World Economic Situation and Prospects

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Chapter II

Macroeconomic prospects and the 2030 Agenda: economics of energy transition

A wide gap remains between today's world and a world in which the energy system underpinning economic activity is compatible with global goals for climate protection, energy access and clean air. The rise in living standards over the past century has relied heavily on the depletion of the world's natural resources and the burning of fossil fuels to power growth. This economic model is clearly no longer viable, as evidenced by the accelerating pace of environmental degradation, rising greenhouse gas (GHG) emissions, and the increasing intensity and frequency of extreme weather events.

Changing the energy mix is the only way to break the link between the economy and GHG emissions

Arresting global warming will require a strong political will and the full strength of all available policy instruments to enhance energy efficiency, develop the required infrastructure and technology, and promote essential behavioural changes. The energy sector accounts for about three quarters of global GHG emissions and will play a crucial role in determining the success of worldwide efforts to rein in climate change. Even with accelerated improvements in efficiency, global demand for energy will continue to rise in the coming decade. Changing the global energy mix to move away from burning fossil fuels is the only way to decisively sever the link between economic activity and GHG emissions. The urgency of this energy transition continues to be underestimated. Many policy instruments still distort incentives towards fossil-fuel industries, encouraging shortsighted decisions that expand investment in carbon-intensive assets. This not only leaves many investors and Governments exposed to sudden losses and macroeconomic instability, but also causes substantial setbacks in efforts to achieve environmental targets.

Policymakers face the challenge of simultaneously meeting energy demand while also achieving environmental goals

The urgent need for a cleaner energy mix must be balanced against the equally urgent need to meet the rising energy demands of a growing population and deliver affordable energy to all. Simultaneously delivering on these objectives at the global level while maintaining economic stability will require a carefully balanced strategy that can best be achieved through close global cooperation. This chapter outlines the case for a rapid energy transition to ease the tension between expanding energy demand and protection of the environment and human health. It then explores some of the socioeconomic implications of the energy transition, which include a number of positive health benefits and opportunities in new sectors but also risks of stranded assets and job losses in fossil-fuel-intensive industries, which will require careful management at both the national and global levels. The final section of the chapter reviews the policy instruments available to accelerate progress and develops a policy road map to facilitate the energy transition process.

The case for a rapid energy transition

Energy gaps, the energy mix and greenhouse gas emissions

Urgent action is needed to reverse the rise of greenhouse gas emissions in order to avoid a climate crisis

Far more rapid progress must be made to reduce the level of GHG emissions associated with economic activity and energy use. Evidence such as historical temperature data indicates a worrying trend. In numerous geographic areas, the hottest years in the past century have occurred over the past decade. At the global level, the past four years have been the hottest in the past 139 years (NOAA, National Centers for Environmental Information, 2019). The world is already 1°C warmer than pre-industrial levels and, as the effects of this change become increasingly felt, a global consensus is emerging around the urgent need to dramatically reduce anthropogenic emissions of CO_2, methane (CH4) and other GHGs. In 2015, 196 countries signed the Paris Agreement and committed to the internationally agreed goal of limiting the global average temperature increase. According to the Intergovernmental Panel on Climate Change (IPCC), there are only 10 years left to make the changes needed if there is to be a reasonable chance of limiting global warming to a maximum of 1.5°C above pre-industrial levels. Beyond this, even half a degree Celsius will substantially increase the risks of drought, floods, extreme heat and poverty for hundreds of millions of people (IPCC, 2018). Many coastal regions and small island developing States (SIDS) are particularly exposed to these changes (see box II.1).

The world is already experiencing weather-related natural catastrophes that are more severe in terms of both magnitude and frequency. This brings home the point that referring to climate change understates the global challenge at hand and fails to convey the urgency of the situation; a more accurate description may be climate crisis or climate catastrophe. United Nations Secretary-General António Guterres stated the following at the closing of the Climate Action Summit on 23 September 2019: "You understand that climate emergency is the fight of our lives, and for our lives".

Global energy demand will continue to rise

At the same time, there is a need to meet the ever-increasing global demand for energy. Based on current announced policies, without more rapid gains in energy efficiency and conservation, global energy demand is projected to grow by about 1 per cent a year until 2040 (IEA, 2019b, Stated Policies Scenario). The bulk of rising energy demand will originate from developing countries owing to stronger economic growth as living standards converge towards those in developed economies, increased access to marketed energy, and rapid population growth and urbanization in some regions. Since 2000, electricity demand in developing economies has nearly tripled as a result of industrialization, middle-class growth and expanded access to electricity. More than half of the projected increase in global energy use is likely to originate from China, India and other Asian countries, driven by strong growth in their energy-intensive industrial sectors.

Progress towards delivering affordable energy to all continues to fall short

According to the Stated Policies Scenario developed by the International Energy Agency (IEA), this projected rise in energy demand would still leave hundreds of millions of people without access to electricity or clean cooking fuels. Access to affordable and reliable energy and clean cooking facilities is indispensable for social and economic welfare and is integral to eradicating poverty, combating inequality and improving health. The impact of energy poverty falls disproportionately on women and is also acutely felt by displaced people and those impacted by disaster. Delivering adequate standards of living across the globe clearly demands far more rapid progress towards the provision of clean, reliable and affordable energy for all. Electricity infrastructure, in particular, has been found to facilitate rising standards of living (Stern, Burke and Bruns, 2019). In 2017, the number of

Box II.1

Climate change challenges for sustainable transport, trade and tourism in small island developing States: the case of Saint Lucia

Caribbean small island developing States (SIDS) are situated in one of the regions most prone to natural disasters, and climate change will exacerbate the already severe hydrometeorological hazards these vulnerable nations face. Risks are amplified by the fact that, due to terrain constraints, the Caribbean countries tend to have high concentrations of population, infrastructure, and economic activity along their coasts—areas that will bear the brunt of climate change effects, particularly those associated with rising sea levels and potential increases in the destructiveness of tropical cyclones and other extreme events (Wong and others, 2014).

Various and interrelated socioeconomic sectors will be increasingly affected. In the Caribbean, as in all island settings, the nexus between transportation, trade and tourism is particularly strong. Coastal international transportation assets (seaports, airports and road networks), which are critical for international connectivity and socioeconomic development, are vulnerable to flooding and other operational disruptions driven by climate change. Even if average global temperatures do not rise beyond 1.5°C above pre-industrial levels, most seaports and some international airports in the Caribbean SIDS could realistically expect to experience severe flooding due to, for example, a 1-in-100-year extreme sea level event in 2050 (Monioudi and others, 2018). Without effective adaptation responses to mitigate impacts of flooding, the associated disruption and losses would likely spill over to other sectors of the economy, in particular the international tourism sector (Asariotis, 2019).

Many Caribbean islands are major international tourism destinations. Tourism accounts for 11-79 per cent of GDP in the Caribbean SIDS (UNECLAC, 2011) and is strongly dependent on the aesthetics and environmental health of the sandy shores (Ghermandi and Nunes, 2013). However, beaches and their backshore infrastructure and assets are heavily exposed to coastal erosion and flooding, presenting substantial risks for the tourism industry and related demand for transportation.

To better understand the severity of the risks of climate change for the economies of the Caribbean, UNCTAD (2017), as part of a larger technical assistance project (https://SIDSport-ClimateAdapt.unctad.org), carried out a study of potential beach erosion in the Caribbean island of Saint Lucia under a wide range of environmental conditions and different climatic scenarios. The results indicate that in response to an extreme sea level event, such as the 1-in-100-year extreme event in 2050, for example, beach erosion could reach up to about 62 metres. A comparison of these projections with the current beach maximum widths in Saint Lucia suggests that, even according to the most conservative projections (see box figure II.1.1.a), about 45 per cent of the 91 recorded beaches would lose at least 50 per cent of their current maximum widths, and 25 per cent would be completely overwhelmed under the 1-in-100-year extreme sea level event in 2050. In terms of backshore asset exposure, at least 16 per cent of those beaches presently fronting infrastructure/assets would be completely eroded during the 1-in-100-year extreme event, suggesting substantial backshore infrastructure and asset damages, even in the case of a total post-storm beach recovery. Under the high-end projections, the situation would be much worse (see box figure II.1.1.b).

Clearly, there is an urgent need for targeted policies that address these projected coastal risks. "Hard" adaptation measures, such as transportation asset elevation and the upgrading of coastal defences (groynes, offshore breakwaters and seawalls/revetments), could be deemed necessary in many cases. However, hard coastal defence schemes might prove ineffective at conserving beaches under increasing mean sea levels (Summers and others, 2018). Given the critical economic importance of beaches in the Caribbean, beach nourishment schemes will likely be required as well, at least for those beaches that are most valuable.

Large quantities of replenishment material would be needed to preserve the current dimensions of the 91 beaches in Saint Lucia. By 2050, mitigation of beach erosion and retreat from the projected mean sea level rise alone would require between 1.06 million and 3.10 million cubic metres of suitable replenishment material that is sufficiently similar in terms of composition and size to the existing (mainly bioclastic) beach sediments. SIDS need to consider the availability and costs of fill, construction and beach replenishment material in their climate change adaptation plans. Marine aggregates constitute

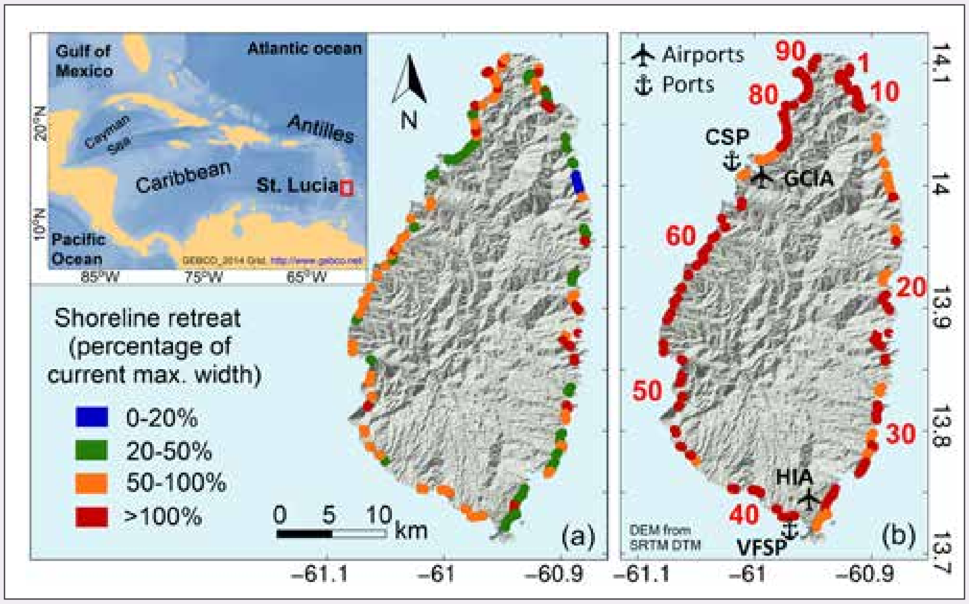
(*continued*)

Box II.1 (*continued*)

Figure II.1.1

Shoreline retreat projections for the beaches of Saint Lucia

Under the 1-in-100-year extreme sea level event in 2050 (RCP4.5 scenario), showing (a) the 10th and (b) the 90th percentiles of range estimates



Source: Based on UNCTAD (2017).

Notes: The maps illustrate the percentages of the current beach maximum widths of the 91 Saint Lucian beaches projected to be eroded under the 10th (a) and the 90th (b) percentiles of range estimates in 2050 under the RCP4.5 scenario. Numbers in (b) show beach ID.

Key: GCIA, George F.L. Charles International Airport; HIA, Hewanorra International Airport; CSP, Port Castries; VFSP, Vieux Fort Seaport.

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the most suitable material for beach replenishment but are often scarce (Peduzzi, 2014); therefore, inventories of such deposits should be established, and their sustainability should be ensured as a matter of priority.

A multifaceted approach will be required to safeguard and strengthen the prospects for sustainable transport, trade, tourism and development in the Caribbean islands under a changing climate.

people without access to electricity fell below 1 billion for the first time. While this represents important progress, trends in energy access are falling well short of targets to provide universal access by 2030 (IEA, 2019b). The global population is projected to rise by about 1 per cent a year until 2030. Roughly half of this increase will occur in sub-Saharan Africa, where nearly 45 per cent of the residents have no access to electricity and 86 per cent are without access to clean fuels and technologies for cooking. Closing electricity access gaps and meeting population pressures alone will require an increase in global electricity consumption of at least 6 per cent by 2030.

The current energy mix takes a heavy toll on human health and the environment

Fossil fuels, when burning, release GHGs that accelerate the pace of global warming, and they also emit a number of air pollutants that are harmful to both the environment and public health. Sulfur dioxide emissions, primarily the result of burning coal, contribute to acid rain and the formation of harmful particulate matter and can exacerbate respiratory ailments. Nitrogen oxide emissions, a by-product of all fossil-fuel combustion, contribute to acid rain and to the formation of smog, which can burn lung tissue and can make people more susceptible to chronic respiratory diseases. Particulate matter emissions produce haze and can lead to chronic bronchitis, aggravated asthma, and an elevated risk of premature death. Meanwhile, household air pollution from cooking over open fires using solid biomass fuels and kerosene in poorly ventilated spaces causes smoky indoor environments, which in turn lead to millions of premature deaths annually.

Air pollution is the fifth largest threat to human health globally (Health Effects Institute, 2019). The World Health Organization (WHO) estimates that indoor and outdoor air pollution caused an estimated 7 million deaths in 2016 (World Health Organization, 2018). Current policy commitments are insufficient to prevent an increase in premature deaths linked to air pollution.

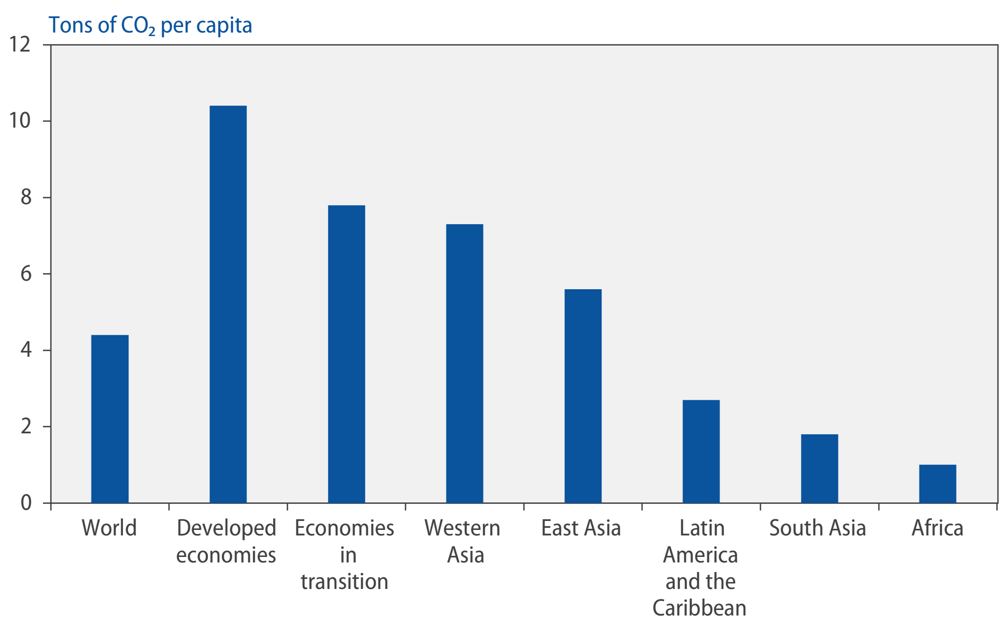
Emission scenarios and the energy mix

Action in the energy sector will make or break chances to meet climate goals

Policymakers face the massive challenges of reducing GHG emissions while simultaneously providing more energy in a reliable and robust manner as living standards rise in developing countries. Action in the energy sector will make or break the world's chances of successfully reining in climate change and protecting human health while meeting the energy needs of a growing population.

CO_2 emissions from the combustion of fossil fuels account for over 65 per cent of global GHG emissions. In per capita terms, production-based CO_2 emissions in developed economies remain vastly higher than those in most developing regions (see figure II.1). Consumption-based emissions in developed economies are even higher, given the high carbon content of imported goods (UNEP, 2019), reflecting an outsourcing of emission-intensive industries to developing countries. While developed countries have historically emitted the largest share of anthropogenic GHGs, since 2007 the share of production-based emissions in developing countries has surpassed that in developed countries. Looking forward, if the energy mix underpinning consumption patterns in developed economies were emulated in developing economies, rising living standards would push global emission levels up substantially.

Figure II.1
Per capita CO_2 emissions from fuel combustion, 2018

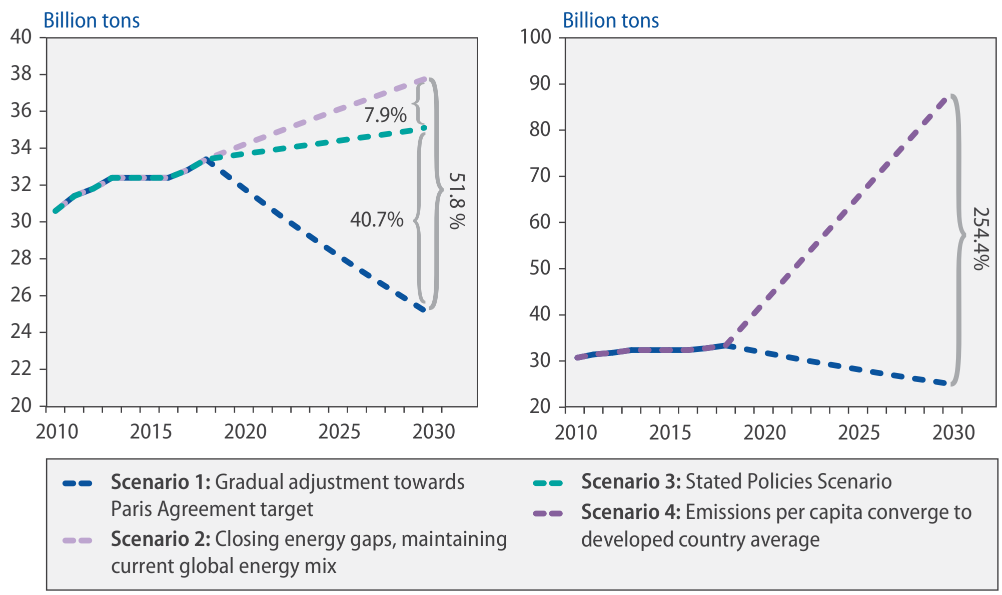


Source: UN DESA, based on data from *BP Statistical Review of World Energy 2019* (https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2019-full-report.pdf).

The current energy mix is incompatible with emission targets, and announced policies remain inadequate

Meeting growing energy demand while reducing GHG emissions can only be accomplished through a dramatic change in the energy mix. Table II.1 shows the composition of global energy demand by fuel type in 2018, indicating that 81 per cent of demand was met by fossil fuels. If advances are to be made towards the targets advised by scientists to achieve the goals of the Paris Agreement, emissions must decline by at least 25 per cent by 2030. Figure II.2 compares the trajectory for carbon emissions that is consistent with the Paris Agreement (scenario 1) with a scenario in which there is no change in the global energy mix or energy efficiency (scenario 2). In scenario 2, global energy demand is assumed to rise in line with population growth, with an additional increase in electricity demand to close existing gaps in electricity access. These two scenarios are also contrasted with the IEA Stated Policies Scenario (IEA, 2019b), which includes all announced policy intentions and targets, including emissions pledges as reflected in nationally determined contributions (scenario 3).

Figure II.2
Global CO_2 emissions from fuel consumption under different scenarios



Sources: UN DESA projections; IEA (2019b) Stated Policies Scenario.

Clearly, the modest shifts in demand and energy mix underpinning the Stated Policies Scenario—with the fossil-fuel share expected to decline to just 77 per cent by 2030—remain far from the trajectory advised by scientists to achieve the goals of the Paris Agreement and tackle climate change. In an extreme hypothetical scenario, where per capita emissions in developing countries rise towards those in developed economies, global carbon emissions would increase by more than 250 per cent (scenario 4), driving home the message that these consumption and energy mix patterns are not compatible with concurrently achieving the goals of universal access and improved standards of living while also meeting emission targets.

Table II.1
Growth of world primary energy demand by fuel

Percentage

	Share of primary demand	Historical growth	Stated Policies Scenario		Sustainable Development Scenario	
	2018	2000–2018	2018–2030	2018–2040	2018–2030	2018–2040
Coal	23	65	1	-1	-36	-62
Oil	37	23	8	9	-11	-32
Gas	21	57	19	36	7	-3
Nuclear	7	5	13	28	26	62
Renewables	7	111	64	125	100	215
Solid biomass[a]	6	-3	-1	-12	-77	-88
Total	**100**	**43**	**14**	**24**	**-4**	**-7**
CO_2 emissions (Gt)[b]		44	5	7	-24	-52
Fossil fuel share (end period)	81	81	77	74	72	58

Source: UN DESA, based on data from IEA (2019b).

a Solid biomass includes its traditional use in three-stone fires and in improved cookstoves.

b Gt = Gigatons.

Moving beyond stated policies

The world risks a great collective failure in mitigating the environmental impacts of energy use

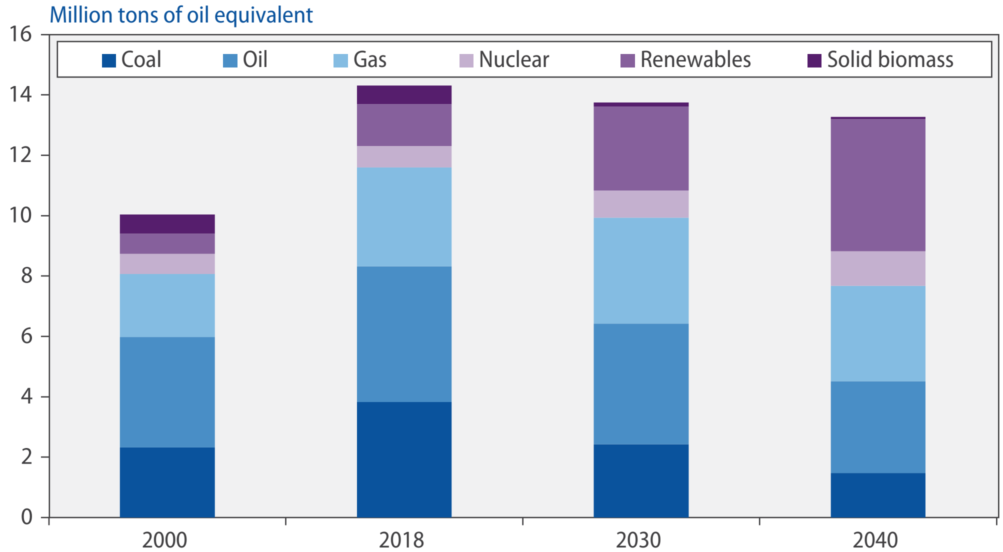
Under the assumptions of the IEA Stated Policies Scenario, demand for fossil fuels will continue to rise over the coming decades (see table II.1). While global coal consumption is expected to level off due to increasingly widespread policy commitments to phase out coal use, oil demand will continue to grow. This reflects higher demand for oil-based fuels for long-distance freight, petrochemicals, and shipping and aviation, which will be partly offset by advances in fuel efficiency and the increased use of electricity to power cars. This minor shift in the energy mix will neither halt the rise in global emissions nor lessen the growing number of premature deaths from air pollution. This would signify a great collective failure to address the environmental implications of energy use.

It is still possible to put the world on track to meet energy-related Sustainable Development Goals

The latest IEA Sustainable Development Scenario describes an alternative path—one that would put energy access, air quality and climate goals on track to be achieved (see table II.1) and would be consistent with the Paris Agreement trajectory shown in figure II.2. In this scenario, world primary energy demand would stabilize by 2025 and gradually decline thereafter (see figure II.3), primarily driven by strong gains in energy efficiency that reduce global energy intensity by more than 3 per cent each year. Adjustment would be effected through steep declines in the higher-emitting fuels, with coal use decreasing at an annual rate of 4.2 per cent. Oil use would peak in the next few years and decline steadily thereafter. Demand for natural gas, which has a lower carbon content than other fossil fuels, would increase over the next decade at an average annual rate of 0.9 per cent. After 2030, accelerated deployment of renewables and energy efficiency measures, together with higher production of biomethane and hydrogen, would lead to declining demand for natural gas.

The share of renewables in the energy mix would grow rapidly, accounting for two thirds of power generation and 37 per cent of final energy consumption by 2040. Renewable energy sources would primarily cover the needed expansion in energy access. Fossil fuels

Figure II.3
World primary energy demand under the Sustainable Development Scenario



Source: UN DESA, based on the IEA (2019b) Sustainable Development Scenario.

would remain dominant despite a significant decline, representing about 58 per cent of the primary energy mix in 2040. Fully transitioning away from the enormous existing stock of fossil-fuel-reliant infrastructure poses a monumental task.

Efficiency gains and behavioural change

Energy efficiency gains can improve energy security, enhance welfare and reduce environmental damage

Changing the energy mix is necessary but will not be sufficient on its own to ensure the realization of all energy-related Sustainable Development Goals. A cleaner energy mix must be accompanied by substantial efficiency gains, the rapid deployment of low-carbon technology, and profound changes in behaviour towards more sustainable consumption.

Raising energy efficiency is one of the most cost-effective methods to improve energy supply security, enhance competitiveness and welfare, and decrease the environmental and health impacts of energy use. However, efficiency gains have slowed markedly since 2015, representing a lost opportunity and a failure of policy to guide the economy away from reliance on fossil fuels and accelerate efficiency investments in key sectors.

Regulation and targeted investment are needed to accelerate efficiency gains

The scope for efficiency gains is evident across most sectors of the economy; for example, buildings could be made more environmentally friendly through the use of thermal insulation and efficient lighting, and the transport sector would benefit from the use of electric vehicles and more efficient internal combustion engines. The implementation of technical and operational measures for ships could increase efficiency and reduce the emissions rate for international shipping by up to 75 per cent; this could be achieved through speed optimization and reduction, fleet adaptation (replacing high-carbon fuels with low-carbon and zero-carbon fuels), improvements in ship design and size, and the optimization of logistics chains (International Maritime Organization, 2009). There are also opportunities to expand the recycling of materials such as steel, aluminium, cement and plastics. Meanwhile, the digitization of the global economy opens up countless opportunities for efficiency gains, enabling greater control and optimization of energy use. Well-designed policy is needed to accelerate progress along all these dimensions (IEA, 2019a).

Socioeconomic implications of the energy transition

Fossil-fuel phase-out, electrification and decentralization

The energy transition will have far-reaching socioeconomic consequences

The economic and social consequences of the global energy transition will be far-reaching. Societal reactions and adjustments to major economic and technological changes of this nature are necessarily complex, as economic, social and cultural factors are inextricably intertwined. As an example, the Industrial Revolution and subsequent economic development changed the way people worked, the way people formed a family unit, the way people were economically productive, and the way people sought cohesion in communities.

The energy transition will push out several socioeconomic status quos while it pulls in new socioeconomic influencing factors. The costs and benefits of these changes will be very unevenly distributed within and between countries. The present section reviews some of the key economic and social developments and outcomes that can be expected as the energy transition gathers momentum, supported by technological advances and policy efforts.

Key elements of the transition are fossil-fuel phase-outs, electrification and decentralization

The cost of electric power generation from renewable energy sources has come down. Moreover, technological breakthroughs in power storage technology, including the development of solid-state batteries, are soon expected to resolve the problem of intermittency in photovoltaic (PV) and wind power generation. Increased battery efficiency will also make electric vehicles more affordable. These recent developments highlight three main elements underpinning the ongoing energy transition: fossil-fuel phase-outs, electrification and decentralization. These three elements are dependent on one another, as it will be the advances in power storage technologies that drive the transition along all three dimensions. The socioeconomic implications of the energy transition can be broadly grouped into impacts relating to locational shifts, occupational shifts, and changes in economic and environmental resilience (see table II.2).

The fossil-fuel phase-out will expose widespread vulnerabilities

The phase-out of fossil-fuel use will expose widespread vulnerabilities among holders of carbon-intensive assets. The impact on the profitability and viability of a number of sectors and technologies will inevitably be significant. This has serious economic and social implications for the many countries and firms that continue to rely on fossil-fuel production, a fossil-fuel-based power supply, and fossil-fuel-intensive industry.

Conventional energy supply chains face losses and stranded assets

As the demand for carbon-laden fuels declines, the regulation of their use tightens, and the costs of associated emissions rise, many existing technologies, infrastructure and resources will become obsolete. This will entail economic losses across the conventional energy supply chains, from exploration to retail supply. Governments that rely on income streams from these activities will face increasing budget constraints and a deterioration in sovereign bond value, while firms will be subject to closure, and associated banks will suffer a deterioration in balance sheets. For the most part, investors and policymakers continue to underestimate the costs and urgency of these coming changes. This is partly the result of distortionary policies, such as fossil-fuel subsidies and investment incentives that support energy-intensive industry. These distortions continue to encourage investment in carbon-intensive assets that will ultimately need to be retired before the end of their technical lifetime. This also has serious environmental implications, locking in energy supply that will not meet the emission targets of the Paris Agreement.

Job losses are likely to fall heavily on upstream sectors

Experience with coal phase-outs shows that job losses related to the shift away from fossil fuels are likely to be felt most acutely in the upstream sectors, as many fossil-fuel-producing countries and regions are not well diversified. As many as 4 million workers have lost their jobs due to coal mine closures over the past half century (World Bank, 2018), and more job losses in this sector are expected as energy transitions progress.

Table II.2

Energy transition: channels of socioeconomic impact

	Locational shifts		Occupational shifts		Changes in resilience	
	Pushed out	Pulled in	Pushed out	Pulled in	Pushed out	Pulled in
Fossil-fuel phase out	Economic decline in fossil-fuel-producing regions Large-scale asset stranding		Job losses in fossil-fuel supply chains Asset stranding in fossil-fuel-intensive industries		Erosion of established energy supply chains Potential price increases for essential goods	Decline in GHG emissions Improved air quality from fewer internal combustion facilities
Electrification		Economic surge in battery-related mineral-producing regions (lithium, cobalt, manganese, nickel, graphite)		Job creation in renewable electricity generation and battery supply chains, including battery recycling	Flexibility in access to different energy sources (electricity, gas, heating oil, gasolines)	Electricity as the main energy source Mining pollution Recycling-related pollution
Decentralization		Provision of wider access to energy as supply goes "wireless"	Erosion of economies of scale of centralized electricity firms	New form of public guarantee to assure energy supply	Erosion of the established energy supply chains	Enhanced energy resilience through individual renewal power generation

Source: UN DESA.

Higher prices for food and heating may disproportionately impact the poor

Policy instruments designed to discourage the use of fossil fuels may also increase the costs of essential goods, at least during a transitional period. For example, food prices may rise as a result of the increased costs of transport, higher costs of operating farming and food-processing equipment, and higher costs for chemical fertilizers. The price of energy for heating and cooking may also increase. Given the central role of fossil fuels in current economic systems and structures, the burdens could fall disproportionately on poorer households, with important ramifications for poverty and hunger. Careful policy design is needed to safeguard the provision of basic necessities and ensure that the most vulnerable are protected.

Many countries stand to gain from the energy transition

The energy transition has the potential to bring not only environmental benefits but also economic and social benefits for many countries. For example, heavy importers of fossil fuels stand to benefit from the development of local renewable energy sources through improvements in energy supply security and external balances (McCollum and others, 2014). Four out of five people live in countries that import fossil fuels, including China and India (World Economic Forum, 2019a). This suggests that, globally, the net impact of the energy transition on employment is likely to be positive (see box II.2).

Meanwhile, some countries may gain from the increased demand for resources used in low-carbon technology, including metals and materials needed for renewable energy systems, energy-efficient buildings and new forms of transportation. Africa, which is especially rich in minerals, "can expect high and rising demand, as the technologies of the low-carbon future are highly materials-intensive" (Addison and Roe, 2018, p. 27). Demand for copper,

Box II.2

The impact of the energy transition on global labour markets

How will the energy transition affect global labour markets?

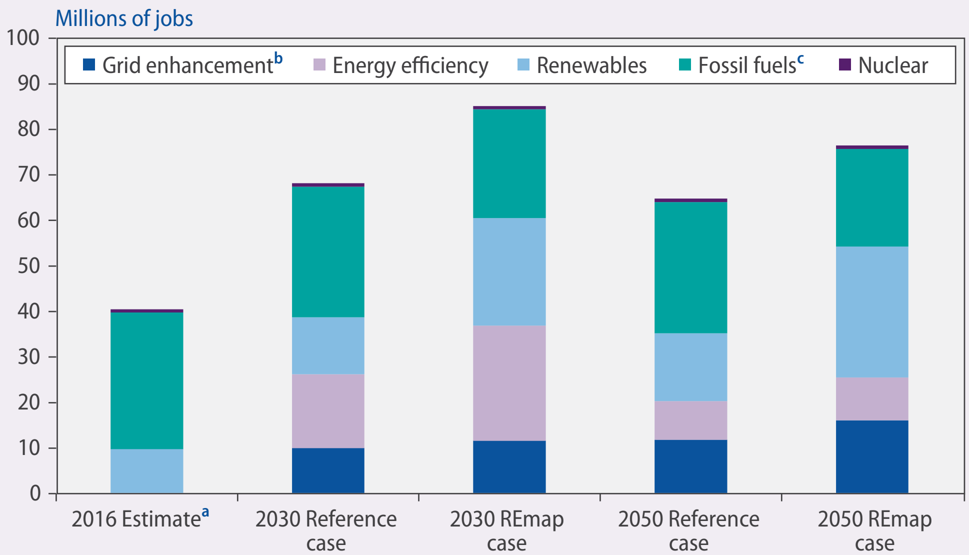
Implications of the energy transition for the world's labour markets are already manifest and will continue to be profound. The transition to a zero-carbon economy will involve job losses in some sectors and job creation or transformation in others.

The Paris Agreement stipulates that adjustment towards a low-carbon economy must "tak[e] into account the imperatives of a just transition of the workforce and the creation of decent work and quality jobs in accordance with nationally defined development priorities". To date, only a few Governments have succeeded in better integrating labour and social policies with climate objectives or have devised strategies to support workers and communities deeply affected by the energy transition (Rosemberg, 2018). The Governments of Germany (Egenter and Wehrmann, 2019), Canada (2018) and Scotland have set positive examples by establishing commissions to think through and manage the implications of the energy transition. The lack of more widespread policy integration and the uncertainty associated with the impacts and timeframe of the transition have resulted in resistance to necessary changes by significant parts of society.

The energy sector, including the power and fuel supply sectors, was responsible for employing almost 41 million people globally in 2016, with 30 million working in fossil-fuel sectors (see box figure II.2.1) (IRENA, 2018).

Figure II.2.1

Employment in the overall energy sector, 2016, 2030 and 2050



Source: UN DESA (2019), based on IRENA jobs database.

a Estimates for jobs in energy efficiency and grid enhancement are not available for 2016.

b Grid enhancement includes jobs in transmission and distribution systems and jobs related to enabling renewable energy to be integrated in the power system.

c Includes all jobs in the fossil-fuel industry, including those relating to extraction, processing and consumption.

Forecasts indicate that employment in fossil-fuel sectors will continue to decline worldwide (see box figure II.2.1). Rising automation in extraction, overcapacity, industry consolidation, regional market shifts, the substitution of coal with natural gas in the power sector, climate policies, and the rise of renewable energy are driving this downward trend (IRENA, 2017a).

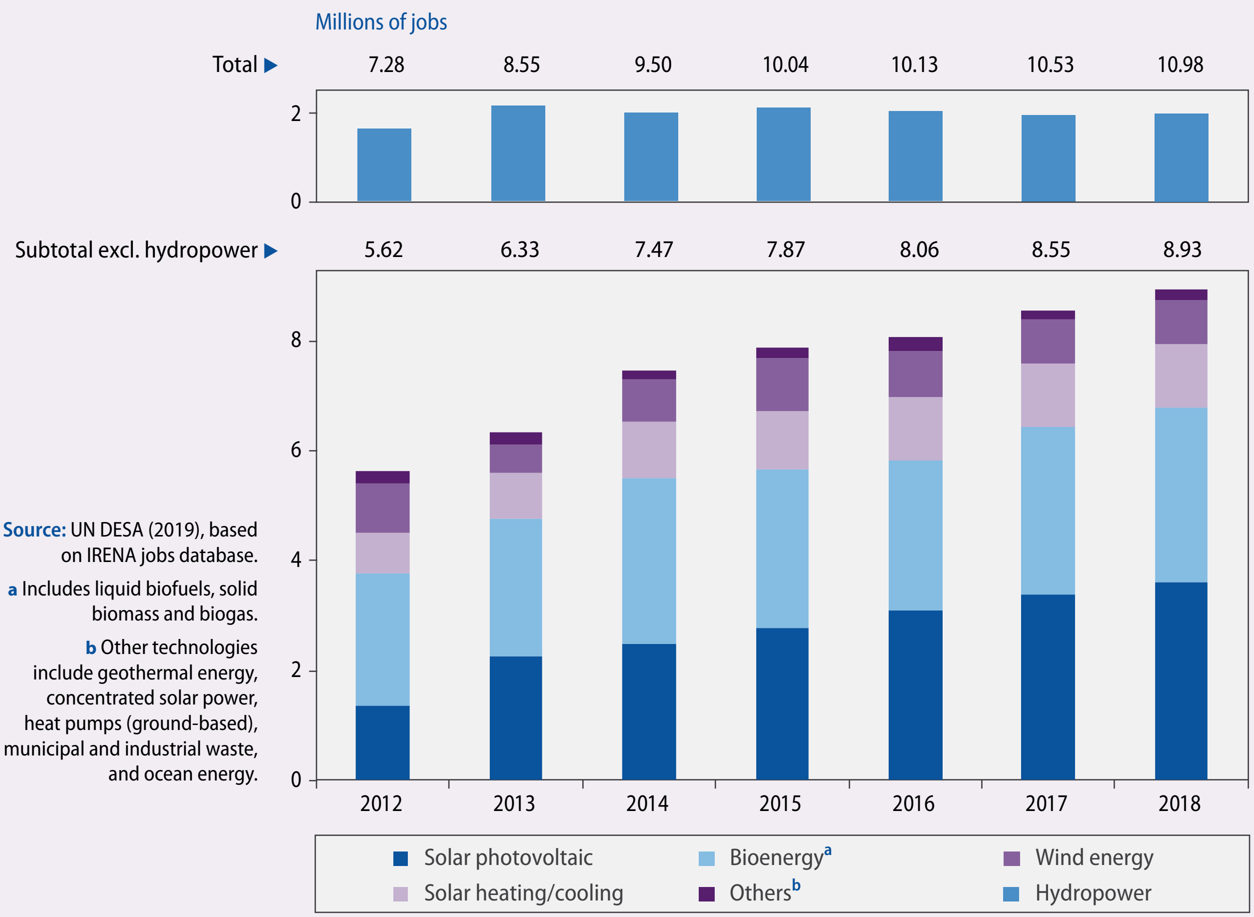
Job losses have become the norm in the global oil and gas industry. Around 440,000 people were laid off in 2015 and 2016 due to low oil prices and oversupply. The United States alone accounted for 40 per cent of job losses, and the United Kingdom and Canada accounted for 28 and 10 per cent, respec-

(*continued*)

Box II.2 (*continued*)

tively. Coal industry jobs are declining even more rapidly due to power plant closures, overcapacity and improved mining technologies. The Government of China plans to close 5,600 mines, which may result in the loss of 1.3 million coal mining jobs (20 per cent of the total workforce in the Chinese coal sector) because of excess supply and a slowing economy. Coal India Limited, the world's largest coal producer, reduced its workforce by 36 per cent over a 13-year period, with the number of employees declining from 511,000 in 2002/03 to 326,000 in 2015/16 (ibid.). Coal production within the European Union has been decreasing for three decades now. The coal mining industry in Germany is down to about 30,000 jobs from 300,000 three decades ago, and in the United States, employment in the coal sector has declined from 174,000 to 55,000 over the same period (ibid.).

Figure II.2.2
Global renewable energy employment, by technology



Source: UN DESA (2019), based on IRENA jobs database.

a Includes liquid biofuels, solid biomass and biogas.

b Other technologies include geothermal energy, concentrated solar power, heat pumps (ground-based), municipal and industrial waste, and ocean energy.

Employment opportunities associated with the energy transition

The global renewable energy sector employed 11 million people in 2018, up from 10.3 million in 2017 (IRENA, 2019b). Renewable energy technologies create more jobs than do fossil-fuel technologies. For instance, in comparison with coal or natural gas, solar PV creates more than twice the number of jobs per unit of electricity generation (IRENA, 2017a). By the end of 2018, solar PV had become the leading job creator within the renewable energy sector, accounting for a third of the total renewable energy

(*continued*)

Box II.2 (*continued*)

workforce globally, or 3.61 million workers (see box figure II.2.2). Rising off-grid solar sales are creating a growing number of jobs while also expanding energy access. Bioenergy is close behind with 3.18 million jobs, while employment in the wind energy sector supports 1.16 million jobs. Onshore wind is still predominant, but the offshore segment is gaining traction, building on the expertise and infrastructure in the offshore oil and gas sector. Hydropower still has the largest installed capacity of all renewables, employing 2.1 million people directly.

Based on the IEA Sustainable Development Scenario, ILO estimates that the energy transition will lead to the net creation of 18 million jobs by 2030, reflecting around 24 million jobs created and 6 million jobs lost globally. There are and will continue to be significant differences across regions, countries and sectors, however. Employment creation is driven by the higher labour intensity of renewable energy production in comparison with the production of electricity from fossil-fuel sources, where losses are greatest. Employment demand will also grow in value chains associated with renewable energy and electric vehicles and in industries involved in the construction of renewable energy and associated infrastructure (ILO, 2018b).

Although renewable energy has an increasingly diverse geographic footprint, renewable energy employment remains largely concentrated in a handful of countries—Brazil, China, India, the United States, and some countries in the European Union. Diverse factors such national deployment and industrial policies, changes in the geographic footprint of supply chains and in trade patterns, and industry consolidation trends will shape how and where renewable jobs are created (IRENA, 2019b).

Conclusions

The transition towards a zero-carbon economy can be expected to lead to a net increase in the global labour force, as job losses in the fossil-fuel sector will be offset by employment gains in the renewable energy sector and associated value chains. However, the impact of the transition will be uneven. In certain parts of the world, such as the Middle East, the impact on the job market will be relatively profound. The energy transition needs to be carefully managed to ensure a just transition for affected workers and communities. Early action is needed to mitigate the costs to communities exposed to wide-scale job losses in the fossil-fuel sector. This would also decrease resistance to the energy transition and climate action as a whole.

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nickel, cobalt, lithium, and several other base metals and materials is expected to rise. Many countries, including Australia, Brazil, Canada, Chile, China, Cuba, Democratic Republic of the Congo, India, Indonesia, Kazakhstan, Mexico, Peru, the Plurinational State of Bolivia, Poland, the Russian Federation, South Africa, Turkey, Ukraine, the United States, Viet Nam and Zimbabwe, are important producers or have important reserves of materials that may see increasing demand.[1]

Battery supply chains offer new opportunities

Electrification will play an important role in delivering a cleaner energy mix—through electrified transport, heating and cooling, and industrial processes, for example—and is expected to create many opportunities. As batteries will be the key component for electrification through renewable sources, the demand for batteries is expected to grow rapidly. Geographical and occupational shifts from fossil-fuel supply chains to battery supply chains can be expected. Upstream, the demand for minerals that are essential for battery production, such as lithium, cobalt, manganese, nickel and graphite, will benefit a relatively narrow group of countries. However, battery recycling technologies offer opportunities to a more diverse group of suppliers. These new supply chains already present significant economic opportunities. Demonstrating an awareness of current trends and the potential

1 For an extended list of mining products used in low-carbon technologies and countries that may benefit from increased demand, see UNCTAD (2019a), table 3.3.

for future growth in this area, the European Battery Alliance has been developing strategies relating to battery supply chains as part of its action plans.[2]

Electrification comes with new environmental concerns

Electrification confers substantial benefits but also introduces new environmental concerns. Coal-fired power plants are responsible for 38 per cent of global electricity generation and remain the single largest source of energy-related GHG emissions. Electrification must develop hand in hand with the ongoing shift towards renewable power generation and the adoption of cleaner technologies for battery production. More aggressive mineral extraction related to battery production and other low-carbon-technology inputs may introduce higher levels of pollution from mineral mines, processing factories and recycling factories. The challenge will be for countries with valuable natural resource wealth to extract the materials needed while limiting the attendant environmental costs so as not to be counterproductive to the aim of expanding the use of "clean" technologies (UNCTAD, 2019a). Realizing the development potential from this mineral wealth will also require effective management and far-sighted policy strategies to avoid the "natural resource curse" that plagues many commodity-dependent developing countries. Key elements of such strategies include strong institutions, a transparent business environment, and targeted investment in the human capital needed to develop industries further up the supply chain.

Decentralization will improve energy access for the poor

The decentralization of the energy supply is expected to take place as the cost of PV electricity generation and power storage comes down to a level competitive for households. More electricity can be supplied off-grid. Affordable autonomous renewable energy solutions improve energy access for the poor. In fact, off-grid renewable energy solutions, including stand-alone solar home systems and mini-grids, have already been deployed in many developing countries; by 2016, more than 133 million people had benefited from such systems (IRENA, 2019a). Recent empirical studies indicate that renewable energy solutions are already sufficiently affordable and financially sustainable in rural communities if they are designed to stimulate income generation (Roche and Blanchard, 2018). Moreover, off-grid solutions will enhance the resilience in electricity supplies where on-grid electricity supplies are unstable. However, they may weaken the natural economies of scale of centralized electricity companies. Conventional centralized power-grid systems will need to be maintained even as off-grid solutions expand, as many autonomous renewable energy solutions are likely to be connected to the grids. The changes will affect the profitability of maintaining these grids, which must be carefully considered in the management of energy transitions.

Cleaner energy systems bring enormous environmental and social co-benefits

The environmental and social returns from a cleaner energy mix and cleaner household energy are manifold, ranging from reductions in air pollution to improvements in human health and gender equality and the mitigation of biodiversity loss. Universal access to clean cooking solutions would help prevent millions of premature deaths each year, primarily among women and children. It would also yield economic returns by reducing the time spent collecting wood or other biomass fuel and creating space for education and paid work. Ultimately, the transition will lead to greater value being placed on natural resources such as the sun, wind and waterways, and to increased support for the protection and expansion of forests as carbon sinks.

2 See European Battery Alliance (https://ec.europa.eu/growth/industry/policy/european-battery-alliance_en).

Coping with stranded fossil-fuel assets

The scale and distribution of assets and resources exposed to stranding

As demand for carbon-laden fuels declines, many countries may be left with stranded assets

As the energy transition progresses and the use of renewable energy, energy-saving technology and electrification expands, many countries and firms will see a portion of their natural resources lose their economic value and will experience a stranding of assets related to fossil-fuel-intensive activities. Stranded assets can be defined as asset holdings that prematurely lose their value or usefulness and must be written off well before the end of their technical lifetime (Bos and Gupta, 2019).

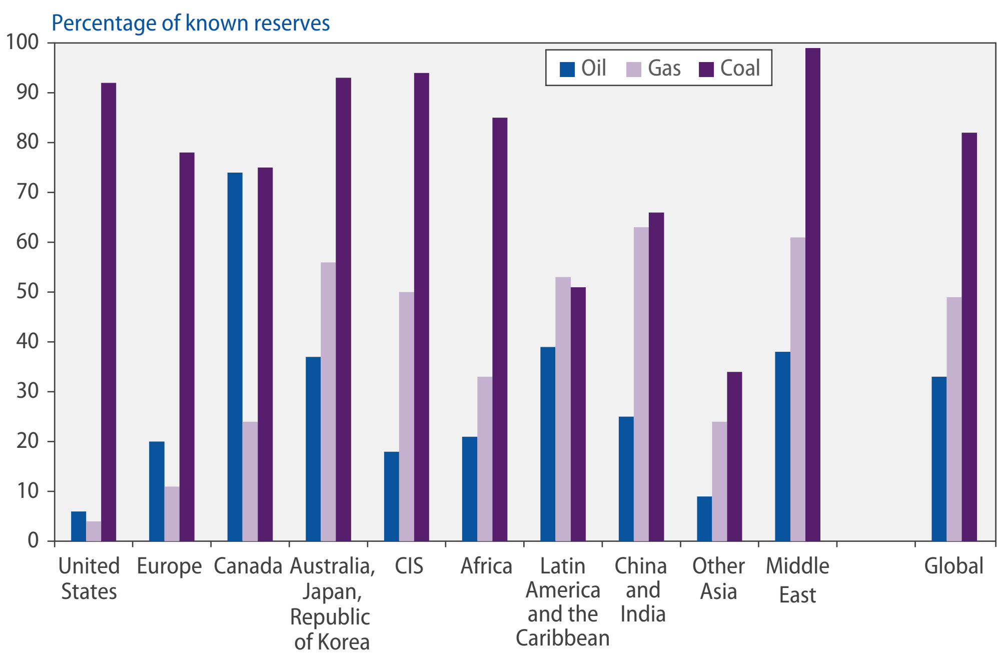
It is estimated that burning the remaining known recoverable reserves of oil, gas and coal would release at least 11,000 Gigatons (Gt) of CO_2 (McGlade and Ekins, 2015). In order for the world to have at least a 50 per cent chance of limiting global warming to 2°C above pre-industrial levels at the end of this century, cumulative emissions of CO_2 between 2011 and 2050 should remain below 1,240 Gt—meaning that the vast majority of remaining resources should already be considered stranded. Figure II.4 provides an estimate of the shares of fossil fuels across regions that must remain unused in order to ensure that cumulative emissions stay below 1,240 Gt through 2050.

Globally, the vast majority of coal reserves, half of the gas reserves and a third of the oil reserves must remain untapped

If there is to be a reasonable chance of meeting long-term climate stabilization targets—including maximum temperatures averaging no higher than 2°C above pre-industrial levels—over 80 per cent of global coal reserves, 50 per cent of gas reserves, and 33 per cent of oil reserves must remain underground. This includes a particularly high share of oil reserves in Canada and the majority of coal reserves in most regions. Obviously, to limit global warming to 1.5°C above pre-industrial levels, an even greater share of recoverable resources must remain untapped. Estimates suggest that in order for there to be a 50 per cent chance of limiting global warming to 1.5°C, cumulative emissions of CO_2 between

Figure II.4

Regional distribution of reserves unburnable under the 2°C scenario



Source: UN DESA, based on McGlade and Ekins (2015), table 1.

Notes: Regional groupings are not strictly aligned with those used throughout the present publication. The scenario assumes widespread use of carbon capture and storage from 2025. Regional shares are determined based on an optimization of emission and extraction costs for different kinds of reserves. Other regional distributions are possible but would produce a higher global cost.

2017 and 2050 should not exceed 580-770 Gt (IPCC, 2018)—roughly half the level in the 2°C scenario.

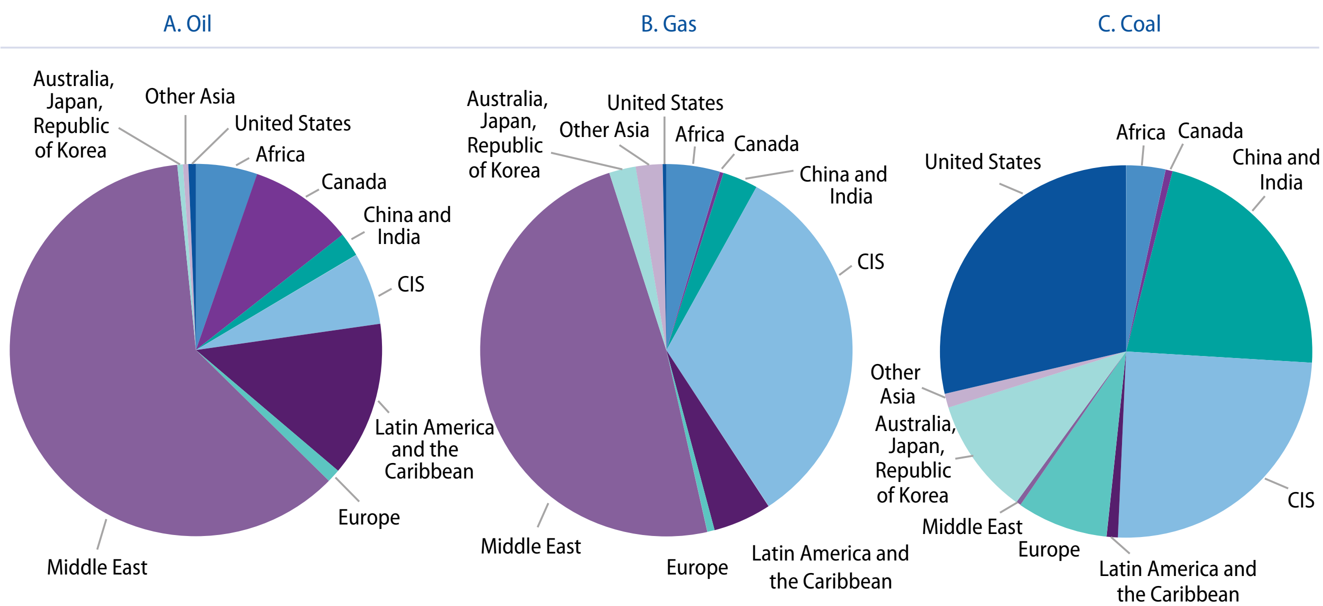
Figure II.4 illustrates the shares of regional reserves that would be stranded in the 2°C scenario. To gauge the magnitude and distribution of these unusable resources, it is also informative to consider the global shares of stranded assets by fuel type in each region (see figure II.5).

Roughly 60 per cent of the global oil reserves and 50 per cent of the global gas reserves that are likely to be unburnable are in the Middle East. Canada, the Bolivarian Republic of Venezuela, Ecuador, and countries in Africa and the CIS also face substantial losses from unusable oil reserves. The CIS is home to about one third of the gas reserves and one fourth of the coal reserves that are expected to remain unburnable. Australia, China, India, the United States, and European countries also have significant quantities of unusable coal. International oil companies hold, on average, around 13 years of reserves at current rates of production in assets, whereas Government bonds in up to 25 countries are backed by an expectation of 25, 50, or in some cases more than 100 years' worth of extractable reserves (World Economic Forum, 2019b).

Over $10 trillion in fossil-fuel-reliant assets are subject to stranding

On top of unusable natural resources, countries across the globe may be left with stranded capital assets in the form of buildings that fail to meet efficiency standards; extraction and power-generation infrastructure designed to burn fossil fuel; fossil-fuel storage, transport and delivery systems; and other fixed capital assets of industries engaged in carbon-intensive activities. According to estimates from the International Renewable Energy Agency (IRENA), global assets likely to be stranded over the period 2015-2050 as a result of the energy transition will cumulatively amount to several trillion dollars, including a minimum of approximately $5 trillion in inefficient buildings and equipment, $4 trillion in the upstream energy sector (equivalent to 45-85 per cent of the valuation of today's upstream oil producers), $900 billion in power generation assets, and $240 billion in industrial assets

Figure II.5
Estimated regional shares of reserves unburnable under the 2°C scenario, by fuel type



Source: UN DESA, based on McGlade and Ekins (2015), table 1.

(IRENA, 2017b). In some cases, current infrastructure can be retrofitted to adapt to a clean energy system, but without policy efforts to support such endeavours and exploit economies of scale, the investment costs may prove prohibitively high.

Resource implications of stranded assets

As the energy transition progresses, countries that rely on revenue streams from the extraction of fossil fuels to finance their fiscal or external spending will come under increasing pressure (see box II.3). The largest publicly traded oil companies hold only 3 per cent of total proven world oil reserves. Therefore, the burden of stranded reserves will fall heavily on national oil companies and national Governments (Jaffe, 2020).

At some point, fossil-fuel extraction will cease to be economically viable

Box II.3

Commodity dependence and climate change[a]

Commodity-dependent developing countries (CDDCs)—those deriving more than 60 per cent of their merchandise export revenue from primary commodities—are affected both by the direct impact of climate change and by the effects of the global shift towards low-carbon economies that is required to limit global warming. It is essential that CDDCs and their development partners account for these additional sources of risk in strategies to achieve the Sustainable Development Goals.

There is a two-way relationship between commodities and climate change. On the one hand, commodity production, processing, transportation and consumption generate GHG emissions. On the other hand, climate change has important consequences for commodity value chains. For example, the burning of fossil fuels is the leading source of anthropogenic GHG emissions, while oil, gas and coal supply chains are vulnerable to various manifestations of climate change, including storms, floods and rises in sea levels. Agriculture accounts for 10-12 per cent of global GHG emissions (IPCC, 2014) but is also a major receiver of the negative effects of climate-related phenomena such as natural disasters, which caused an estimated $96 billion worth of crop and livestock loss between 2005 and 2015 (FAO, 2018). GHG emissions from mining are rising due to growing output and declining ore grades, which lead to higher-energy-intensity metal production. In Australia, for instance, GHG emissions from non-energy mining and quarrying increased at a compound annual rate of 4.5 per cent between 1990 and 2017 (Australia, Department of the Environment and Energy, 2019). At the same time, the increasing frequency and severity of extreme weather events poses threats to mining infrastructure, operations and transportation routes.

Average GHG emissions per capita in CDDCs declined from 1990 to 2014 and are significantly lower than those of the main emitters (see box figure II.3.1). However, CDDCs are among the countries most vulnerable to the impacts of climate change (see box figure II.3.2). According to the Notre Dame Global Adaptation Initiative (ND-GAIN) Country Index, the 26 most vulnerable countries in 2017 were all CDDCs, and among the 40 most vulnerable countries there were only three non-CDDCs.[b]

The Paris Agreement affirms the commitment of developed and developing countries to limit the rise in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels by 2100. The Agreement also includes provisions for strengthening climate resilience and low-carbon development. In this context, CDDCs need to find ways to align adaptation and mitigation policies and programmes with broader development strategies to achieve the Sustainable Development Goals as well as account for the effects of third countries' climate policies. For instance, since a 2°C scenario is not consistent with burning all known reserves of oil, gas and coal, there is a clear risk that CDDCs that depend on exports of fossil fuels will see the markets for their products shrink and leave part of their resources stranded.

The costs of adapting to climate change, which are estimated at between $140 billion and $300 billion per year for developing countries until 2030 (UNEP, 2016), constitute a heavy burden, particularly for low-income CDDCs. However, climate finance provided by developed countries to developing countries has mainly been directed towards mitigation (see box figure II.3.3).

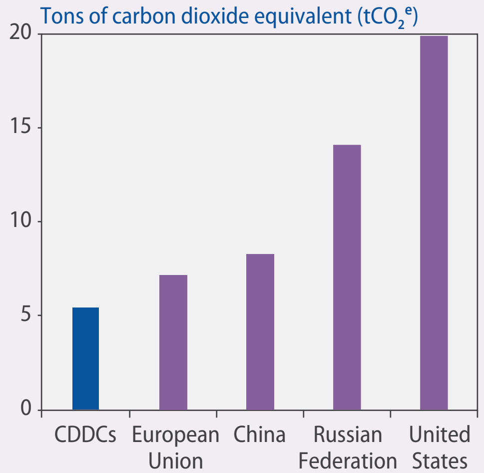
a This box draws from UNCTAD (2019a).

b See https://gain.nd.edu/our-work/country-index/.

(*continued*)

Box II.3 (*continued*)

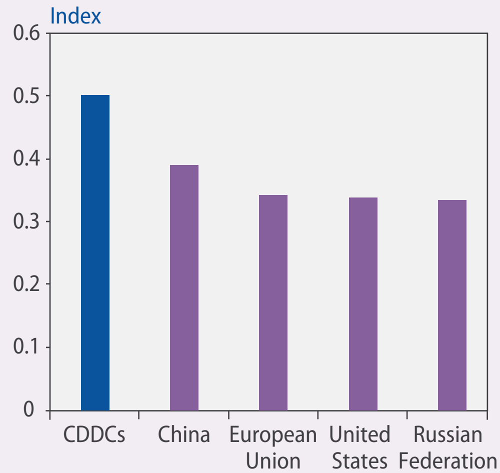
Figure II.3.1
Anthropogenic GHG emissions per capita including land use, land-use change and forestry, 2014



Source: Based on Climate Analysis Indicators Tool (CAIT) Historical Emissions data, available from Climate Watch Data Explorer https://www.climatewatchdata.org.

Note: Data were not available for the following CDDC: Timor-Leste.

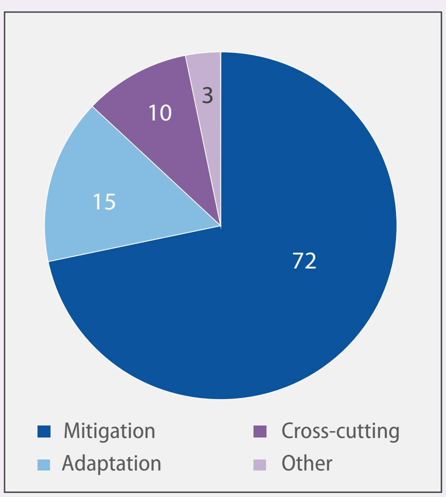
Figure II.3.2
Climate change vulnerability score (ND-GAIN Country Index), 2017



Source: Based on the vulnerability scores reflected in the ND-GAIN Country Index (2017).

Notes: Simple average for country groups. Data were not available for the following CDDCs: Kiribati, Nauru and Palau.

Figure II.3.3
Focus areas of climate finance provided to developing countries through bilateral, regional and other channels, 2016



Source: Based on data from UNFCCC (2018).

There are a number of steps CDDCs can take to successfully address the challenges posed by climate change. First, climate finance flows need to be scaled up and calibrated to reflect the adaptation priorities of the most vulnerable countries, including many commodity-dependent LDCs and SIDS. Second, fiscal policies need to be aligned with Governments' main policy objectives to ensure that taxes, subsidies and similar policy instruments support the implementation of the Paris Agreement as well as the achievement of the Sustainable Development Goals; an example would be reducing or eliminating harmful fossil-fuel subsidies. Third, CDDCs need to work together with development partners to secure access to relevant technologies and to build the technical, regulatory and institutional capacity required for effective climate change adaptation and mitigation. Finally, the diversification of production and exports is essential to mitigate the risks associated with commodity dependence in a changing world. In this context, it is important that the diversification process is inclusive, contributes to job creation, and supports CDDC mitigation and adaptation targets.

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Fossil-fuel producers will face a combination of weaker demand for their products and lower global prices for fossil fuels. They may also face higher extraction costs if subsidies are withdrawn or if policies are put in place that require polluters to shoulder a greater share of the environmental costs associated with their activities (through a carbon tax, for example). This will necessarily reduce the value of existing assets and may impact access to finance. At some point, these fossil-fuel resources will become too costly to extract and will be left fully stranded.

Fossil-fuel-exporting countries will suffer losses via unfavourable terms of trade, reduced external demand and accelerated capital depreciation

The developments described above can be expected to affect fossil-fuel-exporting economies in a number of ways; typically, they will experience a terms-of-trade shock as fossil-fuel prices drop, an external-demand shock as the demand for fossil fuels declines, and an increase in the rate at which carbon-related capital depreciates as assets associated with the extraction and use of fossil fuels lose value. Figure II.6 identifies a set of countries that are likely to be particularly exposed to terms-of-trade and external-demand shocks, as more than one third of their external revenue comes from the export of fossil fuels. Of course, different fossil fuels have different carbon contents, and economies that rely more heavily on natural gas exports may benefit from higher returns in the near term.

A delay in decisive action on the energy transition could double the eventual costs

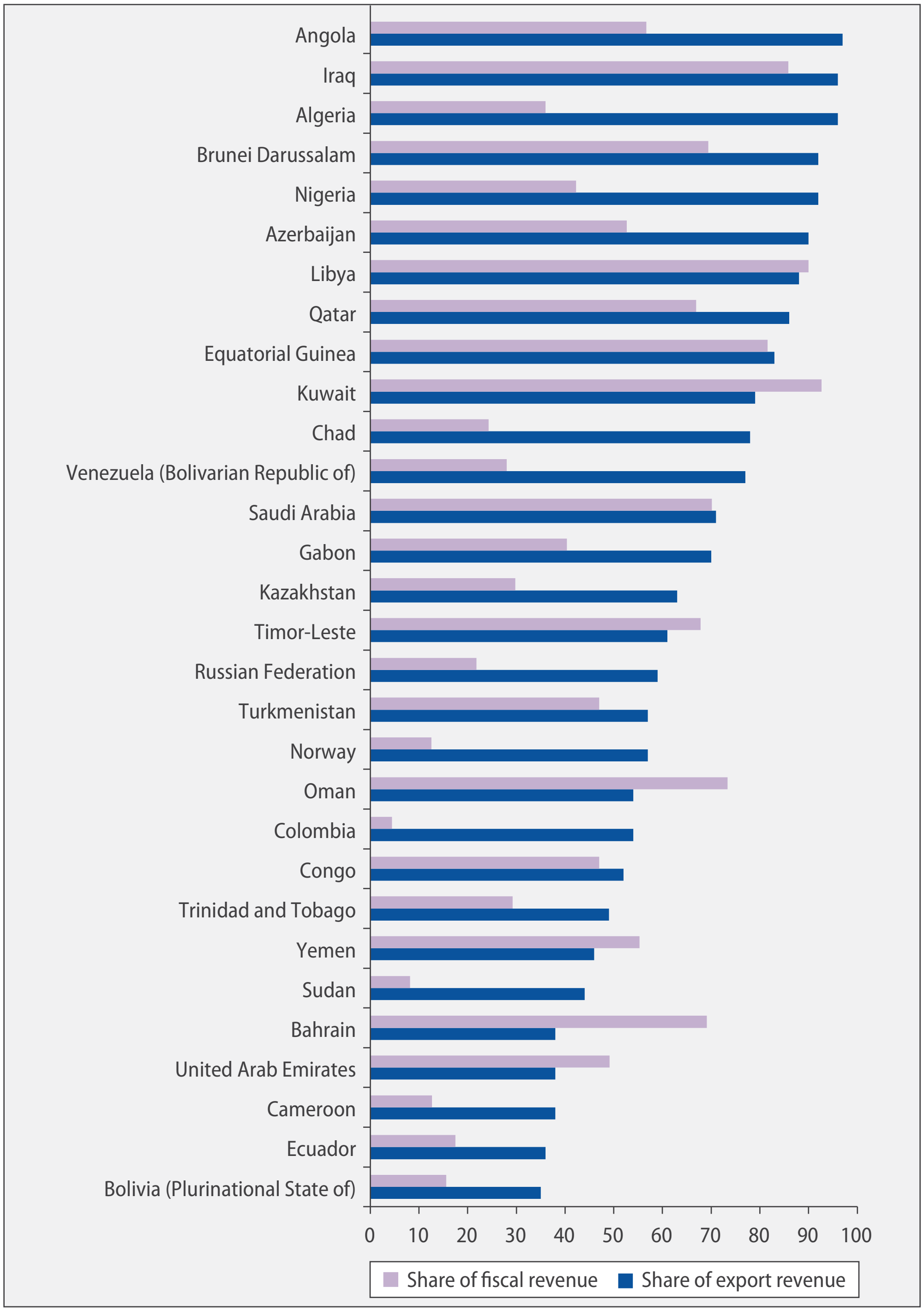
Losses associated with stranded assets may accumulate gradually if firms and policymakers begin making adjustments now to move towards the Sustainable Development Scenario described above. Because the gravity of climate change has not yet been fully acknowledged, however, firms and policymakers continue to underestimate the magnitude, impact and urgency of the energy transition. If decisive action is delayed until 2030, cumulative losses could be at least twice as high once they are eventually absorbed (IRENA, 2017b); this assessment reflects a decade of investment in assets with a lifetime often exceeding 35 years that will become stranded, as well as the sharper and more abrupt adjustment in carbon-intensive activities that will be needed to meet the Paris Agreement targets if emissions are allowed to continue rising until 2030.

Figure II.7 exemplifies GDP prospects for a fossil-fuel producer under three scenarios. The first scenario is a hypothetical case in which no asset stranding occurs. The second scenario is analogous to what would be expected under a gradual adjustment to asset stranding consistent with the Sustainable Development Scenario described above. The third scenario illustrates a delayed adjustment to asset stranding, which requires a much more abrupt correction. The scenarios are modelled for a country that has roughly 50 per cent of its assets and external revenue invested in fossil-fuel exporting. The illustrative example assumes a 50 per cent decline in the producer price of fossil fuels, a 50 per cent decline in global demand for fossil fuels, and a write-off of 50 per cent of fossil-fuel-related capital for the country. In the "gradual adjustment" scenario, the adjustment to asset stranding takes place over a period of 15 years, whereas in the "abrupt adjustment" scenario the adjustment comes as a sudden shock in one year. These simple illustrative scenarios make no allowances for economic diversification or alternative revenue sources, such as drawing down funds from sovereign wealth funds, which could soften the adjustment process.

Unsurprisingly, the losses under both adjustment scenarios are substantial relative to the scenario with no asset stranding. The loss of export revenue affects investment, government spending, jobs, income and consumption. The gradual adjustment scenario leaves greater scope for policy action and economic adjustment to replace the losses suffered by the fossil-fuel industry, and this has the potential to offset much of the shock illustrated in figure II.7. The abrupt adjustment scenario would necessarily deliver a dramatic and prolonged recession. This drives home the message that the failure to act now will ultimately lead to significantly higher costs.

Figure II.6
Share of fuels in merchandise exports and commodity-sourced share of fiscal revenue, 2017

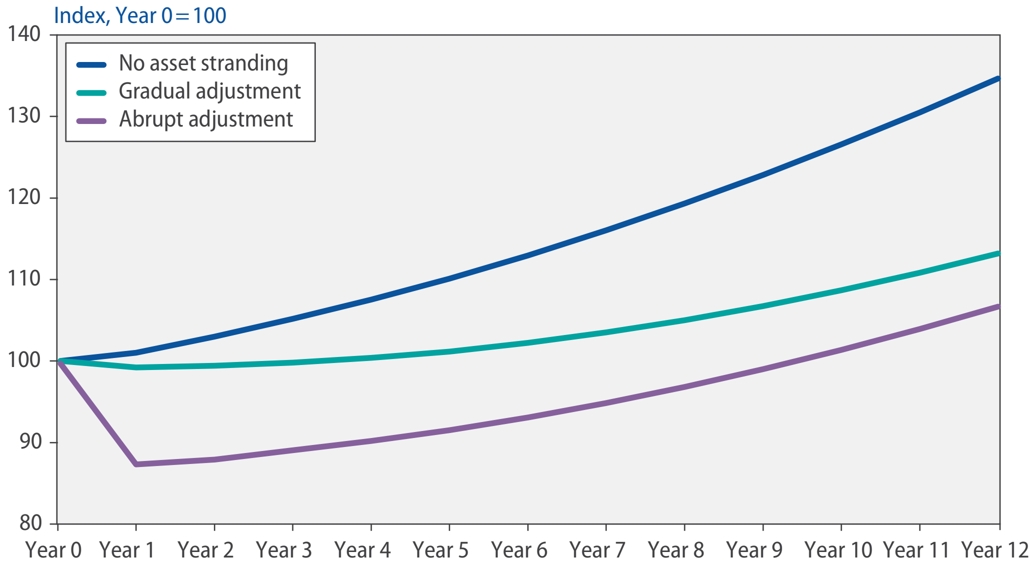
Percentage



Sources: UNCTAD (2019a); IMF, World Economic Outlook database, October 2019; Natural Resource Governance Institute.

Figure II.7

GDP adjustment paths in the face of stranded assets



Source: UN DESA, based on scenarios produced with the WEFM.

A policy road map for a smooth energy transition

Making use of all available policy instruments

Strategies for the energy transition require political prioritization and public support

There is a narrowing window of opportunity to put the world on track to deliver an energy system that is compatible with global goals for climate stabilization, energy access and clean air. Strategies for supporting the transition to clean energy and ensuring the accessibility and reliability of renewable energy sources and systems are available but require political prioritization and public support. Reducing emissions to targeted levels will require technology change to enhance energy efficiency, behavioural change to promote energy conservation (including the preservation and expansion of carbon sinks), investment in the infrastructure and technology required to change the composition of the energy mix, and the development and deployment of carbon-capture and sequestration technologies.

A successful transition will require the full deployment of all policy instruments

Delivering a rapid and just energy transition will require a comprehensive approach that maximizes the effectiveness of all available policy instruments. Fiscal, regulatory and financial instruments must be well coordinated with social policies for a broad policy framework that will support technological development, guide urban design, facilitate acquisition of the necessary skills, and support industries that produce and use clean energy while winding down carbon-intensive activities.

Policy measures to accelerate the shift away from burning fossil fuels include regulating or taxing GHG emissions, removing subsidies that support fossil-fuel use, phasing out coal-fired power plants, providing financial support for clean energy use, and making greater use of regulatory instruments such as efficiency standards (especially in buildings and transport). Industrial and sectoral policies can focus on supporting innovation in key industries, upgrading infrastructure, investing in training to make use of new technologies, and promoting the rapid deployment of best-practice technology.

Lending policies can play a role in the energy transitions

Many countries are making greater use of financial instruments to support the shift to clean energy. For example, the European Investment Bank (EIB) intends to become the world's first "climate bank", phasing out its multibillion-euro financing for fossil fuels by ending its funding for oil, gas and coal projects after 2021 and allocating €1 trillion for funding the transition to cleaner energy. Meanwhile, in Lebanon, the level of reserves a private bank is required to keep at the central bank depends on how much it lends to renewable energy ventures; in Brazil, policymakers require lenders to disclose how they factor environmental risks into calculating capital needs; and in Bangladesh, banks are offered preferential borrowing terms from the central bank if they pass the money on as green loans (Independent Group of Scientists appointed by the Secretary-General, 2019).

In addition to guiding the move away from fossil-fuel use, policymakers must develop action plans to close the current electricity access gaps, with particular attention given to increased investment in both on- and off-grid solutions, the establishment of integrated cross-border grid connections where appropriate, and the development of decentralized renewable energy solutions. Clean-cooking solutions must also become a priority so that substantial numbers of households can move away from traditional biomass usage.

Building public support for policy implementation

The successful implementation of any of the measures described above will require not only political prioritization but also wide-ranging public support. Careful coordination with measures to alleviate the burden on those who will face disproportionate losses is essential—both to protect the vulnerable and to safeguard the political viability of difficult but urgently needed policy actions.

Policies to promote cleaner energy must be coordinated with social measures to protect the vulnerable and support job transitions

As noted earlier, environmental taxes and regulations designed to discourage the use of fossil fuels may translate into higher costs for essential goods such as food and heating, at least during a transition period. Because these essential goods represent a high proportion of a poor household's income, the energy shift has important implications for poverty and inequality. Recent mass protests related to the social repercussions of fuel taxes and fossil-fuel subsidy withdrawal in Ecuador, France, the Islamic Republic of Iran and Sudan illustrate the highly sensitive political-economy aspects of such actions. There are also numerous examples of successful reform measures, many of them within this same set of countries. For example, in 2010, the Islamic Republic of Iran became the first major oil-exporting country to substantially reduce energy subsidies, leading to energy prices that were up to twenty times higher than subsidized prices. Successful experiences demonstrate that policy must be designed so that it is acceptable to affected industries and citizens, with careful consideration given to its distributional consequences and impact on inequality. Establishing a clear communication strategy from the outset is crucial to gaining public support. Country experiences show that the likelihood of success in subsidy reform almost triples with strong political support and proactive public communication (United Nations Inter-agency Task Force on Financing for Development, 2019).

The public must be not only informed of but also fully prepared for the energy transition. In response to this need, several Governments have started introducing special programmes to develop the necessary skills and support labour market transitions to green jobs. For example, New Zealand has established the Just Transitions Unit within the Ministry of Business, Innovation and Employment. Germany has formed the Commission on Growth, Structural Change and Employment and has set out measures to alleviate hardships affecting impacted workers and communities as part of its coal phase-out strategy (Agora Energiewende und Aurora Energy Research, 2019). Canada has set up the Task

Force on Just Transition for Canadian Coal Power Workers and Communities, which has prepared a set of recommendations to ensure that the costs of phasing out coal-fired electricity are not borne exclusively by impacted communities and workers (Canada, 2018). Several other countries, including Costa Rica, South Africa and Spain, have introduced similar initiatives to protect workers that may be left behind by the energy transition.

Public support may also rely on how any revenue gained from fiscal instruments such as carbon taxes or subsidy withdrawals is spent. Using the funds to address issues of high public concern such as air pollution may help to garner support. Direct tax credits or outright payments to consumers may increase public awareness of offsetting compensation linked to the withdrawal of subsidies and help build public support and buy-in. Country preferences vary, with India and Indonesia using budget savings from phasing out fossil-fuel subsidies to expand social protection and infrastructure development, whereas in Japan, the new carbon tax explicitly funds renewable energy and energy efficiency programmes.

Policymaking under conditions of uncertainty

Looming large over the policy task of reining in climate change is enormous uncertainty. Globally agreed targets focus on limiting the rise in the global temperature to no more than 1.5°C or 2°C. In practical terms, this tends to create the impression that policymakers are in a position to determine a specific quantity of CO_2 emissions that would ensure global temperatures do not exceed targeted levels. However, given the complexity and time lags involved in the link between CO_2 emissions and the effects on global temperatures, policymakers face huge uncertainties and cannot target precise policy outcomes with any reasonable degree of accuracy.

Wide uncertainties regarding climate change demand that policymakers err on the side of caution

Given the issues at stake, the lack of precise control over the policy outcome does not negate the need for policy action. On the contrary, it illustrates the urgent need for policy action, and precisely because of the uncertainty involved, these policy actions need to be decisive and meaningful. In other words, the uncontrollability of the precise policy outcome, coupled with the catastrophic dimension in the case of policy failure, makes it imperative for policymakers to err on the side of caution.

Uncertainties in the efficacy and wider impact of available policy instruments also create the need for careful and transparent monitoring mechanisms so that the policy mix can be fine-tuned on a continuing basis to ensure that it is well targeted and effective. The available time frame is short, and the ultimate aims must be clear, credible and achievable.

Pricing carbon: recalibrating relative prices for energy

Amid an unfolding climate crisis, recalibrating the costs of carbon-heavy energy use will help drive behavioural change

Putting a price on carbon and other GHGs can help elicit the necessary changes in behavior while fixing a fundamental flaw in the economic system. Economic decisions that result in the emission of CO_2 and other GHGs create negative effects on the environment and human health. However, with no monetary cost incurred by the polluters, decisions on the production and consumption of goods and services are based on an artificially low cost of using fossil fuels and not on a full-cost assessment that includes these environmental and health externalities. This means that environmental and health damage is borne by society at large but does not feature in the private decision-making of producers and consumers. This understatement of costs has dramatic consequences: certain goods and services are produced and consumed in quantities exceeding environmentally sustainable levels. In other words, individual decisions made on the basis of incomplete sets of price and cost signals impose high environmental costs on society. New statistical frameworks allow an improved understanding of these economic and environmental trade-offs (see box II.4).

Box II.4

Natural capital accounting

Healthy ecosystems provide fuel for energy, clean water and productive soil—all essential for daily living and sustaining human life. However, in conventional national accounting, the environmental dimension is largely ignored; the contributions of natural capital to the economy are overlooked, as are the environmental costs of production and consumption decisions.

Natural capital accounting (NCA)[a] provides a means to ensure that the contributions of nature and the detrimental environmental effects of economic activity appear on the ledger. Through the integration of environmental and economic information using a consistent accounting framework, NCA provides essential information for policymakers. It also supports key global policy frameworks, including the 2030 Agenda and the Paris Agreement.

The System of Environmental-Economic Accounting (SEEA) is the international statistical standard for NCA and provides a framework for organizing and presenting statistics on the environment and its relationship with the economy. It uses an internationally agreed set of concepts, definitions, classifications, accounting rules and tables to produce internationally comparable statistics.

There are two main parts to the SEEA—the SEEA Central Framework (SEEA CF) and the SEEA Experimental Ecosystem Accounting (SEEA EEA). The SEEA CF focuses on individual environmental assets such as energy and water resources to account for how these assets are extracted from the environment, used within the economy, and returned to the environment (as waste or emissions, for example). The SEEA CF comprises several subsystems, including energy, air emissions, environmental protection expenditures and environmental tax accounts, allowing users to understand the economic trade-offs and synergies involved in the use of natural resources and to assess the effectiveness of economic instruments.

A key feature of the SEEA is that it uses the same definitions, concepts, classifications and overall accounting structure as the System of National Accounts (SNA). This allows the calculation of depletion-adjusted aggregates such as "green GDP". For example, the National Institute of Statistics and Geography in Mexico uses SEEA accounts to adjust GDP for the economic cost of environmental depletion and degradation. The link between the SEEA and SNA also provides a crucial tool for countries to understand the economic pathways to carbon neutrality, as shown in the examples below.

Example 1: carbon footprints in the European Union

Footprints (for example, carbon footprints and water footprints) are one of several analytical applications of the SEEA. A carbon footprint represents the amount of CO_2 emitted to produce a final product, including emissions from intermediate inputs and emissions embedded in imported intermediate and final products. This important analytical tool can be used to understand which product- and consumption-related policies can help limit CO_2 emissions. Box figure II.4.1 is derived from Eurostat SEEA air emission accounts and illustrates the respective contributions of broad product groups to the European Union carbon footprint in 2017. While most services (with the exception of transport) generally emit relatively little CO_2 directly, the CO_2 footprint of the "other services" product group represents 23 per cent of the total carbon footprint of the European Union, which is almost on par with the carbon footprint from "materials and manufactured products" (24 per cent). This clearly shows that the demand for services is a significant driver of CO_2 emissions in the European Union, with important implications for policy design.

Example 2: shifting towards low-carbon growth in Indonesia

The Ministry of National Development Planning in Indonesia, in collaboration with the World Bank and other development partners, recently introduced the Low Carbon Development Initiative into the country's National Medium-Term Development Plan 2020-2025.[b] To facilitate a better understanding of the feasibility of low-carbon growth, scenario modelling was conducted using environmental accounting approaches based on the SEEA. This included the use of land cover accounts, land extent accounts and peat accounts developed at the national and provincial levels. These accounts, coupled with the incorporation of an energy and water balance in the model, allowed for the estimation of the impact of natural resource availability and ecosystem service provisioning on economic productivity—and hence on forecasts for GDP growth and other macroeconomic performance indicators. Box figure II.4.2 projec-

(*continued*)

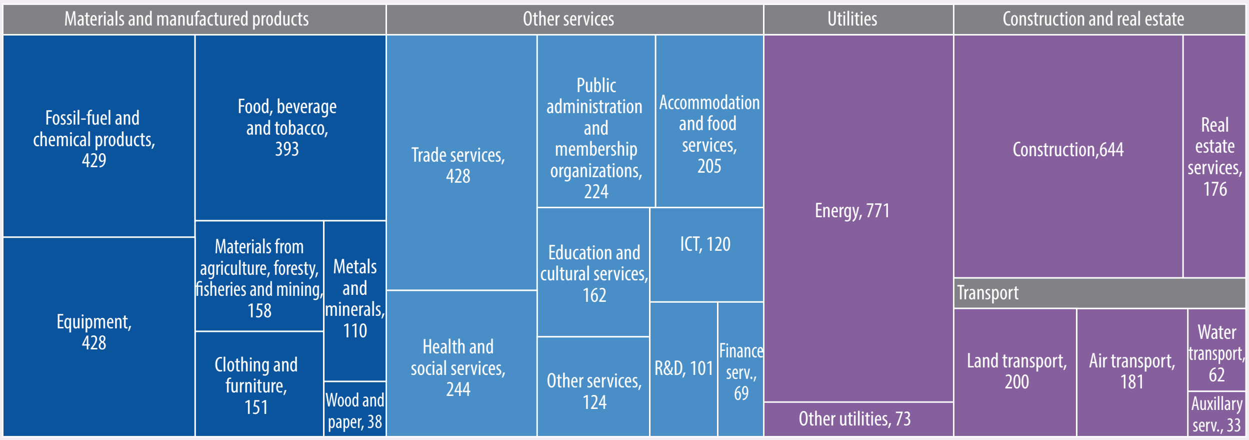
a NCA is used both for the system of natural capital accounting and for natural capital accounts data; in the present context, NCA refers to the former.

b See https://www.bappenas.go.id/id/berita-dan-siaran-pers/pembangunan-rendah-karbon-pergeseranparadigma-menuju-ekonomi-hijau-di-indonesia/.

Box II.4 (*continued*)

Figure II.4.1

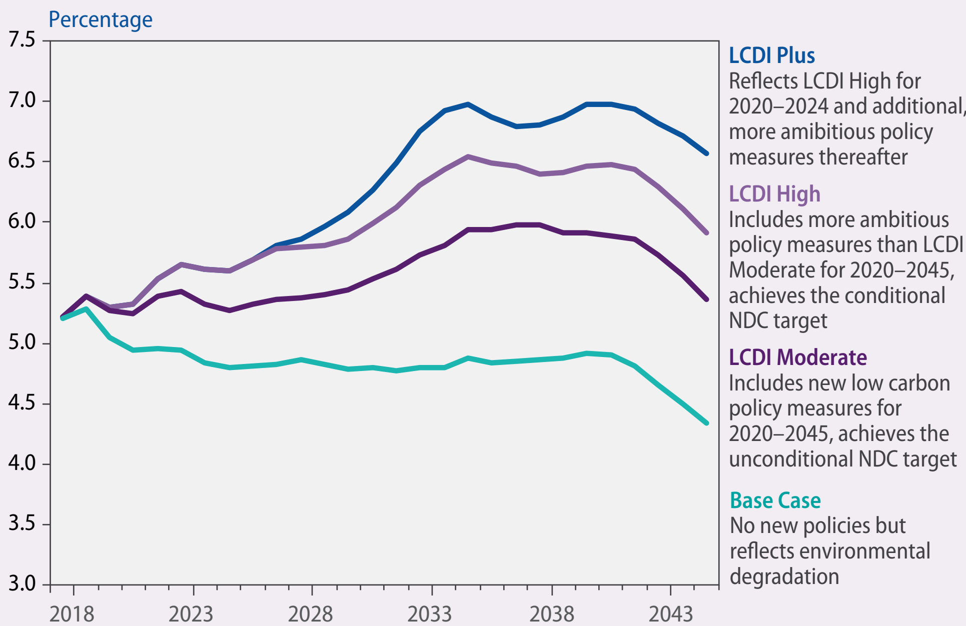
Carbon footprints in the European Union, by product group, 2017



Source: Eurostat (online data code: env_ac_io10).
Note: Estimates.

Figure II.4.2

Indonesian GDP growth trajectories for various scenarios



Source: Indonesia, Bappenas (2019).

tions illustrate that labour productivity and GDP growth increase with the extent of ambition of policy measures introduced in support of low-carbon development.

Example 3: energy intensity of the Costa Rican economy

The energy intensity of economic activities can be estimated by calculating the ratio between final energy use and value added. This indicates how many units of energy (joules) are required to generate a million units of output (in Costa Rican colones) and is therefore a measure of the energy efficiency of economic activities. As box figure II.4.3 shows, the energy intensity of the Costa Rican economy has

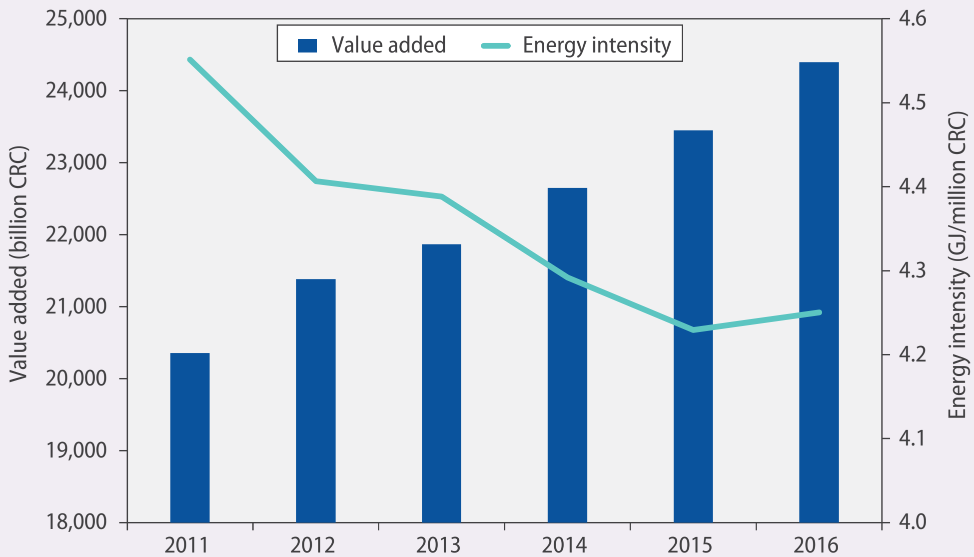
(*continued*)

Box II.4 (*continued*)

decreased since 2011, though 2016 saw a slight increase of 0.5 per cent over the previous year. Since 2013, the electricity and water supply sectors have become more efficient in their energy use, but agriculture has trended in the opposite direction. Because of the consistency between the environmental accounts and the national accounts, such trends can be further analysed by, for instance, undertaking a structural decomposition analysis to assess the drivers of change.

There is increasing interest from a wide range of stakeholders in the use of NCA for the main-

Figure II.4.3
Energy intensity of value added in Costa Rica



Source: Banco Central de Costa Rica, energy accounts (2011–2016) and National Accounts.

Note: The value added series used corresponds to the chained volume at prices of the previous year, year of reference 2012.

streaming of ecosystems and biodiversity in policy. There are currently around 90 countries using the SEEA CF, and about 40 countries are piloting the SEEA EEA. A revision process is under way to develop an agreed statistical framework for ecosystem accounting by early 2021.

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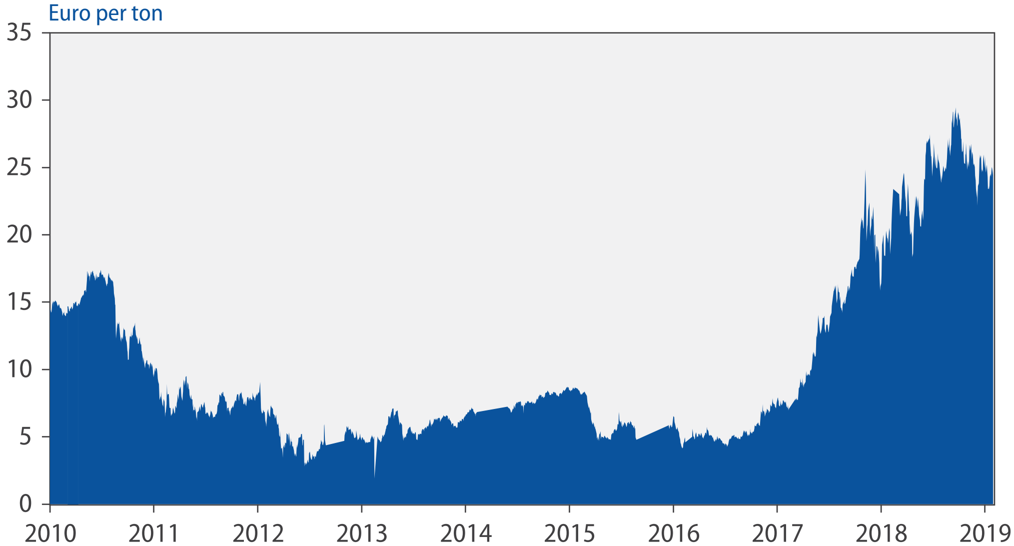
Carbon pricing obliges producers and consumers to integrate into their economic decisions the environmental damage and other costs that have hitherto been offloaded onto society as a negative externality. Establishing a price for emitting CO_2 would shift economic incentives and require the calculation of new, adjusted costs along the extraction and consumption chain for fossil-fuel-based products. To be effective, the price on CO_2 must be sufficiently high and cover all relevant parts of the economy.

Forms of carbon pricing: emission trading systems and carbon taxes

Carbon pricing can take different forms but generally falls into one of two categories or reflects a hybrid of these schemes. The first of these is an emissions trading system (ETS), in which emission quotas are allocated through auction or direct apportionment by the Government, with a ceiling imposed on individual and aggregate CO_2 emissions. The advantage of this approach from the perspective of policymakers is that the total quantity of allowances, and hence the total emission level, is fixed. This can also be a major challenge, however, as getting the total emission quantity right may require repeated policy adjustments. In the European Union ETS, for example, an oversupply of initial allowances depressed the CO_2 price so much that the trading system became largely ineffective. Policymakers subsequently stepped in and made changes to the system, contributing to a meaningful adjustment in the CO_2 price (see figure II.8).

Figure II.8
Implicit CO_2 price in Europe



Source: Markets Insider (https://markets.businessinsider.com/commodities/historical-prices/co2-european-emission-allowances/eur, accessed on 4 December 2019).

Note: Price of European emission allowances. One allowance gives the holder the right to emit one ton of CO_2 or the equivalent amount of nitrous oxide or perfluorocarbons.

The other major form of carbon pricing is a tax or fee on CO_2 emissions. This can take different modalities, depending on whether the price is paid at the source by the producer, on final consumption, or incrementally along the value chain, for example.

There are currently 29 explicit carbon tax regimes and 28 emissions trading systems around the world that have been implemented at the subnational, national or regional level and together cover about 11 Gt of CO_2 equivalent, or about one fifth of global emissions. The effective price of CO_2 ranges from less than $1 to $127 per ton, with about half of these covered emissions priced at less than $10 (World Bank, 2019b).

Current carbon pricing initiatives are well below the levels needed to drive behavioural change

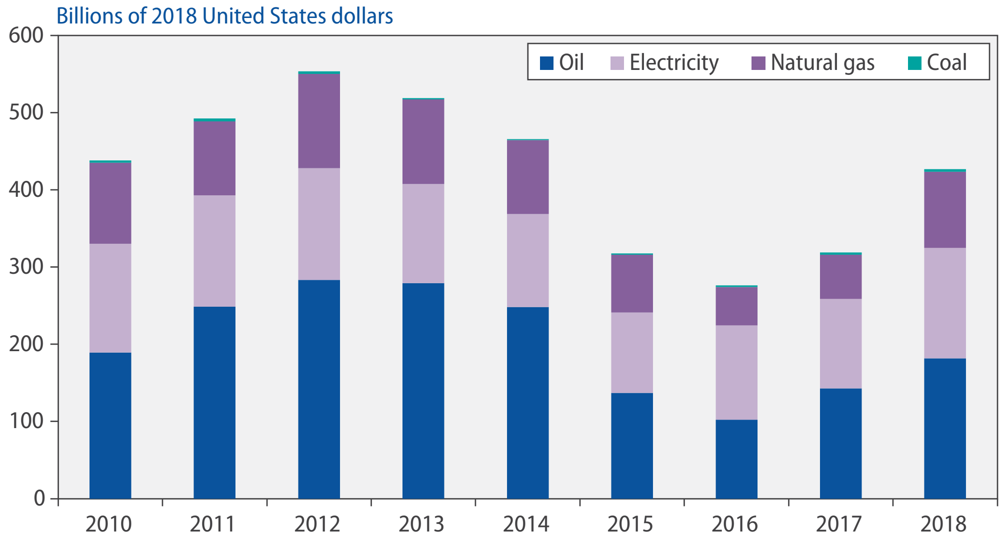
The appropriate price for CO_2 will depend on the broader policy mix, making it difficult and inefficacious to simply compare prices across countries. Nonetheless, it is clear that the price required to curb emissions is much higher than most of the prices currently in place. A number of studies identify a range of $150 to $300 per ton to achieve a sufficiently large reduction in emissions (Independent Group of Scientists appointed by the Secretary-General, 2019). According to the OECD (2018b), the present carbon rates are particularly far off target in the industry sector and the residential and commercial sector. In both sectors, more than 80 per cent of all emissions in 2018 were subject to an effective carbon tax rate of less than €5 per ton.

In most of the countries that have adopted carbon pricing, very generous exemptions are typically offered to affected industries. While this compensates firms for associated losses, it is far less effective at delivering behavioural change. Governments may instead consider approaches such as output-based rebates or negotiated performance agreements in order to align industrial incentives with the shift towards low-carbon alternatives.

The need for policy coherence: carbon pricing must be accompanied by phasing out fossil-fuel subsidies

Fossil-fuel subsidies continue to play an important role in many countries (see figure II.9). Direct support for fossil-fuel consumption amounted to more than $400 billion globally in 2018 (IEA, 2019b). However, this nominal value excludes the various implicit costs deriving from fossil-fuel use, including environmental damage and health-care costs. Taking into account these externalities, the total cost of fuel subsidies is closer to $5.2 trillion—equivalent to 6 per cent of world gross product (Coady and others, 2019). This

Figure II.9
Global subsidies for fossil-fuel consumption



Source: UN DESA, based on data from the IEA fossil fuel subsidies database.

stands in contrast to the global estimate of $150 billion to $200 billion for renewable power generation subsidies (Independent Group of Scientists appointed by the Secretary-General, 2019). In many countries, fossil-fuel subsidies are about 10 times greater than total government environmental expenditures, which typically cover waste management, wastewater management, pollution abatement, biodiversity and landscape protection, and environmental research and development (R&D) (IMF, 2019b).

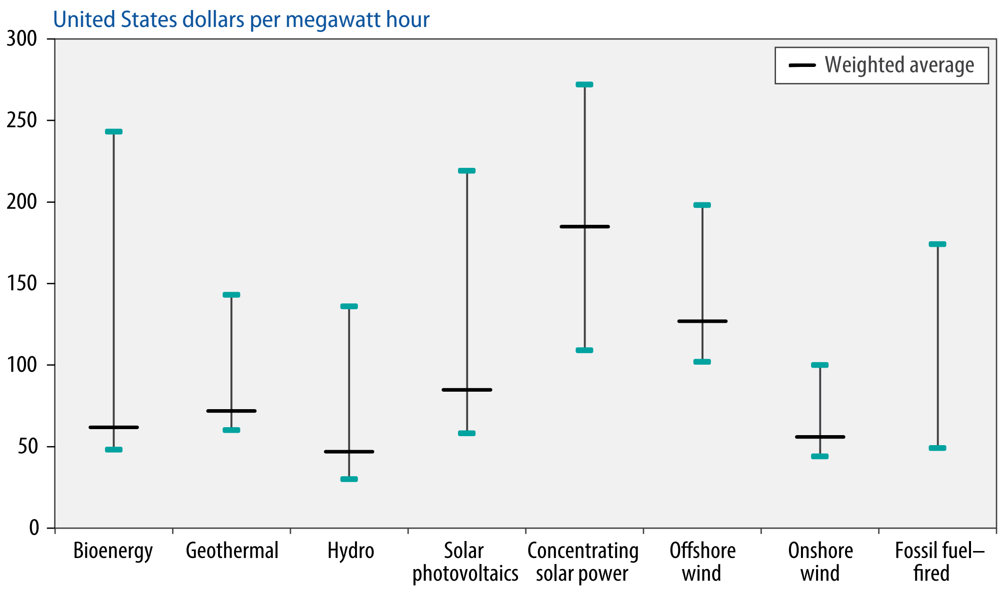
Fossil-fuel subsidies are diametrically opposed to the purpose of carbon pricing, as they reduce the price of fossil fuels relative to the price of renewable energy sources. The failure of Governments worldwide to implement sufficiently high carbon tax rates and eliminate fossil-fuel subsidies can be attributed mainly to political economy constraints. In many cases, fossil-fuel subsidies alleviate the lack of access to affordable energy for the poor. Removing these subsidies without putting an affordable clean energy source in place would create tension between the targets of reducing CO_2 emissions and providing universal access to affordable energy. The sequencing and speed of the transition to cleaner energy sources must be carefully managed to ensure that the most vulnerable are protected. Fiscal space created by the phasing out of fossil-fuel subsidies and the introduction of carbon pricing can be redirected towards alternative technologies such as solar electricity, battery storage and micro-grid management in order to ensure affordable energy access, especially for the poor. These fiscal support measures should be applied to households and affected industries as directly as possible—for example, in the form of grants, price discounts, tax credits or direct installation assistance. This would increase awareness of the offsetting compensation linked to the withdrawal of subsidies and help build public support for the energy transition.

Expanding investment in clean energy innovation will spur the deployment of renewables

Even with the current fossil-fuel subsidies and largely ineffectual carbon pricing, competitive pressures driven by shifts in the cost of using fossil-fuel-based energy relative to the cost of using renewable energy have already elicited and will continue to elicit changes in behaviour. Carbon taxes and subsidy removal are not the only instruments available to effect these relative price changes. Energy efficiency requirements in building codes or ceilings on the average fuel consumption of vehicular fleets are very effective means of delivering behavioural change. Feed-in tariffs paid to renewable energy producers for supplying energy to the electricity grid have helped expand investments in renewables. Policy measures can also be put in place to encourage R&D and innovation in renewable energy technology.

Investment in R&D is driving technological change that is helping to reduce costs for wind and solar energy. This, in turn, is boosting global renewable energy capacity and progress towards a cleaner energy mix. The levelized cost of power generation for solar PV without tracking systems has declined by 83 per cent since 2009 and the cost of onshore wind energy is down 49 per cent, driven by R&D focused on solar and wind technologies, the standardization of such technologies, and economies of scale in manufacturing. This means that two thirds of the world population is now living in countries where either solar or wind is the cheapest choice for electricity generation in terms of all-in costs (Bloomberg New Energy Finance, 2019). This cost decline has increased the competitiveness of these technologies as viable alternatives to fossil fuels (see figure II.10), supporting a rise in the share of renewables in global electricity production from 20 to 26 per cent since 2010. Solar and wind power have also gained in competitiveness relative to other low-carbon energy sources, such as hydropower and nuclear power.

Figure II.10
Global electricity costs in 2018



Source: UN DESA, based on data from IRENA (2019c).

Note: Upper and lower boundaries represent the 5th and 95th percentiles of global cost ranges.

Looking ahead, electric batteries can be expected to follow a similar downward price path and become more efficient to produce through standardization and economies of scale. Electric vehicles have already made great strides, and some of the largest global car producers have announced what essentially amounts to the electrification of their entire range of product platforms. Other car manufacturers are exploring possibilities for using clean energy options such as fuel cells and hydrogen-based propulsion technologies (Phillips, 2019).

Pricing mechanisms must work hand in hand with regulation, education and technology to deliver a rapid energy transition

Encouraging behavioural adjustments through relative price changes is at best a blunt instrument—one that is necessary but by no means sufficient to deliver the rapid change in the energy mix that is required. Consumer and producer behaviour can also be guided by raising environmental awareness, providing access to more energy-efficient options, and implementing regulatory changes that work hand in hand with ongoing changes in relative prices. There is an important role for active fiscal policy in supporting R&D and also in directing investment towards infrastructure development to facilitate network and scale effects, the lack of which can block otherwise viable technologies.

Carbon pricing instruments will create additional fiscal space

Revenue from pricing mechanisms such as taxes on carbon emissions can expand fiscal space, generating valuable resources that can be used to meet development priorities. Governments may choose to channel a portion of this revenue back into society to offset the costs of the energy transition borne by poorer households, for example. Early implementation of such mitigation measures, before new taxes are fully phased in, can demonstrate the political commitment to using revenue to reduce inequality and strengthen public support (United Nations Inter-agency Task Force on Financing for Development, 2019). The additional fiscal space can also be used for other development priorities, including expanding investment in renewable energy and innovation. Given the already strained fiscal positions in many countries and the vast financing needs associated with meeting the Sustainable Development Goals and implementing environment-friendly reforms, creating this additional fiscal space is particularly important. Ensuring universal access to energy would require investment of about $55 billion annually between 2018 and 2030—mainly focused on securing access to electricity (IEA, 2019b).

A policy framework for winding down carbon-intensive activities

Winding down fossil-fuel-related activities will bring wide-ranging challenges

The capacity for many fossil-fuel-rich economies to adapt to a future of declining demand for carbon-intensive products is severely limited by their reliance on related revenue that is needed to finance fiscal spending and essential imports. Many countries also lack the technology and skills needed to develop a more diversified production base and are restricted by a rigid institutional framework. In the short term, a policy decision to reduce or eliminate the extraction of fossil fuels could translate into job losses, reduced tax revenues, and the imposition of costs on firms, power suppliers and homeowners that would need to modify or replace existing infrastructure. There would also be a risk of disruption to the essential energy supply, with related health and safety risks and disruptions in production.

Geopolitical concerns and financial stability risks loom large, as "the loss of revenue from the energy sector could be destabilizing internally, regionally and even internationally" (UNCTAD, 2019a, p. 19). This could also trigger a "price war" scenario, with fossil-fuel producers offering increasingly lower prices in order to maintain a share of global energy supply, testing the resolve of the international community to move away from fossil fuels (Van de Graaf and Verbruggen, 2015).

As pressures mount from a combination of declining demand and more stringent environmental regulation across the world, the exploitation of fossil-fuel resources will become increasingly less profitable, eventually resulting in the closure of mines and extraction facilities. This is already evident in the case of the coal industry, as the operating cost of existing coal-fired power plants is now above the cost of new solar PV and onshore wind in many countries (IRENA, 2019c). This is encouraging a more rapid transition away from coal (see box II.5).

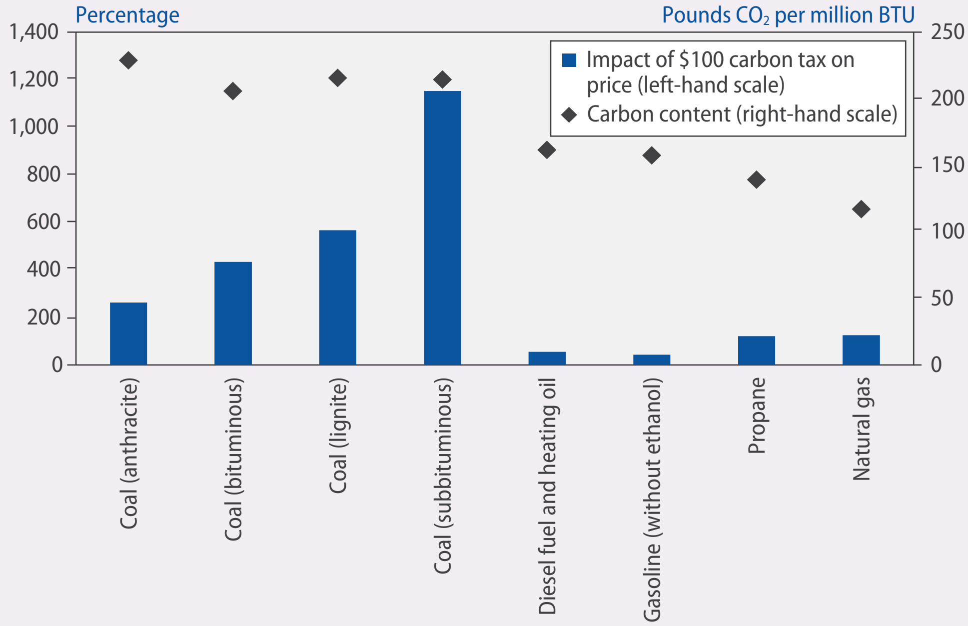
Box II.5

Carbon pricing and the global coal market

Resources may become stranded as a result of changes to regulations, pricing or behavioural norms that create a situation in which there is no longer a market for the resource or the resource is no longer economically viable to extract. For example, widespread use of carbon pricing will raise the cost of using fossil fuels and alter the relative price of different energy sources. This will encourage a shift in the composition of the energy mix and patterns of demand. Box figure II.5.1 shows an example of how the introduction of a $100 carbon tax would impact the price of various fuels; the impact would depend on both the level of carbon emissions associated with burning the fuel and the pre-tax price of that fuel. Pre-tax prices differ significantly across countries, but for the most part a carbon price can be expected to raise the price of coal significantly relative to other fuels, encouraging the transition away from coal.

Figure II.5.1

Carbon content of various fuels and impact of $100 carbon tax on price in the United States



Source: UN DESA, based on data from Hafstead and Picciano (2017) and United States Energy Information Administration (https://www.eia.gov/tools/faqs/faq.php?id=73&t=11).

Coal is the most carbon-intensive fuel and is also responsible for much of the global deterioration in air quality, especially in the big cities of China and India. The need to transition away from coal and towards alternative energy sources has been recognized for decades. The members of the Powering Past Coal Alliance, which include 32 national Governments, 25 subnational Governments and 34 businesses and organizations, have pledged to stop constructing new coal-fired power plants by 2020 and to accelerate the transition towards clean energy with the aim of phasing out coal altogether.

Coal remains the world's largest source of power, and coal-fired power capacity continues to rise

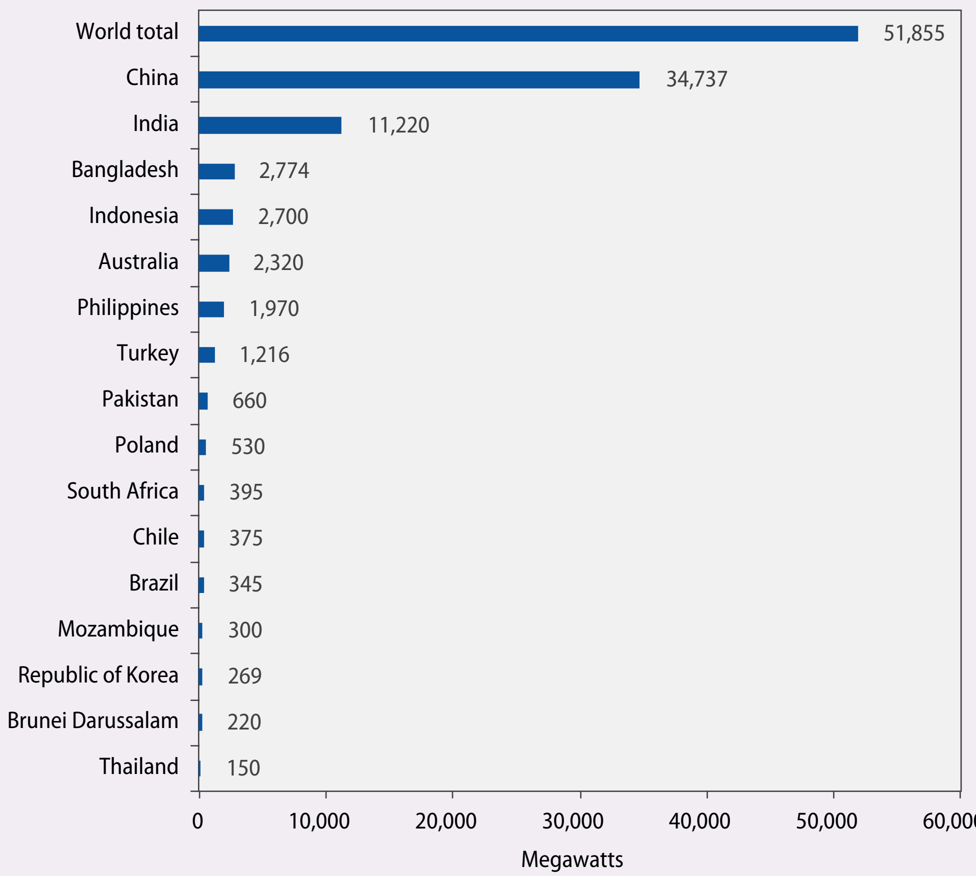
Such plans notwithstanding, coal remains the world's largest source of power, accounting for 38 per cent of the global electricity supply in 2018. Global coal-fired capacity has nearly doubled since 2000, despite an acceleration in the pace of decommissioning and the cancellation of 1,034 planned or announced projects since 2015. Several countries are still involved in the construction of new coal-fired power plants

(*continued*)

Box II.5 (*continued*)

(see box figure II.5.2), which have a life expectancy of up to 75 years (Rode, Fischbeck and Páez, 2017). This demonstrates a persistent lack of recognition of the urgency of transitioning towards clean energy, encouraging financial investment in plants that are likely to become stranded long before the end of their technical life.

Figure II.5.2
Proposed and new coal plants in 2019



Source: Global Energy Monitor, Global Coal Plant Tracker, July 2019.

Note: Sum of newly proposed, started construction, resumed construction and newly operating, less retired. Changes from end–2018 to July 2019.

Coal power generation is declining in much of Europe and North America. Belgium, France, Slovakia, Sweden and the United Kingdom all expect to eliminate coal-fired power in the next few years. Meanwhile, Germany continues to rely on coal-fired plants for 40 per cent of its power and Czechia for roughly half of the national power supply, while in Poland 80 per cent of power is generated by coal-fired plants.

Asia accounts for three quarters of global coal consumption and faces a particularly high risk of stranded assets and asset losses. Of the anticipated cumulative lifetime emissions of electricity generators under construction or planned in early 2017, coal plants in Asia accounted for nearly 60 per cent (Pfeiffer and others, 2018). China has made important strides in reducing the share of coal in the energy mix while also encouraging existing coal-fired power plants to install low-carbon technologies. Nonetheless, to meet the country's rapidly rising electricity demands, coal-fired power supply increased by 4 per cent in 2018. At the same time, China has invested more than $50 billion in coal energy abroad

(*continued*)

Box II.5 (*continued*)

(towards an estimated 70 coal-fired power plants) in connection with the Belt and Road Initiative and China-Pakistan Economic Corridor programme (Gallagher, 2018).

India has also made efforts to reduce the share of coal in electricity production, with the rise in solar and wind capacity outpacing that of coal capacity in recent years. Nonetheless, India is the world's second-largest consumer of coal, and the sector remains highly subsidized. Coal accounts for 57 per cent of total energy consumption and 74 per cent of electricity production. Coal-fired power capacity continued to expand in 2018, albeit at significantly reduced rates relative to previous years.

Most African countries draw only a small share of electricity from coal, but many are considering new coal-fired power plants

Most countries in Africa currently draw only a small share of electricity from coal; the exceptions are South Africa, which generates 93 per cent of its electricity from coal, and parts of North Africa. However, Governments across the continent are considering new coal-fired power plants to meet the urgent need for an expanded power supply. In more than 30 African countries, less than half of the households have access to electricity (Blimpo and Cosgrove-Davies, 2019), most countries lack grid capacity, and power outages are frequent. Meeting these needs is urgent, but utilizing scarce resources to invest in technology that will ultimately have to be retired before the end of its technical life would be a costly endeavour, both financially and environmentally.

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Many developing countries have recently discovered new fossil-fuel resources

Investment in oil and gas exploration continues to expand, rebounding from the drop that coincided with the decline in oil prices during the period 2014-2016. Several countries, including Côte D'Ivoire, Ghana, Guyana, Kenya, Mozambique, Senegal, the United Republic of Tanzania and Uganda, have recently discovered new fossil-fuel resources and are seeking to exploit their revenue potential. Without a realistic assessment of the prospects for future demand, there is a risk of short-sighted policy decisions that lock in stranded assets and losses. At the same time, there is massive potential for the expansion of renewable energy. Africa has the richest solar resources in the world but is home to less than 1 per cent of globally installed solar PV. In many countries, solar PV would provide the cheapest source of electricity.

The policy framework for winding down fossil-fuel activities should develop along five fronts

Creating an appropriate policy framework to facilitate the economic transition away from carbon-intensive activities is crucial. The framework—which must consider the overall costs of adjustment as well as the effects on government revenue, employment and the financial sector—should be developed along the following five fronts:

- For fossil-fuel producers, **revenues from current fossil-fuel sales must be carefully managed** to provide a buffer against potential losses, to ensure that funds are available to support the adaptation and transition process, and to invest in a diverse portfolio of long-term assets. The majority of long-term oil and gas producers, including Algeria, Angola, Azerbaijan, Bahrain, Brunei Darussalam, Colombia, Gabon, the Islamic Republic of Iran, Kazakhstan, Kuwait, Libya, Nigeria, Oman, Qatar, the Russian Federation, Saudi Arabia, Timor-Leste, Trinidad and Tobago, the United Arab Emirates, and the Bolivarian Republic of Venezuela, have already established sovereign wealth funds that may help to ease the transition. A total of 78 commodity-based sovereign wealth funds existed in March 2018 with over $7.4 trillion (9 per cent of world gross product) in assets (World Economic Forum, 2019b). However, many newcomers to fossil-fuel production lack these essential resources, and the size of the funds is sometimes limited.
- **The dependence of public finances on fossil-fuel-related revenue must be reduced** by expanding and diversifying the tax base. At least 14 fossil-fuel exporters around

the world continue to rely on fossil-fuel sales to fund more than half of their fiscal spending (see figure II.6). Unless major diversification efforts are undertaken, there is a risk of a dramatic shortfall in public services as this revenue source dwindles.

- **Economic diversification—especially into industries that produce and use clean energy—should be encouraged** through targeted investments in technology, infrastructure, training and skill development. This will help ease the burden on external balances as commodity-related revenues decline, create new employment opportunities, and promote a smooth transition to a cleaner energy mix. Private-sector engagement may be supported through the establishment of a transparent business environment backed by sound institutions.
- **Risk-sharing agreements with existing and potential private-sector investors in carbon-intensive activities must be transparent and balanced**. Developing natural resource industries requires significant investment in both human and physical capital. This presents an important challenge for many developing countries, which often rely on foreign investors and companies to undertake costly exploration activities and establish the foundations of such industries. As the longevity of such investments becomes increasingly uncertain, countries that are considering further investment in fossil-fuel industries must ensure that these risks are clearly addressed in contractual agreements and shared transparently with private-sector partners.
- Where decisions on fossil-fuel production are in the hands of the private sector, **credible and predictable policy is needed to guide behaviour**. Effective use should be made of all available policy instruments, including emission standards, carbon pricing, restrictions on extraction activities, and support for cleaner energy sources. The policy framework must be carefully coordinated with social programmes to support job transitions and alleviate hardship for vulnerable populations.

Coordinating global carbon policy

Cooperative solutions at the global level are needed to adjust for the uneven distribution of energy transition costs and benefits

To date, policy measures put in place to accelerate the energy transition fall well short of what is needed. Fossil-fuel subsidies remain prevalent, outstripping subsidies for renewable power generation. Coal is still the world's largest source of power, and coal-fired power capacity continues to rise. Carbon pricing tools have been introduced on a very limited and fragmented basis and generally at levels too low to drive behavioural change. As progress accelerates along these fronts, the costs and benefits of the energy transition will be very unevenly distributed within and among countries, and this imbalance must be recognized and addressed through cooperative agreements in order to ensure a fair transition. Measures to alleviate the burden on those facing disproportionate losses are essential.

The energy transition calls for new national and global social contracts

Some segments of society will be particularly vulnerable to the social impacts of the energy transition. With socioeconomic upheaval on the horizon, Governments must take steps to craft new social contracts at the national and global levels to ensure that the transition is just. For many countries, the impact of the energy transition will have a strong regional dimension, with losses concentrated in particular locations; in such cases, particular attention should be given to regional policies. To ensure a just transition for all social groups, well-coordinated policy interventions are essential. Policy dialogues with stakeholders, including those who face economic losses from the energy transition, are also crucial. The Paris Agreement highlights the importance of public participation and comprehensive social protection in its preamble, and the Climate Action Summit of 2019 affirmed that the social dimension of climate change was a priority, stressing the importance of including in national commitments a just transition for people whose jobs and livelihoods are impacted.

Carbon leakage and emission front-loading highlight the need for a multilateral approach

As the reality of asset stranding takes shape, there is a risk that some economies may accelerate the extraction of their fossil-fuel resources while global demand remains firm in an effort to avoid losses in the future. This "Green Paradox" would encourage a short-term glut in fossil fuels, put downward pressure on fossil-fuel prices, delay the transition to cleaner energy sources, and ultimately require a more abrupt adjustment to realign supply with diminishing demand. This piecemeal approach to global carbon policy brings the risk of carbon leakage, whereby carbon-intensive industries are relocated to jurisdictions with more lax regulation, potentially even increasing global emission levels. The heavy carbon content of imports in developed economies suggests that there is some precedent for this behaviour. Consequently, there is an urgent need for coordinated multilateral action on carbon policy. Unified principles and standards would also facilitate the alignment of measures such as carbon pricing with other major policy areas, such as trade and international finance. Absent a global solution, accelerating the development and implementation of regional and subregional carbon policy mechanisms would be a second-best alternative, given the urgency of the challenge at hand.

The transition to a low-carbon global economy will require the rapid diffusion of technology

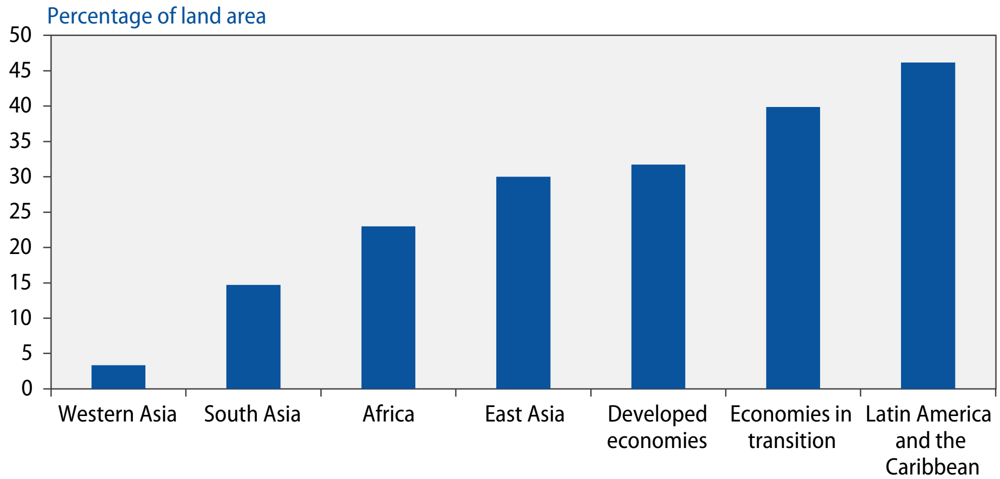
Global efforts must also prioritize the rapid diffusion of essential technologies, including those that allow energy efficiency gains, provide widespread access to clean energy, and support carbon capture and sequestration (to reduce CO_2 emissions from existing coal- and gas-fired power plants and industrial processes). Technologies put in place today have long-term financial and environmental implications. Leapfrogging towards low- and no-carbon technologies can preclude the creation of new stranded assets, which could lock in a carbon-intensive path for decades. In many cases the transition will necessitate the phasing in of energy technologies that, in the absence of a carbon price, are not among the most affordable options available at that point. Thus, climate finance will likely need to be significantly increased to support the transition in many developing countries, especially the LDCs (see box II.6). Large-scale financial and technology transfers from developed economies will be crucial.

Global carbon pricing would redefine the notion of economic liabilities and wealth

Putting a global price on net carbon emissions would underpin a far-reaching redefinition of what constitutes economic liabilities and wealth. At the national level, carbon-intensive activities would be subject to financial liabilities, incentivizing the avoidance of environmental pollution and the development of clean-energy solutions. At the global level, countries that continue to emit carbon would make financial transfers to countries that are net absorbers of carbon. This would create an entirely new economic paradigm, with the preservation and expansion of forests increasingly valued as a global asset. Countries in Latin America and the Caribbean have the potential for particularly high returns from such an initiative (see figure II.11).

The global transition to a low-carbon economy will encompass monumental changes in consumption choices, technology, industrial structure and policy design. The climate imperative is clear, and the window of opportunity for decisive policy action is narrowing. Any delay will significantly increase the ultimate costs. The transition to a cleaner energy mix has the potential to deliver environmental and health benefits worldwide and to provide economic opportunities for many countries. However, the economic and social consequences will be unevenly distributed. Successful execution of the global energy transition will require a clearly communicated and well-coordinated strategy, with close cooperation within and between countries.

Figure II.11
Forest cover by region



Source: UN DESA, based on data from World Bank, World Development Indicators database.

Box II.6
Falling behind? Recent trends in climate change finance for least developed countries

The least developed countries (LDCs) have been recognized as a group that is especially vulnerable to the negative impacts of climate change. The intrinsic vulnerability of ecosystems and human systems is a risk factor for a wide range of countries, but the LDCs have the added burden of low gross national income per capita, which constrains their ability to respond and build resilience. Therefore, the need to provide financial assistance, technology transfer and capacity-building to help the LDCs address climate change has been reflected in international agreements on climate change, disaster risk reduction and sustainable development.[a]

Sources of climate change finance for LDCs for adaptation and mitigation can be divided into private and public flows from developed countries to LDCs, from developing countries to LDCs (South-South cooperation), and from domestic sources. Public climate change finance flows to LDCs come from bilateral, multilateral and other sources.

Accurate and comprehensive data on climate change finance flows for LDCs are available only for public sources of finance from official multilateral channels. While 64 per cent of global climate change finance is estimated to have come from private sources in 2016, in LDCs private sources of climate change finance are likely to be much smaller, given the low volumes of FDI flowing to this group (UNFCCC, 2018). The data on private sources of climate change finance for LDCs are too incomplete to produce reliable numerical estimates.

The Global Environment Facility (GEF) oversees the GEF Trust Fund, as well as two climate change funds—the Special Climate Change Fund (SCCF) and the Least Developed Countries Fund (LDCF)—established under the United Nations Framework Convention on Climate Change. Based on calculations from the GEF Secretariat's project database, $781 million had been made available from the GEF Trust Fund up to November 2019 for national projects on climate change in LDCs. In addition, the GEF Trust Fund has financed regional and global projects on climate change that are benefiting both developing countries and LDCs. If the estimated contribution to LDCs from regional and global climate change projects is included, LDCs have received at least $1.74 billion, equivalent to approximately 12.2 per cent of total climate change funding from the GEF Trust Fund. The resources have primarily been used for mitigation, with a substantial share directed towards energy generation, distribution and efficiency. However,

a See, for example, article 4.8 and 4.9 of the United Nations Framework Convention on Climate Change, articles 4.6, 9.4, 9.9, 11.1 and 13.3 of the Paris Agreement, the Sendai Framework, the 2030 Agenda for Sustainable Development, and the Addis Ababa Action Agenda.

(*continued*)

Box II.6 (*continued*)

the need for investment in adaptation is far more urgent, given that a single climate-related disaster can erase years of development gains, while the share of global greenhouse gas emissions attributable to LDCs is relatively small.

From the time the SCCF was established in 2001 to the end of March 2019, cumulative pledges to the Fund amounted to $354 million; of this amount, $352 million was used for 78 projects (most of them under the SCCF Adaptation Programme), with $240 million going to LDCs.

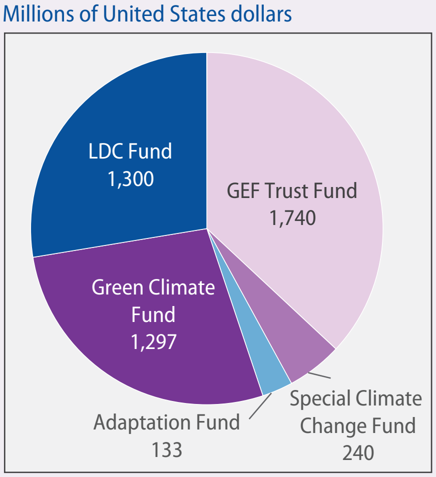
The LDCF supports a work programme that provides LDCs with assistance in the preparation and implementation of national adaptation programmes of action (NAPAs), which are country-driven strategies that identify the most immediate needs for climate change adaptation. The LDCF focuses on reducing the vulnerability of key sectors identified through the NAPA process, financing on-the-ground adaptation activities that provide concrete results in support of vulnerable communities. Between the time the LDCF was established in 2001 and the end of March 2019, 50 current and graduated LDCs accessed a total of $1.3 billion for 271 projects. The demand for LDCF resources continues to exceed the funds available for new approvals.

The Adaptation Fund was established under the Kyoto Protocol in 2001 and launched in 2007. It is administered by its own Adaptation Fund Board. The Adaptation Fund is financed through voluntary pledges as well as through a levy of 2 per cent raised from the sale of certified emission reductions under the clean development mechanism. The Fund reports that by June 2019 it had approved 23 projects for LDCs worth a total of $171 million, as well as readiness grants for 13 LDCs worth $635,000. Most funding has been allocated to adaptation projects relating to food security and rural development.

Formally established in 2010, the Green Climate Fund (GCF)—like the GEF—serves the Paris Agreement. The GCF aims to mobilize climate change finance to support scaled-up mitigation and adaptation action in developing countries. It seeks to achieve a balance between mitigation and adaptation investments over time and to ensure that at least 50 per cent of adaptation funding goes to the most vulnerable countries, including LDCs, SIDS and African States. From 2010 to September 2019, the GCF received pledges amounting to $10.3 billion, making it the largest dedicated climate fund. For the period 2015-2019, $5.6 billion in new allocations was approved, the bulk of it for project funding. Data from the GCF website indicate that by September 2019, total funding for LDCs had reached $1.4 billion (or 25 per cent of the GCF global portfolio). As at December 2019, $9.78 billion had been pledged for the first replenishment for the period 2020–2023.

Figure II.6.1
Multilateral climate change funding for LDCs, cumulative amounts since 1991

Millions of United States dollars



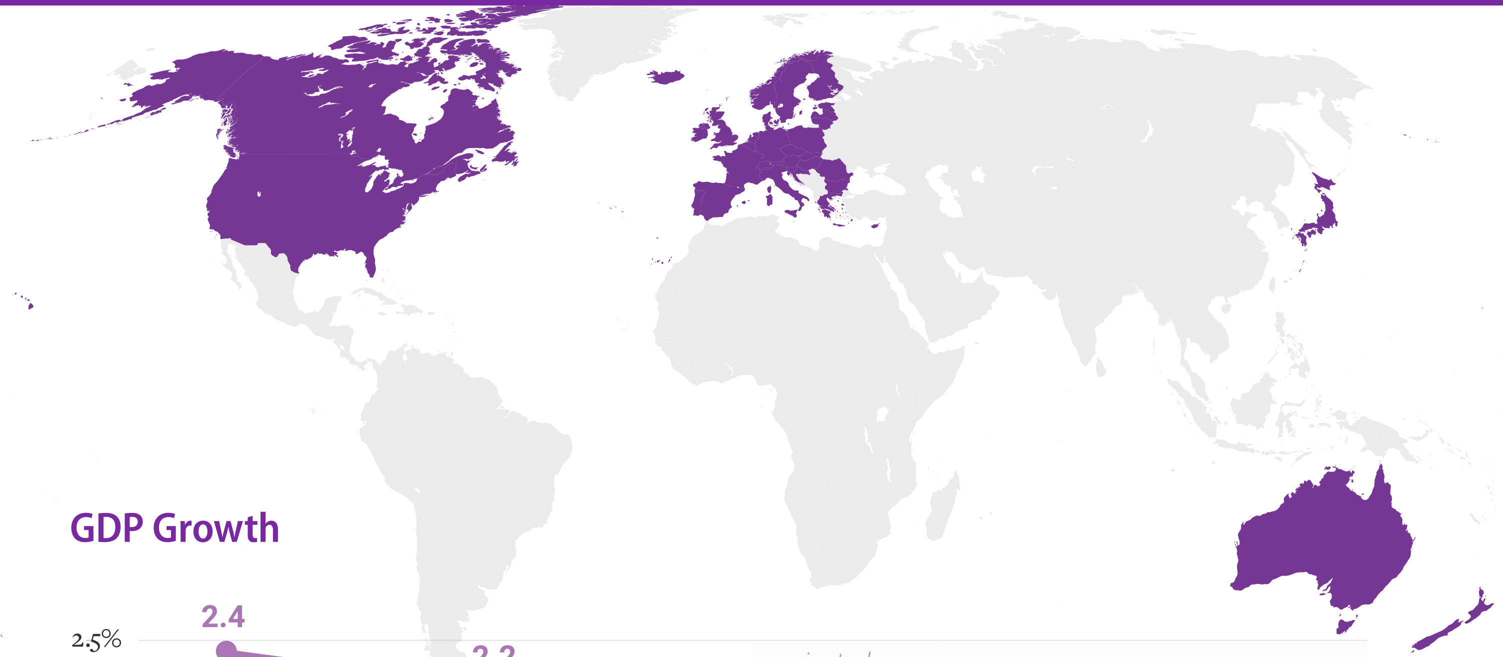
Sources: Adaptation Fund (2019a; 2019b); GEF Secretariat (2019); Global Environment Facility (2019); Green Climate Fund (2019a; 2019b; 2019c; 2019d).

The amounts referred to above are far short of estimated requirements. According to one study, more than $5 billion per year is needed just to fund the NAPAs for the LDCs (Uprety, 2015). The total amount of climate change finance needed to fund both mitigation and adaptation measures post-2020 in the LDCs has been estimated at $93 billion per year, based on the intended nationally determined contributions (INDCs) submitted by 44 LDCs in the lead-up to the 2015 United Nations Climate Change Conference (COP 21) (International Institute for Environment and Development, 2015; UN-OHRLLS, 2018).

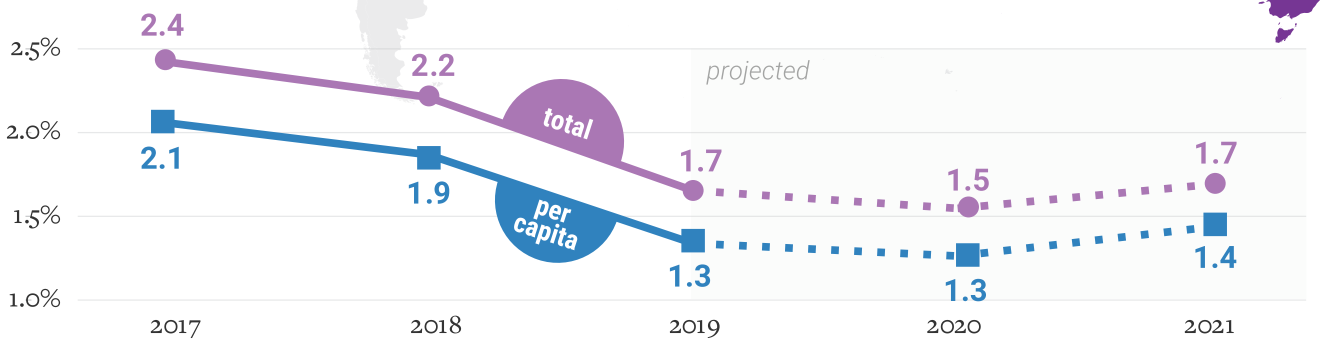
Some progress has been made in the replenishment of the GCF, but both traditional and non-traditional donors will need to contribute ambitiously. While the Climate Action Summit convened by the Secretary-General of the United Nations in September 2019 provided important political momentum, the international community will face major challenges in providing the resources required by LDCs to meet one of the gravest of threats to their sustainable development.

Authors: Aniket Ghai and Lysiane Lefebvre (UN-OHRLLS).

Developed economies

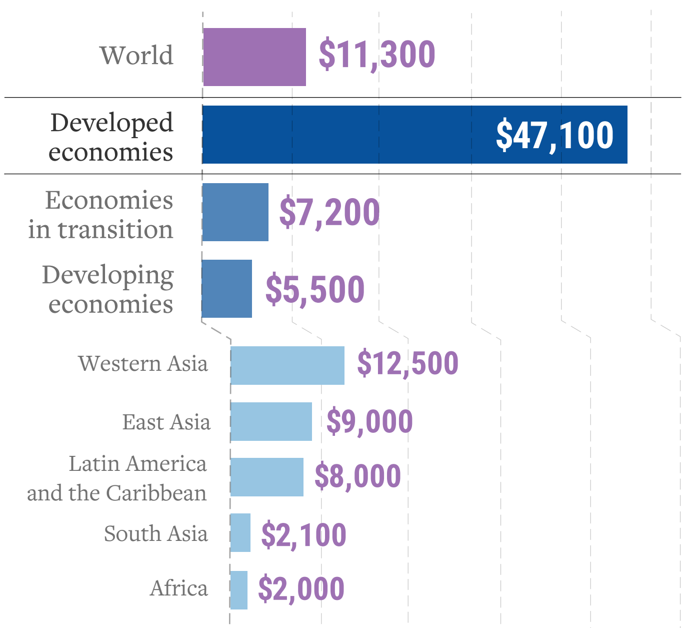


GDP Growth



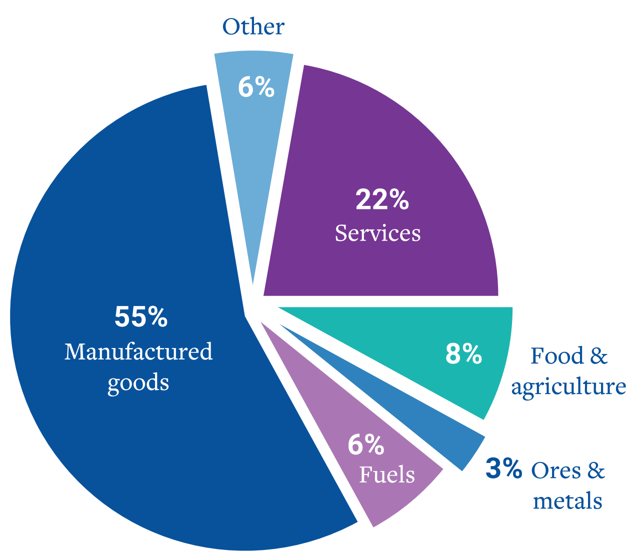
GDP per capita

2019



Export Structure

2018



The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

The map represents countries and/or territories or parts thereof for which data is available and/or analysed in *World Economic Situation and Prospects 2020*. The shaded areas therefore do not necessarily overlap entirely with the delimitation of their frontiers or boundaries.

Chapter III

Regional developments and outlook

Developed economies

- Headwinds from global trade tensions are affecting investment in Europe and North America.
- Capacity constraints and labour market shortages are evident in many developed economies, including Canada, Germany, Japan and the United States.
- Deteriorating economic prospects have prompted monetary easing in Australia, Europe, New Zealand and the United States.

United States: trade tensions take an increasing toll on investment

Policy uncertainty will continue to weigh on economic activity

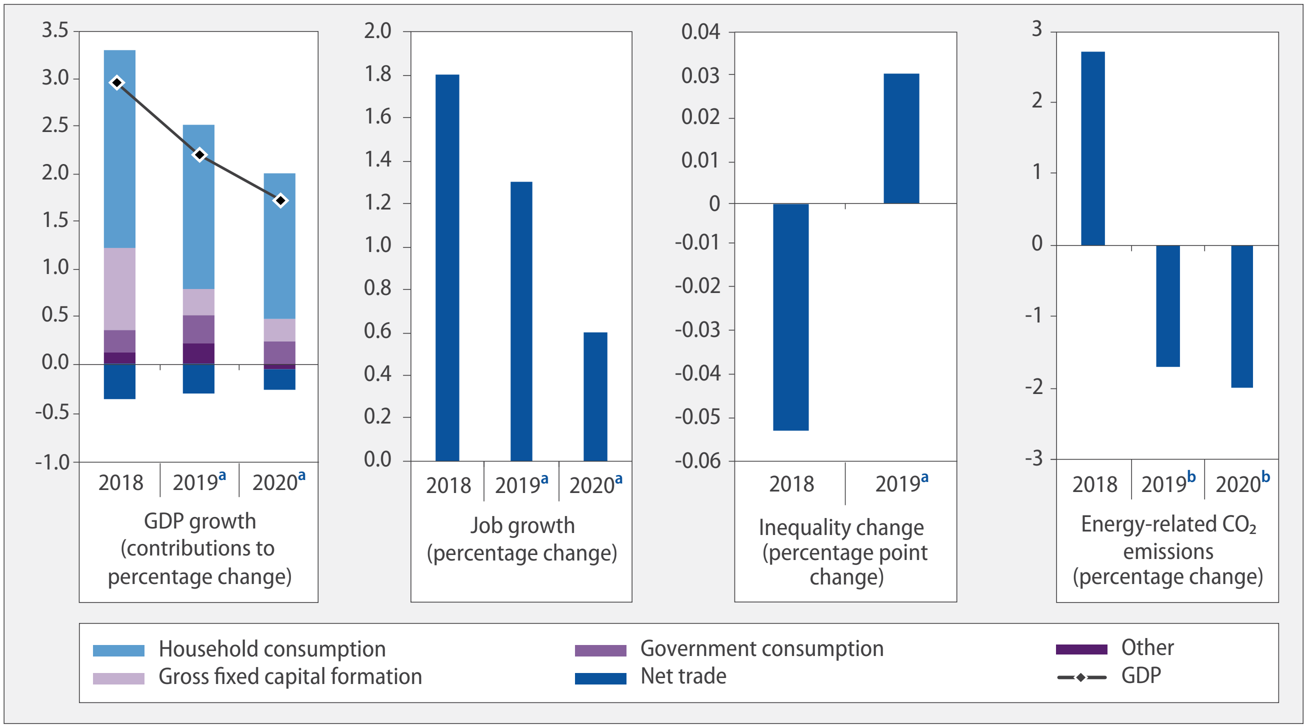
Economic activity in the United States has decelerated, largely reflecting the toll on investment of prolonged trade policy uncertainty and the impact of tariffs on specific sectors. At the same time, the effects of fiscal stimulus measures introduced in 2018 are fading; a lower global oil price has discouraged investment in the fossil fuel industry; and residential investment remains weak, partly reflecting labour shortages in the construction sector. Muted inflationary pressures and the deepening of trade disputes over the course of 2019 prompted a reversal in the monetary policy stance of the United States Federal Reserve. The target range for the federal funds rate was reduced by a cumulative 75 basis points in the second half of the year, while the Federal Reserve balance sheet was also allowed to rise; between September and November 2019, the central bank's balance sheet increased by over 7 per cent, reversing declines in the first eight months of the year. GDP growth is estimated to have moderated to 2.2 per cent in 2019, and a further slowdown towards 1.7 per cent is forecast for 2020. Even as trade tensions ease along some fronts, the potential for setbacks are high, and firms and households are expected to remain cautious.

Trade between the United States and China has plummeted by over 13 per cent

As trade tensions between the United States and its major trading partners continued to intensify, export volumes contracted by an estimated 1.2 per cent in 2019, while in value terms trade between the United States and China plummeted by over 13 per cent in the first nine months of 2019 in comparison with the same period a year earlier. Although China and the United States have reached agreements in some areas, a comprehensive agreement will require progress on many fronts, addressing issues that have yet to be tackled in depth, and there is a risk that trade tensions may re-escalate going forward. Tensions with trading partners in the European Union are also elevated in connection with issues surrounding agricultural access, tariffs imposed in response to the Airbus subsidy ruling, and repeated threats to impose tariffs on automobiles imported from the European Union.

Business confidence has been on a steady downward trend since the escalation of trade disputes in August 2018. Manufacturing production fell by 2.5 per cent in the first nine months of 2019, with a particularly sharp decline in the production of motor vehicles. While China has suspended the additional tariffs imposed on automobiles made in the

Figure III.1
Key indicators for the United States



Sources: UN DESA, United States Bureau of Labor Statistics, and United States Energy Information Administration.
Notes: Inequality is measured as the ratio of usual weekly earnings of the highest 10 per cent of earners to the lowest 10 per cent of earners.
a UN DESA estimates and forecasts.
b Estimates and forecasts from United States Energy Information Administration (2019).

United States, the industry is heavily impacted by tariffs imposed on imports of car parts into the United States from China, as well as by steel tariffs that raise input costs across the industry. One of the stated aims of recent trade measures is to increase investment in the domestic car industry, but to date production figures show little evidence of this boost. Recent negotiations also focus on increasing exports of agricultural goods from the United States to China. According to the United States Department of Agriculture, the soybean sector, in particular, has suffered from tariff hikes, with an estimated 60 per cent decline in exports to China between 2017 and 2019. However, removing these tariffs and resuming the purchase of agricultural products will not be sufficient to regain lost exports, as demand for soybeans in China has also fallen off steeply as a result of the outbreak of African swine fever and its impact on demand for animal feed.

While tariffs have increased selected prices in the United States, inflation has drifted below the Federal Reserve target of 2 per cent since late 2018 despite some upward pressure on wages from the extremely low unemployment rate. Subdued inflation is largely a reflection of movements in the oil price. Headline inflation is more sensitive to oil price dynamics in the United States than in most other developed economies, partly as a result of lower levels of taxation on gasoline and other carbon-intensive inputs and consumables.

The consumer price inflation rate (excluding energy) has remained steady at 1.6–2.2 per cent for several years, inching up to 2.3 per cent in the second half of 2019.

Inflation and investment in the United States are sensitive to oil price movements

Investment in the United States is also increasingly sensitive to the oil price, reflecting the short-term nature of investment activity in the shale industry, which now accounts for over 60 per cent of United States oil and gas production. In 2018, the oil price rose by 30 per cent, which was associated with a 24 per cent rise in investment in mining exploration, shafts and wells. In the first three quarters of 2019, the oil price was 10 per cent lower than a year earlier, and investment in mining exploration, shafts and wells declined by 5 per cent. This shift alone accounted for roughly 30 per cent of the slowdown in non-residential private investment growth in 2019.

The important role of the fossil fuel sector in the economy acts as an obstacle to more rapid progress towards environmental goals. While the majority of states have passed legislation requiring greater use of renewable energy by electric power plants, progress towards a cleaner energy mix is lagging behind most of Europe, and there has been a steady unwinding of environmental regulation over the last few years.[1] Nonetheless, total energy-related carbon emissions are estimated to have declined by 1.7 per cent in 2019, offsetting much of the rise seen in 2018 (see figure III.1). The improvement largely reflects a 5 per cent decline in summer cooling degree days, which were exceptionally high in 2018 (United States Energy Information Administration, 2019).

The number of households living in deep poverty has risen…

Despite the recent deceleration in growth, labour markets appear relatively strong, with the unemployment rate at its lowest level since 1969 and the ratio of workers to the total population of prime-age adults (aged 25 to 54) at its pre-recession high of 80.3 per cent. Poverty levels in the United States are closely correlated with job creation, and the steep decline in unemployment since 2010 has pulled a significant number of people out of poverty. However, sufficient social protection is failing to reach those at the very bottom of the income distribution, for whom the standard of living has deteriorated further over the past decade. The number of households living on less than $15,000 a year has increased by more than 1 million since 2007.

… and inequality continues to increase

Job quality is also uneven, and inequality remains a significant obstacle to a higher sense of well-being in the United States. After-tax income inequality in the United States is the highest among the developed economies and has continued to rise steadily since the mid-1970s. Following modest improvement in 2018, inequality—as measured by the ratio of usual weekly earnings of the highest 10 per cent of earners to the lowest 10 per cent of earners—increased in 2019 (see figure III.1). Inequalities in health and access to quality health care are also stark, with significant disparities according to race, ethnicity and educational background. The share of the population with no form of health insurance began to rise again in 2018 following several years of improvement, suggesting that health inequalities may widen further.

As the stimulus from the 2017 Tax Cuts and Jobs Act dissipates and consumer confidence is increasingly affected by economic uncertainty, household consumption growth is expected to slow. Government spending will also remain moderate. Higher discretionary funding limits for 2020 and 2021 that were established in the Bipartisan Budget Act of 2019 offer some scope for higher spending, including on defence and disaster preparedness and relief, which acts as a small upside risk to current short-term forecasts.

1 See, for example, Climate Deregulation Tracker, Sabin Center for Climate Change Law, Columbia Law School, Columbia University Earth Institute (https://climate.law.columbia.edu/climate-deregulation-tracker).

Canada: fossil-fuel subsidies undermine carbon pricing efforts

Global trade uncertainty has driven a sharp contraction in business investment

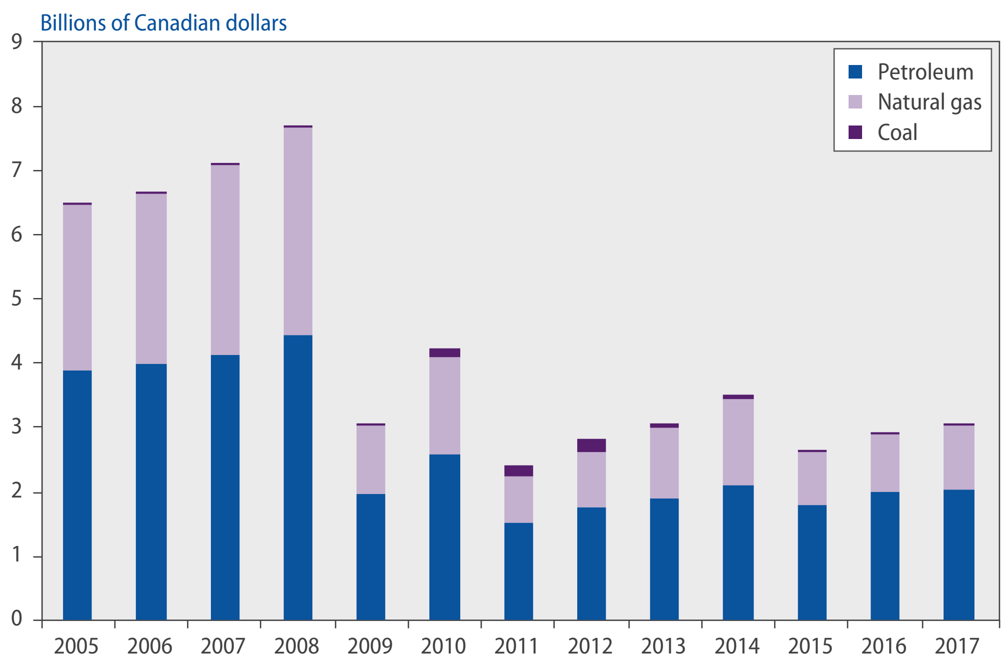
GDP growth in Canada slowed to an estimated 1.5 per cent in 2019 as global trade uncertainty and weak demand from the United States, the country's most important export market, delivered a sharp contraction in business investment. In an environment of heightened risk and uncertainty, GDP growth is forecast to remain below potential at 1.5 per cent in 2020.

The successful renegotiation of the United States-Mexico-Canada Agreement (USMCA) eases some downside risks for the Canadian economy. However, until the agreement is ratified by all parties, a resurgence of global trade tensions will remain a critical concern. Inflation in Canada remains close to the central bank target of 2 per cent; as a result, the Bank of Canada did not follow the global trend of greater monetary accommodation in 2019. The Bank's Governing Council remains open to interest rate cuts in 2020 if economic conditions deteriorate further and will carefully monitor developments in the exchange rate and labour markets. While the unemployment rate is near an historical low, with many companies reporting a shortage of skilled workers, persistent economic weakness in energy-producing regions has contributed to extended layoffs.

Fossil-fuel subsidies are at odds with the national carbon tax

Canada has set ambitious targets to meet emission commitments under the Paris Agreement. In 2019, the federal Government established a national carbon tax[2] as part of the Pan-Canadian Framework on Clean Growth and Climate Change. While this marks a decisive step, the federal Government and individual provinces continue to provide various types of subsidies to the fossil-fuel industry, which remains an important sector of the Canadian economy (see figure III.2). These subsidies, which include tax breaks, reduced

Figure III.2
Total support for fossil fuels in Canada by fuel type



Source: OECD Inventory of Support Measures for Fossil Fuels.

2 Provinces that did not introduce their own carbon pricing plan by 2019 received a federally mandated carbon tax.

royalty rates, and R&D support programmes, conflict with the incentives and targets of the carbon tax. Removing this double standard would accelerate progress towards the country's 2030 Agenda targets.

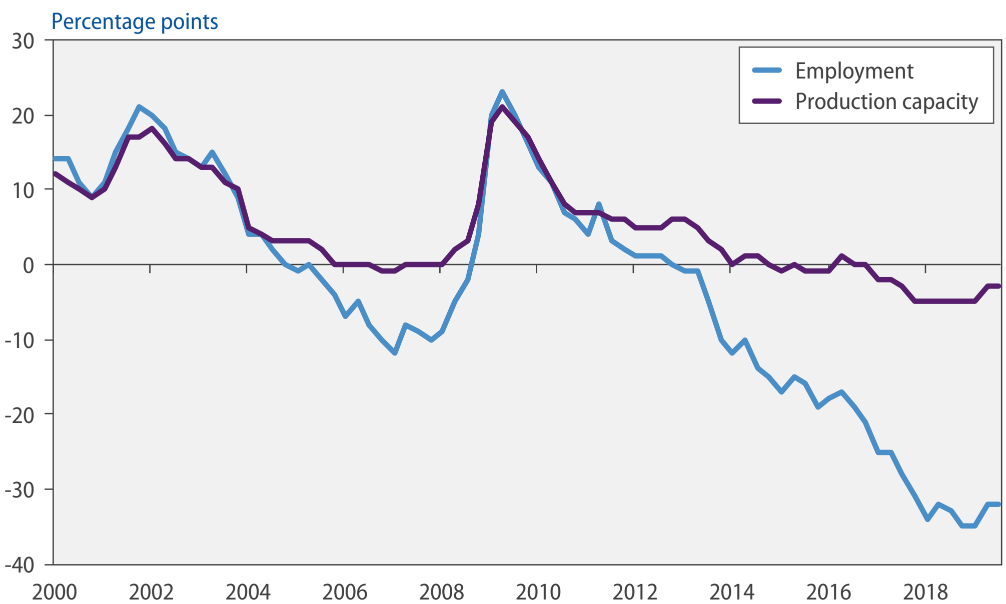
Japan: resilient investment sustains growth against weakening consumption and exports

In Japan, real GDP growth is estimated at 0.7 per cent for 2019 and is forecast to remain below 1 per cent in 2020 for the third year in a row. The country's weak economic performance reflects weak external demand; domestic demand has remained more resilient. Slowing demand from China, in particular, has impacted exports of the automobile and electronics sectors. Although corporate profits are in decline as a result of sluggish export earnings, capital investments remain firm, particularly in software, information technology and R&D. Private consumption has been constrained by declining real wages and a hike in the consumption tax rate in October 2019. A modest acceleration in GDP growth to 1.3 per cent is expected for 2021 as the impact of the consumption tax rise dissipates and real wages stabilize. However, the slowing growth of other East Asian economies, especially China, will continue to act as a drag on the Japanese economy.

Labour shortages reported by firms

The decline in average real wages in 2019 occurred despite a further tightening in the labour market. In August, the unemployment rate fell to 2.2 per cent for the first time in 27 years, and the quarterly Tankan survey revealed continuing labour shortages (see figure III.3); however, this has yet to put significant upward pressure on wages. Weak inflationary pressures overall partly reflect spare capacity in the business sector. The Tankan survey indicates that the utilization of capital equipment of business enterprises is well below capacity limits. Consumer price inflation declined to 0.7 per cent in 2019, and a similar rate is forecast for 2020; while a modest rise to 1.3 per cent is projected for 2021, the goal of meeting the Bank of Japan's inflation target of 2 per cent soon is becoming increasingly elusive.

Figure III.3
Diffusion indices on employment and production capacity in Japan



Source: Bank of Japan, Tankan survey.

Note: Figures are for all enterprises. Negative values indicate a shortage of labour or production capacity in the majority of businesses. Diffusion indices measure the difference between the share of enterprises identifying "excessive" employment or capacity minus the share reporting "insufficient" employment or capacity.

Monetary policy focuses on yield curve control

The Bank of Japan continues to maintain a set of unconventional monetary easing measures known as Quantitative and Qualitative Monetary Easing (QQE) with Yield Curve Control (YCC). The rate of asset expansion under QQE has decelerated from an average of 17 per cent in 2017 to just 3 per cent year-on-year in September 2019. The year-on-year growth rate of the broad money stock (M2) decelerated from the 2017 average of 4 per cent to 2.4 per cent in September 2019. The focus of monetary policy has now shifted to the YCC component, as the Bank of Japan is actively involved in controlling the yield curve of Japanese Government Bonds (JGBs). YCC is aimed at maintaining the short-term interest rate at -0.1 per cent, the yield on 10-year JGBs at zero per cent, and long-term interest rates at a positive value.

Substantial appreciation of the yen remains the principal downside risk

As the interest rate differentials with other major currencies are narrowing, the Japanese yen is projected to appreciate. An abrupt and rapid appreciation of the yen remains the main downside risk for the Japanese economy. The deflationary effects of a stronger currency would erode fragile business confidence and deter the investment that is currently sustaining domestic demand.

The fiscal stance has tightened, as the Government is committed to lowering its debt dependency. Structural reforms have focused fiscal expenditures on areas such as the expansion of social protection systems. The expansion of childcare services is a priority, as the lack of such services deters a significant number of (mainly female) single parents from pursuing decent employment opportunities.

Australia and New Zealand: expansionary policies underpin economic growth

Mineral and fuel sectors lead export growth in Australia

The Government of Australia has shifted to a more expansionary fiscal stance, thanks to an improved fiscal position; coupled with a more expansionary monetary stance, this is offsetting weaknesses elsewhere in the economy. Real GDP growth is estimated to have dropped to 1.8 per cent in 2019 from 2.7 per cent the previous year, but the Australian economy is projected to grow by 2.1 per cent in 2020 and 2.2 per cent in 2021. Private consumption and residential investments are constrained by the weakness in residential property prices, which have been declining in Sydney and Melbourne, and have yet to show signs of recovery. Wage growth also remains sluggish, in part reflecting an increase in labour force participation, which has expanded the pool of jobseekers. With weak wage growth and subdued private sector demand, consumer price inflation dropped to 1.6 per cent in 2019. Export performance has been mixed. A surge in the price of iron ore in the first half of 2019 supported export revenue from the mineral and fuel sectors, but wheat exports have declined as a result of severe drought in eastern Australia. Weaker demand from China is expected to weigh on the economy in the near term.

Business sentiment appears pessimistic in New Zealand, but export growth remains resilient

In New Zealand, real GDP growth is estimated at 2.6 per cent for 2019 and projected to be 2.9 per cent in 2020 and 2.8 per cent in 2021. The mild acceleration into 2020 reflects a policy-led expansion in domestic demand. As in Australia, developments in the real estate sector continue to subdue private sector spending. Business sentiment has turned increasingly pessimistic. While export growth has thus far remained resilient, there are growing concerns regarding demand from East Asia, the country's major export destination. Consumer price inflation remains low, estimated at 1.4 per cent in 2019, allowing space for monetary easing. A series of policy interest rate cuts in 2019 is expected to give some relief to the real estate sector and boost business confidence. Moreover, the fiscal stance is expected to be mildly expansionary since a more flexible debt target was adopted in the 2019 budget.

Europe: external conditions, policy uncertainty and structural changes take a toll on growth

The European Union is expected to see only limited growth of 1.6 per cent in 2020 and 1.7 per cent in 2021. Against the backdrop of heightened global trade tensions, exporters face numerous challenges, including tariffs, weaker or delayed demand, and having to make corporate decisions under greater policy uncertainty. In addition, structural challenges and changes in significant sectors such as the car industry put long-established business models in doubt and create the need for companies and policymakers to develop new economic paradigms. As these factors will suppress the contribution of exports to economic performance, domestic demand will remain the mainstay of growth. Lower unemployment, solid wage gains and additional monetary stimulus on top of the already supportive monetary stance will underpin solid household consumption. The very accommodative monetary policy stance will continue to drive investment in domestically oriented sectors such as residential construction, creating positive knock-on effects for many small and medium-sized companies.

Trade tensions and Brexit constitute significant downside risks

The outlook for Europe remains subject to numerous risks and challenges that could lead to a significant slowdown in growth. First, an escalation of trade tensions could have a considerable impact on European exporters, affecting not only direct exports but also exports from foreign production sites—including, for example, various models produced by European car manufacturers in the United States for export to China.

Second, some aspects of the exit of the United Kingdom from the European Union remain unresolved. While the baseline forecast assumes that an orderly withdrawal of the United Kingdom from the European Union will be concluded during the transition period, a disorderly exit would open the field to a host of negative consequences across the real economy and financial markets. With the modalities of the exit unclear and limited information regarding the nature and structure of the legal and economic relations of the United Kingdom with the European Union and the rest of the world after the exit, corporate investment decisions have already become subject to tremendous political uncertainty.

A third risk stems from monetary policy. After a brief period of starting to move away from a very accommodative policy stance, the ECB has again reversed course by providing even more stimulus, driven by persistently low inflation and global economic challenges. This will increase the potential for a run-up in asset prices, with associated risks to financial stability. It also leaves little scope for additional monetary easing in the event of an economic crisis.

Germany has experienced a structural disruption to its car industry

In many cases, it is difficult to distinguish between cyclical developments in regional growth performance and more fundamental issues such as structural disruptions in certain economic sectors as a result of policy or technological change. Germany, the largest economy in the region, is a case in point. After solid growth momentum in 2017, the economy slowed significantly in the second half of 2018 and in 2019, in tandem with rising global trade tensions and significant headwinds for the important automotive sector. The car industry struggled to adjust to stricter emissions tests and had to deal with the fallout from the diesel emissions scandal. Combined with an increasing policy focus on climate change and air quality, both at the national level and in numerous German cities where legal battles emerged over outright bans on certain types of cars, this pressured car manufacturers to fundamentally question their business models. As a result, the automotive sector has seen a drastic reorientation, culminating in major long-term investment programmes to create mainly electric-based product portfolios and a redefinition of corporate missions. A number of car manufacturers now emphasize their role as mobility companies encompassing areas such as autonomous driving technologies and the operation of car-sharing platforms.

The external headwinds and structural change stand in contrast to strong domestic fundamentals. Private consumption in Germany will remain buoyant because of low unemployment, rising wages and low interest rates. The same applies to investment. While some companies have become more cautious regarding investment related to external demand, this will be more than offset by investment needs to address capacity constraints, skill shortages and technological change. In the baseline forecast, which assumes no further escalation in trade tensions and an orderly exit of the United Kingdom from the European Union, Germany will see higher but still only moderate growth of 1.3 and 1.4 per cent in 2020 and 2021, respectively.

Negative fundamentals inhibit growth in Italy

France experienced a dip in growth in 2019 due to the more negative external environment, but private consumption and investment will underpin a projected expansion of 1.5 per cent in 2020 and 1.6 per cent in 2021. High capacity-utilization rates and recent reforms that impact the business environment, including changes to the tax code, will spur investment. Italy, by contrast, faces a more challenging outlook. Growth remained barely positive in 2019, as the more negative external conditions were compounded by domestic political and policy uncertainties. As the impact of some of these uncertainties eases, the economy will track the uptick in growth in the other large economies in the region, with a projected expansion of 0.6 per cent in 2020 and 0.7 per cent in 2021. However, negative fundamentals such as high sovereign debt, a complex regulatory system and a weak banking sector will continue to inhibit economic activity.

Uncertainties surrounding Brexit dampen business activity in the United Kingdom

In the United Kingdom, the intended exit from the European Union and the absence of relevant procedural specifics and details have created a political situation that leaves economic decisions by firms subject to the highest degree of uncertainty; businesses in the United Kingdom essentially do not know what market they will be operating within in a few weeks or months. The lower value of the pound sterling is reflecting this uncertainty, and while this provides some support for exporters, import prices have increased. Even more problematic is the looming disruption to supply chains. Membership in the European Union allows the free passage of production inputs and half-finished products across borders, in many cases numerous times before becoming a finished product. The mere possibility of a disorderly exit from the European Union is making this notion of market integration obsolete, forcing companies to reconsider their investment plans. Based on the assumption of an orderly exit from the European Union, the economy of the United Kingdom is projected to expand by 1.2 per cent in 2020 and 1.8 per cent in 2021, with significant downside risks in the case of a disorderly exit.

Rapid growth in EU-11 countries supports convergence in income levels within the European Union

EU-11 countries[3] are expected to register GDP growth rates well above the European Union average for the period 2019–2021, which will facilitate their gradual convergence towards the more advanced economies of the European Union. Several countries are expected to achieve growth rates exceeding 4 per cent in 2019 (in Hungary, growth may approach 5 per cent); unemployment rates in the EU-11 have dropped to record lows and real wages have soared, stimulating private consumption. Many projects funded under

3 Defined here as countries that have joined the European Union since 2004, with the exceptions of Cyprus and Malta: Bulgaria, Croatia, Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia.

the 2014–2020 European Union budget cycle are still in progress and should further support economic expansion over the forecast horizon. However, the external environment is becoming challenging; structural challenges in the automotive industry will weigh on production and exports, and financing from the 2021–2027 Multiannual Financial Framework of the European Union is expected to contract.

Monetary policy has reversed course towards renewed stimulus

Monetary policy in the euro area has undergone a sharp reversal. Before the spike in international trade tensions and signs of a global growth slowdown, the ECB had signaled that is was beginning to move away from its historically loose policy stance; this included halting asset purchases, which had become a core element of the adopted non-standard policy measures. With decelerating growth rates and inflation remaining below its target of just under 2 per cent, the ECB decided in September of 2019 to reverse course again by providing further monetary stimulus in addition to an already very accommodative policy stance. The announced measures included reducing the deposit rate for banks from -0.4 to -0.5 per cent while maintaining the main refinancing rate at zero per cent and the marginal lending facility rate at 0.25 per cent; the restart of net purchases under the asset purchase programme at a monthly pace of 20 billion euros; and the forward guidance that interest rates will remain at their present or lower levels until inflation has moved closer to the policy target, dropping the previous reference to the first half of 2020.

ECB asset purchases face a number of potential pitfalls

While the adjusted ECB policy stance offers short-term support to offset some global and internal policy uncertainties, it also poses some risks and potential policy challenges. The ECB has increased its demand for sovereign and corporate bonds. This compounds a problem that has increasingly cropped up in the course of this strategy: the ECB has set limits on the share of individual bond issues it will purchase, and under these guidelines it may eventually run out of bonds to buy. Having the ECB as a major buyer in the market also means that the added demand is driving bond prices up further, with the intended effect (from the EBC perspective) of reducing yields. This has already suppressed yields in bond markets (see figure III.4), to the point that at times all debt issued by Germany

Figure III.4
Yield on euro area 10-year government bonds

Source: European Central Bank.
Note: Figure is based on daily data on AAA-rated euro area central government bonds.

has traded with negative yields across all maturities, making investors search for yield elsewhere. The consequences of this include the run-up in stock market prices, the boom in real estate markets, and stronger demand in riskier parts of international debt markets. This brings with it the risk of a sudden bursting of a bubble of artificially inflated asset prices. Critics of quantitative easing have also raised legal concerns that this policy constitutes a form of financing fiscal budgets, reducing incentives for fiscal efficiency, as the central bank stands as the sovereign bond buyer of last resort. The monetary policy stance also raises questions of how to deal with the next crisis. If a pronounced economic crisis were to materialize, with sharp declines in growth and employment, the scope for effective further monetary easing would be increasingly constrained.

Low or negative interest rates offer opportunities for targeted public investment increases in some countries

High levels of public debt relative to GDP continue to constrain the fiscal position in many countries in Europe, including Belgium, Greece and Italy. However, zero or negative borrowing costs in countries such as Germany offer scope to increase investment in areas such as digital infrastructure, public transportation and large-scale renewable energy technologies, boosting long-term productivity and promoting green-growth initiatives while also allowing a relatively prudent fiscal stance to be maintained. Stronger fiscal support in countries that retain some fiscal space would ease the pressure for further monetary easing and alleviate associated risks.