD Publishing, Paris.

Fossil-fuel support

Fossil-fuel support to both production and consumption is still prevalent in most OECD and partner economies. The majority of the support is targeted to fossil-fuel consumption; however, there has been an increase in the level of support for oil and gas production in recent years. Among energy products, petroleum remains the largest component of support (about 75%), followed by natural gas, electricity and coal. There are currently around 1200 individual government policies in place in OECD and Key Partner countries supporting fossil fuels. These fossil-fuel support measures undermine global efforts to mitigate climate change, which also leads to biodiversity loss and aggravates local pollution problems, causing further damage to human health and the environment. Moreover, they represent an opportunity cost to society: the resources could instead be directed to other more productive uses.



Note: The 2005-07 average for Indonesia (IDN) of 2.9% was excluded to improve readability. Fossil-fuel support encompasses all direct budgetary transfers and tax expenditures that provide a benefit or preference for fossil-fuel production or consumption, either in absolute terms or relative to other activities or products.

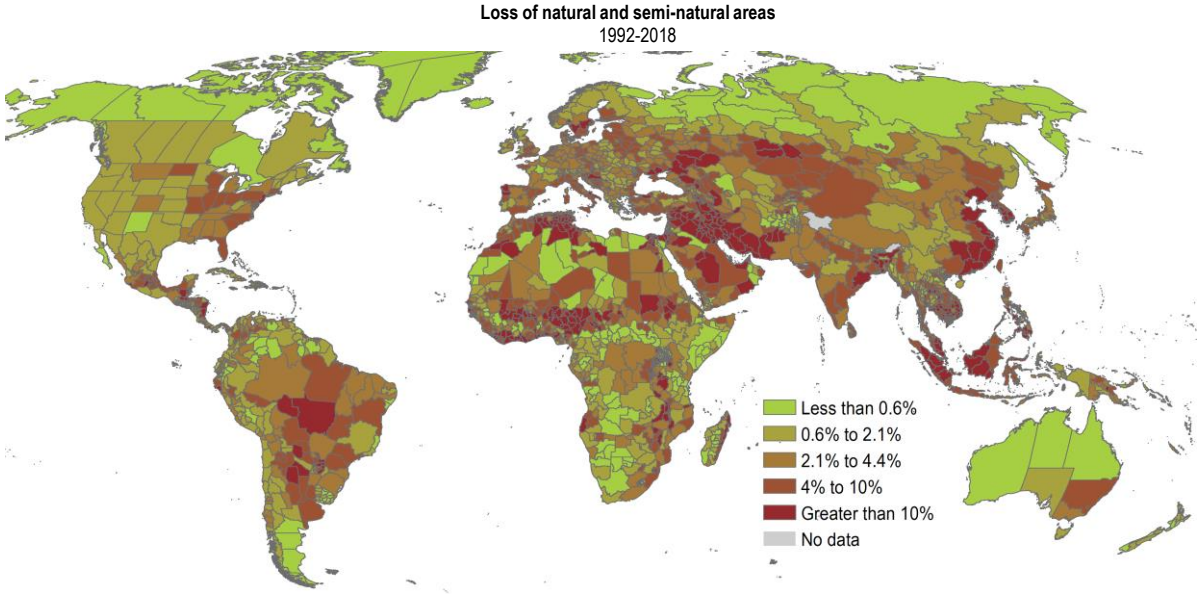
Data on tax expenditures, which represent the majority of the support mechanisms, need to be interpreted with caution bearing in mind that tax regimes can differ substantially (e.g. depreciation allowances). Fossil-fuel support is often calculated as deviation from the benchmark taxation. However, countries define the benchmark in different ways, making international comparisons potentially difficult. This indicator features in the global list of SDG indicators and is used to monitor progress towards SDG 12.c.1.

Source: OECD (2020), "OECD Inventory of Support Measures for Fossil Fuels ", OECD Environment Statistics (database).

Biodiversity

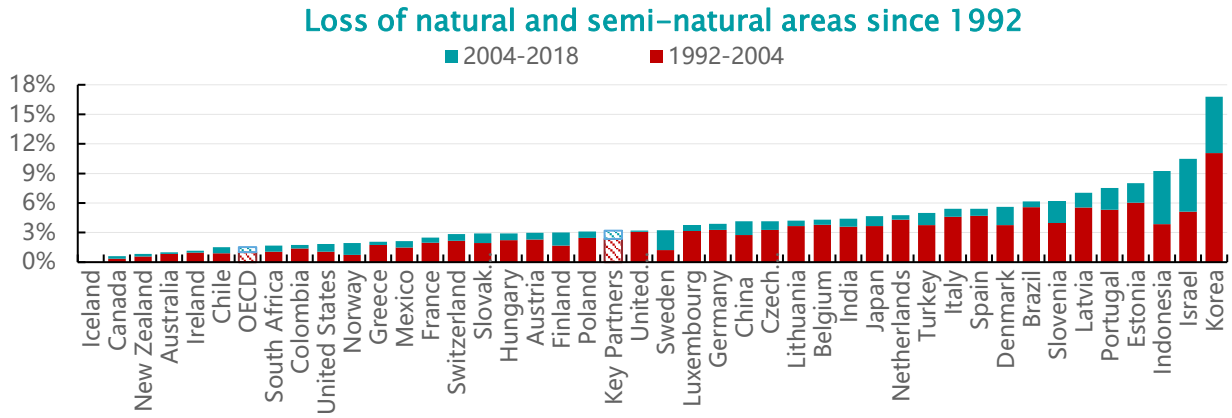
Land cover change

Land and soil resources are essential for the provision of ecosystem services and biodiversity conservation. The loss of natural and semi-natural areas contributes to the release of CO_2 and exerts pressure on biodiversity through habitat fragmentation and loss. Land cover change is mainly due to urbanisation and land clearing for grazing and agriculture. While the conversions from (semi-) natural land into agricultural land and artificial surfaces show a slower rate in the past 15 years, conversions to artificial surfaces remain a serious concern given the existing level of urbanisation in many countries and its cumulative character.



Note: Natural and semi-natural areas include forests, grasslands, wetlands, shrubland and other vegetated land. Subnational regions are shaded by quintile (i.e. 20% of subnational regions experienced losses greater than 10%). Loss is shown as a percentage of the natural and semi-natural vegetated land at the start of the period. It should be kept in mind that where the starting 'stock' is small (such as in desert regions), trivial changes can be large in percentage terms; conversely, very large natural land losses in (e.g.) heavily forested regions can appear modest. In some regions with significant commercial forestry there have been concomitant gains of natural and semi-natural land that equal or exceed losses.

Source: OECD (2020), "Land resources: Land cover change in countries and regions", OECD Environment Statistics (database) using data from the European Space Agency CCI-Land Cover project. Subnational boundaries include data from FAO GAUL (2015).



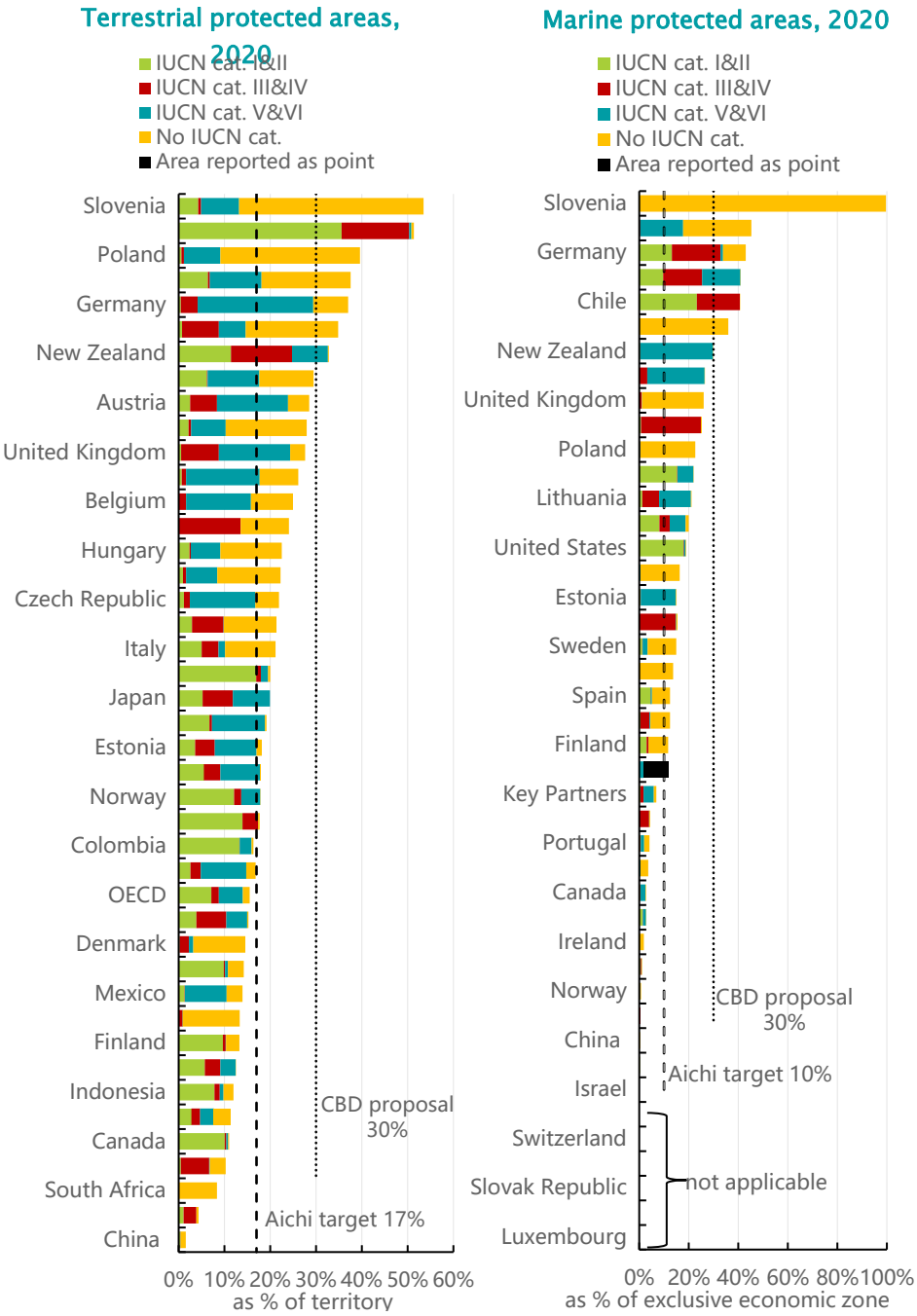
Note: The Key Partners aggregate (Key p.) includes the Russian Federation. Natural and semi-natural areas include forests, grasslands, wetlands, shrubland and other vegetated land.

Land cover changes are the outcome of complex and connected natural and anthropogenic processes that are challenging to characterise; therefore, data gaps remain about the drivers and impacts of these changes. Recent improvements in global land monitoring capacities (e.g. using remote sensing) increasingly allow identifying where changes such as deforestation or urbanisation are most intense.

Source: OECD (2020), "Land resources: Land cover change in countries and regions", OECD Environment Statistics (database) using data from the European Space Agency CCI-Land Cover project.

Protected areas

Protected areas contribute significantly to biodiversity conservation and the provision of ecosystem services. The size of protected areas is growing in most countries. In OECD countries, they cover on average 16% of the land area and 20% of marine areas (i.e. exclusive economic zones - EEZ), compared to respectively 10% and 2% in 2000. 26 OECD countries meet the Aichi 2020 target to protect at least 17% of their land area and 21 countries the target to protect at least 10% of coastal and marine areas. However, there are large variations among countries in the extent, quality and management objectives of terrestrial and marine protected areas.



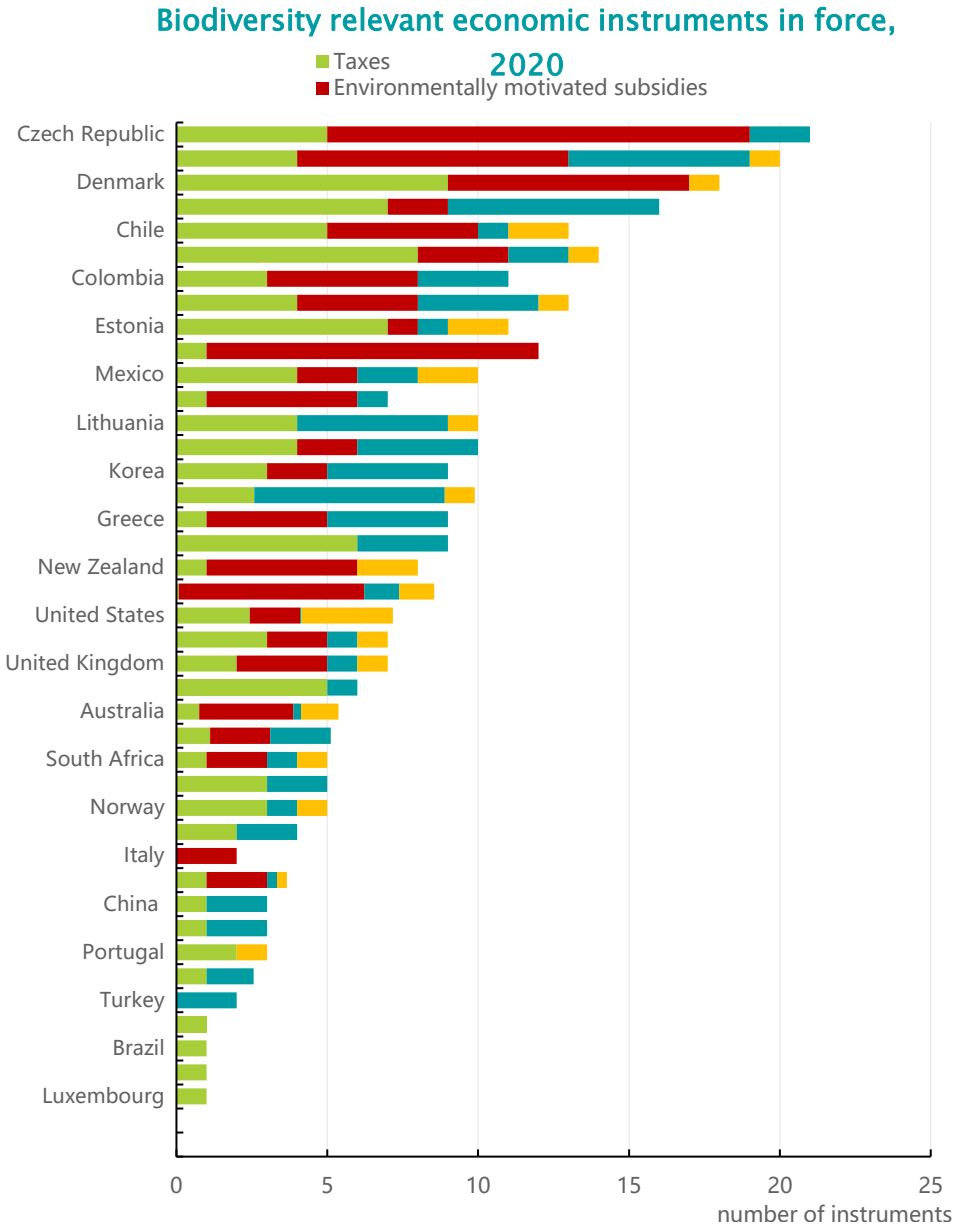
Note: The Key Partners aggregate (Key p.) includes the Russian Federation. Protected areas include all areas with a management category by the International Union for Conservation of Nature (IUCN). IUCN management categories I-II designate strict nature reserves, national parks and wilderness areas. Categories III and IV establish habitats and species management areas. Categories V and VI indicate areas protected for the preservation of cultural heritage or the promotion of sustainable resource use. Some countries use regional and international designations such as the European Natura 2000 regional network, which do not correspond to an IUCN category. Areas with overlapping management categories are only included once to avoid double counting.

These indicators should be interpreted with caution. Protected areas are not always sufficiently connected, or representative of national biodiversity. Also, indicators on the extent of protected areas do not reflect the management effectiveness of these areas.

Source: OECD (2020), "Biodiversity: Protected areas", OECD Environment Statistics (database) using the UNEP-WCMC World Database on Protected Areas April 2020 release.

Economic instruments relevant for biodiversity

Biodiversity-relevant taxes, fees and charges, subsidies, and other economic instruments provide important market signals that can encourage more sustainable production and consumption patterns. The number of economic instruments relevant for biodiversity, as well as the number of countries implementing such instruments, have increased over time. According to the data reported to the OECD PINE database, in 2020, 41 OECD and Key Partner economies have 458 biodiversity-relevant economic instruments in force, of which 30% are at the sub-national level. In 2000, 36 countries had active instruments, and their number was 20% lower. Alarmingly, there has been almost no progress since the Aichi Targets came into force in 2010.



Note: These counts include national and sub-national instruments in force as of the 1st of January 2020. The number of sub-national instruments are weighted by the number of large regions (territorial level 2) for every country. Biodiversity-relevant taxes include taxes on pesticides, fertilisers, forest products and on timber harvests. Fees and charges include entrance fees to national parks, fees on hunting licenses, charges on land-based sewage discharge, charges for groundwater abstraction and biodiversity-relevant non-compliance fines. Biodiversity-relevant subsidies are those targeting forest management and reforestation, subsidies for organic or environmentally-friendly agriculture, for pesticide-free cultivation, and for land conservation. Tradable permits include individual transferable quotas for fisheries, tradable development rights, and tradable hunting rights.

Care should be taken when interpreting this indicator. The existence of an instrument does not guarantee its enforcement. Moreover, the level of stringency might not be adequate for the desired environmental outcome. The data does not include information on payments for ecosystem services (PES) and biodiversity offsets, though such data will be collected by the OECD shortly.

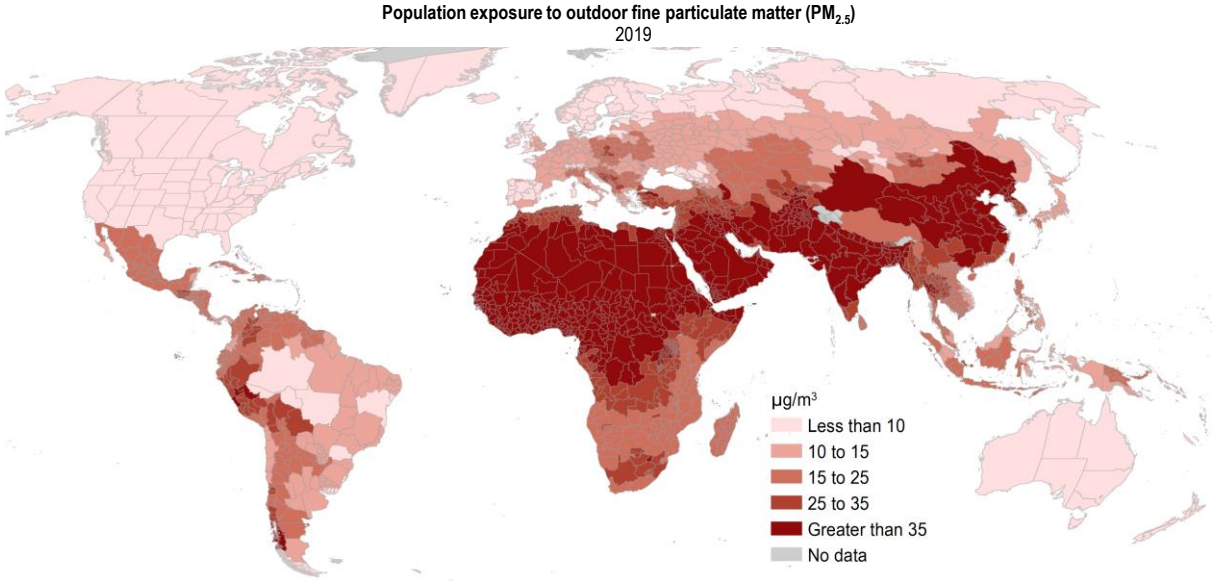
Source: OECD Policy instruments for the Environment (PINE) database (August 2020 edition). See also OECD (2020) *Tracking Economic Instruments and Finance for Biodiversity*, for more information.

Other environment dimensions

Exposure to air pollution

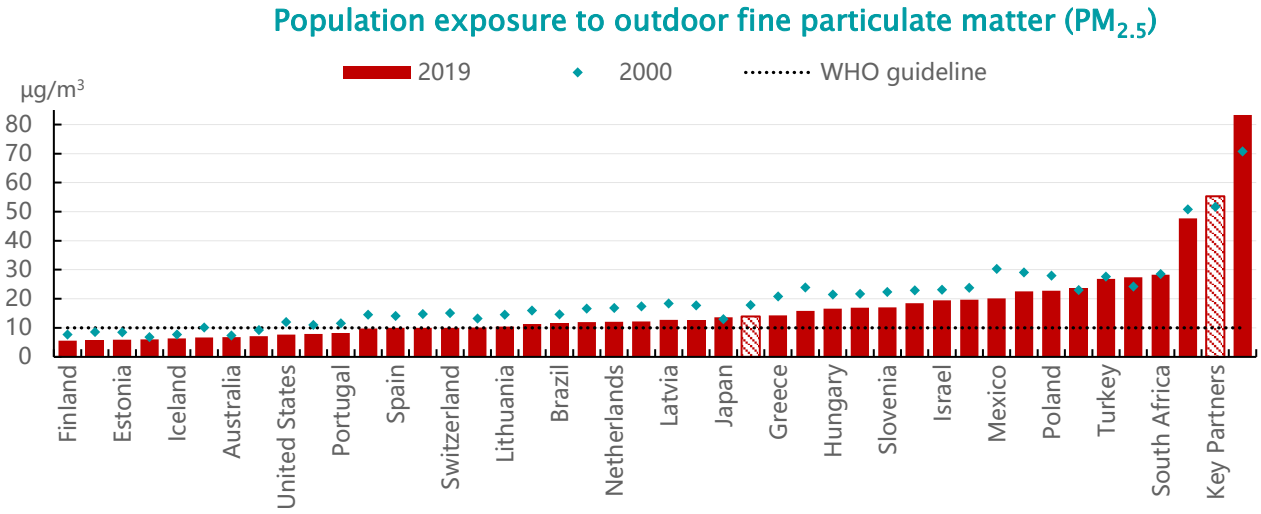
Air pollution is the single greatest environmental health risk worldwide. Fine particulate matter ($PM_{2.5}$), in particular, is the most serious pollutant globally from a human health perspective. Chronic exposure even to moderate levels of $PM_{2.5}$ substantially increases the risk of heart disease, stroke, and respiratory diseases.

Despite commendable improvements in reducing exposure to air pollution ($PM_{2.5}$), the populations of most OECD countries remain chronically exposed to harmful levels of $PM_{2.5}$. While the map of mean exposure shows highest levels of $PM_{2.5}$ across the Sahara, Middle East, India and People's Republic of China (some of which is due to natural sources), the problem is nevertheless severe in OECD countries, notably in cities. Less than one in three OECD countries meet the WHO Air Quality Guideline for annual average $PM_{2.5}$ exposure of 10 micrograms per cubic metre (µg/m^3). Even this value is not a "safe" level; the 10 µg/m^3 guideline is still associated with elevated risk of heart and respiratory diseases.



Note: Mean population exposure to fine particulate matter is the concentration level, expressed in micrograms per cubic meter (µg/m^3), to which a typical resident is exposed throughout a year.

Source: OECD Environment Statistics (database) (2020), OECD calculations using IHME GBD 2019 concentration estimates (forthcoming). using IHME GBD 2017 concentration estimates. Subnational boundaries include data from FAO GAUL (2015).



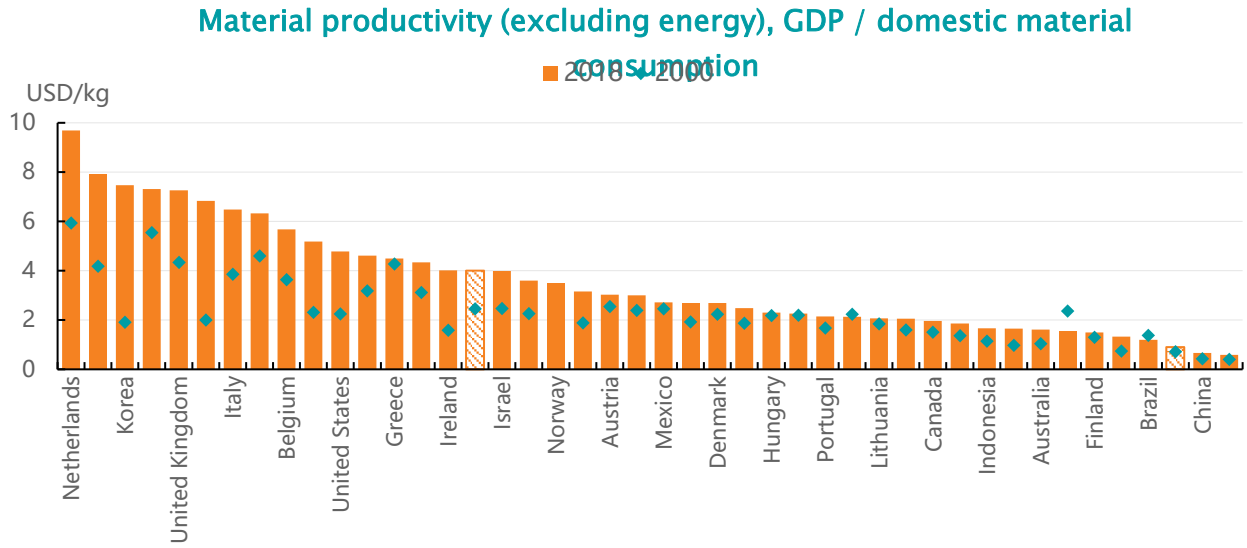
Note: The Key Partners aggregate (Key p.) includes the Russian Federation. Mean population exposure to fine particulate matter is the concentration level, expressed in micrograms per cubic meter (µg/m³), to which a typical resident is exposed throughout a year.

Exposure indicators provide only a partial view of air pollution severity and consequences aggregated across the entire population. Importantly, there is generally no "safe level" of exposure for many pollutants.

Source: OECD Environment Statistics (database) (2020), OECD calculations using IHME GBD 2019 concentration estimates (forthcoming).

Material productivity

The use of raw materials from natural resources and the related production and consumption processes have environmental, economic and social consequences beyond national borders. Non-energy material productivity has been improving in most OECD countries (especially in some European countries). However, it remains low and stagnant in Key Partner economies. In 2018, OECD economies generated about USD 4 000 of income (in terms of GDP) per tonne of non-energy materials used. That is more than four times the value generated by Key Partner economies (USD 900 per tonne).



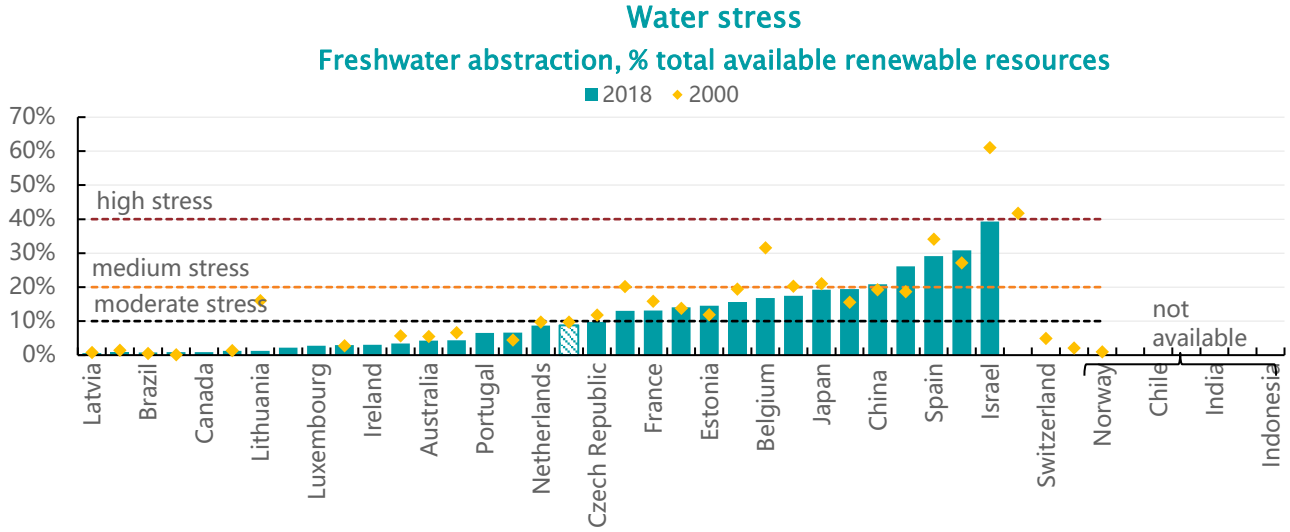
Note: Data refer to the indicated year or to the latest available year. The aggregate for Key Partners (Key p.) includes the Russian Federation. Material consumption includes biomass for food and feed, construction minerals, industrial minerals, metals and wood. GDP is expressed at constant 2015 USD using purchasing power parities (PPPs).

These measures should be read in conjunction with information on commodity prices, flows of secondary raw materials, and consumption levels and patterns. In general, caution is needed when drawing conclusions based on country-level data. Changing trade patterns and the displacement of resource intensive production to other countries play a role in productivity gains. *Source: OECD (2020), "Material resources", OECD Environment Statistics (database).*

Water stress

Freshwater resources are of major environmental, social and economic importance. Various forces exert pressure on water resources. These include over-abstraction and degradation due to pollution loads from human activities (agriculture, industry, households), changes in climate and weather conditions, and the introduction of invasive species.

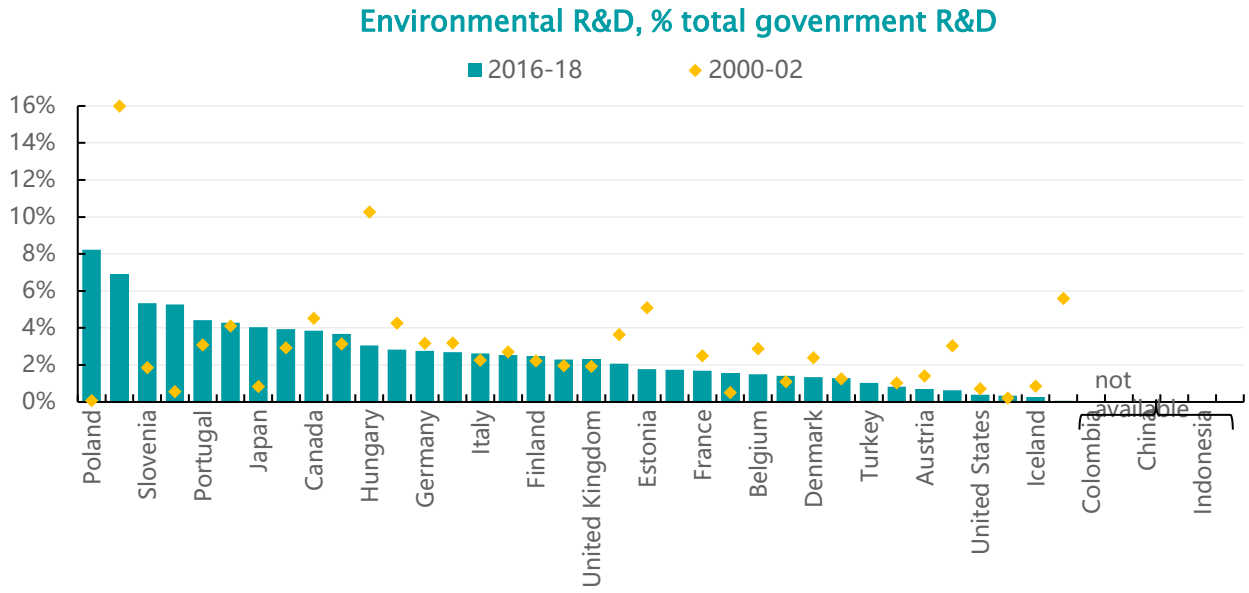
The availability of renewable fresh water resources and the levels of water stress show wide variation among and within countries. Most OECD countries face at least seasonal or local water quantity problems. In more than one-third of the OECD, freshwater resources are under moderate to medium-high stress. In a few countries, water resources are abundant and population density is low. Several have extensive arid or semi-arid regions where scarce water constrains economic development. In these cases, public water supply has to rely on other sources of water (e.g. desalinated seawater or non-renewable groundwater).



Note: Data refer to the indicated year or to the latest available year. National-level indicators as shown here should be complemented with information at the sub-national (river basin) level. They should also be read in connection with indicators on water quality. *Source: OECD (2020), "Water: Freshwater abstractions", OECD Environment Statistics (database).*

Research and Development

Innovation is a key driver of productivity and economic growth. It can help achieve environmental objectives at lower costs, and lead to new business opportunities and markets. Government Research and Development budgets have increased in many countries since 2000. However, the amount dedicated to environmental objectives has remained relatively stable in the OECD overall, with large variations among countries in the evolution of this share.



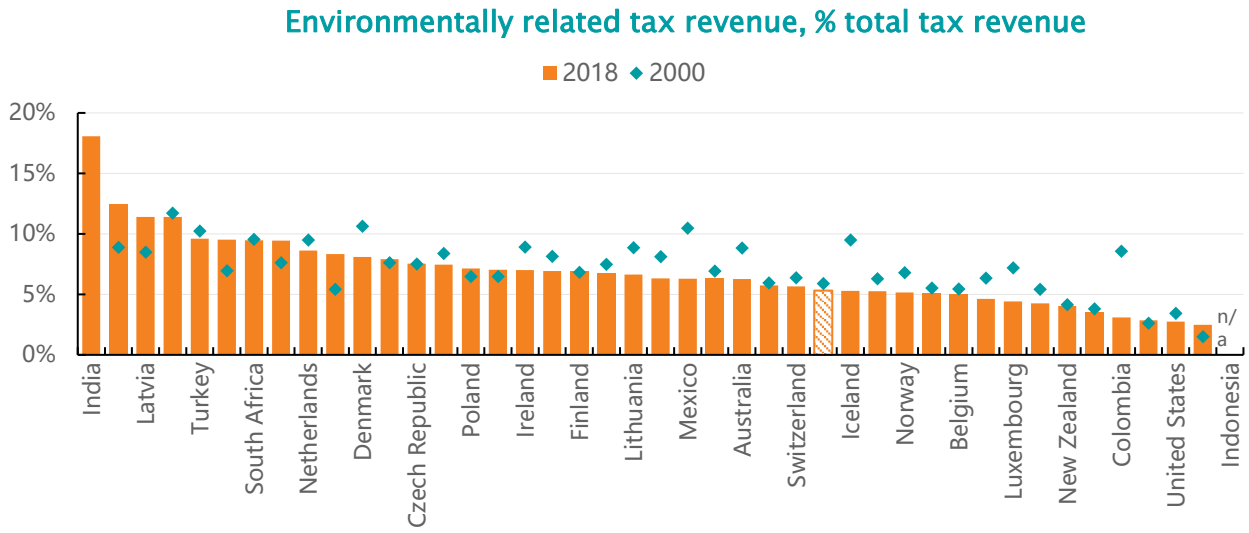
Note: Data refer to the indicated average or to the latest available average. Government budget for R&D refers to the funds allocated to R&D. Estimates of environment-related government R&D include research directed at the control of pollution and on developing monitoring facilities to measure, eliminate and prevent pollution. It is expressed as a percentage of all-purpose government R&D budget. R&D expenditure is an input measure that indicates an economy's relative degree of investment in generating knowledge. It thus reflects intent, not an outcome: high R&D spending alone does not mean superior innovation performance.

Source: OECD (2020), "Research and Development Statistics: Government budget appropriations or outlays for RD", OECD Science, Technology and R&D Statistics (database).

Environmentally related tax revenue

Market-based instruments encourage the lowest-cost abatement across polluters. They also provide incentives for abatement at each unit of pollution. In addition, the revenue raised can be used to support fiscal consolidation or to reduce other taxes (e.g. taxes on labour and capital that distort the labour supply and saving decisions). Shifting the overall tax burden away from labour and capital towards environmentally harmful consumption and production patterns, while maintaining the overall level of redistribution constant, can improve economic efficiency.

Overall, the share of environmentally related tax revenue (ERTR) continues to decline in OECD countries, amounting to 5.3% of total tax revenue in 2018, down from 6% in early 2000s. ERTR is also decreasing relative to GDP and fell to 1.5% of GDP in 2018. The bulk of revenue is raised from taxing energy (71%), in particular motor fuels, and transport (26%), while pollution and resource tax bases play a minor role in generating revenue.

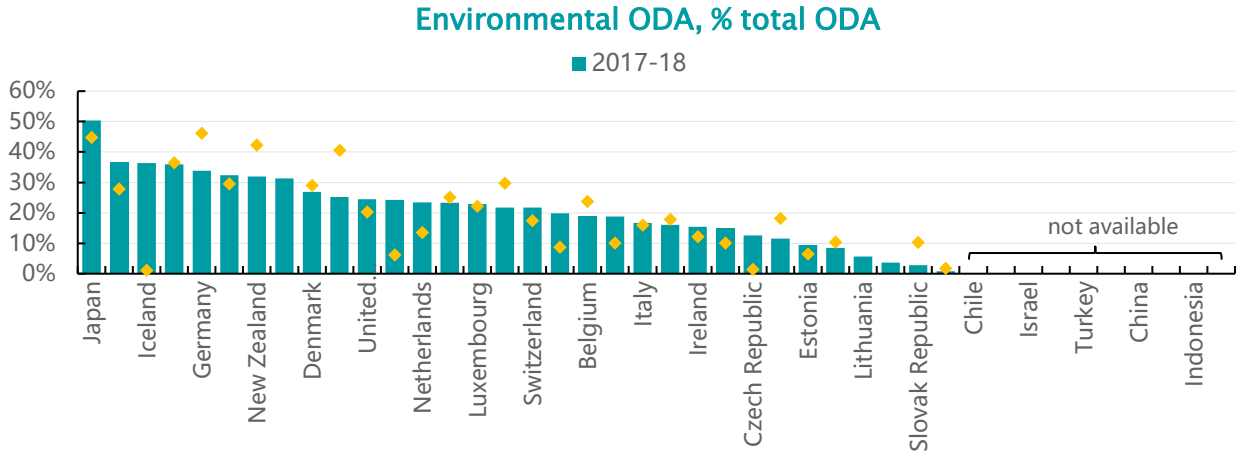


Note: Data refer to the indicated year or to the latest available year. Data for India for the year 2000 is not available. Environmentally related taxes include taxes on energy, transport pollution and resources. The indicators on environmentally related taxes should not be used to assess the "environmental friendliness" of the tax systems. For such analysis, additional information, describing the economic and taxation structure of each country, is required.

Source: OECD (2020), "Environmental policy: Environmentally Related Tax Revenue", OECD Environment Statistics (database); OECD (2020), Policy Instruments for the Environment (PINE) database.

Environmental Official Development Assistance

Official development assistance (ODA) is an important source of government-funded international financial flows. It can help catalyse investment for environmental projects and technologies, thus fulfilling the twin development-environment objectives. Members of the OECD Development Assistance Committee (OECD-DAC) provide as much as 95% of global development aid. The amount of environmental ODA targeting the biodiversity, climate change and desertification objectives of the Rio Conventions has been increasing since 2010. However, the share in total ODA has remained relatively stable overall, with large variations among countries. Most of these environmental funds target climate change mitigation and adaptation projects.



Note: Environmentally related Official Development Assistance is identified using the set of "Rio Markers". The Rio Markers screen for policy objectives of a cross-sectorial nature, including climate change, biodiversity and desertification. This variable includes only data on bilateral commitments and is calculated from microdata on individual projects. There is no internationally agreed methodology for tracking actual disbursements of ODA related to each environmental objective. Thus, it remains difficult to determine the environmental purpose of existing commitments and projects. There are also data gaps for some donors. Moreover, Rio markers for ODA refer to donors' commitments (i.e. policy objectives).

Source: OECD (2020), "Creditor Reporting System: Aid activities", OECD International Development Statistics (database).

Endnotes

[1] Please see: *The Inequalities-Environment Nexus: Towards a people-centred green transition*, COM/SGE/GG/IG(2020)1/REV1.

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[10] Brazil, China, India, Indonesia, and South Africa.

[11] See https://www.energypolicytracker.org/region/g20/.

[12] See https://www.vivideconomics.com/casestudy/greenness-for-stimulus-index/.

[13] Rhodium Group (2020), *It's Not Easy Being Green: Stimulus Spending in the World's Major Economies* https://rhg.com/research/green-stimulus-spending/

[14] For example, there is ample evidence that fossil-fuel prices are positively correlated with global patenting activity in low-carbon technologies. See Dechezlepretre, A. et al. (2011), "Invention and Transfer of Climate Change-Mitigation Technologies: A Global Analysis", *Review of Environmental Economics and Policy*, Vol. 5/1, pp. 109-130, http://dx.doi.org/10.1093/reep/req023.

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[26] See https://platform2020redesign.org/

[27] Shardul Agrawala, Damien Dussaux and Norbert Monti (2020), *What policies for greening the crisis response and economic recovery?*, https://www.oecd-ilibrary.org/environment/what-policies-for-greening-the-crisis-response-and-economic-recovery_c50f186f-en.

[28] The benchmark rate of EUR 30 is a low-end estimate of the damage that carbon emissions cause. EUR 60 per tonne of CO_2 is a midpoint estimate of carbon costs in 2020, as well as a forward-looking low-end estimate of carbon costs in 2030. Rising benchmark values over time for carbon costs reflect that the marginal damage caused by one tonne of CO_2 increases with the accumulation of CO_2 in the atmosphere.

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