Chapter 3

Structural change for a new development model

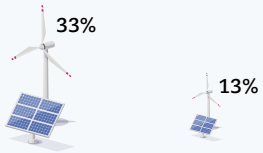
The recovery agenda in the LAC region calls for an integrated holistic approach that enables a green and just transition. This chapter presents three key building blocks to advance a more sustainable development model in LAC: energy, production and social protection. The chapter starts by analysing the current energy matrix and goes on to look at the possibilities industrial policies and the circular and the blue economy offer for enhancing current productive structures. Lastly, it reviews the potential impacts the green transition could have on the future of work, and the role social protection systems can play in protecting the most vulnerable during the transition.

Structural change for a new sustainable development model in LAC

More sustainable and diversified energy and production matrices will help LAC reduce GHG emissions, harness its renewable energy potential and create quality jobs

LAC is endowed with high potential for renewable energy resources

Renewables as % of total energy supply



LAC is in a strategic position to supply key minerals for the green transition

61% of **lithium** global lithium reserves

39% of global **copper**

and 32% global of **nickel and silver**

were in LAC in 2017

Universal access to electricity is a pending challenge

A total of **17 million people** still have **no access to electricity** especially in rural areas

Industrial, circular and blue policies can transform LAC's production structure

New industrial policies are needed to encourage investment in green innovation

Gross domestic expenditure in research and development (GERD) as % of GDP, 2018

The circular economy is expected to have net positive effects on GDP growth and employment by 2030, in selected countries

2.4% GDP net growth

1.9% new net jobs

The Blue economy can contribute to LAC's development

The total GDP contribution of ocean services was estimated at **USD 25 billion** for LAC in 2018

A green transition can create quality jobs for Latin Americans

In a high-impact scenario it could add **10.5% more net jobs** in the brown and green sectors

A green transition that is just should:

- Expand social protection systems to the most vulnerable
- Boost quality job creation
- Support workers in the case of job losses
- Provide necessary skills and life-long learning opportunities

Introduction

Policy makers in the LAC region – and across the globe – are confronting increasing urgency in the need to deal with the complexity of numerous and interconnected economic, social and environmental challenges. Climate change mitigation and adaptation call for transformative change[1] to solve such issues simultaneously. Transformative policies could reduce greenhouse gas emissions (GHG) by 40% to 70% globally (IPCC, 2022[1]).

Governments need to start thinking about (re)designing systems that work for people and the planet. Systems that, by design, increase people's well-being while requiring less materials, producing fewer emissions and producing better socio-economic and environmental outcomes. LAC has the opportunity to rethink what these systems should be like and what policies are needed to transition from the current situation to a more sustainable, inclusive and just development model.

A green transition goes beyond fighting climate change. It also aims to advance a more sustainable and inclusive model of production and consumption that creates new quality green jobs, generates the conditions for workers to successfully navigate the transition, and supports firms to adopt more sustainable production schemes and citizens to change their consumption habits (Chapter 2).

This chapter presents three key building blocks to advance a more sustainable development model in LAC. The first two sections focus on the need to transition to a new energy matrix and better productive structures. The third section analyses potential impacts of the green transition on the future of work and the role of social protection systems to promote a just transition. The chapter then presents a selection of policy messages to advance a more sustainable development model.

Advancing towards a more sustainable and diversified energy matrix

The transformation of the energy matrix is key to promoting greater well-being for citizens, leaving no-one behind, and avoiding environmental impacts through a green transition. LAC generated 5.8% of global total energy supply in 2018 (UN DESA, 2021[208]). The energy sector is responsible for the highest share of GHG emissions, although its contribution to global GHG is lower than in other regions. It is therefore essential to rethink the region's energy matrix to meet international climate targets and foster resiliency (Chapters 2 and 6). LAC is endowed with high potential for renewable energy resources throughout the region including: hydropower (throughout the region); wind (particularly but not limited to Patagonia, the Atlantic Coast of South America, the Isthmus of Tehuantepec and the Guajira Peninsula); solar (in different regions including Atacama and Sonora-Chihuahua); geothermal (in specific locations, such as the Andes and the Central American Cordillera) and biomass (throughout the region and, particularly, in Brazil) (UNEP, 2019[2]).

Investing in renewables technologies for LAC countries currently dependent on fossil fuels for power generation (mainly Central American and Caribbean countries), can deliver lower-cost power and reduce reliance on imported fossil fuel products, which can be subject to significant price fluctuations and risk of supply disruption and can have damaging impacts on the balance of trade.

Those LAC countries whose power generation largely comes from hydropower should also envisage other renewable energy sources. An over-dependence on generation from hydro can have negative economic impacts in times of drought (IDB, 2021[3]). Moreover, changes in rainfall patterns and intensity as a consequence of climate change will make hydropower a less reliable source of energy to meet burgeoning demand in the coming years.

Public policies to accelerate the much-needed sustainable and inclusive energy transition should advance simultaneously in five pillars: 1) increase the share of renewable sources in the energy matrix, 2) universalise access to electricity and reduce energy poverty, 3) increase energy efficiency in all buildings and economic sectors, 4) strengthen regional energy integration and interconnection, and 5) increase energy security and resilience in the face of external shocks.

Renewable electrification and integration to accelerate progress towards systemic decarbonisation

A successful transition to net zero emissions will be contingent on systemic decarbonisation through renewable electrification across all sectors, also covering the remaining more than 17 million people that lack access to electricity in mainly rural and isolated areas of the region. This will entail a massive scale-up in electricity demand – between 210% and 560% in deep decarbonisation scenarios in LAC by 2050 – as these sectors move away from reliance on fossil fuels and switch to electrification (IDB and DDPLAC, 2019[5]). Meeting such a large increase in demand for power and achieving Paris Agreement objectives will require LAC countries to undertake substantial renewable energy capacity additions while also implementing demand-side measures to increase energy efficiency and promote systems that demand less resources and materials across all sectors.

Advancing electrification will require LAC countries to implement effective power sector long-term planning through integrated resource plans. The plans should help match necessary investments in generation with forecast growth in demand, enable absorption of future variable renewables energy generation capacity, and provide incentives for timely investment in energy projects and in transmission, distribution and storage infrastructure. Long-term energy planning has proven to be a crucial instrument in the region to accelerate the transition to renewable energies, since it points out routes and generates an enabling environment for the necessary investment in each country and territory.

Digitalisation and innovation could strengthen decarbonisation, for example by digitalising payment collection from consumers or increasing the robustness of transmission infrastructure to ensure renewables generation can be added at scale. Moreover, digitalisation can help better manage demand response to eliminate short-term demand spikes, facilitate variable renewable energy integration, fostering the adoption of advanced metering infrastructure (AMI) and can support Fintech options for clean energy investment by improving electricity access or promoting new business models (e.g. energy as a service vs traditional models of providing power and other services separately).

Energy integration in LAC, particularly electricity trading, could provide benefits from economies of scale in production and a reduction of costs, thereby improving security in the supply, reducing the impact of unanticipated shocks, and achieving better service quality and environmental protection (CAF, 2021[6]). Existing international interconnections tend to be underutilised. Electricity trade among three subregions (Andean, Central and Mercosur) could boost overall trade by 13%, generating trade value of USD 1.5 billion per year. A fully integrated electricity trade system – involving 20 countries in the region – could boost electricity trade by 29%, increasing the overall trade value to USD 2 billion per year (Timilsina, Curiel and Chattopadhyay, 2021[7]). However, fully functioning and efficient interconnections and electricity trading can be challenging to establish, requiring a commitment to the free trade of electricity among countries, adequate interconnection infrastructure and harmonisation of transmission fees. Regional progress towards energy integration has been uneven. Central America has advanced with the creation of a regional electricity market and the physical interconnection of six countries. By contrast,

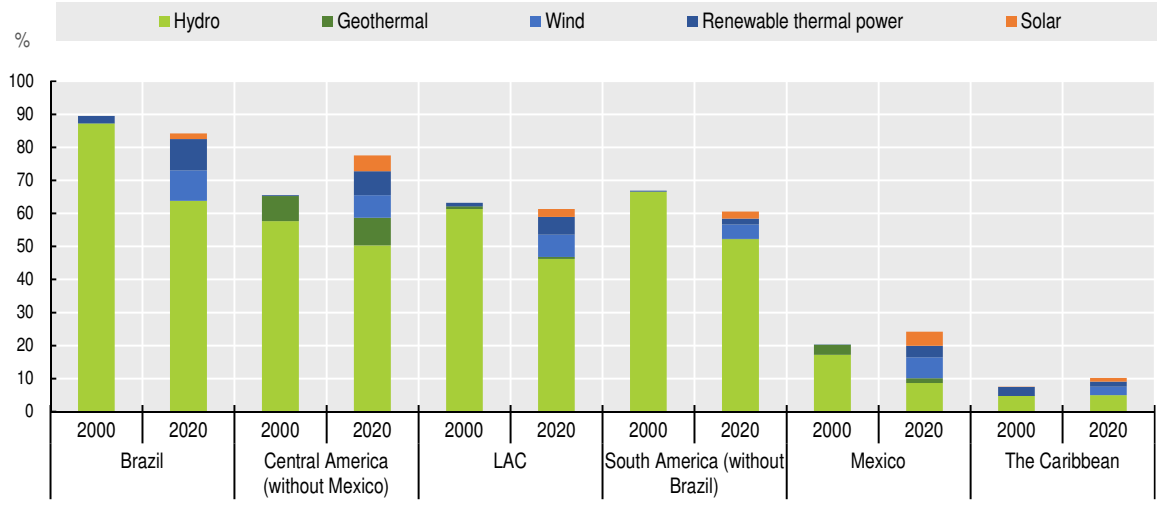
South America has advanced only in bilateral interconnections, with relatively more success in the Andean subregion than the Southern Cone (CAF, 2021[6]).

Different scenarios have been projected to explore the complementarity of electricity systems and the use of renewable energies in the region. Based on LAC's great renewable energy potential, the electrification of the transport and industrial sectors is key to reduce their high dependence on fossil fuels and increase energy security in the region (see section: Holistic energy policies are needed to make the green transition possible).

LAC has vast renewable energy resources but variations and risks across the region should be considered

Over the last two decades, many LAC countries have made substantial progress in building renewable energy markets and diversifying their energy mix. In 2020, 33% of total energy supply in LAC was generated by renewables compared with 13% at the global level (Chapter 2) and renewable energy accounted for 61% (952 TWh) of regional electricity generation (of which 75% came from hydroelectricity and 25% from solar, wind, biomass and geothermal) (Figure 3.1). Central America has shown the greatest increases in renewables in the last two decades, from 65% to 77%, followed by the Caribbean with a modest increase of 3 percentage points. The overall achievement in the region has been the increase in the diversification of renewable sources of power; shifting from mainly hydropower to growing shares of thermal, wind, and solar energy. However, significant variations exist across the region. For instance, Brazil generates 84% of its electric power from renewables, including 6.9% from solar, 10.9% from wind and approximately 65% from hydropower (Government of Brazil, 2022[8]). By contrast, Jamaica generates 87% of its electric power from imported oil derivatives. In Ecuador, about 60% of the installed capacity[2] is hydropower (UNEP, 2019[2]), although approximately one-third of electric power is still generated from fossil fuels (USAID, 2020[9]).

Figure 3.1. **LAC: Proportion of renewable sources in the total electricity supply matrix, 2000 and 2020**



Notes: South America includes (nine countries) Argentina, Bolivia, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay and Venezuela. Central America includes (six countries) Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama. The Caribbean includes (eight countries) Cuba, Grenada, Guyana, Haiti, Jamaica, Dominican Republic, Suriname, and Trinidad and Tobago. Belize and Barbados are also included in the Caribbean in 2020. Mexico generates almost six times more electricity than the other Central American countries together, which is why it is excluded from Central America and showed aside. Brazil generates more electricity than all the countries of South America together, so it was also decided to exclude it and show it aside.

Source: (sieLAC OLADE, 2022[4]).

StatLink https://stat.link/23ov56

The LAC region has seen significant investment in renewable energy in recent years, exceeding USD 35 billion over 2014-19 (excluding hydropower), with 70% of this total being directed towards Argentina, Brazil, Chile and Mexico. Moreover, Brazil (USD 13.58 billion), Mexico (USD 11.58 billion) and Chile (USD 8.16 billion) were among the top five renewables investment destinations by volume between 2009 and 2018, after India at USD 24.64 billion and the People's Republic of China (hereafter "China") at USD 18.52 billion (UNEP, 2019[2]). The composition of these investments attests to the rapid evolution of the region's energy mix towards a more diversified portfolio of renewable energy sources – particularly in Brazil, Chile and Mexico compared to other LAC countries.

The region can close its energy deficit and achieve an electricity matrix with 100% of renewable energy participation (ECLAC, 2021[11]). The RELAC (Renewables in Latin America and the Caribbean) initiative aims to reach at least 70% of renewable energy participation in the region's electricity matrix by 2030 (Box 3.1). Two conditions are needed to achieve these targets. The first is to invest 1.3% of regional gross domestic product (GDP) for ten years, equivalent to USD 114 per capita (i.e. USD 80 billion in constant 2010 prices), with some countries needing a greater or lesser proportion of GDP depending on local circumstances. The second is to increase renewables technologies (mostly solar and wind) in line with the targets of Sustainable Development Goal 7 (SDG 7) on access to affordable and clean energy. These actions could create 7 million green jobs and reduce GHG emissions by 30% by 2030 (ECLAC, 2021[11]). In line with this initiative, the Caribbean Community[3] has set a regional target of 47% renewable energy in total electricity generation by 2027. Many Caribbean countries[4] have already made significant efforts towards the adoption of renewable energy technologies, with utility-scale solar installations, wind projects and efforts to harness geothermal energy (ECLAC, 2021[12]).

Box 3.1. **Renewables in LAC: The RELAC initiative**

RELAC is a regional initiative created in 2019 within the framework of the United Nations Climate Action Summit. It has 15 member countries in the LAC region[5] that have voluntarily agreed to promote renewables with: 1) a concrete goal; 2) a monitoring scheme; and 3) an operating structure designed to support countries in the process.

The initiative's general goals are to accelerate the carbon neutrality of electricity systems in LAC; improve the resilience, competitiveness and sustainability of the sector; and create green jobs, improving air quality and minimising harmful health effects for Latin Americans. To do this, RELAC aims to establish a climate action platform for LAC countries and international organisations to enable sharing sustainable solutions.

Source: RELAC (2020[13]).

Governments play a key role in promoting investments towards renewables at the speed and to the depth required for the energy paradigm shift in the region. The development of renewables demands implementing long-term national policies and plans that include achievable goals with a toolbox that should include regulations and economic instruments, such as subsidies and incentives to productive enterprises, institutions and households, and the deployment of information and training on energy efficiency and renewables. LAC governments should maintain a permanent dialogue with the private sector and civil society to agree on shared roles and responsibilities to accelerate the adoption of renewables and thus generate climate resilience and energy security while also recovering the economy, employment and income in a sustainable and fair manner (Chapter 5).

Investment in alternative fuels is necessary to decarbonise hard-to-abate sectors

Investments in hydrogen and other low-carbon fuels, including sustainable biofuels, will be necessary to support decarbonisation in heavy industries and transportation – such as chemicals, steel, road freight, aviation and shipping – for which there are currently no viable alternatives to fossil fuels. Decarbonising hard-to-abate sectors is key to building the necessary demand at scale to increase the commercial viability of the hydrogen industry and can create a virtuous cycle between decarbonisation efforts and sustainable industrial development (section: Towards a new industrial policy to promote a more sustainable production model).[6]

Several LAC countries have significant possibilities for developing a competitive green hydrogen industry. Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Mexico and Peru have advantages in entering the hydrogen market because of their abundance of low-cost renewables and their relatively clean electricity matrices (ECLAC, 2022[14]). Mainstreaming hydrogen in the political, institutional and legal frameworks in LAC, by including it in public agendas, supporting the engagement of the private sector, an promoting a regional agenda on the topic can foster synergies to increase competitiveness and help the kick-start of the industry in the region. Several LAC countries have developed or are preparing hydrogen strategies (Box 3.2).

Box 3.2. **Hydrogen strategies in LAC**

A total of 11 LAC countries have either published or are currently preparing national hydrogen strategies and roadmaps. In turn, a pipeline of more than 25 low-carbon hydrogen projects are in the early stages of development. Several examples of national hydrogen development strategies are underway:

- **Chile** launched a green hydrogen strategy in 2020. It aims to establish 5 GW of electrolyser capacity in 2025 and 25 GW by 2030, as well as to produce the world's cheapest hydrogen by 2030, and become one of the world's top three hydrogen exporters by 2040 (IRENA/UNELCAC/GET.transform, 2022[15]). An Interministerial Committee (formed by 11 ministries and CORFO, the national economic development agency) has been created with the aim of developing the hydrogen industry, which is conceived as a national policy priority.
- **Colombia**'s National Hydrogen Strategy and Roadmap (2021) outlines plans to facilitate the development of a green hydrogen industry, taking advantage of the country's abundant renewable energy potential. It aims to deliver cost-competitive green hydrogen by 2030. The strategy also considers production of blue hydrogen, using carbon capture, utilisation and storage (CCUS) to capture emissions. Colombia's Energy Transition Law outlines fiscal incentives for the production of green and blue hydrogen (Government of Colombia, 2021[209]).
- Argentina, Bolivia, Brazil, Costa Rica, El Salvador, Panama, Paraguay, Trinidad and Tobago, and Uruguay are preparing national hydrogen plans. In particular, Argentina, Chile and Costa Rica are identifying commonalities and specificities of enabling market conditions and financing mechanisms that can foster the development of green hydrogen.

Source: IEA (2021[16]) and Cordonnier and Saygin (forthcoming[210]).

LAC countries producing electricity from renewables can position themselves as green hydrogen industrial hubs particularly in hard-to-abate sectors, such as steel and cement that will need access to abundant green hydrogen and for which global demand will continue to expand in line with the growing global population, industrialisation and urbanisation. Transforming the existing industrial and petrochemical hubs where currently grey hydrogen is consumed to kick-start green hydrogen deployment and

production can help reduce countries dependence on exports, reduce energy prices volatility and provide grid stability by enabling energy storage and adding renewable energy to the grid, particularly in countries suffering intermittency issues associated with renewable energy sources. Green hydrogen in LAC also has the potential for vertical and horizontal linkages along its value chain, yielding more value added to the whole chain and avoiding it becoming only a commodity and thus fostering innovative new industries and sustainable inclusive development. Regional co-operation on hydrogen infrastructure development, cross-border regulation and free trade agreements can support demand creation to increase the commercial viability of regional hydrogen industries.

The gas sector can play a role as a "bridge" to blue and green hydrogen. LAC countries with established natural gas industries (e.g. Argentina, Bolivia, Brazil, Colombia or Peru) may be well placed to produce and export blue hydrogen (hydrogen produced from natural gas with carbon capture utilisation and storage- CCUS-), which could be an important source of foreign exchange in a scenario of declining fossil fuel exports. Countries with substantial solar and wind resources can then make the conversion to green hydrogen as renewables generation in their power matrices is gradually expanded.

LAC countries that are fossil fuel producers may have an opportunity to offset the significant capital expenditures (CAPEX) investments required to develop a hydrogen industry by repurposing existing oil and gas infrastructure. For example, pipelines for hydrogen transport or depleted oil and gas reservoirs for CCUS projects. Existing hydrogen demand in refining or petrochemical represents one of the first opportunities to start low-carbon hydrogen development. Hydrogen could help decarbonise heavy transport, for example by replacing diesel mining trucks in countries including Chile, Colombia and Peru. Although these solutions are not yet at commercial levels, costs are expected to come down in the coming years. The development of a hydrogen industry in LAC will demand government-sponsored demonstration projects, as well as collaboration with the industry at the national and regional levels to create market demand (a key factor in raising finance for hydrogen projects).

Fossil fuels decarbonisation

The transformation of the global energy mix from fossil fuels to renewable energy is necessary to meet the Paris Agreement goals (Chapter 5) and to prevent irreversible damage to the world's environment and ecosystems. However, fossil fuel use will continue in the short to medium term and will also remain an important part of the energy mix even after the world has transitioned to a low-carbon and green economy. By 2050, fossil fuels are still expected to represent 20% of the global energy supply (IEA, 2021[17]).

Several LAC countries have significant oil and gas production, and fossil fuels remain an important source of export earnings, as well as an input for domestic power generation. Key producers in the region are Argentina, Bolivia, Brazil, Colombia, Ecuador, Mexico, Trinidad and Tobago, and Venezuela. In terms of global crude oil reserves, LAC has the second-highest share (19.1%), behind the Middle East (48.3%) and ahead of North America (14.0%), the Commonwealth of Independent States (8.4%), Africa (7.2%) and the Asia-Pacific (2.6%). In addition, LAC countries currently hold a 4.3% share of the global reserves of natural gas (BP, 2021[18]).

Consequently, LAC countries should take steps to ensure that oil and gas production is as low-carbon as possible, as a transitional step towards a net-zero economy in which fossil fuels continue to form part of the energy mix. This can be achieved through a mix of regulations, policy incentives and the deployment of best-available technologies and practices to reduce flaring, venting and methane emissions across the upstream oil and gas sectors. LAC governments should implement economy-wide decarbonisation measures

and structural reforms to reduce fossil fuel dependence and accelerate systemic change engaging the private sector and civil society as key stakeholders (Chapters 1, 4 and 5). In the context of Russia's invasion of Ukraine, and for a time-limited period, the European Commission's "Taxonomy Delegated Act" includes specific nuclear and gas energy activities under certain conditions, in the list of environmentally sustainable economic activities covered by the so-called "EU Taxonomy" by considering them as "transitional activities" (European Parliament, 2022[23]).

Five key actions could help LAC countries advance towards decarbonisation: 1) reducing methane emissions; 2) maximising the potential of associated gas; 3) electrification of the oil and gas industry upstream with renewables technologies; 4) advancing carbon capture utilisation and storage (CCUS); and 5) phasing out fossil fuel-fired thermal generation.

Reducing methane emissions

Reducing methane emissions is the single most important and cost-effective way to bring down GHG emissions and to improve efficiency in the oil and gas industry, which accounts for 20% of global methane emissions (GMI, 2011[19]). LAC governments can play an important role in reducing methane emissions by, first, establishing regulatory frameworks for the measurement, disclosure, and verification of methane flaring, methane venting, and carbon dioxide (CO_2) emissions. Second, they can integrate methane emissions reduction in their Nationally Determined Contributions (NDCs). Third, they can require oil and gas companies to design leak-detection and repair programmes. To foster compliance and accountability, Argentina and Mexico require public disclosure of methane emissions data by companies (IEA, 2021[20]). Colombia has integrated all methane-related measures under a unique regulatory instrument to reduce fugitive emissions from upstream oil and gas activities, thereby becoming the first South American nation to regulate methane emissions from oil and gas (Banks and Miranda-González, 2022[21]).

LAC governments should consider methane emissions in the liquefied natural gas (LNG) value chain. The global LNG industry is rapidly expanding with LNG projects projected to account for around 80% of the increase in global gas trade up to 2040 (Stern, 2019[22]). LAC countries that currently export LNG (Peru and Trinidad and Tobago) and those exploring the development of an LNG export market (Argentina, Colombia and Mexico) should consider how the introduction by importer countries of new GHG reduction regulations may affect LNG projects over their operating lives. In fact, several of the largest LNG importing countries (including France, Japan, Korea, Spain and the United Kingdom) have pledged to become carbon-neutral by 2050. The European Union is creating country profiles for methane emissions from oil and gas to inform EU's purchasing choices (Banks and Miranda-González, 2022[21]) (Chapter 6).

Making the most of associated gas

Flaring of associated gas[7] not only contributes to climate change but also wastes a valuable energy resource that could be used to advance sustainable development and the low-carbon transition in producing countries. LAC governments can implement a number of policies and incentives to ensure that associated gas is monetised rather than flared. For example, Brazil's National Agency of Petroleum, Natural Gas and Biofuels encourages the capture and use of associated gas by charging royalties for all gas that is flared (IEA, 2021[20]). The government is working to develop a midstream market and to drive domestic demand for natural gas, notably to electrify rural communities and support industrial growth (IEA, 2021[20]).

Upstreaming electrification of the oil and gas industry with renewables technologies

Electricity generation at oil and gas facilities needs to be fully decarbonised using electricity supplied by renewable energy sources in order to meet climate objectives.

Grid-based electricity could be an option, when possible, but for remote oil and gas operations, off-grid electricity options will be necessary. LAC governments could provide incentives or requirements for oil and gas operators to take advantage of the steady cost decline over the past years in renewable energy technology and to integrate off-grid electricity generation into their upstream operations, for example through a mix of off-grid solar photovoltaics (PV), wind, hydro, small modular reactors and battery storage systems. A similar logic applies to the mining sector (section on sustainable mining in Annex 3.A1).

Advancing carbon capture, utilisation and storage

The Intergovernmental Panel on Climate Change (IPCC) and the International Energy Agency (IEA) have recognised the critical role for CCUS[8] in reducing CO_2 emissions and achieving net-zero emissions by 2050. Of 135 CCUS facilities in operation worldwide, only one is located in the LAC region (IOGP, 2022[24]). The Petrobras's Santos Basin Pre-Salt Oil Field CCUS facility, opened in 2011, is located 300 kilometres off the coast of Brazil. The Santos Basin programme is the third-largest CCUS project in the world, accounting for around 12% of global capacity (IOGP, 2022[24]). Potential policy measures to scale up CCUS in LAC are: 1) undertake geological mapping to establish a national register of potential CO_2 storage sites; 2) determine whether highly concentrated, large point-source emitters of CO_2 (e.g. petroleum, cement and fertiliser industries) are relatively close and well connected to potential storage sites; and 3) implement robust CCUS regulatory frameworks that include an independent third-party verification role to provide the private sector with the necessary confidence to invest (Global CCS Institute, 2020[25]). Risks and trade-offs with broader environmental objectives associated with CCUS should be addressed accordingly.

Phasing out fossil fuel-fired thermal generation

LAC countries need to consider phasing out fossil fuel-fired thermal generation capacity earlier than intended. Committed emissions from existing and planned infrastructure in the LAC power sector will be 6.9 Gt CO_2 by 2050, more than is consistent with limiting global warming to either 1.5°C or 2°C (IDB and DDPLAC, 2019[5]). Retiring power plants early can be politically contentious because the nature of project finance relies on capital being recouped over the full life of a project (normally a 20- to 40-year period) and early retirement is likely to entail significant losses for a utility and investor. Early planning for retirement, as well as defining clear criteria based on which plants will be selected and ongoing dialogue with operators, can help mitigate negative market perceptions and open up avenues for financing early retirement. In specific contexts, repurposing older, high-polluting plants with renewable energy and storage can significantly reduce overall CAPEX requirements for the transition and provide a more efficient avenue for the renewables capacity addition because projects can rely on existing infrastructure, including substations and transmission and evacuation lines, rather than building renewable energy infrastructure from scratch. However, given the varying local conditions, types, sizes and ages of thermal power plants – and the varying roles they play in the local economy – and the need to meet national electricity demand and to stabilise the grid, the feasibility of repurposing will be contingent on local circumstances, and a one-size-fits-all approach is unlikely to bear fruit.

In Central America, a low-carbon energy pathway could be more cost-effective than current polluting alternatives. The Renewable Energy Roadmap for Central America finds that the decarbonised pathway would cost the subregion around USD 20 billion less than the planned scenario 2018-50. Central America has a unique opportunity to ensure sustainable development with renewable energy resources. They can bolster

energy security, mitigate fossil fuel dependence while reducing costs, stimulate the subregion's post-coronavirus (COVID-19) recovery and help address climate change (IRENA, 2022[26]).

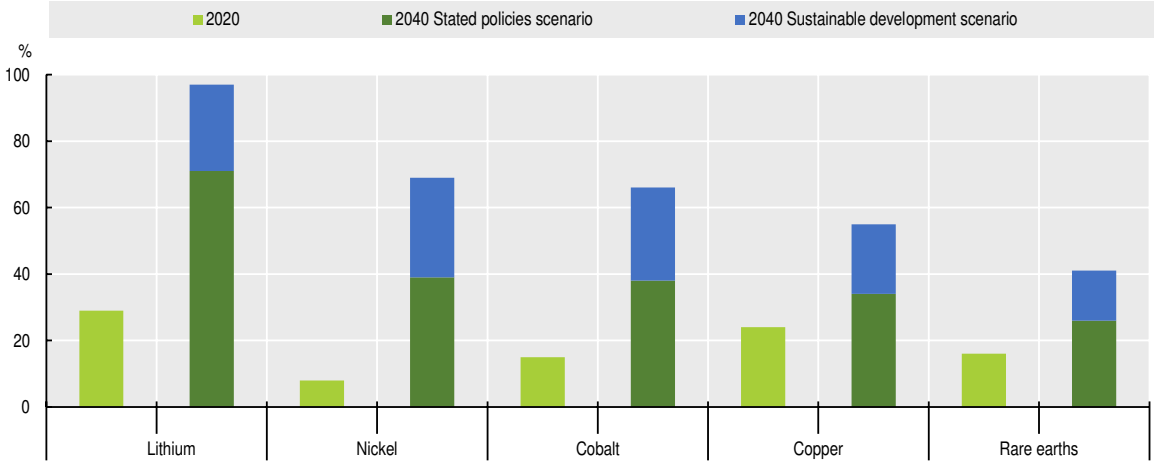
Rising demand for minerals and LAC's strategic position

The green energy transition, boosted by the unstable global and geopolitical context, is driving a surge in demand for minerals that are abundant in LAC. Raw materials for green energy technologies are set to become the fastest-growing segment of mineral demand. Based on the Sustainable Development Scenario projection, by 2040 their share of total demand edges up to over 40-50% for copper and rare earth elements; 60-70% for nickel and cobalt; and almost 90% for lithium (Figure 3.2).

Several LAC countries will be strategically positioned as suppliers of these minerals. The region includes the world's biggest copper producer (Chile), the world's biggest silver producer (Mexico), the third-biggest steel producer (Brazil), the world's second and third largest Lithium producers (Chile and Argentina, respectively), and the seventh-biggest bauxite producer (Jamaica). In 2017, a total of 61% of global lithium reserves, 39% of copper reserves and 32% of nickel and silver reserves, respectively, were in LAC (ECLAC, 2018[28]) (section on "Other key selected sectors for the green transition"). Over the period 2020 to 2021, investments in lithium in LAC increased by 117%, with increases of 559% in Chile and 77% in Argentina (S&P Global Market Intelligence, 2022[29]).

Figure 3.2. **The energy transition is driving a global demand surge for minerals**

Clean energy technologies share of global energy demand for selected minerals, actual and projected



Note: Stated Policies Scenario provides an indication of where the energy system is heading based on a sector-by-sector analysis of today's policies and policy announcements; the Sustainable Development Scenario, indicates what would be required in a trajectory consistent with meeting the Paris Agreement goals. Neodymium demand is used as indicative for rare earth elements.

Source: (IEA, 2022[27]).

StatLink https://stat.link/tk3qdi

LAC countries should apply a sustainable mining approach as they transform exploration spending into mineral production and processing growth to take this opportunity as a lever in the green transition. The challenge will be to not repeat the mistakes of previous transitions. This time, the region should aim to integrate into global value chains in a more sophisticated way, putting sustainability, citizens' well-being and the potential for productive integration at the centre. Mining activity has faced high social opposition in the region, highlighting the need for good governance, consultation

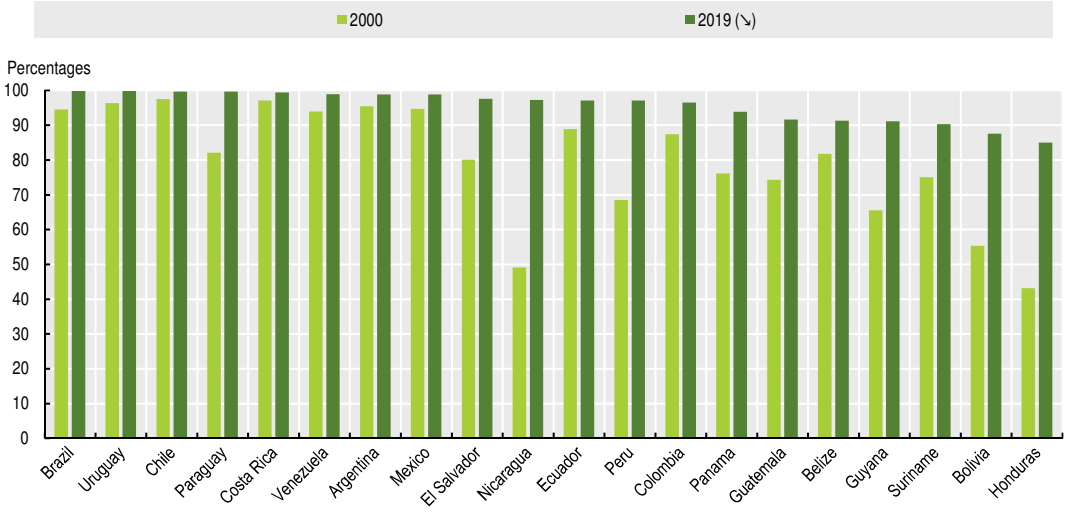
and ensuring that local communities benefit from projects as a part of the low-carbon transition (Chapter 5).

Closing the energy access gap: Universal access to electricity as a pending challenge

Addressing energy poverty is a crucial element of a sustainable, inclusive and just transition as it can help overcome historical social inequalities and provide a path for local economic growth. Universal electricity access is a key enabler for improved livelihoods, inclusive local economic growth and increased well-being (in terms of access to health and education, increasing the time available for new activities, and contributing to the creation of productive processes, among other positive outcomes).

Access to electricity in LAC has increased 15.7% in the last two decades, reaching 95.5% in 2019 (Figure 3.3). Still, a total of 17 million people have no access to electricity, especially in rural areas, where the electrification rate is around 76%. Substantial amounts of additional grid capacity (from gas or renewables) may not alone solve the problem, given the prohibitive costs of infrastructure development. Off-grid solutions, such as off-grid solar PV, have contributed to improving rural electrification in Peru (IRENA, 2018[30]), and could be a good alternative for the region. In Ecuador's Amazon basin, off-grid electrification efforts through solar PV in local communities enabled the provision of an electromobility solution to improve the transport of children to school along the Tupungayo River. The replacement of the gasoline outboard engine for electric ones improved the regularity of the boat service, reduced emissions, facilitated the decoupling between the growth of mobility demand and the demand for fossil fuels, mitigated the noise and the risk of water pollution. The project meant a paradigm shift in the provision of basic services (energy, water, and mobility) for the local communities (Wilmsmeier and Jaimurzina, 2017[31]).

Figure 3.3. **Electricity access in Latin America, 2000-19**



Source: (IEA, 2022[32]).

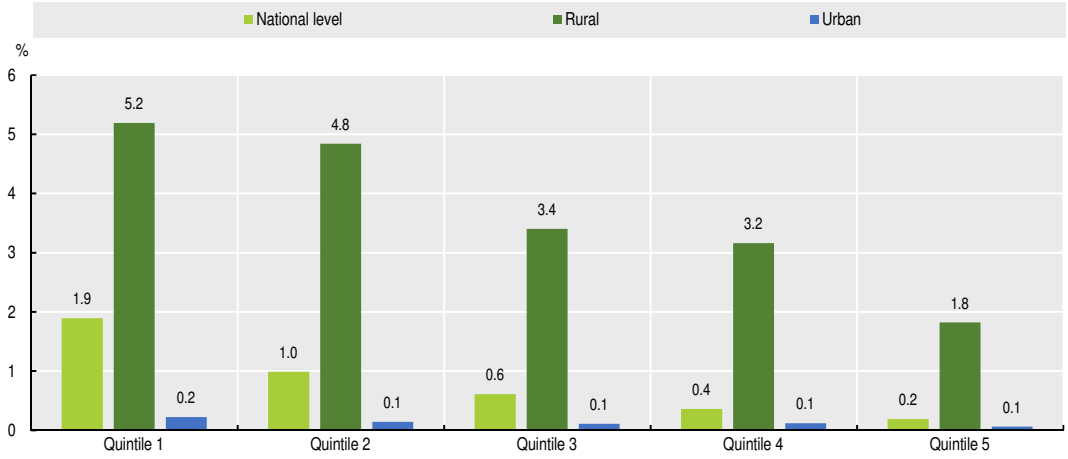
StatLink https://stat.link/2iktq9

The lack of access to electricity in LAC is correlated to income, geographical and ethnic issues: for all income quintiles, the rural population has less access to energy resources (Figure 3.4). On average, 15% of the population living in precarious housing has no access to electricity. In Bolivia, Chile, El Salvador, Honduras, Guatemala and Nicaragua,

this figure reaches between 30% and 40%. Moreover, the percentage of total household budget that the poorest quintiles of the region's population spend on electricity and gas is twice – and in some cases three times – that of the richest quintiles. The proportion of the indigenous and Afro-descendant population without access to electricity is, on average, double and, in some cases, triple the respective proportion of the non-indigenous and Afro-descendant population (sieLAC OLADE, 2022[4]).

Figure 3.4. **Lack of access to electricity in LAC is higher for the first quintiles and in rural areas**

Proportion of the population without access to electricity by income quintile (rural, urban and total), latest available year



Note: Latest year available: 2017 for Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Paraguay, Peru, and Uruguay; 2016 for Honduras, México and Dominican Republic; 2014 for Guatemala, Nicaragua and Venezuela.
Source: Authors' elaboration based on latest household surveys, Banco de Datos de Encuestas de Hogares (BADEOHG).
StatLink https://stat.link/hkutp3

Achieving universal access to electricity based on renewables in LAC by 2030 will require an investment of approximately USD 852 billion (ECLAC, 2020[34]). To make it possible, LAC governments may consider establishing an energy access fund, capitalised by development finance institutions and fossil fuel export revenues, to roll out energy access programmes via mini-grids. Financing for off-grid entrepreneurs and affordability for poorer households are among the biggest challenges that must be addressed to achieve energy equality throughout the region (Chapter 4).

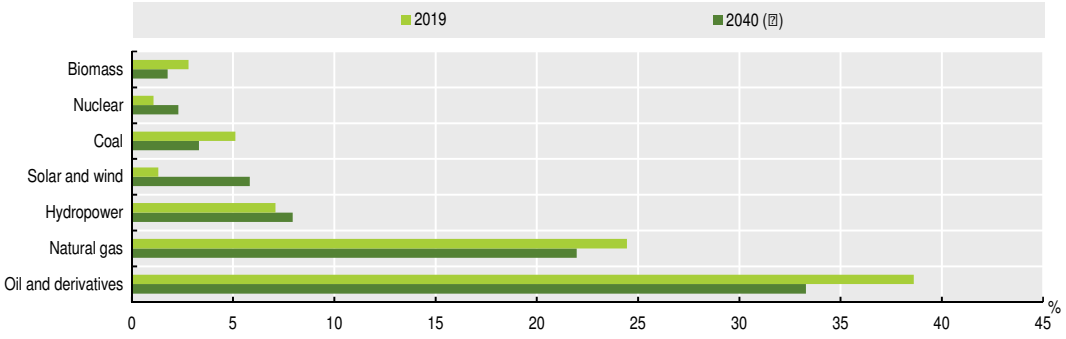
The combined use of renewable technologies has the capacity to serve on-site and decentralised electricity to rural, isolated and remote communities where interconnected systems do not currently reach, thus achieving the universalisation sought in the energy transition. It is therefore a matter of generating electricity based on renewables in the territories, achieving "the last mile" to universalise access in a sustainable way, leaving no one behind. This is possible as long as public-private partnerships are established to attract investment in these local energy markets.

Holistic energy policies are needed to make the green transition possible

LAC needs bold energy plans to effectively transform its energy mix. Based on the current objectives of energy policies applied in the region, the changes achieved by 2040 in the regional energy mix total energy supply will only be marginal, since the investments provided for national energy plans are not sufficiently transformative (Figure 3.5). According to a review of policies to be applied, the transition will not occur

fast enough to comply with NDCs unless negative externalities of fossil fuels are properly priced, incentives for renewables are applied, and governments provide clear guidance on the way forward.

Figure 3.5. **LAC: Total energy supply and demand mix in current policies, actual and projected**



Source: Authors' calculations based on (IEA, 2021[10]).

StatLink https://stat.link/6t4bq8

Policies focused on energy efficiency, upstreaming methane reductions, re-evaluating fossil-fuels subsidies and investing in renewable energy could reduce more than 90% of LAC regional emissions (IEA, 2015[33]). In particular, energy efficiency policies applied to industry, buildings and transport could reduce the region's emissions by 40%. Moreover, energy efficiency could reduce GHG emissions if applied to industrial motors, road transport, heating and cooling appliances, and lighting (IEA, 2015[33]). Going beyond efficiency, applying a systemic approach to combine energy policies with productive, social and environmental ones will be needed to improve environmental and social results.

A regional sustainable, inclusive and just energy transition requires a framework of innovation, co-operation and integration across LAC. The progressive construction of innovative ecosystems, shaped by a new culture of renewability, energy efficiency, security and resilience, in which education policies, investment instruments and regulations converge will be key. These innovation ecosystems need to be articulated regionally, promoting co-operation and integration to increase economies of scale and overcome barriers to the development of renewable energies.

Governance, civil society participation and public-private co-operation are fundamental to accelerating the energy transition. Better integrated governance of energy resources – including stability, clear regulations and guarantees for investors and financiers – are needed to underpin the energy transition. Strengthening the role of national regulatory and planning bodies to implement adequate mechanisms and instruments that resolve information asymmetries between regulators and private agents, provide guidance and clear signals to attract infrastructure investments will be key. These investments, both private and public, should be oriented to meet three key characteristics: sustainability, quality and resilience.

Structural change in the energy transition also requires greater citizen participation from the outset of projects, in turn requiring decentralisation and democratic forms of governance aimed at improving the distribution of power and decisions (Chapter 5). Energy citizenship has a key role to play in individual capacities and willingness to participate, especially in what some define as prosumers, highlighting the importance of access to smart and small-scale technology.

LAC countries are using long-term scenarios and energy planning tools to inform national planning and advance clean energy transitions (IRENA/UNELCAC/GET.transform, 2022[15]). Good practices in the region show that long-term scenarios are:

- Being developed with a broad scope incorporating social and environmental factors, for example, in Argentina (Towards a Shared Vision of Argentina's Energy Transition to 2050), Ecuador (National Energy Plan 2050) and the Dominican Republic (prioritising geographic security of its power system).
- Linked to climate goals. For example, Chile has institutionalised its long-term energy planning with ambitious targets, such as achieving carbon neutrality by 2050.
- Incorporating participation processes in energy planning. Brazil, Costa Rica and Panama involved key stakeholders (e.g. regional community leaders, academia and businesses) to take part in the development of their National Energy Plans 2050 (NEPs).
- Promoting more renewable energy and more efficient energy consumption. Chile plans to develop its renewable energy potential in solar, wind, hydropower and green hydrogen, while Mexico has developed clean energy generation and demand simulations and modelling.
- Incorporating transparent energy data and statistics. For example, Colombia shares all data used in the National Energy Plan 2020-2050 on a publicly accessible government website.
- Being supported by international co-operation. El Salvador, for example, received support from the Latin American Energy Organization and the International Renewable Energy Agency (IRENA) to develop its National Energy Plan 2020-2050. With financial support from Canada, management support from the IDB and technical support from Brazilian consultants, Peru developed a software tool for optimising long-term integrated energy planning.

Going forward, integrated and holistic long-term scenarios can help advance the systemic changes that the green transition demands in the energy sector, the transformation of LAC's production structure, its labour market (next sections) and sustainable territorial development (Chapter 2).

The energy transition can be accelerated in LAC countries by enabling proper ecosystems for investment. The implementation of renewable technologies, the achievement of a 100% renewable electricity matrix, and greater regional electricity integration will be key to reduce the region's high dependence on fossil fuels, a situation that implies great energy insecurity for the region, and which can be addressed through the electrification of different sectors, particularly the transport and industrial sectors, by taking advantage of the region's great renewable potential (ECLAC, 2020[34]).

Three scenarios of renewable energy adoption have been defined for the LAC region.[9] First, the Base Scenario (BS)[10] in which the adoption of renewables is calculated based on the 2020 national long-term renewable energy expansion plans of LAC countries (solar and wind increase their share of total electricity generation from 12% to 24.6%). Second, the High Share of Renewable Energy (RE) scenario incorporates a high proportion of renewable energy generation by 2032 (89% renewables, including large-scale hydro), but energy interconnections are maintained as in the Base Scenario (low regional transmission integration). The solar and wind (non-hydro) would increase their share of electricity generation from 12% to 41.1%.The third scenario is the High Renewable Energy Adoption and High Regional Transmission Integration (RE+INT) Scenario. This scenario incorporates in a cost-effective way a high proportion of renewable energy generation by 2032 (achieving 100% renewables, including large-scale hydro), and a high degree of

regional interconnection that allows for a high degree of renewable energy integration and a more efficient electricity system (ECLAC, 2020[34]).

The analysis of the different scenarios[11] shows that achieving decarbonisation in the electricity sector in LAC is possible. It requires investing 1.3% of the region's annual GDP over the next ten years to incorporate renewable energies, universalise access to electricity for all, and increase regional electricity integration (ECLAC, 2020[34]). Greater regional electricity integration and the development of a regional electricity market are vital to achieving greater energy security and independence from fossil fuels. Investment to promote the adoption of renewables (solar and wind) would provide a more flexible and efficient electricity grid in LAC. The complementarity between these sources, together with hydropower and the potential use of storage in the medium term, is vital for the correct functionality of a new sustainable and inclusive electricity system (ECLAC, 2020[34]). Moreover, in the ER+INT Scenario: 1) generation of GHG emissions from the regional electricity system would decrease by 31.5% (compared to -30.1% in the RE Scenario, and -4.8% in the BS); 2) approximately 7 million new jobs will be created by 2032; and 3) if the renewable energy industry were located in LAC, manufacturing the solar panels and wind turbines needed to achieve this scenario would represent almost 1 million new jobs by 2032 (ECLAC, 2020[34]). Given the geographic characteristics of the Caribbean, it is impossible to carry out this type of study in the subregion. Nonetheless, it would be important to explore the opportunities and costs presented by the potential for electricity integration via the use of subsea cables with generation based on geothermal energy (e.g. in St. Lucia, St. Vincent and the Grenadines, St. Kitts and Nevis, and Dominica) and maximise the benefits of distributed generation based on solar and wind technology (ECLAC, 2020[34]).

Industrial, circular and blue policies to transform LAC's production structure

The green transition offers an opportunity to address one of the region's greatest challenges: transforming the production structure. Productivity has remained stagnant in recent decades, with the productive structure biased towards activities that have high intensity for materials and natural resources, plunging the region into a productivity trap that reinforces the environmental trap (OECD et al., 2019[35]). Currently, 75% of the region's total exports are primary products and natural resource-based manufactures (OECD et al., 2021[36]).

Productive policies for a green transition must advance a more sustainable production model that promotes regional competitiveness and formal employment. Therefore, LAC countries should enhance innovation, embrace green technologies and diversify the energy and productive matrix towards less resource-intensive sectors. It will be key to attract greener investments and take advantage of new trade opportunities to foster regional integration and to join global chains in higher-value segments, while gradually complying with environmental criteria in exports and in sustainable and responsible sourcing of materials (Chapter 6).

The production and export of environmental goods could facilitate structural transformation and improve international competitiveness by increasing the intensity of green technologies and innovation. Green policies have the potential to increase the competitiveness of LAC economies by setting green standards and certifications that enable firms to differentiate their products vertically. These standards demand a period of transition towards this model and renewed international co-operation (Chapter 6). Firms can increase revenues by selling and adopting green technologies; in turn, that can lead to productivity improvements and knowledge spillovers in the innovation processes as

a way to enhance competitiveness (Altenburg and Assmann, 2017[37]). All these processes are gradual and should be accompanied by due diligence, respect for environmental standards and transparency in public procurement (ECLAC, 2020[35]).

Towards a new industrial policy to promote a more sustainable production model

Industrial policies in LAC should shift towards a green transition that prioritises technical change, generates new quality employment and reduces the region's environmental footprint. The transformation of production requires a combination of policies on investment, foreign trade, science, technology and innovation, and training and skills development, with a special focus on micro-, small- and medium-sized enterprises (MSMEs). Policies to close the gaps in the infrastructure, transport and energy sectors, in both urban and rural areas, are also key (ECLAC, 2020[35]). Strategic sectors for developing green industrial policies include renewable energy, sustainable transportation systems, digital transformation, bioeconomy, the circular economy, sustainable tourism, and sustainable agriculture and livestock, water and waste management, plastics and sustainable mining (see also section: "Other key selected sectors for the green transition").

The transition towards more inclusive and sustainable economies, therefore, depends largely on the opportunities associated with the future disruptive changes in the new technological cycle where a new advanced manufacturing (Industry 4.0) is needed. The current and accelerating "fourth industrial revolution" coupled with post-globalisation, demands sound industrial policies to avoid increasing existing production and technological gaps and their associated negative consequences. In the aftermath of the COVID-19 crisis and the complex current global context, a special need exists to implement mission-oriented policies aimed at industrial transformation, innovation and productive resilience, with job formalisation at the centre.

Developing renewable energy value chains can be vectors for economic development and energy security. The LAC region is endowed with sufficient skilled human capital and critical raw materials for renewables including production and storage (i.e. lithium batteries) to create more value-added across all value chains to ensure renewables and clean energy can be deployed at their fullest potential. However, these efforts require planning and co-ordination to achieve industrial and energy scales and policies for the expansion and integration of renewable technology value chains. Investment and funding and technical support to firms are also key.

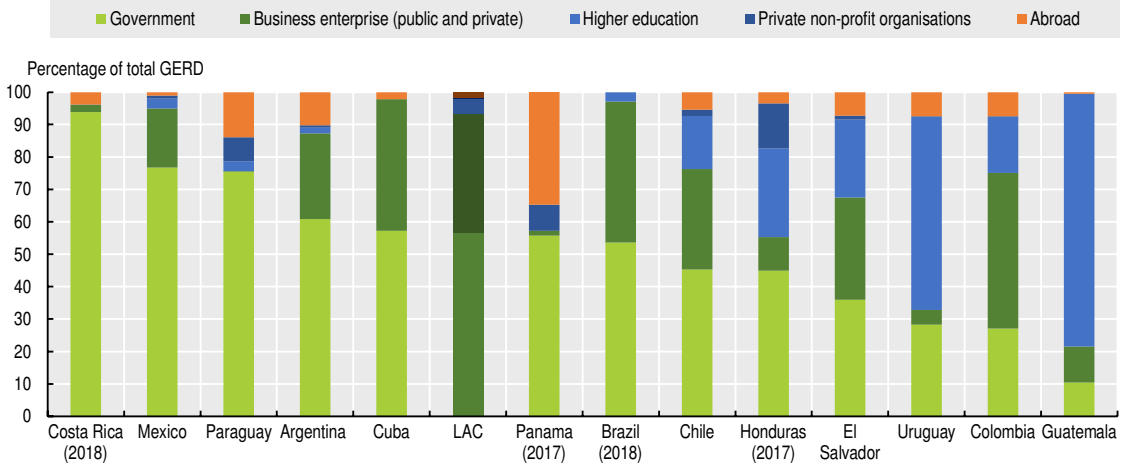
LAC should promote regional production of inputs and equipment for the manufacturing, storage and distribution of renewable energies to develop true regional energy security, instead of just importing equipment and technology from global suppliers. The more that renewable inputs, technologies and know-how are sourced from within the region, the greater the energy security and resilience to global events (e.g. pandemics) and geopolitical conflicts will be. Renewable energies show the greatest dynamism and potential as vectors of development for the region, particularly solar PV, wind and, increasingly, green hydrogen. To bring about this paradigm shift, it is necessary to foster and maintain a continuous debate with policy makers, the private sector and stakeholders in each country and across the region. Promoting investment in R&D and industrial promotion programmes through higher and technical education programmes is also key.

Investment in innovation is a first key step for industrial policies and a green innovation ecosystem in LAC. Nonetheless, the region's gross domestic expenditure in research and development (GERD) has remained flat in the past decade, amounting to 0.3% of GDP in 2018. By contrast, GERD has consistently grown in the countries belonging to the Organisation for Economic Co-operation and Development (OECD), from 1.5% of GDP in 2000 to 2% of GDP in 2018. Brazil is the only LAC country that spends more than

1% of GDP in research and development (R&D); in the rest of the region, GERD ranges from 0.5% in Cuba to as low as 0.03% in Guatemala (UNESCO, 2021[38]).

R&D in LAC remains highly government driven (56.5% of total GERD), highlighting the need to increase private investment in R&D to promote innovation in the region. In 2019, business enterprises in LAC represented only 22.7% of total expenditure in R&D on average vs. 49.1% in the OECD area, although heterogeneity remains high in LAC (Figure 3.6). A new industrial policy with the environmental dimension at the centre should engage the private sector by increasing the co-ordination and dialogue across various actors, including national and sub-national authorities, the private sector and academia, on a new development strategy for each country of the region (OECD/UNCTAD/ECLAC, 2020[39]; OECD et al., 2019[40]). Entrepreneurs and start ups can be a source of innovation by the creation of new more sustainable businesses models. There are some examples of public-private collaboration in LAC that connect firms with entrepreneurs working on cross-cutting solutions to issues such as social inclusion, education, support for MSMEs and environmental protection. A total of 60% of the technological solutions promoted by this initiative will benefit vulnerable communities and the remaining 40% will promote environmental protection (IDB, 2021[42]).

Figure 3.6. **Share of gross domestic expenditure in research and development (GERD) by source of funds, selected LAC countries**



Notes: Data for 2019 or latest year available. Costa Rica: company data correspond to amounts financed by private companies but not reported as R&D amounts executed by companies (data collected through the business innovation questionnaire). El Salvador: the information provided corresponds to the expenditure made by the higher education and government sectors. Guatemala: the information provided corresponds to the expenditure of the government and higher education sector. Paraguay: as a source of financing, the government sector includes public universities.

Source: (RICYT , 2021[41]).

StatLink https://stat.link/zeh35t

In particular, the proper design and implementation of environmental policy can improve the economic performance of firms through innovation. Environmental regulation may help managers overcome behavioural biases and draw their attention to inefficiencies or new opportunities in production processes (Porter and van der Linde, 1995[43]). Environmental policy can help firms reduce input costs of energy or raw materials through process innovation or facilitate access to new markets through the development of new products if the right policies are in place (Box 3.3) (Dechezleprêtre et al., 2019[44]; Lanoie et al., 2011[45]).

Box 3.3. **Innovation for sustainable agriculture and livestock: The case of Brazil**

In the last decades, Brazil has implemented different types of innovations to promote more sustainable agricultural and livestock sectors through different stages, from technological innovation to the production of data, the creation of monitoring capacity, and social innovation work with local communities or public-private collaboration experiences. Some selected examples are:

- **The ABC and ABC+ plans**. The Sectoral Plan for Adaptation to Climate Change and Low Carbon Emissions in Agriculture (the ABC Plan) was designed in 2010 to reinforce the innovation system in tropical soils responsible for the so-called "Brazilian agricultural revolution", which transformed the country from an importer to an exporter of food. From 2010-20, the ABC focused on sustainable agricultural production technologies: (i) pastures recovery, (ii) crop-livestock-forestry and agroforestry systems, (iii) no-tillage system, (iv) biological nitrogen fixation, (v) planted forests and (vi) animal waste treatment. These technologies helped mitigate 170 million tons of CO_2e in two decades. For 2020-30, the plan was updated (ABC+) to include new technologies: (vii) bio-inputs, (viii) sustainable irrigation systems, and (ix) intensive fattening on pastures aiming to expand them across 72 million extra hectares to curb more than 1 billion tons of CO_2e. The ABC+ includes an Integrated Landscape Approach which considers different elements of rural landscapes to ensure that natural elements such as carbon, water, soil and biodiversity, can work sideways with agricultural production in a sustainable way.
- **Observatory of Brazilian Agriculture.** This public access portal includes data and statistics from more than 200 databases on Brazilian agriculture, such as: 1) a statistical platform containing data of various agricultural indices; and 2) a geospatial platform, which presents territorial and cartographic data on national agribusiness. The observatory aims to transform these data into ways to increase productivity and transparency throughout all agribusiness production and value chains, promote sustainable practices and improve monitoring actions. Key areas of consultation available are: sustainable agriculture and the environment; fishery and aquaculture; rural credit; agricultural products; agricultural zoning of climate risk; and Brazilian soils.
- **Public-private collaboration**. Brazil has been investing in the conservation of biodiversity and natural resources for more than 50 years. The Brazilian Ministry of Agriculture, Livestock and Food Supply (MAPA), the Agricultural Research Corporation (Embrapa), and the Agriculture and Livestock Confederation have been collaborating on the implementation of integrated systems and low-carbon emission agriculture. One concrete experience is the Integrated Crop-Livestock-Forestry System, which currently covers 45% of farms, contributes to minimising GHG emissions by up to 40% and helped develop the production of verified carbon-neutral beef.
- **Support of local communities to promote forest protection and the bioeconomy.** The Federal Programme for Community and Family Forest Management and the Bioeconomy and Sociobiodiversity, run by the Secretariat of Family Agriculture and Cooperativism (part of MAPA), have implemented a strategy to support local communities, thereby strengthening value chains and consolidating sustainable markets for non-timber forest products while conserving agrodiversity and providing renewable energy (mainly solar) to family agriculture.

Sources: Ministry of Agriculture, Livestock and Food Supply (2022[45]; 2021[46]; 2019[47] and Michail, 2019[48]).

MSMEs: A fundamental player for production transformation

Micro-, small- and medium-sized enterprises (MSMEs) are major job creators in LAC. They represent 60% of jobs, 99.5% of businesses and 25% of total production in LAC (Herrera, 2020[49]) but are characterised by low productivity and low competitiveness (Dini and Stumpo, 2019[50]). A new industrial policy should support MSMEs to increase their participation in regional and global value chains by promoting innovation, disseminating new knowledge and production linkages, creating and strengthening clusters, and partnering networks (ECLAC, 2020[34]).

Policies focused on MSMEs should be part of the general industrial sustainable development strategies implemented through horizontal approaches that focus on building capacities in priority production chains and territories, taking into account the needs of (private and/or social) MSMEs. The governance of these policies needs to have a local dimension while also guaranteeing a space for regional action (Chapters 5 and 6) (ECLAC, 2020[34]). For instance, in 2009, Uruguay launched an auctioning of small wind farms that required at least 20% locally produced content, 80% local jobs and a control centre based in Uruguay (IRENA, 2015[51]). These local content requirements make the green transition more inclusive and can contribute to promoting local quality jobs in greener sectors as the economies disengage from natural resource-intensive production and polluting activities (section: "Social policies for a just transition: the role of the labour market").

Institution building is essential for a sustainable industrial policy and its implementation. Stronger intergovernmental co-ordination at the regional and subregional levels would improve governance results. Areas including data and information generation, climate change adaptation, water resources management, environment and health, sustainable production and consumption, and biodiversity management would be strengthened through regional co-ordination and a renewed multilateralism (Chapter 6).

Shifting towards circular productive processes to promote a structural sustainable change

The circular economy approach can contribute to the implementation of the mentioned green industrial policies and of key sectoral policies that are needed to advance towards a more sustainable development model and rethink the way goods and services are produced and consumed.

The circular economy seeks to preserve the value of materials and products for as long as possible and minimise waste generation, as opposed to the dominant paradigm of the linear production-consumption-disposal economy (OECD, 2022[52]). Promoting circularity means designing and manufacturing products that have a longer useful life and can be upgraded, repaired, reused, reconditioned or remanufactured. It also means promoting eco-design policies that minimise the use of resources, take advantage of secondary resources, and promote re-use and recycle high-quality materials. It also involves combating planned obsolescence and standardising design elements (e.g. building universal chargers for electrical and electronic equipment or designing "circular" buildings) (Bárcena et al., 2018[53]).

There are at least 100 definitions of the circular economy (Kirchherr, Reike and Hekkert, 2017[54]), of which four have been selected for this publication. A first definition conceives the circular economy as one that "helps to keep resources flowing within rather than through the economy by modifying the flow of products and materials through three main mechanisms: Closing resource loops through the substitution of secondary materials and second-hand, repaired or remanufactured products in place of their virgin equivalents; slowing resource loops through the emergence of products which remain in the economy for longer, usually due to more durable product design; and narrowing

resource flows through more efficient use of natural resources, materials and products, including the development and diffusion of new production technologies, an increased utilisation of existing assets and shifts in consumption behaviour" (McCarthy, A., R. Dellink and R. Bibas, 2018[55]; Yamaguchi, 2018[56]; OECD, 2022[52]). The second definition understands the term as: "an industrial system that is restorative or regenerative by intention and design. It replaces the 'end-of-life' concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse, and aims for the elimination of waste through the superior design of materials, products, systems, and, within this, business models" (Ellen MacArthur Foundation, 2013[57]). A third approach, defines the circular economy as an economic system based on business models that replace the 'end-of-life' concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes, thus operating at the micro level (products, companies, consumers), meso level (eco-industrial parks) and macro level (city, region, nation and beyond), to accomplish sustainable development, which implies creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations (Kirchherr, Reike and Hekkert, 2017[54]). Finally, the circular economy is also seen as one that promotes systemic change through a new economic model that works for and with the planet (UNEP, 2021[58]).

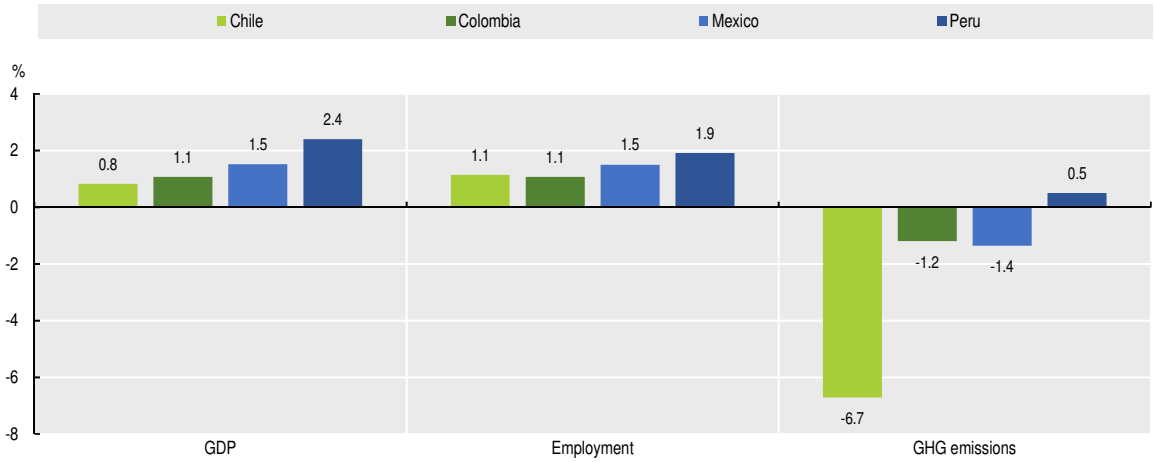
The circular economy approach reinforces climate change mitigation actions. While the transition to renewable energy and energy efficiency would help reduce 55% of total GHG emissions, the circular economy can help eliminate the remaining 45% that are generated by the way goods are manufactured and used (Ellen MacArthur Foundation, 2019[59]). Other research estimates that materials management activities account for up to two-thirds (67%) of global GHG emissions (UNDP, 2017[60]) and projects that by 2060 materials management activities will be responsible for two-thirds of GHG emissions, mainly coming from the combustion of fossil fuels for energy from agriculture, manufacturing and construction (OECD, 2019[61]).

The innovation process behind the circular economy could translate into more sustainable economic growth through new activities due to more productive and efficient use of natural resources. These processes require skilled labour for new material recovery processes, employment generation and investments in innovation and technology incorporation.

The circular economy can be a driver of sustainable development. Its transformative, systemic and functional characteristics can foster several SDGs, including SDG 12 on sustainable and responsible production and consumption patterns; SDG 6 on water; SDG 7 on energy; SDG 9 on infrastructure, industrialisation and innovation; SDG 11 on sustainable cities and communities; SDG 13 on climate action; and SDG 15 on life on land (OECD, 2020[62]).

The transition to a circular economy is expected to have net positive effects on GDP growth and employment while reducing GHG emissions (Chateau and Mavroeidi, 2020[63]). Although the transition to the circular economy and cleaner production imposes economic costs for certain sectors, the net effects expected for Chile, Colombia, Mexico and Peru are increased GDP (from 0.82% in Chile to 2.4% in Peru) and job creation (from 1.1% in Chile and Colombia to 1.9% in Peru). These figures also grow over time, in line with those in Europe, although at a slightly lower pace. The effects on emissions reduction depend on each country's energy matrix characteristics, emission factors, fuel use reduction goals and size of the effect on GDP (Figure 3.7). GHG emissions are expected to fall in Chile (6,8%), Colombia (1.2%) and Mexico (1.4%). In the case of Peru, economic growth is still very dependent on fossil fuels and the fossil fuel reduction goal set by the country was only 5% (compared to 30% in Chile, 18% in Colombia or 15% in Mexico). That is why a 2.4% increase in GDP would have a slightly positive effect on the overall emissions levels (0.5%) (Econometría Consultores, 2022[64]).

Figure 3.7. **Potential effects of the circular economy transition by 2030 on GDP, employment and GHG emissions, selected LAC countries**



Source: (Econometría Consultores, 2022[64]).

StatLink https://stat.link/c0q64g

The circular economy goes beyond recycling and could help reduce informality in the waste management sector in LAC. Strategic solid waste management has the potential to have positive economic and social effects. Indeed, if LAC's waste and recycling sector were to develop into a key sector with a municipal waste recycling rate equivalent to that of Germany, it could contribute to a green economic revival: almost 450 000 stable jobs would be created and the region's GDP would increase by 0.35% (ECLAC, 2020[34]).

The circular economy is gaining momentum in LAC. Although still in their initial phase, more than 80 circular economy public policy initiatives are being implemented in the region, and an increasing number of national circular economy roadmaps and strategies are under development. Examples of national circular economy policy strategies include the Roadmap for a Circular Chile by 2040 (2021), the Circular Economy National Strategy of Colombia (2019), Ecuador's Law for an Inclusive Circular Economy (2021), Mexico's General Circular Economy Law (2021), Peru's Circular Economy Roadmap for Industry (2020), and the Circular Economy Action Plan of Uruguay (2019) (UNEP, 2021[58]). Moreover, the Circular Economy Coalition for Latin American and the Caribbean was officially launched in February 2021 to accelerate the circular transition in the region and has published keys ideas to develop a shared circular economy vision (UNEP, 2021[58]).National circular economy initiatives can become a pathway for the creation of regional or state initiatives such as the city of Querétaro Circular Economy System. This framework has served as a benchmark for sectoral circularity initiatives such as the Querétaro's Circular Economy System (SECQ), led by the Querétaro Automotive Cluster. The SECQ is expected to implement 100 circular projects by the end of 2022 (800 projects by the end of 2025) and reach 1 000 companies by 2027, fundamentally reducing environmental impacts in terms of materials, carbon footprints, energy use, water consumption, and waste generation (Estado de Querétaro, 2022[65]).

Governance is key to enable the circular transition in LAC. Governments can promote the circular economy through several economic, regulatory, voluntary, information, education and research and co-operation measures. Economic incentives (e.g. favourable tax or extended producer responsibility [EPR] schemes, incentive subsidies, tradeable permits or deposit-refund systems) and financing initiatives (e.g. public circular contests to finance circular business model initiatives or dedicated public budgets as in Peñalolén, Chile) can help boost local entrepreneurship and circular innovation by providing

market signals to influence the behaviour of producers and consumers (OECD, 2020[62]; OECD, 2022[52]). Regulatory instruments foster legislation and regulation to remove potential barriers (e.g. adapting waste regulations). They can limit or ban polluting activities (e.g. introducing plastic bans or setting waste reduction targets), or promote circular production and consumption (e.g. introducing standards and certification for reused, remanufactured or recycled products). Green public procurement can be an essential tool for implementing national, regional and local circular economy initiatives. It can encourage the use of circular business models, promote circular construction developments, incorporate secondary materials, and encourage repair and reuse actions through public purchases (OECD, 2020[62]). The adoption of circular strategies and programmes, long-term visions for the circular economy (e.g. the Roadmap for a Circular Chile by 2040 or the National Strategy for the Circular Economy in Colombia) can help define clear responsibilities, objectives and actions, within the public sector and help guide the needed co-operation with the private sector, academia and civil society (triple and quadruple helix innovation processes).

Other governance measures that can help promote the circular economy in LAC are: voluntary measures to help sectors find more affordable means to achieve objectives (e.g. voluntary certification standards in the construction industry, or in agro-food chains); information instruments to enable consumers, companies and public authorities to make responsible purchases (e.g. via eco-labelling); education and research promotion (e.g. capacity-building through education and training programmes, creating circular economy observatories and knowledge networks); and measures to facilitate co-operation (e.g. private-public, coalition building across the private sector via circular hotspots and across value chains (OECD, 2022[52]).

Extended Producer responsibility (EPR)[12] is a useful instrument implemented by several LAC countries aiming to advance towards circularity: 14 LAC countries[13] currently have an EPR law (de Miguel et al., 2021[66]; Van Hoof et al., 2022[67]). EPR legislations are fundamentally waste management rules designed to mitigate the volume of waste sent to landfill, incentivising its re-use and improving its commercial value. However, waste collection, sorting and management require the development of cost-intensive infrastructure, as well as the use of natural resources. Specific legislation and waste collection infrastructure are needed to mitigate the costs generated by waste collection, attributing more responsibility to the producers in waste generation (Forti et al., 2020[68]; Wagner et al., 2022[69]). Electronic waste is the fastest-growing waste stream in LAC. Between 2000 and 2019, per-capita waste generation from electrical and electronic equipment almost tripled, from 3.4 kg to 8.8 kg per inhabitant, surpassing the global average of 7.3 kg per inhabitant indicated by the United Nations Institute for Training and Research. Only 1.5% of e-waste was recycled in LAC in 2017, falling to 1.3% in 2019 (ECLAC, 2021[70]). In 2018, a regional initiative for the management of electrical and electronic waste and the dismantling of dangerous chemical compounds was launched across 13 LAC countries (UNIDO, 2018[71]).

In the case of the energy sector, circular economy strategies are needed to help manage the waste associated with the production of renewable energies in line with the waste hierarchy. The solar PV panels and wind turbines installed to date were designed with a life-cycle of roughly 25 to 30 years, without much forethought about their eventual decommissioning. At the global level, waste from the solar PV sector alone is expected to reach between 1.7 Mt and 8 Mt in 2030 and between 60 Mt and 78 Mt in 2050 (IRENA, 2016[72]). Along with reducing waste and toxins, circular economy principles applied to renewable technologies could open new market opportunities, using effective technology and economically viable methods to separate the materials embedded in the renewable energy technologies (e.g. some companies have started trying to recycle crystalline PV panels). Despite current efforts, renewable energy technologies recovering and recycling in LAC are

still in their early stages (Contreras-Lisperguer et al., 2017[73]) Although renewable energy technology waste offers a rich source of materials that can be re-used and converted into inputs for the production of new renewable energy devices and/or other products, e-waste legislation in the LAC region has given little consideration to treatment and re-use of e-waste, amid generally low awareness on the issue among policy makers and the public. Public policies should create the conditions for manufacturers to include designs for non-energy intensive disassembly and total reusability of materials embedded in energy technologies, replacing toxic components with non-toxic ones to assess the potential to implement up-cycling at a commercial scale (Contreras-Lisperguer et al., 2017[73]).

Other necessary conditions for the circular economy are capacity-building initiatives (e.g. training, research and networking events), digitalisation efforts (e.g. exchange and awareness platforms, waste tracking apps or open-access online tools), and the production and sharing of data (e.g. on energy consumption, air quality or waste production). The promotion of circular business models (e.g. circular supply, collaborative consumption, service systems or hiring and leasing instead of buying) is crucial (OECD, 2020[62]; OECD, 2019[74]). Stakeholder engagement is key for the circular transition. The public and private sectors, citizens, and academia need to be involved through communication, consultation, participation, representation, partnership or co-decision/-production mechanisms to promote innovative circular business models, advance towards a more sustainable production matrix, and change unsustainable consumption patterns.

The blue economy as a means for development

The blue economy is a driver of economic activity, employment and other social benefits. In 2018, the total GDP contribution of ocean services was estimated at USD 25 billion for LAC and USD 7 billion for Caribbean countries (IDB, 2021[75]). More than 2.5 million people in the region worked directly in fisheries or aquaculture in 2018 (IDB, 2021[75]). Blue carbon ecosystems protect coasts from flooding, buffer ocean acidification, enhance water filtration, promote biodiversity conservation, help carbon sequestration, and boost sustainability in fishery productivity, which in turn creates jobs and increases economic returns (IPCC, 2019[76]).

Given increasing awareness of the importance of the ocean for human well-being and economic activities, a blue approach must be adopted in the LAC region to spur sustainable growth opportunities. The blue economy approach has two complementary goals: it protects marine and coastal ecosystem assets and services while simultaneously addressing the economic challenges of coastal countries (ECLAC, 2020[77]).

LAC's marine area is considered one of the most important and productive in the world. With unique marine biodiversity, it is home to 47 of the 258 global marine ecoregions and to the second-largest barrier reef in the world (ECLAC, 2020[77]). Marine and coastal activities are particularly important in LAC given that more than 27% of the population lives in coastal areas and the sea accounts for a large share of the region's territory (IDB, 2021[75]).

Ocean warming and acidification are damaging marine ecosystems and compromising the ability of the ocean to provide food, livelihoods and safe coastal living (IPCC, 2019[76]). Increased coastal erosion, greater bleaching of corals and increasing flooding of ecosystems are some of the expected effects of climate change on the ocean. Despite this alarming situation, policies related to the management of ocean resources are still underdeveloped and many countries have not incorporated blue carbon into their climate change mitigation strategies (UNESCO, 2020[78]). SDG 14 on the protection of life below water remains the most underfunded of all 17 SDGs, despite its immense potential to be a game changer in addressing the triple planetary crisis: climate change, air pollution and biodiversity loss (UNDP, 2022[79]).

The blue economy for climate change mitigation and adaptation

Protecting, conserving and restoring coastal, river and marine ecosystems directly contributes to climate change mitigation. Blue carbon coastal ecosystems (seagrass meadows, tidal marshes and mangroves) are habitats that uptake and store carbon from the atmosphere in the ocean (carbon sequestration). They are among the most intensive carbon sinks in the biosphere. The degradation of these ecosystems can cause the release of billions of tonnes of GHG; they should be conserved and restored to enhance their sequestration potential (UNESCO, 2020[78]). Mangroves represent a promising mitigation opportunity, particularly in LAC, because they have the capacity to store between three and four times more carbon than most of the forests on the planet (ECLAC, 2020[77]).

LAC is one of the regions with the greatest water availability: up to 33% of the world's total available water (Vargas, 2021[80]). Nevertheless, a great part of the region suffers from water scarcity, given the varied spatial distribution of water resources. Integrated management of river basins and lakes is key to the blue economy approach in LAC, to protect communities' well-being. Freshwater ecosystems provide the foundation to fulfil basic necessities, such as drinkable water, food, health, sanitation, and water for irrigation systems and agriculture. The effects of climate change on water resources compromise water and food security in LAC. Rivers and lakes in the region are highly exposed to polluting sources and the management of water for agriculture is inefficient. The sector uses around 70% of available water (Vargas, 2021[80]). A sustainable blue approach that guarantees water security requires an integrated regional response to protect rivers, decrease deforestation and pollution, and promote sustainable economic activities that minimise harm to ecosystems, as well as a management strategy that includes measures to mitigate and adapt to the effects of climate change. A comprehensive social approach to water management is necessary, especially in rural areas where people are highly exposed to climate events and rely heavily on freshwater resources (Vargas, 2021[80]).

The adoption of a blue carbon approach is a way to help countries meet their NDCs (IDB, 2021[75]). Yet further international action is needed to internalise the positive externalities of those activities, for instance by developing the new blue carbon markets. The ratification of Article 6 of the Paris Agreement at the 2021 UN Climate Change Conference in Glasgow (COP26), which recognises voluntary co-operation in the implementation of NDCs to allow for higher ambition, could mark a milestone for establishing these markets. Participating governments have the chance to mainstream blue carbon solutions by including them in their NDCs (Claes et al., 2022[81]).

Blue economy opportunities in LAC: Fishery and aquaculture, sustainable tourism, and renewable energy

Blue policies have great potential aside from climate-related benefits. Human activities, including overfishing, destructive fishery practices, coastal development, and domestic and industrial contamination, have damaged marine and river ecosystems. Transitioning to blue sustainable economic opportunities in LAC presents particular prospects in three key sectors: fishery and aquaculture, sustainable tourism, and renewable energy generation.

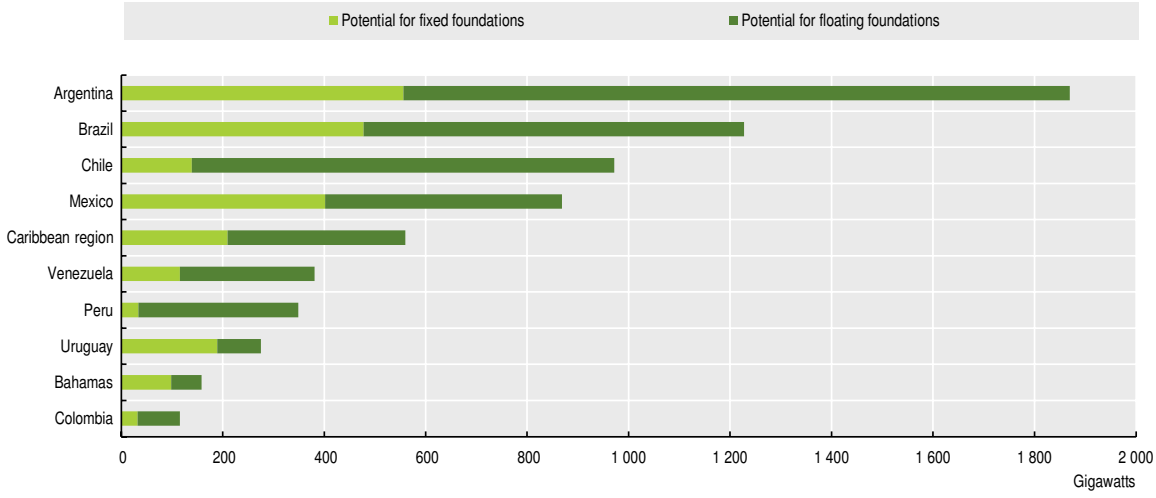
Advancing towards a more sustainable fishery sector, with due regard for the protection of marine and river ecosystems, offers an opportunity to increase employment, improve food security and promote exports. To achieve this, management plans that help restore fish stocks are needed, alongside supportive regional and international policy and regulatory frameworks. It is crucial to end unsustainable overfishing by tackling illegal, unreported or unregulated fishing, banning destructive fishing practices, and eliminating harmful subsidies that contribute to overfishing (Rustomjee, 2016[82]). An example of blue innovation for fishing is the Mexican smartphone app PescaData, which enables local fishers

to monitor populations of birds, sea mammals, fish and crustaceans to manage overfishing, fight non-selected fishing and define some fishing areas as sanctuaries (AFD, 2022[83]).

Despite the COVID-19 pandemic roughly halving tourism's contribution to LAC GDP from 2019 to 2020, economies are recovering and tourism demand is increasing (Annex Table 3.A.6 Sustainable tourism). Ecotourism, as part of the blue economy, offers great potential to lift the region out of its current economic downturn (UNWTO/CAF, 2021[84]). Costa Rica has earned an international reputation for its unique marine natural assets and has managed to boost coastal and biodiversity-based tourism (UNCTAD, 2019[85]) (Annex Table 3.A.1).

As a promising component of the blue economy, the ocean also offers various renewable energy options, such as offshore wind, wave and tidal and the use of temperature and salinity gradients to produce energy. Among these, offshore wind is a highly promising but still largely underfunded option, given that LAC[14] is the region with the highest technical potential[15] globally (6 830 GW), and many of its countries show particularly suitable conditions (Figure 3.8). Argentina could benefit from the golden combination of windswept waters and relatively shallow sea territory, however, its potential still has not been exploited (BNamericas, 2021[86]). Brazil is currently the leading country with six offshore wind power projects under review for licences. The country has the second highest technical potential, followed by Chile and Mexico (ECLAC, 2020[77]). Colombia has an offshore technical potential of 110 GW and recently approved the roadmap for offshore wind projects in the Pacific Ocean. The explored areas could produce 1 GW of energy by 2030 and up to 9 GW by 2050 (currently, the country generates 0.725 GW of solar energy), and are expected to attract an investment of USD 27 billion and create 50 000 jobs (Hidalgo, Fontecha Mejía and Escobar, 2022[87]). Offshore wind energy offers a great opportunity for the Caribbean as well; it has the potential to generate around 560 GW (World Bank/ESMAP, 2020[88]).

Figure 3.8. **Technical potential for offshore wind generation in LAC**



Notes: The offshore wind technical potential is an estimate of the amount of generation capacity that could be technically feasible with current technology, considering only wind speed and water depth, and it is expressed in terms of installed power capacity in gigawatts (GW) within 200 kilometres of the shoreline. Results report the total fixed foundations potential and the total floating foundations potential. Above 50 m depth is considered optimal for fixed foundations and, 50-1 000 m depth is where floating wind can be considered. The Caribbean region includes Antigua and Barbuda, Barbados, Bahamas, Belize Cuba, Dominica, Dominican Republic, Grenada, Jamaica, Haiti, Saint Kitts and Nevis, Saint Vincent and the Grenadines, Saint Lucia, Suriname, and Trinidad and Tobago.

Source: Authors' calculations based on (World Bank/ESMAP, 2020[88]).

StatLink https://stat.link/z91ng5

Policy options against marine plastic waste

Plastic threatens marine ecosystem services that underpin the blue economy, as it accelerates climate change and is a massive source of waste (Diez et al., 2019[89]). Lifecycle emissions from plastic, over 99% of which is derived from fossil fuels, could reach 10-13% of the entire remaining global carbon budget by 2050 (Hamilton and Feit, 2019[90]). In the form of waste, plastic items and microplastics harm marine organisms through entanglement, ingestion, smothering and leakage of associated chemicals (Tekman et al., 2022[91]). The OECD estimated a total inflow of macroplastics into the ocean of 1.7 Mt in 2019 and projects this number to reach 4 Mt by 2060 (OECD, 2022[92]). This poses a major risk to the LAC region, where beaches show the second-highest levels of pollution in the world in terms of macro litter density (after Asia) (Haarr, Falk-Andersson and Fabres, 2022[93]).

The region lags in terms of waste management, including plastics. Almost 90% of plastics are mismanaged or sent to landfill in LAC, although this could be prevented at moderate costs. Only around 10% of plastic waste generated in LAC countries[16] was recycled in 2019, while 47% was landfilled and almost 42% mismanaged. The region's yearly plastic waste generation is expected to more than double by 2060. With current policies in place, these figures will improve insufficiently by that year, reaching only 17.5% recycled and still 25% mismanaged. This could be prevented at moderate costs: it is estimated that LAC could almost entirely prevent plastic leakages into its aquatic environments by 2060 at an annual cost of only 0.74% of its GDP (OECD, 2022[92]).

Marine plastic pollution is becoming a policy priority for the LAC region (UNEP, 2021[94]). Countries have set specific goals to reduce plastic waste (Box 3.4). Plastic-specific policies should target different lifecycle stages: 1) restrain demand (fiscal instruments that disincentivise the production and use of plastics, and other policies that enhance product design to increase their durability and favour reuse and repair). For example, taxes on plastics, packaging, promotion of circular design or repair services); 2) enhance recycling (includes instruments such as recycled content targets, extended producer responsibility (EPR) schemes or region-specific recycling rate targets); and 3) close leakage pathways (aims to decrease and eliminate mismanaged plastic waste by investing in waste management infrastructure and increasing litter collection rates) (OECD, 2022[92]). For plastic that cannot be avoided, the focus should be on circular design, recycling and closing leakage pathways (OECD, 2022[92]; Geyer, 2020[95]). Four critical levers for "bending the plastic curve" are: recycled (secondary) plastics markets; technological innovation for more circular plastics value chains; more coherent and ambitious domestic policy measures; and greater international co-operation.

Box 3.4. **Selected LAC commitments on plastics**

Chile's Plastic Pact commits (by 2025) to eliminating unnecessary and problematic single-use plastic packaging, ensuring that 100% of plastic packaging is reusable, recyclable, or compostable and incorporates 25% recycled content (Pacto Chileno de los Plásticos, 2020[96]). The National Strategy for Marine Waste and Microplastics Management commits to preventing 40% of waste from entering aquatic ecosystems by 2030 and to taking recovery actions (Ministerio del Medio Ambiente, 2021[97]). The EPR legislation requires 45% of plastic packaging to be recovered and recollected in households and 55% in other establishments by 2034 (Ministerio del Medio Ambiente, 2021[98]). The Roadmap for a Circular Chile by 2040 includes a 65% recyclability goal (Ministerio del Medio Ambiente, 2022[99]).

Box 3.4. **Selected LAC commitments on plastics** *(cont.)*

Colombia has launched a national plan for single-use plastics, all of which should be reusable, recyclable or compostable and have a minimum average recycled content of at least 30% by 2030 (Mesa Nacional para la Gestión Sostenible del Plástico, 2021[100]). The National Circular Economy Strategy (adopted in 2019) reinforces this goal (Gobierno de la Republica de Colombia, 2019[101]).

Mexico is collaborating with Canada and the United States in a project to transform recycling and solid waste management, to reduce waste (particularly plastics), close material loops and help minimise environmental impacts throughout value chains. North America has the highest per capita plastic consumption in the world. The region represents 21% of total global plastics consumption and four times the global average per capita paper consumption (Commission for Environmental Cooperation, 2021[102]).

Chile, Colombia and Mexico support the process towards a binding global treaty, which was launched in March 2022 with the adoption of the "End plastic pollution" resolution at United Nations Environment Assembly 5.2 (UNEP, 2022[103]).

Integrated collaborative policy responses are needed

Due to the variety of its sectors and the relationship between ecosystem services and human welfare, the blue economy requires comprehensive and integrated management of human activities to ensure that ecosystem goods and services are used sustainably and that balances environmental, economic and social concerns (Le Tissier, 2020[104]).

As a response to problems in coastal LAC – such as chaotic urbanisation, threats to indigenous cultures, degradation of ecosystems, loss of biodiversity, and effects of climate change on the socio-ecological system – integrated coastal zone management (ICZM) has been emerging as an effective strategy for ecosystem-based adaptation (Barragán Muñoz, 2020[105]). ICZM also offers important policy instruments for plastic waste abatement such as co-ordinated cleanups and the creation of marine protected areas (UNEP, 2021[106]). ICZM performance in LAC countries is still unsatisfactory, although results are heterogeneous. While most countries lack an adequate set of ICZM policies, strategies, regulation or institutions, Belize, Brazil and Puerto Rico are in developed stages of its application. This heterogeneity and the fact that coastal ecosystems are shared among countries call for greater international co-operation to achieve a joint response (Barragán Muñoz, 2020[105]).

An integrated solution also needs to highlight the role of the marine space. To prevent conflict among policy priorities and to reconcile nature conservation with economic development, human activities can be regulated and organised through maritime spatial planning (MSP). The status of MSP adoption differs greatly across LAC countries. Ecuador has applied MSP to the management and zoning planning of the Galapagos Islands while many countries in Central America and the Caribbean have initiated MSP, often with international funding support (e.g. the Caribbean Regional Oceanscape Project funded by the World Bank and the Global Environmental Facility) (World Bank, 2021[107]). Mexico is at a more advanced stage: it controls one of the largest exclusive economic zones in the world, which it has divided into planning regions based on ecosystem considerations for which it is developing regional marine spatial plans (Ehler, 2021[108]).

Due to their dependence and impact on ecosystems, ICZM and MSP should be applied as ecosystem-based approaches (EBA) to manage the interactions and trade-offs among the goods and services provided by ecosystems and various economic and social objectives. This implies the development of long-term ecosystem objectives and indicators for

adequate monitoring (Altvater and Passarello, 2018[109]; European Commission, 2021[110]). Monitoring tools, such as the Ocean+ Habitats Platform (UNEP-WCMC, 2022[111]) are crucial to enable data-based decision making. The Sustainable Ocean Economy Database provides policy analysis and guidance for the blue economy, sustainable use and conservation of the oceans, and management of climate-related risks (OECD, 2022[112]).

Key selected sectors for the green transition

Annex 3.A1 presents a list of selected sectors[17] identified as strategic for the LAC region to advance the green transition towards a more sustainable development model. These sectors are: 1) nature-based solutions, use of land, and biodiversity and forestry preservation (Annex Table 3.A.1); 2) sustainable agriculture and livestock (Annex Table 3.A.2); 3) the bioeconomy and regenerative food systems (Annex Table 3.A.3); 4) water management (Annex Table 3.A.4); 5) waste management and plastics (Annex Table 3.A.5); 6) sustainable tourism (Annex Table 3.A.6); and 7) sustainable mining (Annex Table 3.A.7). For each sector, some key facts are presented to show their importance for the region and their relevance to advance the green transition. Policy instruments and relevant experiences adopted are also detailed, to contribute to the policy-making process of the green transition.

Social policies for a just transition: The role of the labour market

The green transition will have a great impact on LAC societies. The job market, for example, will experience deep transformations. If properly addressed, broad green policies can create quality job opportunities for Latin Americans. If well-designed social and labour policies are implemented, better-paid formal jobs could be created by innovative firms, which will emerge in the green industries. Workers can benefit from this green dividend by transitioning to jobs with better working conditions. In LAC, where more than half of workers are informal, the green agenda can be an opportunity to create formal jobs (OECD, 2021[112]). However, the green transition will also entail economic costs. Fossil fuel extractive sectors will face considerable job losses, especially for the affected regions. Displaced workers may face skills obsolescence, which results in fewer opportunities to find new jobs (Dutz, Almeida and Packard, 2018[114]).

In this context, labour market and social policies play a crucial role both in stimulating the creation of high-quality new jobs and in cushioning the downside consequences of the transition to cleaner economies. Unemployment benefits and unemployment assistance should help workers affected by the transition's costs. In parallel, well-designed active labour market policies (ALMPs), such as training programmes, hiring incentives or placement services, are crucial both to promote green jobs and to boost the skills of workers who will lose their jobs. Non-contributory social protection policies, such as income support measures or conditional cash transfer programmes, may play a positive role in minimising the income losses of families with workers negatively affected by the green policies. The green transition can be an opportunity to move towards comprehensive and universal social protection systems, which include universal health insurance programmes, thanks to the shift towards formal jobs (ECLAC, 2022[14]; Grundke and Arnold, 2022[115]).

Quality green jobs for greater inclusion

The green agenda will be an unprecedented opportunity to improve well-being in LAC (Chapter 2). The effects of mitigation and adaptation policies on the labour markets of LAC countries will involve both the creation of new job opportunities and the loss of jobs due to the obsolescence of current technologies (Vona et al., 2018[116]). This section presents a sectoral forecast exercise to estimate the impact of green policies (Box 3.5).

Two types of economic sectors, the green and the brown sectors, have been identified. The rationale behind the empirical strategy is that adaptation to climate change policies, technological transformation, investment, and new green skills would boost job creation in green sectors. By contrast, some mitigation policies and regulations aimed at cutting GHG emissions and other pollutants would lead to job destruction in brown sectors, which have nonetheless recently been showing very low net employment growth in the region. The net effect on jobs will depend on both the industrial structure of each country and the effectiveness of the reform packages in boosting green job creation while softening the negative impact of mitigation policies on firms and the labour market.

Box 3.5. **Estimating the impact of the green agenda on net job creation**

The methodology implemented to analyse the impact of broad green agendas on net job creation in LAC countries is described in detail in OECD (forthcoming[117]).

Green jobs and green sectors

Green jobs are defined according to the methodology of Vona, Marin, Consoli, & Popp (2018[116]). The green transition will transform technologies. Jobs created will increasingly involve new tasks associated with less polluting and greener production processes. The Bureau of Labor Statistics O*NET database contains standardised, occupation-specific descriptors for nearly 1 000 occupations, covering the US economy. Detailed information is presented on the tasks that workers carry out in the labour market. The proportion of tasks that are green as a percentage of the total tasks carried out in each occupation is an indicator of the intensity of green tasks – i.e. of how green each occupation will be, based on the technological frontier. Under the assumption that green tasks performed by workers in LAC do not differ extensively from the ones at the frontier, for each LAC country, tasks identified in O*NET are matched to the labour force survey data on occupation, using the crosswalk provided in Hardy, Keister and Lewandowski (2018[118]). The level of detail of each match depends on the original occupation coding of the national labour force survey, resulting in

The definition of green sectors is based on the definition of green jobs. The distribution of green occupations across sectors is calculated. The ten industries that employ the most of green jobs are defined as green sectors. In LAC countries, green sectors represent between 6% and 90% of green jobs. These sectors should be considered "potentially green", as not all jobs in these industries are green, given the present distribution of tasks.

Brown sectors

Brown sectors will experience the destruction of jobs (Figure 3.12 and Figure 3.13). They are defined following the Climate Analysis Indicators Tool (CAIT) database on total GHG emissions (Climate Watch, 2020[119]). Brown sectors account for the most emissions. They are: 1) agriculture; 2) energy and heat production; 3) extraction and production of fossil fuels plus construction; 4) industrial processes; 5) transportation; and 6) waste management. The data on emissions are matched with national accounts data on value added by activity and employment time series from labour force surveys using ISIC Rev 3.1 or ISIC Rev 4 classifications of industries, depending on the availability in each LAC country.

Methodology of the forecasts

For both brown and green sectors, the forecasts present three scenarios compared to the business-as-usual (BAU) scenario. BAU assumes that value added and employment in green sectors for each LAC country will grow as in the past ten years (from 2010 and 2020). The effect of change in value added on employment is estimated at the sectoral level using a dynamic panel regression model (Arellano-Bond estimator) (Arellano and Bond, 1991[120]).

Box 3.5. **Estimating the impact of the green agenda on net job creation** *(cont.)*

Based on realistic assumptions found in the literature (OECD, forthcoming[117]), for green sectors, three policy scenarios assume the following impacts of green policies on investment in fixed and human capital: 1) in the high-impact scenario, value added will grow in each sector by 3 percentage points more than what would have been the case in the absence of any policy; 2) the medium-impact scenario assumes an additional sectoral value-added growth of 2 percentage points; and 3) in the low-impact scenario, the additional growth will be just 1 percentage point. In all three scenarios, total factor productivity (TFP) will grow by 1% due to the technological shifts induced by the green transition.

For brown sectors, it is assumed that green policies will reduce total emissions by 5% per year in each of the top emissions-intensive industries defined above. This would imply a reduction of approximately 40% in total CO_2 emissions in 2030 with respect to 2020 levels. Three future scenarios are assumed for each Latin American economy: 1) in the high-impact scenario, value added will decrease by 5 percentage points each year; 2) in the medium-impact scenario, it will decrease by 4 percentage points each year; and 3) in the low-impact scenario, it will decrease by 3 percentage points each year. In all three scenarios, total factor productivity (TFP) will grow by 1 percentage point, due to the technological shifts induced by the green transition.

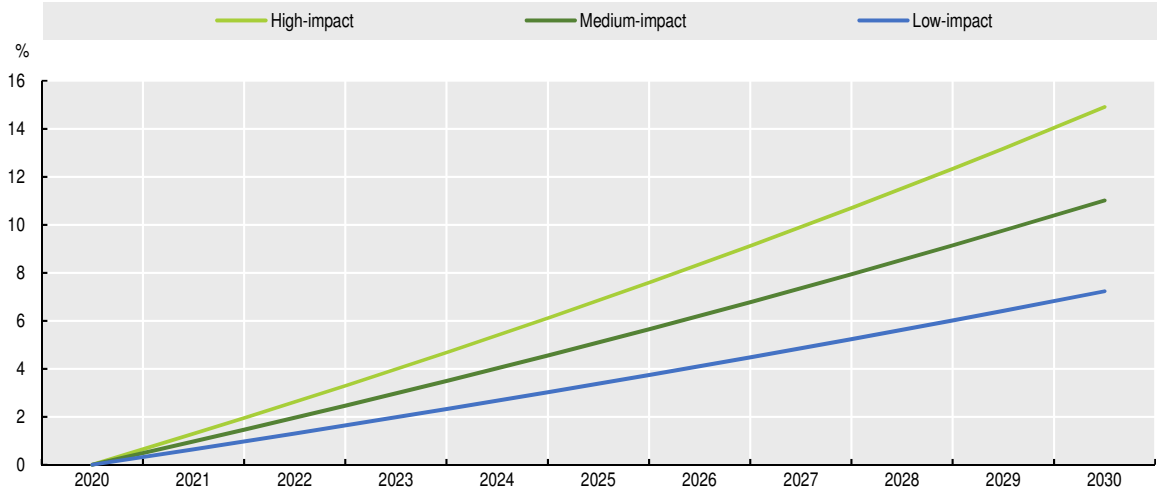
The estimated effects on employment are presented in proportional change compared to the BAU employment levels in the green and brown sectors in 2020. They represent the additional change compared to what would be in the absence of any policy change.

The overall effect of effective green policies on the Latin American labour market can be substantial. In the case of high-impact green policies, employment in green sectors could grow by 15% in LAC by 2030 compared to the baseline scenario (Figure 3.9). In absence of any policy intervention, the yearly average growth of employment would be 0.9% in green sectors. Green policies with high impact in stimulating private and public investment in new technologies and human capital would increase the yearly growth rate to 2.3%. Employment in potential green sectors represents 55% of total employment across LAC. The forecasts of employment growth in green sectors by 2030 are 11.0% in the case of medium impacts and 7.2% for low impacts compared to BAU. In the case of high impacts, estimates range from 18.9% for Bolivia to 12.6% for Brazil (Figure 3.10), signalling the potential of job creation in green sectors in all the countries of the region. The green transition can also be beneficial as a tool to boost overall economic growth and enhance productivity. Among the countries that would benefit the most are Ecuador, Guatemala and Paraguay, all with GDP per capita lower than the regional average.

The identification of green sectors depends on the distribution of green tasks across occupations and on the industrial structure of each LAC country, under the assumption that the tasks' content of jobs is similar to the one observed in the United States. However, some insights emerge at the regional level. Five out of ten sectors are present in at least six out of the nine countries covered. They are food production, construction, retail and wholesale trade, transport, and public administration. In total, they account for 67% of employment in potential green sectors in LAC, in 2020; as such, they would contribute the most to job creation over the next decade. Compared to the 15% of the total of green sectors, food production should add more jobs, with a forecasted 18.8% deviation from BAU in 2030, in the high-impact scenario. The other sectors would show a deviation from BAU as follows: public administration (14.6%), construction (14.3%), trade (14.1%) and transport (14.1%).

Figure 3.9. **Job creation in green sectors in LAC, 2020-30**

Change in employment in green sectors, under various green policies scenario, in LAC, compared to the BAU, as percentage of 2020 baseline employment in green industries



Notes: LAC countries include Argentina, Bolivia, Brazil, Colombia, Ecuador, Guatemala, Mexico, Paraguay and Uruguay. The data refer to an unweighted average over the countries' forecasts. Green sectors are defined in each country by first identifying the number of green tasks that workers perform in their occupations and then by looking at the top ten industries in which those jobs are distributed. The baseline scenario assumes that, in each green sector, value added and employment will follow the same dynamic as in the past ten years. The counterfactual scenarios are defined according to the impact of a green policy that aims to boost investment in fixed and human capital, with a positive impact on value added growth in each green sector. The high-impact scenario assumes that the value added in each sector will increase by 3 percentage points each year, adjusting to the new equilibrium. The medium-impact scenario assumes that the value added will increase by 2 percentage points, while the low-impact scenario assumes that it will increase by 1 percentage point each year. In all forecasts, Total factor productivity will increase by 1 percentage point due to lower climate damages and new technology-induced change. Employment change is forecasted using the estimated short-term elasticity to the value added, using a panel dynamic model, defined by each sector and country, in the last ten years.

Sources: Authors' estimates based on Labour Force Surveys, National Accounts data by industries, (Vona et al., 2018[115]) and (Hardy, Keister and Lewandowski, 2018[117]).

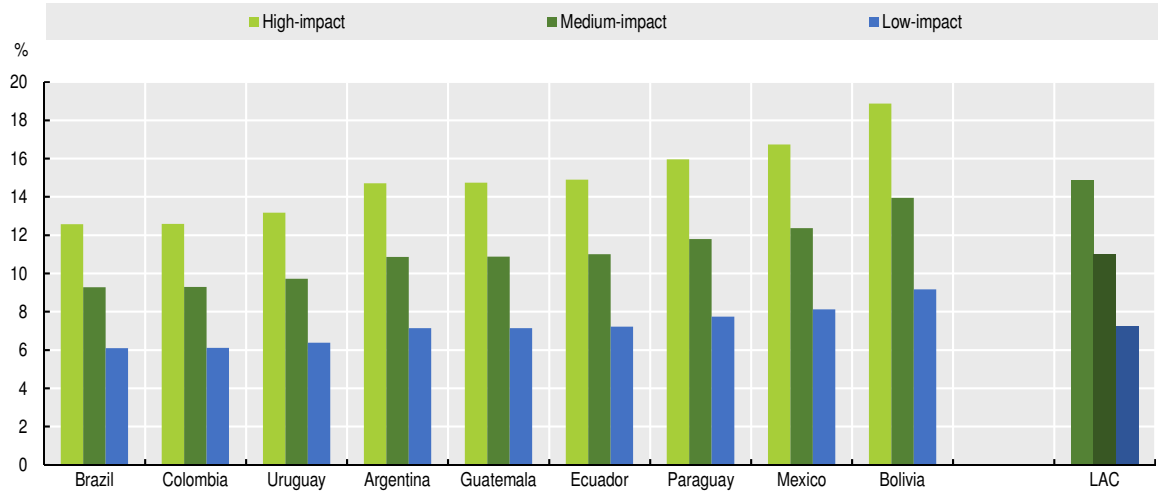
StatLink *https://stat.link/gpamzt*

Using a different methodology, the International Labour Organization (ILO) reports that agriculture will have more job creation (Saget, Vogt-Schilb and Luu, 2020[120]). Green policies would add 19 million full-time equivalent jobs by 2030, in this sector, with respect to the high-emissions scenario, a 54% increase. Employment in the renewable energy sector would add 22% more jobs in the decarbonisation scenario compared to the high-emissions scenario, representing 100 000 additional jobs. The construction sector would contribute 540 000 additional jobs linked to energy efficiency investments, representing a growth of 2% in employment in the sector compared to the baseline scenario. Some 120 000 jobs would be created in manufacturing to support low-carbon technologies, a net addition of 0.4% of employment in the sector. The forestry sector would create 60 000 jobs (6% of the sector's jobs). Green policies could increase the energy sector's productivity and create direct formal employment if they promote a green fiscal stimulus aimed at the energy industry. This is particularly the case in developing and middle-income countries with segmented and informal labour markets. After suffering adverse aggregate demand shocks it will be important to seek a bigger and longer-lasting boost to green labour-intensive projects. In these circumstances, the green transition and job creation may well go hand in hand (Bowen, 2012[123]). If green policies aiming at increasing the cost of carbon emissions are coupled with a reduction in labour tax wedge, the green transition may grant a double dividend in terms of both environmental goals and net job creation in LAC (OECD, 2018[124]; Willis et al., 2022[125]).

Only 0.8% of the LAC workforce was employed in the energy production sector in 2020, similar to the OECD average of 0.9% (Figure 3.11). Already today, more than half of all energy-related jobs in Central and South America are related to clean energy (IEA, 2022[122]) and this share is bound to increase further. Some 11.7% of workers were employed in manufacturing, which accounts for the majority of total CO_2 production in the economy, less than the OECD average of 15.2%. In LAC, the share of employment in the transport sector, another growing contributor to overall GHG emissions and pollution, stood at 6.7%, higher than the OECD average of 5.5%. Agriculture (the second-largest emitter of the region) accounts for 18% of the workforce, much higher than the OECD average of close to 6% in 2020.

Figure 3.10. **Job creation in green sectors in LAC countries**

Change in employment in green sectors under various impacts of green policy scenarios in selected LAC countries, compared to the BAU, as percentage of 2020 baseline employment in green industries



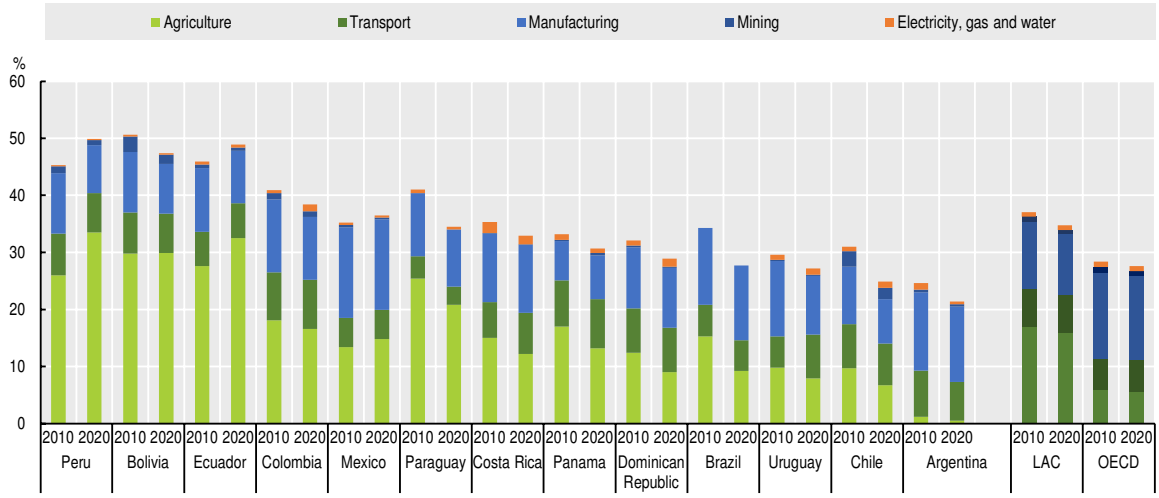
Notes: Green sectors are defined in each country by first identifying the number of green tasks that workers perform in their occupations and then by looking at the top ten industries in which those jobs are distributed. The baseline scenario assumes that, in each green sector, value added and employment will follow the same dynamic as in the past ten years. The counterfactual scenarios are defined according to the impact of a green policy that aims to boost investment in fixed and human capital, with a positive impact on value added growth in each green sector. The high-impact scenario assumes that the value added in each sector will increase by 3 percentage points each year, adjusting to the new equilibrium. The medium-impact scenario assumes that the value added will increase by 2 percentage points, while the low-impact scenario assumes that it will increase by 1 percentage point each year. In all forecasts, Total factor productivity will increase by 1 percentage point due to lower climate damages and new technology-induced change. Employment change is forecasted using the estimated short-term elasticity to the value added, using a panel dynamic model, defined by each sector and country, in the last ten years.

Sources: Authors' estimates based on Labour Force Surveys, National Accounts data by industries, (Vona et al., 2018[115]) and (Hardy, Keister and Lewandowski, 2018[117]).

StatLink https://stat.link/w4v0up

Figure 3.11. **Employment shares in industries with high intensity of GHG emissions**

As a percentage of total employment, 2010 and 2020



Notes: Data for Argentina refer to the urban areas. LAC and OECD refer to an unweighted average of the LAC and OECD countries. The industry categorisation follows the ISIC Rev. 4 codification of economic sectors.

Sources: Authors' estimates based on (ECLAC, 2022[122]) and (OECD, 2022[123]).

StatLink https://stat.link/3y8own

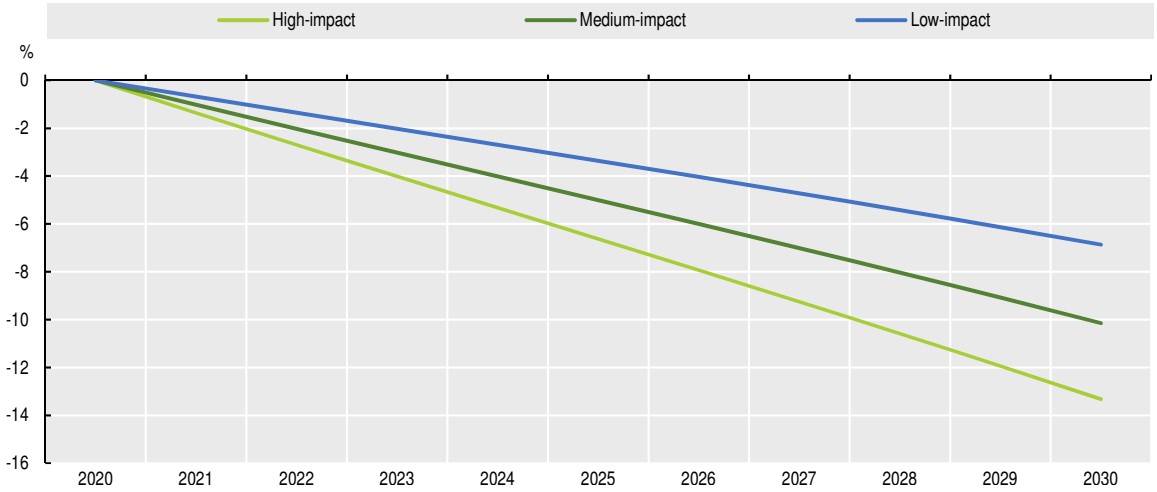
The green transition will inevitably have heterogeneous impacts in the agricultural sector in LAC, even if the effect on net job creation should be positive. Transitioning to cleaner and capital-intensive technologies in agriculture will translate into jobs losses, especially for informal workers (ECLAC/ILO, 2018[125]), even if the total net effect should be positive. The local dimension should be at the centre of green policies, as agriculture accounted for 53.5% of total employment (most being informal workers) in rural areas in 2020.

LAC countries have experienced a 20% growth in employment in industries linked to energy production, water supply and mining activities over the last decade. Manufacturing firms, which consume more energy, have added only a few jobs thanks in part to the process of digitalisation and robotisation, which normally implies more capital-intensive and labour-saving technologies. By contrast, employment shrunk in agriculture (-4.5%).

In the transition to a net-zero carbon economy, many jobs will be destroyed, and workers dismissed due to the technological shifts needed to achieve lower emissions, especially in brown industries. On average across LAC, brown industries could experience a higher decline in jobs – as much as 13.3% compared to the BAU scenario, in which no green policy is effectively put in place (Figure 3.12). All forecasted scenarios imply a bold target of -5% GHG emissions each year. If these targets were met, GHG emissions would decline by 40% in 2030 compared to 2020 levels. If firms invest in fixed capital more proactively and workers acquire greener skills and human capital, job losses will be significantly lower. For instance, in the medium- and low-impact scenarios, deviation from BAU in 2030 would be 10.1% and 6.9%, respectively. Public policies may help alleviate the transition. Public investment supporting technological transformation and adoption may help firms. ALMPs, such as retraining and education programmes, may help workers retain their jobs in the new technological environment or switch to new ones, with lower aggregate losses.

Figure 3.12. **Job losses in brown sectors in LAC, 2020-30**

Change in employment in brown sectors, under various mitigation policies scenarios in LAC, compared to the BAU, as percentage of 2020 baseline employment in brown industries



Notes: LAC countries include Argentina, Bolivia, Brazil, Colombia, Ecuador, Guatemala, Mexico, Paraguay and Uruguay. The data refer to an unweighted average over the country forecasts. Brown sectors are defined according to the CAIT definition (https://datasets.wri.org/dataset/cait-country). The baseline scenario assumes that, in each brown sector, GHG emissions, value added and employment will follow the same dynamic as in the past ten years. The counterfactual scenarios are defined according to the impact of a green policy that aims to reduce total GHG net emissions by 50% in 2030 compared to the 2020 levels in each brown sector. The high-impact scenario assumes that the value added in each brown sector will decrease by 5 percentage points each year, adjusting to the new equilibrium. The medium-impact scenario assumes that the value added will decrease by 4 percentage points, while the low-impact scenario assumes that it will decrease by 3 percentage points each year. In all forecasts, TFP will increase by 1 percentage point due to lower climate damages and new technology-induced change. Employment change is forecast using the estimated short-term elasticity to the value added, using a panel dynamic model, defined by each sector and country, in the last ten years.

Source: Authors' estimates based on CAIT data, labour force surveys and national accounts data by industries.

StatLink https://stat.link/fpgdl7

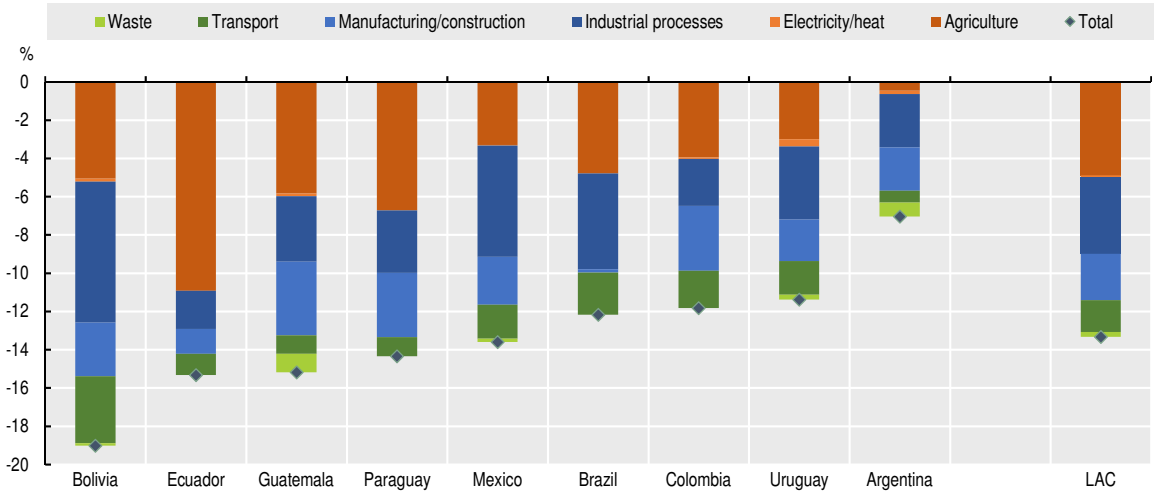
The net effect of the green transition on employment could be positive and will depend on the adaption mechanisms to create formal jobs resulting from the implementation of green policies. Even in the worst-case scenario, the effects would be positive compared to BAU. This is because brown sectors in LAC represent 35% of total employment, compared to 55% for green sectors. For instance, if green sectors created jobs according to the low-impact scenario and brown sectors destroyed jobs according to the high-impact scenario, this would still translate into an additional 1.8% of total employment in those sectors in 2030. In the case of medium-impact and high-impact policies for green sectors, in 2030, additional job creation would be 6.0% and 10.5% of total employment in the brown and green sectors, respectively. There is a clear incentive for governments to promote an active transition for green sectors, as it will increase job creation and formalisation.

Job losses would be felt among the brown industries of LAC, especially in agriculture and manufacturing, with 37% and 30% of the total losses, respectively. The transport sector would account for 12% of the total.

Across countries, jobs losses would range from 19% in Bolivia to 7% in Argentina (Figure 3.13) in the high-impact scenario, as it depends heavily on each industrial structure. In Ecuador, Guatemala and Paraguay, agriculture would account for the biggest part of the contraction (71%, 39% and 47% of the total, respectively). In Argentina, Brazil, Mexico and Uruguay, manufacturing would likely be the industry most affected, as it would account for 40%, 41%, 43% and 36% of total jobs by 2030, respectively.

Figure 3.13. **Job losses in brown sectors in a high-impact scenario in LAC**

Change in employment by 2030, compared to the BAU, as percentage of 2020 baseline employment in brown industries



Notes: LAC countries include Argentina, Bolivia, Brazil, Colombia, Ecuador, Guatemala, Mexico, Paraguay and Uruguay. The data refer to an unweighted average over the country forecasts. Brown sectors are defined according to the CAIT definition (https://datasets.wri.org/dataset/cait-country). The baseline scenario assumes that, in each brown sector, GHG emissions, value added and employment will follow the same dynamic as in the past ten years. The counterfactual scenarios are defined according to the impact of a green policy that aims to reduce total GHG net emissions by 50% in 2030 compared to the 2020 levels in each brown sector. The high-impact scenario assumes that the value added in each brown sector will decrease by 5 percentage points each year, adjusting to the new equilibrium. TFP will increase by 1 percentage point due to lower climate damages and new technology-induced change. Employment change is forecast using the estimated short-term elasticity to the value added, using a panel dynamic model, defined by each sector and country, in the last ten years. For Brazil, Colombia, Ecuador, and Paraguay, the waste sector could not be identified due to lack of disaggregated data either for value added or employment by industry.

Source: Authors' estimates based on CAIT data, labour force surveys and national accounts data by industries.

StatLink https://stat.link/kmnz6c

The IDB and the ILO show similar forecasts in terms of job losses. By 2030, 7.5 million jobs would be destroyed in fossil fuel electricity, fossil fuel extraction and animal-based food production (Saget, Vogt-Schilb and Luu, 2020[120]). More specifically, 4.3 million jobs would be lost in the livestock, poultry, dairy, fishing and animal-based food processing sectors compared to the high-emissions scenario, representing 29% of jobs in the sector. Fossil fuel extraction would lose more than 520 000 jobs (46%), while electricity from fossil fuel generation would also suffer a relatively important downsizing, with 60 000 fewer jobs (51%) compared to the baseline scenario.

Wages and job quality of jobs in brown sectors

Globally, the energy sector demands more high-skilled workers than other industries, with 45% of the workforce requiring some degree of tertiary education, from university degrees to vocational certifications. Less than 10% of energy employment is in low-skilled labour (IEA, 2022[122]). For the latter reason, energy sector wages typically see a premium over economy-wide average wages, though this premium ranges substantially from 10% to 50% across advanced economies alone. These premiums remain true across all regions, but the differences between wages in advanced economies and EMDEs remain pronounced, with the range of wages between geographies being larger than the range of jobs within the energy sector within the same region (IEA, 2022[122]).

Across the LAC region, jobs in the energy production industries are generally well paid, with wages standing close to 2 000 international dollars per month in 2020. Over the last decade, those wages experienced a 51% growth in real terms, one of the highest

among all industries. In industries that are normally highly dependent on energy and are the greatest net GHG emissions contributors, wages are generally higher than the mean across all sectors. They stand at 600 international dollars per month in agriculture, 1 500 in mining, 1 200 in manufacturing and 1 300 in transport. Great variation exists across countries. For instance, in the energy production sector, monthly earnings vary from USD 3 200 in Argentina to USD 650 in Guatemala. Jobs created in the sectors more exposed to the green policies are normally of high quality, but any job loss resulting from the technological transformation will also entail high costs in terms of income. Plant workers employed by large electricity generators in countries with good collective bargaining coverage, such as Chile, may benefit from agreements with their employers that allow them to keep their jobs and transition to other power plants in the country. This can be the case more generally for upstream fossil fuel workers employed by firms that diversify into renewable energy production (Saget, Vogt-Schilb and Luu, 2020[120]).

How to ensure a green and just transition for all

The green transition will inevitably affect groups of people in dissimilar ways. Jobs losses in high-carbon energy production firms may well be concentrated among older workers or workers lacking up-to-date skills to transition to cleaner technology firms. Moreover, workers in fossil base sectors are relatively few compared to the whole economy but concentrated in certain regions. It is essential to identify the socio-demographic groups and the regions that will benefit and those most at risk (Chapter 2), to design the best labour market and social policies to build an inclusive green agenda, where the most vulnerable people are not left behind and share the overall economic benefit of the transition. When assessing the just transition, the quality of clean energy jobs is as important as their quantity. Key criteria determining job quality include wages, medical insurance, retirement and other benefits, job security, terms of employment, occupational safety standards, union membership, and overall scope of labour rights. Globally, energy jobs pay more than the median national wage, however there are disparities between segments. Workers in less established clean energy industries typically earn less than jobs in the fossil fuel or nuclear industries (IEA, 2022[122]). Moreover, they high degree of labour informality in LAC poses further social issues (OECD et al., 2021[36]).Green policies must be designed to tackle successfully the redistributive effects of the transition.

Informal work and the green transition

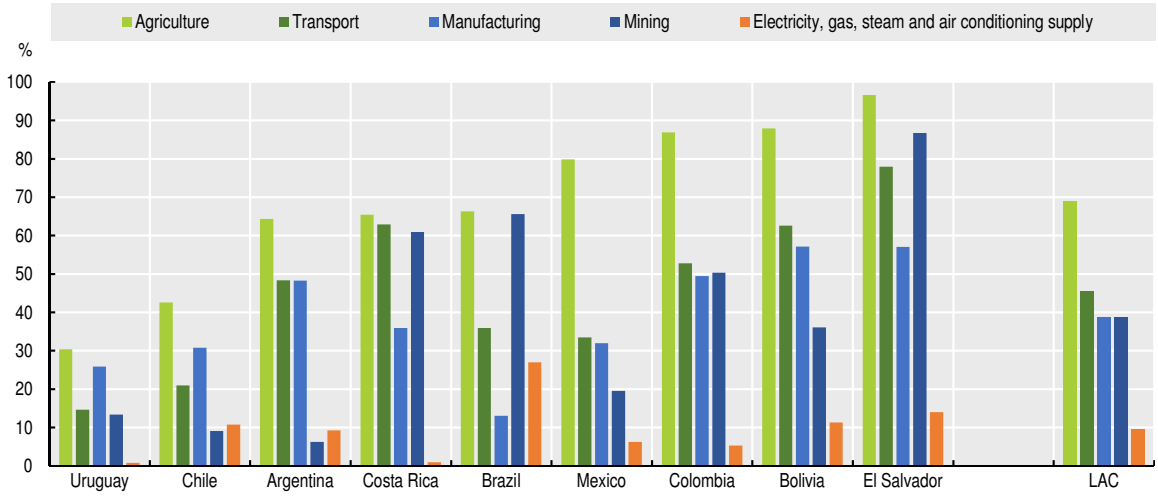
Informality is a widespread concern in LAC (Chapter 1). The share of informal employment excluding the agricultural sector is still close to 50% on average and close to 80% in several lower middle-income countries, such as Bolivia, Guatemala, Honduras and Nicaragua (OECD et al., 2021[37]). Informality rates among women are even higher (ILO, 2019c). Moreover, informal employment is higher in the agricultural sector (69% across LAC). In agriculture, child labour is also widespread; 71% of child labour globally occurs in agriculture (ILO, UNICEF, 2020[126]).

Across LAC, almost four out of ten workers in mining, manufacturing and transport services are informal. In agriculture, almost seven out of ten workers are informal (Figure 3.14). The heterogeneity is large across LAC countries. Mining industries are affected by large labour informality in Bolivia (36.0% of workers are informal), Colombia (50.3%), Costa Rica (60.9%) and El Salvador (86.7%). In manufacturing, the incidence of informal work is lower than or close to 30% in Brazil, Chile, Mexico and Uruguay. In transport services, informal workers represent more than half of the workforce in Bolivia, Colombia, Costa Rica and El Salvador. In these industries, the green transition will entail challenges, as technological transformation will be needed, and many informal workers may find themselves without jobs or forced to find new ones in other informal industries.

On the positive side, across LAC, less than 10% of workers in the electricity, gas, steam and air conditioning supply industries are informal. The incidence of labour informality is particularly low in Argentina (9.2%), Colombia (5.3%), and Costa Rica and Uruguay (less than 1%). Therefore, any direct transformation in the energy production matrix induced by policy changes will probably entail the creation of new formal jobs and opportunities for skilled workers, in the case of dismissal (OECD et al., 2021[37]).

Figure 3.14. **Informal work in sectors with a high intensity of GHG emissions**

As a percentage of total employment in each sector, 2019 or latest available year



Note: The LAC average is an unweighted average of the countries shown.
Source: Authors' estimates based on national household income surveys.

StatLink https://stat.link/7eskd2

A crucial step in extending contributory social insurance to the informal economy has been the extension of social and labour rights to domestic workers through a mix of: 1) enforcement and simplification measures (for instance in Argentina, Brazil, Ecuador and Uruguay); 2) including self-employed workers in social insurance schemes through adapted mechanisms and simplified registration, tax and contribution payment mechanisms (Argentina, Peru and Uruguay); 3) adapting contribution calculation and payment modalities to the characteristics of workers and employers affected by particular business conditions, such as seasonality (Brazil); 4) harnessing digital and mobile technology to facilitate access to social protection (Brazil and Uruguay); and 5) extending pension coverage through existing or new schemes adapted to the needs of self-employed workers (Brazil and Costa Rica) (OECD/ILO, 2019[127]).

Skills and life-long learning

New skills will have to be developed to attract new green investments (Cedefop, 2021[128]; ILO, 2019[129]). "Skills bottlenecks" and the supply of competences that do not meet firms' demand are among the barriers to investment in green industries. Severe skills shortages are already evident in fast-growing sectors, such as renewable energies and energy efficiency. Increased investments in a green industry may result in increased demand for a certain occupation, with no change in the skills needed for the job. In this case, skills are quantitatively scarce, and policies should focus on providing more specific training for potential new workers (ILO, 2018[130]). On the other hand, the green transition may change the bundles of skills needed to perform the same job, or it may cause the loss of certain occupations. In these cases, skills policies should focus on upskilling or

retraining the workers involved in the technological transformation. Sustainability and nature preservation should be considered new skills in the green transformation (OECD/Cedefop, 2014[131]). Skills anticipation and forecasting have been used extensively to define future developments of the tasks and the skills needed to perform greener jobs (Consoli et al., 2016[132]; Vona et al., 2018[116]).

Green jobs need an adaptation of existing on-the-job training courses. Effective examples already exist, in some OECD countries, like the Green Jobs Programme funded by the EU (Cedefop, 2022[133]). Nonetheless formal education and work experience are still important for green skills formation. Formal course offerings and degree programmes for these jobs are not yet well developed. Policies that promote learning by doing can fill the short-term gaps in current education policy (OECD/Cedefop, 2014[131]). Workforce development in green sectors is an area in which the private sector can play a key role. The private sector has put in place initiatives across the region, to allow companies to discover and connect with local talent to respond to emerging challenges with an open and collaborative mind-set. These strategic innovation hubs work with stakeholders, including business incubators, universities, and government institutions, to transform traditional businesses, effectively upskilling and developing these new green business models in the LAC region (OECD, forthcoming[134]).

Skills requirements of the new green jobs

In the green transition, workers need new skills to perform tasks in the new jobs created (ILO, 2019[129]; Cedefop, 2018[135]). Moreover, compliance with green energy regulations requires specialised skills and knowledge (Vona et al., 2018[116]). Many countries have adopted regulations on renewable energy or energy efficiency, including rules on skills certification and/or professional training. These rules often target specific occupations in certain sectors more linked to the green transformation, such as energy auditors, inspectors, assessors, energy managers, installers and operators of equipment and buildings (ILO, 2018[130]). Establishing regional policies on skills certification and training provision may increase investor confidence in a country's skills capital and help boost investment.

Although the sectoral approach has many benefits, including the relative ease of stakeholder co-ordination and the identification of specific skills needs, it is not sufficient to ensure comprehensive skills development for the green transition (Cedefop/OECD, 2015[136]; OECD/Cedefop, 2014[131]). From an economy-wide perspective, all sectors have potential for greening. It is crucial to identify skills needs arising from both direct and indirect job creation along supply chains and, in turn, design and implement training programmes. Because of the difficulties in co-ordinating the major players, there are few examples of good practices across countries (ILO, 2018[130]).

The assessment of skills needs can be both quantitative and qualitative. The green transition will cause changes in the number of workers in various occupations (quantitative assessment), as well as changes in the skills required for existing occupations (qualitative assessment) (Gregg, Strietska-Ilina and Büdke, 2015[137]). All major stakeholders should be involved in the green transition. For instance, the Chamber of Industry in Costa Rica carried out a study covering 100 of its 800 members to identify their skills needs for the green transition (ILO, 2018[130]). On the managerial side, new entrepreneurial skills will be essential to foster the adoption of innovative, environmentally friendly technology, human resource designs and higher productivity. Updating curricula is also key to ensure that future workers receive an education that allows them to take part in the transition (Saget, Vogt-Schilb and Luu, 2020[120]).

The role of lifelong learning in the acquisition of skills needed in the green transition

Skills gaps are a persistent issue over the working life cycle in LAC, and life-long training systems must be adapted to face the challenges of the green transition. The percentage of workers who receive some form of training is around 15% in LAC, much lower than the 56% across OECD countries (Alaimo et al., 2016[138]). In addition, life-long training is often offered to workers with higher education levels and those in formal and full-time employment, who are also the ones with more incentives and interests in skills' development along their careers. This perpetuates and amplifies the inequities acquired within the education system, feeding a vicious cycle of low investment in human capital, inadequate or obsolete skills, and low productivity levels (González-Velosa, Rosas and Flores, 2016[139]).

Expansion of social protection systems for a just green transition

This section explores the labour market policies and social protection mechanisms needed to boost job opportunities and other social outcomes of the green agendas, as well as to overcome and minimise the transition costs. In LAC, the unemployment rate is relatively low but with high labour turnover. Many workers are unemployed at some point, often resulting in losses in income and wages, which leads to significant welfare costs (Alaimo et al., 2016[138]; OECD et al., 2021[36]). The lack of employment and other social safety nets is a costly feature of LAC labour markets. The green transition will likely result in substantial job reallocations. It can be an opportunity to rethink social protection systems, boost job creation and protect workers in the case of job losses (OECD et al., 2021[36]; Saget, Vogt-Schilb and Luu, 2020[121]). OECD countries have put in place a broad range of policy actions towards green growth (OECD, 2015[140]; OECD, 2011[141]). LAC countries can benefit from the experience and design effective labour market mechanisms, along with social safety nets, aiming at an inclusive green growth strategy.

Unemployment benefits for workers dismissed due to the green transition

Unemployment benefits are inadequate in the LAC region. In 2020, 700 000 individuals received unemployment benefits (ECLAC, 2022[14]). Even where there is official coverage (Argentina, Brazil, Chile, Colombia, Ecuador, Mexico and Uruguay), unemployment insurance schemes often cover only a small proportion of workers and exclude underemployed and informal workers. Public expenditure on social security is limited, in part because of fiscal constraints. Structural fiscal reforms are therefore needed (Chapter 1) (ILO, 2018[130]). The green transition can be an opportunity to foster unemployment benefit schemes across the region. Some countries, such as Brazil, have invested considerably in creating a national registry of people and families to target and follow up on all social protection schemes. The main obstacles to adequate unemployment benefit schemes come not only from the high degree of labour informality but also from the financing, which increases labour costs for firms, with obvious impacts on employment levels (OECD et al., 2021[37]).

The traditional way in which most LAC countries protect workers from unemployment risks is through a combination of high severance payments and low unemployment insurance or unemployment assistance, with very low coverage overall. Through these systems, workers obtain job security at the cost of reduced employment creation, less capacity by firms to adapt to change and engage in technical innovation and increased atypical contracts and informal jobs (Cortázar, 2001[142]). Designing and implementing new unemployment insurance schemes may prove challenging, in the context of the green transition, where many sectors of the economy will be involved in profound technological transformations.

The competitiveness of many LAC countries is based partly on wages being lower than those of developed economies, which is not favourable for sustainable green growth (OECD et al., 2021[36]; OECD et al., 2020[143]). Governments must foster labour institutions, such as unemployment protection mechanisms, that transform employment relations through progressive structural change. In Latin America, unemployment insurance or similar schemes only operate in some countries, including Argentina, Brazil, Chile, Colombia, Ecuador, Mexico, Uruguay and Venezuela, and have undergone deep structural changes in the last two decades. In Argentina, Uruguay and Venezuela, they operate as pay-as-you-go systems, financed mainly from the affiliates' monthly contributions. Brazil's system relies on non-contributory schemes financed by general government revenues. In Ecuador, the two systems co-exist (Isgut and Weller, 2016[144]). In the rest of the region, the increase in coverage of social insurance has faced steep financing constraints. Individual saving accounts to cope with unemployment risks in Latin America are one of the possible policy options (Ferrer and Riddell, 2009[145]). Such accounts operate in a small but growing number of middle and high-income countries, where firms are legally obliged to make periodic contributions. The corresponding deposits earn interest and are paid as a lump sum or in monthly instalments subject to some eligibility conditions. When a worker loses his or her job, a certain amount can be withdrawn each month. However, individuals precariously attached to the labour market (e.g. those with part-time jobs, piecework contracts or fixed-term jobs, or employed in the informal sector, many of whom are women or young people) have very limited possibilities for accumulating the savings needed to cope with unemployment episodes. Moreover, these people tend to be unemployed most frequently. Individual accounts are rarely useful to them.

Active Labour Market Policies for greener economies

ALMPs refer to a broad range of policies that aim to activate workers with low employability or those who have lost their jobs due to dismissal. Policies include placement services, training programmes, hiring incentives, job rotation schemes or direct employment creation by public authorities (OECD/EU, 2020[146]).

ALMPs in LAC generally have a broader range of objectives (including poverty reduction, community development and equity promotion) compared to OECD countries, where ALMPs have mostly been seen as tools to address inefficiencies in labour markets, such as suboptimal investment in training and other labour market frictions (Escudero et al., 2018[147]). Despite the interest in ALMPs in developing countries, evidence of their effectiveness is still scarce (McKenzie, 2017[148]). In contrast to developed countries, ALMPs in developing countries, particularly in LAC, generally show positive, although small, effects on vulnerable groups (Card, Kluve and Weber, 2018[149]). Recent evidence from LAC shows that ALMPs are statistically more effective for women and youth than for the rest of the population (Escudero et al., 2018[147]). In the context of the green transition, in segmented labour markets with pervasive informality, induced structural change, green or otherwise, should be accompanied by active labour market policies, in order to grant an employment dividend (Bowen, 2012[123]).

If well designed, ALMPs can prove effective in the context of high informality. Providing job seekers with information about job vacancies and wage subsidies to work in a formal firm may improve their chances of employment, formality and earnings. These schemes are particularly important in the context of green agendas, as they may offset the negative effects of dismissal, especially for the most vulnerable groups, such as youth, informal workers and women (Novella and Valencia, 2019[150]). Such programmes could benefit from a component of skills training, which would help those who lose jobs gain the skills needed to re-enter the labour market. Active labour market policies targeted to dismissed workers, particularly those implemented during the COVID-19 pandemic, need to include

conditional clauses on skills training and, more broadly, education outcomes (Chapter 1). Certainly, these skills training mechanisms should emphasise factors affecting the future of jobs, such as green and digital transformations.

Given the high prevalence of labour informality, self-employment and entrepreneurship programmes are another tool to support the start-up and development of independent work activities or microenterprises. Usually, self-employment and microenterprise creation programmes include technical services, such as counselling, training and assistance with business planning, and direct financial support for the newly created business. All reviewed studies that have evaluated the employment impacts of self-employment and microenterprise creation programmes find positive effects. By contrast, findings are mixed concerning raising earnings or profits (Escudero et al., 2018[147]). Support to informal workers or micro-enterprises in the context of the green transition may be a viable solution, in case marginal firms face financial difficulties in coping with more stringent environmental regulations.

Expanding social protection systems to the most vulnerable

Social security coverage remains insufficient in LAC. More than half of workers in the region do not participate in any contributory social security system against risks related to illness, unemployment and old age (ILO, 2018[130]). In 2020, on average, only 40% of vulnerable people received some form of social assistance and around 60% of the population was covered by at least one social protection benefit. However, over the last 15 years, LAC countries have expanded the coverage of both contributory (financed by wages) and non-contributory (financed by taxes) social protection schemes (OECD et al., 2021[37]).

While significant progress has been made in building LAC social protection systems, many informal workers often remain excluded from them (OECD et al., 2021[36]; OECD/ILO, 2019[127]; ECLAC, 2022[14]). In many LAC countries, large groups in the population are not covered. Despite lower incomes and greater need for protection, informal workers often fall through the cracks of social protection systems, making many incomes insecure or vulnerable to income poverty, affecting families.

Recent trends show that extension of social protection coverage often occurs through the development of both contributory and non-contributory schemes (OECD/ILO, 2019[127]; OECD et al., 2021[36]). Many countries rely largely on public resources, including for subsidising contributions, which puts growing pressure on government budgets. In most LAC countries, the funding gap to extend social protection to informal workers remains particularly pronounced (Chapter 1).

Some Latin American countries have extended the coverage of contributory social protection schemes to informal workers. Success owes to several measures, such as combining support for the formalisation of enterprises with access to social protection schemes, extending statutory coverage to previously uncovered workers, adapting benefits, contributions and administrative procedures to reflect the needs of informal workers, and subsidising contributions for those with very low incomes. In addition, several countries expanded the fiscal space needed to scale up social protection programmes financed through general government revenues. These efforts have significantly contributed to building safety nets that guarantee universal health coverage and at least basic income security throughout the life cycle, for instance through tax-financed pensions, disability benefits, child benefits, maternity benefits or employment guarantee schemes (OECD et al., 2021[36]).

Individuals and households in LAC have a long tradition of informal networks of mutual support to cope with risks and uncertainty, especially in contexts where public options are

absent or limited, as in rural areas. Informal support is often organised around life cycle or livelihood risk and vulnerability. Private transfers received from friends, relatives and other households are another element of this form of inter-household informal protection. Around the mid-2010s, the share of private transfers in household income ranged from 4% in Bolivia and Honduras to around 15% in Costa Rica (OECD/ILO, 2019[127]). However, informal social protection has limitations. Studies suggest that informal risk-sharing mechanisms are close to efficiency when they protect from idiosyncratic shocks linked to individuals, households or life-cycle events, such as illness or death. They may fall short when it comes to broader shocks that affect a wider geographical area, such as a neighbourhood or community, which is likely the case for environmental health risks and the broad changes brought by green agendas. Income shocks may hurt poorer households, which are already financially constrained (Watson, 2016[151]). It is therefore crucial that public policies complement the informal mechanisms in place, to ensure a just, green transition for all people (OECD/World Bank, 2020[152]; ITF, forthcoming[153]; OECD, 2021[113])

Key policy messages

Box 3.6 presents preliminary policy messages to advance towards a more sustainable development model in LAC, based on the analysis presented in this chapter.

Box 3.6. **Key policy messages**

Towards a more sustainable energy matrix for LAC

- Transition towards diversified and adapted energy systems to include higher shares of renewable energy.
- Unlock non-hydro renewable energy potential, creating the necessary conditions in terms of regulation, economic incentives and promoting investment.
- Foster electrification to accelerate progress towards systemic decarbonisation by implementing integrated and effective power sector planning.
- Advance towards a systemic approach to the energy sector within national and regional economies, promoting energy systems that are better integrated across sectors, are more energy efficient and reduce total energy demand. The industrial and transport sectors have considerable savings potential.
- Increase energy integration between countries to generate economies of scale. Regional electricity integration could help incorporate variable renewables into energy systems and address potential vulnerabilities related to climate change (e.g. if a drought affects hydropower capacity in producing countries, alternative energy sources could be provided by neighbouring countries).
- Promote investments in electricity grids (transmission and distribution) to close territorial gaps between energy generation and energy demand areas.
- Advance towards universal access to electricity in LAC by, for example, establishing an energy access fund to roll out energy access programmes via mini-grids and to finance off-grid entrepreneurs and improve affordability for low-income households.
- Harness the opportunities arising from the surge in global demand for critical minerals that are abundant in LAC. The region should aim to integrate into global value chains in a more strategic way that in past transitions, putting sustainability, citizens' well-being and the potential for productive integration at the centre.

Box 3.6. **Key policy messages** *(cont.)*

- Build regional energy security and resilience in the face of external shocks. Increase efforts, particularly in the Caribbean subregion, to transition towards a more renewable energy matrix, profiting from solar, wind, ocean, geothermal and biomass potential, as a strategy to ensure energy security and mitigate GHG emissions.

Transformation of the production structure

- Develop industrial policies to advance a more sustainable production structure including policies on investment, foreign trade, science, technology and innovation, and training and skills development, with a special focus on MSMEs
- Promote innovation, adoption of green and energy-efficient technologies, and diversification towards less resource-intensive sectors, by connecting representatives from governments, industry, academia and civil society.
- Encourage and attract investments in green innovation, while taking advantage of new trade opportunities, both to foster regional integration and to join global chains in higher-value segments, ensuring environmental criteria in exports, and sustainable and responsible sourcing.
- Develop or update national sustainable and circular economy strategies that are open to all stakeholders and to all levels of government, advancing towards place-integrated and interconnected policies.
- Promote R&D investment to foster innovation to increase the competitiveness of industrial sectors, enabling solutions in products, services, business models and behaviour (consumption/use) with lower emissions and resource intensity.
- Unlock the blue economy potential for the green transition by adopting an ecosystem-based approach that manages trade-offs and pays particular attention to fishery and aquaculture, sustainable tourism, renewable energy generation, integrated management of river basins and lakes, and marine ecosystems protection.
- For the service-based economies of the Caribbean, adopt a circular economy strategy that minimises material and energy use and promotes sustainable tourism models that generate quality formal jobs, and reduce emissions and negative externalities.

Quality green jobs for greater inclusion

- Foster job creation in the new green technologies with a tailored mix of innovation and employment incentives, training schemes and job placement services.
- Promote additional public and private investments that contribute to increase the necessary value added of green sectors to boost the creation of formal jobs.
- Protect workers from job losses due to the green transformation, through well-designed and co-ordinated social assistance schemes, individual unemployment accounts and ALMPs to activate the most vulnerable workers negatively affected by the transformation.
- Create a social protection floor to protect living standards for those who have no access to unemployment benefits or assistance; guarantee at least universal access to essential health care and targeted basic income, while ensuring sustainable and equitable financing of these measures.
- Incentivise the transition of informal workers to new, productive firms involved in green technologies. Reinforce self-employment and entrepreneurial programmes through ALMPs to help the formalisation of micro-firms negatively impacted by the transition.

Box 3.6. **Key policy messages** *(cont.)*

- Ensure continued social protection coverage during labour market transitions, including by ensuring coverage for workers in all types of employment and by facilitating portability of entitlements between schemes.
- Tackle environmental health risks by expanding general health coverage and/or targeting measures to the most exposed people, such as those who lack sanitation services or adequate access to good quality air or water.

Notes

1. Transformative change is defined as "a system-wide change that requires more than technological change through consideration of social and economic factors that, with technology, can bring about rapid change at scale" (IPCC, 2022[1]), thus associating transformative change to the notion of systemic change or change in the system structure and its interactions.
2. Installed capacity is the maximum amount of electricity that a generating station can produce under specific conditions. While electricity generation is the amount of electricity that is produced over a specific period of time. Given that some renewable sources of energy depend on the sun or the wind, one refers to their installed capacity as a measure of their potential contribution to electricity generation.
3. The Caribbean Community is an intergovernmental organisation with 15 member states: Antigua and Barbuda, Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, Haiti, Jamaica, Montserrat, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, and Trinidad and Tobago.
4. Antigua and Barbuda, Aruba, Barbados, Curacao, Guadeloupe, Guyana, Jamaica, Saint Lucia, Saint Kitts and Nevis, and Saint Vincent and the Grenadines are some of the countries that already have or are actively pursuing RE installations (ECLAC, 2021[12]).
5. Bolivia, Chile, Colombia, Costa Rica, the Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Nicaragua, Panama, Paraguay, Peru and Uruguay. The technical secretariat of RELAC is led by the Inter-American Development Bank (IDB).
6. The OECD "Equitable Framework and Finance for Extractive-based Countries in Transition (EFFECT)" assists policy makers in designing comprehensive strategies to advance the low-carbon transition, avoid high-carbon lock-in and leave no-one behind in a global low-carbon economy.
7. Associated gas is natural gas produced along with crude oil, which is often seen as an inconvenient by-product of oil production.
8. CCUS refers to the process of capturing, utilising, transporting and storing underground CO_2 to avoid its release into the atmosphere.
9. The study has been carried out using the PLEXOS Integrated Energy Model, a simulation software designed for energy market analysis by Energy Exemplar. It was first developed as an electricity market simulator. Later, its functionality was extended so that the latest versions of PLEXOS integrate electricity, gas, heat and water (https://energyexemplar.com/solutions/plexos/).
10. This scenario considers only existing binational interconnections and low transmission integration between countries in the region. The supply seeks to meet the projected demand of the region by 2032.
11. The main results in the scenario of greater integration (RE+INT) show lower levels of solar PV and wind technology adoption than in the non-integrated scenario (RE and BE). This is due to higher system efficiencies and the ability to reduce the number of new generation plants.
12. Extended Producer Responsibility (EPR) is a policy approach under which producers are given a significant responsibility – financial and/or physical – for the treatment or disposal of post-consumer products. Assigning such responsibility could in principle provide incentives to prevent waste at the source, promote product design for the environment and support the achievement of public recycling and materials management goals (OECD, 2016[207]).
13. Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, Guatemala, Honduras, Mexico, Panama, Peru, Dominican Republic and Uruguay.

14. LAC includes territories in Antigua and Barbuda, Argentina, Bahamas, Barbados, Belize, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, Grenada, Haiti, Honduras, Jamaica, Peru, Mexico, Nicaragua, Panama, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, Trinidad and Tobago, Uruguay, and Venezuela.
15. Technical potential is a term used to describe the energy that is extractable with current technology. It specifically refers to the total Installed Capacity [GW] for fixed and floating foundations within 200 kilometres of the shoreline (World Bank/ESMAP, 2020[88]).
16. The average for LAC countries does not include Chile, Colombia, Costa Rica and Mexico, since these countries were included in the OECD group for analysis (OECD, 2022[92]).
17. The selection of sectors was based on discussions held with LAC delegates to the Governing Board of the OECD Development Centre, public officials, experts, academics and private-sector representatives at the following events: Experts Meetings (28-29 April 2022 and 3 August 2022); LAC Forum 2022 (8 July 2022); OECD Emerging Markets Network LAC Roundtable Consultation on the Latin American Economic Outlook 2022 (17 June 2022); and desk research.

References

AFD (2022), *A smart App for sustainable fishing in Mexico*, Agence Française de Développement, Paris, http://www.afd.fr/en/actualites/smart-app-sustainable-fishing-mexico (accessed on 25 July 2022). [83]

Alaimo, V. et al. (2016), *Jobs for Growth*, Inter-American Development Bank, Washington, DC, https://doi.org/10.18235/0000139. [138]

Alova, Galina (2018), "Integrating renewables in mining: Review of business models and policy implications", *OECD Development Policy Papers*, No. 14, OECD Publishing, Paris, https://doi.org/10.1787/5bbcdeac-en. [206]

Altenburg, T. and C. Assmann (eds.) (2017), *Green Industrial Policy: Concept, Policies, Country Experience*, UN Environment; German Development Institute / Deutsches Institut für Entwicklungspolitk (DIE), Geneva/Bonn, https://wedocs.unep.org/20.500.11822/22277. [37]

Altvater, S. and C. Passarello (2018), *Implementing the Ecosystem-Based Approach in Maritime Spatial Planning*, European MSP Platform, Brussels, https://maritime-spatial-planning.ec.europa.eu/sites/default/files/20181025_ebainmsp_policybrief_mspplatform.pdf. [109]

Aramendis, R., A. Rodríguez and L. Krieger Merico (2018), *Contribuciones a un gran impulso ambiental en América Latina y el Caribe: bioeconomía*, Economic Commission for Latin America and the Caribbean, Santiago, https://repositorio.cepal.org/handle/11362/43825. [174]

Arellano, M. and S. Bond (1991), *Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations*, Oxford University Press, Oxford, http://www.jstor.org/stable/2297968. [120]

Banks, J. and A. Miranda-González (2022), *A Methane Champion: Colombia becomes first South American country to regulate methane from oil and gas*, Clean Air Task Force, Boston, http://www.catf.us/2022/02/methane-champion-south-america-colombia-becomes-first-south-american-country-regulate-methane/ (accessed on 1 August 2022). [21]

Bárcena, A. (2020), *Mobilizing international solidarity, accelerating action and embarking on new pathways to realize the 2030 Agenda and the Samoa Pathway: Small Island Developing States*, Economic Commission for Latin America and the Caribbean, Santiago, http://www.cepal.org/en/presentations/mobilizing-international-solidarity-accelerating-action-and-embarking-new-pathways. [168]

Bárcena, A. et al. (2018), *Economics of climate change in Latin America and the Caribbean: a graphic view*, Economic Commission for Latin America and the Caribbean, Santiago, https://repositorio.cepal.org/bitstream/handle/11362/43889/1/S1800475_en.pdf. [53]

Barragán Muñoz, J. (2020), "Progress of coastal management in Latin America and the Caribbean", *Ocean and Coastal Management*, Vol. 184, https://doi.org/10.1016/j.ocecoaman.2019.105009. [105]

BIOFIN Costa Rica (2021), *Finance for Biodiversity*, Habitat Restoration Specialist for Biodiversity Finance Initiative Costa Rica, San José, https://biofin.cr/en/ (accessed on 15 July 2022). [197]

BNamericas (2021), *Unlocking Argentina's leviathan offshore wind potential*, BNamericas, Santiago, https://www.bnamericas.com/en/interviews/unlocking-argentinas-leviathan-offshore-wind-potential (accessed on 10 July 2022). [86]

Borges, M. et al. (2021), *Contribución de la bioeconomía a la recuperación pospandemia de COVID-19 en el Uruguay*, Recursos Naturales Ydesarrollo 208, Economic Commission for Latin America and the Caribbean, Santiago, https://www.cepal.org/sites/default/files/publication/files/47255/S2100314_es.pdf. [177]

Bowen, A. (2012), *'Green' Growth, 'Green' Jobs and Labor Markets*, World Bank, https://doi.org/10.1596/1813-9450-5990. [123]

BP (2021), *bp Statistical Review of World Energy 2021*, BP, London, https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html. [18]

CAF (2021), *RED 2021: Pathways to integration: trade facilitation, infrastructure, and global value chains*, Development Bank of Latin America, Caracas, http://scioteca.caf.com/handle/123456789/1907. [6]

CAF (2017), *Agua y saneamiento en la nueva ruralidad de América Latina*, Development Bank of Latin America, Caracas, https://www.caf.com/es/actualidad/noticias/2017/02/agua-y-saneamiento-en-la-nueva-ruralidad-de-america-latina/ (accessed on 3 August 2022). [178]

Card, D., J. Kluve and A. Weber (2018), "What Works? A Meta-Analysis of Recent Active Labor Market Program Evaluations", *Journal of the European Economic Association*, Vol. 16/3, pp. 894-931, https://doi.org/10.3386/w21431. [149]

Cedefop (2022), https://www.cedefop.europa.eu/en/tools/matching-skills/all-instruments/green-jobs-programme. [133]

Cedefop (2021), *Get your skills together for Europe's green deal*, https://www.cedefop.europa.eu/en/news/get-your-skills-together-europes-green-deal#group-related. [128]

Cedefop (2018), *Skills for green jobs: 2018 update*, https://www.cedefop.europa.eu/files/3078_en.pdf. [135]

Cedefop/OECD (2015), *Green skills and innovation for inclusive growth*, Publications Office of the European Union, Luxembourg, https://doi.org/10.2801/49143. [136]

Chateau and Mavroeidi (2020), "The jobs potential of a transition towards a resource efficient and circular economy", *OECD Environment Working Papers*, No. 167, OECD Publishing, Paris, https://doi.org/10.1787/28e768df-en. [63]

Circular Economy Coalition of Latin America and the Caribbean (2022), *Circular Economy in Latin America and the Caribbean: A Shared Vision*, United Nations Evironment Programme Circular Economy Coalition of Latin America and the Caribbean, https://emf.thirdlight.com/link/5fhm4nyvnopb-e44rhq/@/#id=0. [189]

Claes, J. et al. (2022), *Blue carbon: The potential of coastal and oceanic climate action*, McKinsey & Company, https://www.mckinsey.com/capabilities/sustainability/our-insights/blue-carbon-the-potential-of-coastal-and-oceanic-climate-action. [81]

Climate Watch (2020), *Country Greenhouse Gas Emissions Data [database]*, Climate Watch, Washington, DC, https://datasets.wri.org/dataset/cait-country (accessed on 20 June 2022). [119]

Climate-ADAPT (2021), *Water management*, Climate-ADAPT, https://climate-adapt.eea.europa.eu/eu-adaptation-policy/sector-policies/water-management (accessed on 6 July 2022). [180]

Commission for Environmental Cooperation (2021), *Transforming Recycling and Solid Waste Management in North America*, Commission for Environmental Cooperation, Montreal, http://www.cec.org/transforming-recycling-and-solid-waste-management-in-north-america/ (accessed on 29 June 2022). [102]

Consoli, D. et al. (2016), "Do green jobs differ from non-green jobs in terms of skills and human capital?", *SPRU Working Paper*, University of Sussex Business School, Brighton, https://www.sussex.ac.uk/webteam/gateway/file.php?name=2015-16-swps-consoli-etal.pdf&site=25. [132]

Contreras-Lisperguer et al. (2017), *Cradle-to- Cradle approach in the life cycle of silicon solar photovoltaic panels*. [73]

Cordonnier, J. and D. Saygin (forthcoming), "Green hydrogen opportunities for emerging and developing economies: Identifying success factors for market development and building enabling conditions", *OECD Environment Working paper*, OECD Publishing, Paris. [210]

Cortázar, R. (2001), "Unemployment Insurance Systems for Latin America", in *Labor Market Policies in Canada and Latin America: Challenges of the New Millennium*, Springer, Boston, https://doi.org/10.1007/978-1-4757-3347-1_4. [142]

CTAGUA (2022), *Centro Tecnológico del Agua*, Centro Tecnológico del Agua, Montevideo, https://ctagua.uy/ (accessed on 12 May 2022). [183]

de Miguel, C. et al. (2021), "Economía circular en América Latina y el Caribe: oportunidad para una recuperación transformadora", *Documentos de Proyectos*, (LC/TS.2021/120), Economic Commission for Latin America and the Caribbean, Santiago, https://hdl.handle.net/11362/47309. [66]

Dechezleprêtre, A. et al. (2019), "Do environmental and economic performance go together? A review of micro-level empirical evidence from the past decade or so", *International Review of Environmental and Resource Economics*, Vol. 13/1-2, pp. 1-118, https://doi.org/10.1561/101.00000106. [43]

Diez, S. et al. (2019), *Marine Pollution in the Caribbean: Not a Minute to Waste*, World Bank, Washington, DC, https://documents1.worldbank.org/curated/en/482391554225185720/pdf/Marine-Pollution-in-the-Caribbean-Not-a-Minute-to-Waste.pdf. [89]

Dini and Stumpo (2019), "Mipymes en América Latina: un frágil desempeño y nuevos desafíos para las políticas de fomento", *Project Documents*, (LC/TS.2019/20), Economic Commission for Latin America and the Caribbean, Santiago, https://www.cepal.org/es/publicaciones/44603-mipymes-america-latina-un-fragil-desempeno-nuevos-desafios-politicas-fomento. [50]

Dominish, E., N. Florin and S. Teske (2019), *Responsible Minerals Sourcing for Renewable Energy*, Report prepared for Earthworks, Institute for Sustainable Futures, University of Technology Sydney, https://earthworks.org/wp-content/uploads/2021/09/MCEC_UTS_Report_lowres-1.pdf. [203]

Dutz, M., R. Almeida and T. Packard (2018), *The Jobs of Tomorrow: Technology, Productivity, and Prosperity in Latin America and the Caribbean*, Directions in Development--Information and Communication Technology, World Bank, Washington, DC, https://openknowledge.worldbank.org/handle/10986/29617. [114]

ECLAC (2022), *CEPALSTAT [database]*, Economic Commission for Latin America and the Caribbean, Santiago, https://statistics.cepal.org/portal/cepalstat/dashboard.html?lang=en (accessed on 30 July 2022). [123]

ECLAC (2022), *Social Panorama of Latin America 2021*, (LC/PUB.2021/17-P), Economic Commission for Latin America and the Caribbean, Santiago, https://repositorio.cepal.org/bitstream/handle/11362/47719/1/S2100654_en.pdf. [14]

ECLAC (2022), *Water resources*, Economic Commission for Latin America and the Caribbean, Santiago, https://www.cepal.org/en/topics/water-resources (accessed on 28 May 2022). [179]

ECLAC (2021), "Conceptualizing a circular economy in the Caribbean: perspectives and possibilities", *Policy Brief*, No. LC/CAR/2021/7, Economic Commission for Latin America and the Caribbean, Santiago, https://repositorio.cepal.org/bitstream/handle/11362/47604/LCCAR2021_07_en.pdf?sequence=1&isAllowed=y. [12]

ECLAC (2021), *Latin America and the Caribbean Has All the Right Conditions to Become a Renewable Energy Hub with Great Potential in Green Hydrogen*, Economic Commission for Latin America and the Caribbean, Santiago, https://www.cepal.org/en/news/latin-america-and-caribbean-has-all-right-conditions-become-renewable-energy-hub-great (accessed on 10 August 2022). [11]

ECLAC (2021), *SDGs in Latin America and the Caribbean: Statistical knowledge management hub: Regional SDG statistical profiles by target [database]*, Economic Commission for Latin America and the Caribbean, Santiago, https://agenda2030lac.org/estadisticas/regional-sdg-statistical-profiles-target-1.html?lang=en (accessed on 9 May 2022). [70]

ECLAC (2020), *Building a New Future: Transformative Recovery with Equality and Sustainability. Summary*, Economic Commission for Latin America and the Caribbean, Santiago, https://www.un-page.org/files/public/eclac_recovery_modelling.pdf. [34]

ECLAC (2020), *Economics of climate change in Latin America and the Caribbean: A Graphic View*, Economic Commission for Latin America and the Caribbean, Santiago, https://repositorio.cepal.org/bitstream/handle/11362/43889/1/S1800475_en.pdf. [186]

ECLAC (2018), *Gobernanza de los Recursos Naturales en América Latina y el Caribe para el desarrollo sostenible*, Economic Commission for Latin America and the Caribbean, Santiago, https://www.cepal.org/sites/default/files/presentation/files/181119-final_final_corta-giz_revisada_alicia_barcena_ministros_mineria_limarev.pdf. [28]

ECLAC/ILO (2018), *Employment Situation in Latin America and the Caribbean: Environmental sustainability and employment in Latin America and the Caribbean*, No. 19 (LC/TS.2018/85), Economic Commission for Latin America and the Caribbean, Santiago, https://repositorio.cepal.org/handle/11362/44186. [125]

Ecoins (2022), *Preguntas frecuentes*, Ecoins, San José, https://ecoins.eco/preguntas-frecuentes/ (accessed on 2 August 2022). [193]

Econometría Consultores (2022), *Modeling of the macroeconomic effects of the transition to the circular economy for Latin America: cases of Chile, Colombia, Mexico and Peru*, Economic Commission for Latin America and the Caribbean, Santiago, https://www.euroclima.org/images/2022/03/02/Modelo_Economia_Circular.pdf (accessed on 27 May 2022). [64]

Ehler, C. (2021), "Two decades of progress in Marine Spatial Planning", *Marine Policy*, Vol. 132, https://doi.org/10.1016/j.marpol.2020.104134. [108]

Ellen MacArthur Foundation (2019), *Completing the Picture: How the Circular Economy Tackles Climate Change*, Ellen MacArthur Foundation, Cowes, https://emf.thirdlight.com/link/w750u7vysuy1-5a5i6n/@/preview/1?o. [59]

Ellen MacArthur Foundation (2013), *Towards The Circular Economy*, Ellen MacArthur Foundation, Cowes, https://www.werktrends.nl/app/uploads/2015/06/Rapport_McKinsey-Towards_A_Circular_Economy.pdf. [57]

Escudero, V. et al. (2018), "Active Labour Market Programmes in Latin America and the Caribbean: Evidence from a Meta-Analysis", *Research Department Working Paper*, No. 20, International

Labour Office, Geneva, https://www.ilo.org/wcmsp5/groups/public/---dgreports/---inst/documents/publication/wcms_577292.pdf. [147]

Estado de Querétaro (2022), *Sistema Economía Circular Querétaro*, https://autoqro.mx/economia-circular (accessed on 20 July 2022). [65]

European Commission (2021), *Communication from the Commission on a new approach for a sustainable blue economy in the EU: Transforming the EU's Blue Economy for a Sustainable Future*, European Commission, Brussels, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2021%3A240%3AFIN. [110]

European Parliament (2022), *Taxonomy: MEPs do not object to inclusion of gas and nuclear activities*, European Parliament, Luxembourg City, https://www.europarl.europa.eu/news/en/press-room/20220701IPR34365/taxonomy-meps-do-not-object-to-inclusion-of-gas-and-nuclear-activities (accessed on 10 August 2022). [23]

FAO (2021), *Climate Smart Agriculture Sourcebook*, Food and Agriculture Organization, Rome, https://www.fao.org/climate-smart-agriculture-sourcebook/production-resources/module-b6-water/chapter-b6-4/en/. [181]

FAO (2021), *Hacia una agricultura sostenible y resiliente en América Latina y el Caribe. Análisis de siete trayectorias de transformación exitosas*, Food and Agriculture Organization, Regional Office for Latin America and the Caribbean, Santiago de Chile, https://doi.org/10.4060/cb4415es. [154]

FAO (2014), *Agriculture, Forestry and Other Land Use Emissions by Sources and Removals by Sinks*, FAO Statistics Series, ESS/14-02, Food and Agriculture Organization, Rome, http://www.fao.org/3/i3671e/i3671e.pdf. [159]

FAO/UNEP (2020), *The State of the World's Forests 2020: Forests, biodiversity and people*, Food and Agriculture Organization/United Nations Environment Programme, Rome, https://doi.org/10.4060/ca8642en. [155]

Ferrer, A. and W. Riddell (2009), "Unemployment Insurance Savings Accounts in Latin America: Overview and Assessment", *Social Protection Discussion Paper*, No. SP 0910, World Bank, Washington, DC, http://documents.worldbank.org/curated/en/438061468044956180/Unemployment-insurance-savings-accounts-in-Latin-America-overview-and-assessment. [145]

Food Navigator (2019), *'A major step forward': Brazil founds trade group for carbon-neutral meat*, Food Navigator, Montpellier, France, http://www.foodnavigator-latam.com/Article/2019/02/25/A-major-step-forward-Brazil-founds-trade-group-for-carbon-neutral-meat?utm_source=copyright&utm_medium=OnSite&utm_campaign=copyright. [172]

Forti, V. et al. (2020), *The Global E-waste Monitor 2020: Quantities, flows and the circular economy potential*, United Nations University (UNU)/United Nations Institute for Training and Research (UNITAR) – co-hosted SCYCLE Programme, International Telecommunication Union (ITU) & International Solid Waste Association (ISWA), Bonn/Geneva/Rotterdam, https://ewastemonitor.info/wp-content/uploads/2020/11/GEM_2020_def_july1_low.pdf (accessed on 5 May 2021). [68]

Global CCS Institute (2020), *Global Status Report 2019: Targeting Climate Change*, Global CCS Institute, Melbourne, https://www.globalccsinstitute.com/wp-content/uploads/2019/12/GCC_GLOBAL_STATUS_REPORT_2019.pdf. [25]

GMI (2011), *Oil and Gas Systems Methane: Reducing Emissions, Advancing Recovery and Use*, Global Methane Initiative, Washington, DC, http://www.globalmethane.org/documents/oil-gas_fs_eng.pdf. [19]

Gobierno de la Republica de Colombia (2019), *Estrategia nacional de economía circular. Cierre de ciclos de materiales, innovación tecnológica, colaboración y nuevos modelos de negocio*, Presidencia de la República/Ministerio de Ambiente y Desarrollo Sostenible/Ministerio de Comercio, Industria y Turismo, Bogotá, http://andi.com.co/Uploads/Estrategia%20Nacional%20de%20EconA%CC%83%C2%B3mia%20Circular-2019%20Final.pdf_637176135049017259.pdf. [101]

Gobierno Federal Sectur (2020), *Programa de Turismo sustentable 2030*, Gobierno Federal Sectur, Mexico City, https://adaptur.mx/pdf/Mexico-Estrategia-de-Turismo-Sostenible-2030.pdf. [200]

González-Velosa, C., D. Rosas and D. Flores (2016), "On-the-Job Training in Latin America and the Caribbean: Recent Evidence", in *Firm Innovation and Productivity in Latin America and the Caribbean: The Engine of Economic Development*, Palgrave Macmillan, New York, https://doi.org/10.1057/978-1-349-58151-1_5. [139]

Government of Brazil (2022), *Renewable energy in the Brazilian energy matrix: the share of solar energy reached 6.9% and wind energy, 10.9%*, Government of Brazil, Brasília, https://www.gov.br/en/government-of-brazil/latest-news/2022/renewable-energy. [8]

Government of Colombia (2021), *National Hydrogen Strategy and Roadmap*, https://www.minenergia.gov.co/es/micrositios/enlace-ruta-hidrogeno/ (accessed on 25 April 2022) [209]

Gregg, C., O. Strietska-Ilina and C. Büdke (2015), *Anticipating skill needs for green jobs: A practical guide*, International Labour Organization, Geneva, http://www.ilo.org/wcmsp5/groups/public/---ed_emp/---ifp_skills/documents/publication/wcms_564692.pdf. [137]

Grundke, R. and J. Arnold (2022), *Mastering the transition: A synthetic literature review of trade adaptation policies*, OECD Publishing, Paris, https://doi.org/10.1787/5fad3487-en. [115]

Gütschow, J. et al. (2016), "The PRIMAP-hist national historical emissions time series", *Earth System Science Data*, pp. 571-603, https://essd.copernicus.org/preprints/essd-2016-12/essd-2016-12.pdf. [170]

Haarr, M., J. Falk-Andersson and J. Fabres (2022), "Global marine litter research 2015–2020: Geographical and methodological trends", *Science of The Total Environment*, Vol. 820, pp. 153-162, https://doi.org/10.1016/j.scitotenv.2022.153162. [93]

Hamilton, L. and S. Feit (2019), *Plastic & Climate: The Hidden Costs of a Plastic Planet*, Center for International Environmental Law, Geneva, https://www.ciel.org/plasticandclimate/. [90]

Hardy, W., R. Keister and P. Lewandowski (2018), "Educational upgrading, structural change and the task composition of jobs in Europe", *Economics Of Transition*, Vol. 26, https://doi.org/10.1111/ecot.12145. [118]

Heidbreder, L. et al. (2019), "Tackling the plastic problem: A review on perceptions, behaviors, and interventions", *Science of the Total Environment*, Vol. 668, Elsevier, Amsterdam, pp. 1077-1093, https://www.sciencedirect.com/science/article/abs/pii/S0048969719309519. [191]

Herrera, D. (2020), *MSME Financing Instruments in Latin America and the Caribbean During COVID-19*, Inter-American Development Bank, Washington, DC, https://doi.org/10.18235/0002361. [49]

Hidalgo, C., J. Fontecha Mejía and S. Escobar (2022), *Principales aspectos del despliegue de energía eólica costa afuera en Colombia*, Holland & Knight, Tampa, https://www.hklaw.com/en/insights/publications/2022/05/principales-aspectos-del-despliegue-de-energia-eolica-costa-afuera (accessed on 23 May 2022). [87]

IDB (2021), "BID y Telefónica lanzan iniciativa para conectar emprendedores y corporaciones", https://www.iadb.org/es/noticias/bid-y-telefonica-lanzan-iniciativa-para-conectar-emprendedores-y-corporaciones (accessed on 15 July 2022). [42]

IDB (2021), *Climate policies in Latin America and the Caribbean: success stories and challenges in the fight against climate change*, Inter-American Development Bank, Washington, DC, https://doi.org/10.18235/0003239. [3]

IDB (2021), *Una visión azul para América Latina y El Caribe*, Inter-American Development Bank, Washington, DC, https://blogs.iadb.org/sostenibilidad/es/una-vision-azul-para-america-latina-y-el-caribe/. [75]

IDB (2020), *Plastic Waste Management and Leakage in Latin America and the Caribbean*, Inter-American Development Bank, Washington, DC, https://publications.iadb.org/en/plastic-waste-management-and-leakage-latin-america-and-caribbean. [185]

IDB and DDPLAC (2019), *Getting to Net-Zero Emissions: Lessons from Latin America and the Caribbean*, Inter-American Development Bank, Washington, DC, https://doi.org/10.18235/0002024. [5]

IEA (2022), *SDG7: Data and Projections*, International Energy Agency, Paris, http://www.iea.org/reports/sdg7-data-and-projections. [32]

IEA (2022), *The Role of Critical Minerals in Clean Energy Transitions*, International Energy Agency, Paris, http://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions/executive-summary. [27]

IEA (2022), *World Energy Employment*, IEA, Paris, https://www.iea.org/reports/world-energy-employment. [122]

IEA (2021), *Driving Down Methane Leaks from the Oil and Gas Industry: A Regulatory Roadmap and Toolkit*, International Energy Agency, Paris, http://www.iea.org/reports/driving-down-methane-leaks-from-the-oil-and-gas-industry. [20]

IEA (2021), *Hydrogen in Latin America: From near-term opportunities to large-scale deployment*, International Energy Agency, Paris, https://iea.blob.core.windows.net/assets/65d4d887-c04d-4a1b-8d4c-2bec908a1737/IEA_HydrogeninLatinAmerica_Fullreport.pdf. [16]

IEA (2021), *Net Zero by 2050*, International Energy Agency, Paris, http://www.iea.org/reports/net-zero-by-2050. [17]

IEA (2021), *World Energy Balances [database]*, International Energy Agency, Paris, http://www.iea.org/data-and-statistics/data-product/world-energy-statistics-and-balances. [10]

IEA (2015), *World Energy Outlook 2015*, International Energy Agency, Paris, http://www.iea.org/reports/world-energy-outlook-2015. [33]

IFPRI (2021), "Achieving sustainable agricultural practices: From incentives to adoption and outcomes", *IFPRI Policy Brief*, International Food Policy Research Institute, Washington, DC, https://ebrary.ifpri.org/utils/getfile/collection/p15738coll2/id/134262/filename/134472.pdf. [161]

IICA (2021), *Transformar el conocimiento en evidencia para la transformación sostenible de los sistemas alimentarios de América Latina y El Caribe*, IICA Blog, Inter-American Institute for Cooperation on Agriculture, San José, https://bit.ly/389vHB4. [166]

ILO (2021), *Hacia una recuperación sostenible del empleo en el sector del turismo en América Latina y el Caribe*, International Labour Organization, Geneva, https://www.ilo.org/wcmsp5/groups/public/---americas/---ro-lima/documents/publication/wcms_809290.pdf. [195]

ILO (2019), *Skills for a greener future: A global view based on 32 country studies*, https://www.ilo.org/wcmsp5/groups/public/---ed_emp/documents/publication/wcms_732214.pdf. [129]

ILO (2018), *World Employment and Social Outlook 2018: Greening with jobs*, International Labour Office, Geneva, https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_628654.pdf. [130]

ILO, UNICEF (2020), *Child Labour: Global estimates 2020, trends and the road forward*, https://www.ilo.org/ipec/Informationresources/WCMS_797515/lang--en/index.htm. [126]

IOGP (2022), *Map of Global CCUS Projects*, International Association of Oil & Gas Producers, London, https://www.iogp.org/bookstore/product/map-of-global-ccs-projects/ (accessed on 18 May). [24]

IPCC (2022), *Global Warming of 1.5°C: IPCC Special Report on Impacts of Global Warming of 1.5°C above Pre-industrial Levels in Context of Strengthening Response to Climate Change, Sustainable Development, and Efforts to Eradicate Poverty*, Cambridge University Press, Cambridge/New York, https://doi.org/10.1017/9781009157940. [1]

IPCC (2019), *IPCC Special Report on the Ocean and Cryosphere in a Changing Climate*, Cambridge University Press, Cambridge/New York, https://doi.org/10.1017/9781009157964. [76]

IRENA (2022), *Renewable Energy Roadmap for Central America: Towards a Regional Energy Transition*, International Renewable Energy Agency, Abu Dhabi, https://www.irena.org/publications/2022/Mar/Renewable-Energy-Roadmap-for-Central-America. [26]

IRENA (2018), *Policies and Regulations for Renewable Energy Mini-Grids*, International Renewable Energy Agency, Abu Dhabi, https://www.irena.org/publications/2018/Oct/Policies-and-regulations-for-renewable-energy-mini-grids. [30]

IRENA (2016), *End-of-life Management: Solar Photovoltaic Panels*, International Renewable Energy Agency, Abu Dhabi, https://www.irena.org/publications/2016/Jun/End-of-life-management-Solar-Photovoltaic-Panels. [72]

IRENA (2015), *Renewable Energy Policy Brief: Uruguay*, International Renewable Energy Agency, Abu Dhabi, https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2015/IRENA_RE_Latin_America_Policies/IRENA_RE_Latin_America_Policies_2015_Country_Uruguay.pdf. [51]

IRENA/UNELCAC/GET.transform (2022), *Scenarios for the Energy Transition: Experience and Good Practices in Latin America and the Caribbean*, International Renewable Energy Agency, Abu Dhabi, https://www.irena.org/publications/2022/Jul/Scenarios-for-the-Energy-Transition-LAC. [15]

IRP (2020), *Mineral Resource Governance in the 21st Century: Gearing extractive industries towards sustainable development*, United Nations Environment Programme, Nairobi, https://www.resourcepanel.org/reports/mineral-resource-governance-21st-century. [205]

Isgut, A. and J. Weller (2016), *Institutions for improving workforce integration in Latin America and Asia*, Economic Commission for Latin America and the Caribbean, Santiago, https://repositorio.cepal.org/bitstream/handle/11362/40661/6/S1600550_en.pdf. [144]

Isla Urbana (2021), *Isla Urbana*, Isla Urbana, Mexico City, https://islaurbana.org/isla-urbana/ (accessed on 17 June 2022). [182]

ITF (forthcoming), *Developing Accessibility Indicators for Latin American Cities*, International Transport Forum, Paris. [153]

Karasik, R. et al. (2020), *20 Years of Government Responses to the Global Plastic Pollution Problem: The Plastics Policy Inventory*, Nicholas Institute for Environmental Policy Solutions, Duke University, Durham, NC, https://nicholasinstitute.duke.edu/publications/20-years-government-responses-global-plastic-pollution-problem. [190]

Kaza, S. et al. (2018), *What a Waste 2.0: A Global Snapshot of Solid Waste Management in 2050*, Urban Development Series, World Bank, Washington, DC, https://doi.org/10.1596/978-1-4648-1329-0. [184]

Kirchherr, J., D. Reike and M. Hekkert (2017), "Conceptualizing the Circular Economy: An Analysis of 114 Definitions", *Resources, Conservation and Recycling*, Vol. 127, pp. 221-232, https://doi.org/10.1016/j.resconrec.2017.09.005. [54]

Lanoie, P. et al. (2011), "Environmental policy, innovation and performance: New insights on the Porter Hypothesis", *Journal of Economics & Management Strategy*, Vol. 20/3, pp. 803-842, https://doi.org/10.1111/j.1530-9134.2011.00301.x. [44]

Le Tissier, M. (2020), "Unravelling the Relationship between Ecosystem-Based Management, Integrated Coastal Zone Management and Marine Spatial Planning", in *Ecosystem-Based Management, Ecosystem Services and Aquatic Biodiversity*, Springer, Cham, https://doi.org/10.1007/978-3-030-45843-0_20. [104]

Letcher, T. (ed.) (2020), *Production, use and fate of synthetic polymers*, Academic Press, Cambridge, MA, https://doi.org/10.1016/B978-0-12-817880-5.00002-5. [95]

McCarthy, A., R. Dellink and R. Bibas (2018), *The Macroeconomics of the Circular Economy Transition: A Critical Review of Modelling Approaches*. [55]

McKenzie, D. (2017), "How effective are active labor market policies in developing countries? A critical review of recent evidence", *Policy Research Working Paper*, No. 8011, World Bank, Washington, DC, http://hdl.handle.net/10986/26352. [148]

MCTI (2021), *Programa Brasil-Biotec vai fortalecer pesquisa e desenvolvimento da biotecnologia nacional*, Ministério da Ciência, Tecnologia e Inovações, Government of Brazil, Brasília, https://www.gov.br/mcti/pt-br/acompanhe-o-mcti/noticias/2021/02/programa-brasil-biotec-vai-fortalecer-pesquisa-e-desenvolvimento-da-biotecnologia-nacional. [176]

Mesa Nacional para la Gestión Sostenible del Plástico (2021), *Plan Nacional para la gestión sostenible de plásticos de un solo uso*, Ministerio de Ambiente y Desarrollo Sostenible, Bogotá, http://vip.acoplasticos.com.co/_lib/file/doc/PLAN_PLASTICOS.pdf. [100]

Michail, N. (2019), "A major step forward: Brazil founds trade group for carbon-neutral meat", *FoodNavigator-LATAM*, William Reed, Crawley, https://www.foodnavigator-latam.com/Article/2019/02/25/A-major-step-forward-Brazil-founds-trade-group-for-carbon-neutral-meat?utmsource=copyright&utm_medium=OnSite&utm_campaign=copyright (accessed on 20 July 2022). [48]

Ministério da Agricultura, Pecuária e Abastecimento (2019), *Serviço Florestal Brasileiro (2019) Bioeconomia da Floresta A Conjuntura da Produção Florestal Não Madeireira no Brasil*, https://ava.icmbio.gov.br/mod/data/view.php?d=17&rid=3228. [47]

Ministerio de Ambiente (2020), *Plan Maestro de Turismo Sostenible 2020-2025*, Ministerio de Ambiente, Panama City, https://www.atp.gob.pa/Plan_Maestro_de_Turismo_Sostenible_2020-2025.pdf. [201]

Ministerio de Industria y Comercio (2020), *Política de Turismo Sostenible: "Unidos por la Naturaleza"*, Government of Colombia, Bogotá, https://www.mincit.gov.co/minturismo/calidad-y-desarrollo-sostenible/politicas-del-sector-turismo/politica-de-turismo-sostenible. [199]

Ministerio del Medio Ambiente (2022), *Roadmap for a Circular Chile by 2040*, Ministerio del Medio Ambiente, Santiago, https://economiacircular.mma.gob.cl/wp-content/uploads/2022/01/HOJA-DE-RUTA-PARA-UN-CHILE-CIRCULAR-AL-2040-EN.pdf. [99]

Ministerio del Medio Ambiente (2021), *Decreto 12: Establece Metas de Recolección y Valorización y Otras Obligaciones Asociadas de Envases y Embalajes*, Ministerio del Medio Ambiente, Santiago, https://www.bcn.cl/leychile/navegar?idNorma=1157019. [98]

Ministerio del Medio Ambiente (2021), *Estrategia Nacional para la Gestión de Residuos Marinos y Microplásticos*, Ministerio del Medio Ambiente, Santiago, https://mma.gob.cl/wp-content/uploads/2021/08/Estrategia-Nacional-para-la-gestion-de-residuos-marinos-y-microplasticos.pdf. [97]

Ministry of Agriculture, Livestock and Food Supply (2022), *Observatory of Brazilian Agriculture*. [45]

Ministry of Agriculture, Livestock and Food Supply (2021), *ABC+: Plan for adaptation and low carbon emission in agriculture strategic vision for a new cycle*, https://www.gov.br/agricultura/pt-br/assuntos/sustentabilidade/plano-abc/arquivo-publicacoes-plan. [46]

Novella, R. and H. Valencia (2019), "Active Labor Market Policies in a Context of High Informality: The effect of PAE in Bolivia", *Inter-American Development Bank Working Paper Series*, Inter-American Development Bank, Washington DC, https://publications.iadb.org/en/active-labor-market-policies-in-a-context-of-high-informality-the-effect-of-pae-in-bolivia. [150]

OECD (2022), "Closing the loop in the Slovak Republic: A roadmap towards circularity for competitiveness, eco-innovation and sustainability", *OECD Environment Policy Papers*, No. 30, OECD Publishing, Paris, https://doi.org/10.1787/acadd43a-en. [52]

OECD (2022), *Global Plastics Outlook: Policy Scenarios to 2060*, OECD Publishing, Paris, https://doi.org/10.1787/aa1edf33-en. [92]

OECD (2022), *OECD work for a sustainable ocean*, OECD, Paris, https://www.oecd.org/ocean/ (accessed on 23 September 2022). [112]

OECD (2022), *OECD.Stat [database]*, Labour Indicators, OECD, Paris, https://stats.oecd.org/Index.aspx. [124]

OECD (2021), *How's Life in Latin America?: Measuring Well-being for Policy Making*, OECD Publishing, Paris, https://doi.org/10.1787/2965f4fe-en. [113]

OECD (2020), *The Circular Economy in Cities and Regions: Synthesis Report*, OECD Urban Studies, OECD Publishing, Paris, https://doi.org/10.1787/10ac6ae4-en. [62]

OECD (2020), *Towards Sustainable Land Use: Aligning Biodiversity, Climate and Food Policies*, OECD Publishing, Paris, https://doi.org/10.1787/3809b6a1-en. [162]

OECD (2019), *Business Models for the Circular Economy: Opportunities and Challenges for Policy*, https://doi.org/10.1787/g2g9dd62-en. [74]

OECD (2019), *Global Material Resources Outlook to 2060: Economic Drivers and Environmental Consequences*, OECD Publishing, Paris, https://doi.org/10.1787/9789264307452-en. [61]

OECD (2018), *Impacts of green growth policies on labour markets and wage income distribution: a general equilibrium application to climate and energy policies*, https://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=ENV/EPOC/WPIEEP(2016)18/FINAL&docLanguage=En. [124]

OECD (2016), *Extended Producer Responsibility: Updated Guidance for Efficient Waste Management*, OECD Publishing, Paris, https://doi.org/10.1787/9789264256385-en. [207]

OECD (2015), *Towards Green Growth?: Tracking Progress*, OECD Green Growth Studies, OECD Publishing, Paris, https://doi.org/10.1787/9789264234437-en. [140]

OECD (2011), *Towards Green Growth*, OECD Green Growth Studies, OECD Publishing, Paris, https://doi.org/10.1787/9789264111318-en. [141]

OECD (forthcoming), *Business Insights on Emerging Markets 2023*, OECD Emerging Markets Network, OECD Development Centre, Paris. [134]

OECD (forthcoming), *Transición verde y formalización laboral en Colombia*, Making Development Happen series, OECD Development Centre, Paris https://www.oecd.org/dev/mdh.htm. [117]

OECD et al. (2020), *Latin American Economic Outlook 2020: Digital Transformation for Building Back Better*, OECD Publishing, Paris, https://doi.org/10.1787/e6e864fb-en. [143]

OECD/Cedefop (2014), *Greener Skills and Jobs*, OECD Green Growth Studies, OECD Publishing, Paris, https://doi.org/10.1787/9789264208704-en. [131]

OECD et al. (2021), *Latin American Economic Outlook 2021: Working Together for a Better Recovery*, OECD Publishing, Paris, https://doi.org/10.1787/5fedabe5-en. [36]

OECD et al. (2019), *Latin American Economic Outlook 2019: Development in Transition*, OECD Publishing, Paris, https://doi.org/10.1787/g2g9ff18-en. [35]

OECD et al. (2019), *Production Transformation Policy Review of Colombia: Unleashing Productivity*, OECD Development Pathways, OECD Publishing, Paris, https://doi.org/10.1787/9789264312289-en. [40]

OECD/EU (2020), *Impact evaluation of labour market policies through the use of linked administrative data*, OECD/European Union, Paris/Brussels, https://www.oecd.org/els/emp/Impact_evaluation_of_LMP.pdf. [146]

OECD/FAO (2022), *OECD-FAO Agricultural Outlook 2022-2031*, OECD Publishing, Paris, https://doi.org/10.1787/f1b0b29c-en. [171]

OECD/ILO (2019), *Tackling Vulnerability in the Informal Economy*, Development Centre Studies, OECD Publishing, Paris, https://doi.org/10.1787/939b7bcd-en. [127]

OECD/UNCTAD/ECLAC (2020), *Production Transformation Policy Review of the Dominican Republic: Preserving Growth, Achieving Resilience*, OECD Development Pathways, OECD Publishing, Paris, https://doi.org/10.1787/1201cfea-en. [39]

OECD/World Bank (2020), *Health at a Glance: Latin America and the Caribbean 2020*, OECD Publishing, Paris, https://doi.org/10.1787/6089164f-en. [152]

Pacheco, P. et al. (2021), *Deforestation Fronts: Drivers and Responses in a Changing World*, World Wildlife Fund, Gland, Switzerland, https://www.worldwildlife.org/publications/deforestation-fronts-drivers-and-responses-in-a-changing-world-full-report. [158]

Pacto Chileno de los Plásticos (2020), *El Pacto Chileno de los Plásticos*, Fundación Chile/Ministerio del Medio Ambiente, Santiago, https://fch.cl/wp-content/uploads/2020/01/roadmap-pacto-chileno-de-los-plasticos.pdf. [96]

Perrine, T. et al. (2020), *Don't Throw Caution to the Wind: In the Green Energy Transition, Not All Critical Minerals Will Be Goldmines*, Columbia Center on Sustainable Investment, New York, https://ccsi.columbia.edu/sites/default/files/content/docs/Dont%20Throw%20Caution%20to%20the%20Wind_0.pdf. [204]

Pietrobelli, C. and B. Calzada (2018), *En busca de una minería innovadora y sustentable en Latinoamérica*, Inter-American Development Bank, Washington, DC, https://blogs.iadb.org/innovacion/es/en-busca-de-una-mineria-innovadora-y-sustentable-en-latinoamerica/. [202]

Porter, M. and C. van der Linde (1995), "Toward a new conception of the environment-competitiveness relationship", *The Journal of Economic Perspectives*, Vol. 9/4, pp. 97-118, https://www.jstor.org/stable/2138392. [42]

Rateau, M. and L. Tovar (2019), "Formalization of wastepickers in Bogota and Lima: Recognize, regulate, and then integrate?", *EchoGéo*, No 47, Pôle de recherche pour l'organisation et la diffusion de l'information géographique, Aubervilliers, France, https://journals.openedition.org/echogeo/16614. [194]

RELAC (2020), *What is RELAC?*, REnovables in Latin America and the Caribbean, Energy HUB, Inter-American Development Bank, Washington, DC, https://hubenergia.org/en/relac#home__section--one (accessed on 15 March 2022). [13]

RICYT (2021), *Network for Science and Technology Indicators –Ibero-American and Inter-American [database]*, Ibero-American and Inter-American Network of Science and Technology Indicators, Buenos Aires, http://app.ricyt.org/ui/v3/comparative.html?indicator=GASIDSFPER&start_year=2010&end_year=2019. [41]

Rodriguez, A., A. Mondaini and M. Hitschfeld (2017), *Bioeconomía en América Latina y el Caribe: contexto global y regional y perspectivas*, Economic Commission for Latin America and the Caribbean, Santiago, https://www.cepal.org/es/publicaciones/42427-bioeconomia-america-latina-caribe-contexto-global-regional-perspectivas. [156]

Rodríguez, A., M. Rodrigues and O. Sotomayor (2019), "Towards a sustainable bioeconomy in Latin America and the Caribeean: Elements for regional vision", *Natural Resources and Development series*, N°193 (LC/TS.2019/25), Economic Commission for Latin America and the Caribbean, Santiago, https://www.cepal.org/en/publications/44994-towards-sustainable-bioeconomy-latin-america-and-caribbean-elements-regional. [175]

Rustomjee, C. (2016), "Developing the Blue Economy in Caribbean and other Small States", *CIGI Policy Brief*, No. 75, Centre for International Governance Innovation, Waterloo, https://www.cigionline.org/sites/default/files/pb_no.75web_1.pdf. [82]

S&P Global Market Intelligence (2022), *Lithium and Cobalt Exploration Trends*, S&P Global Market Intelligence, New York, https://pages.marketintelligence.spglobal.com/Lithium-and-cobalt-infographic-interactive-MS.html (accessed on 6 July 2022). [29]

Saget, C., A. Vogt-Schilb and T. Luu (2020), *Jobs in a net-zero emissions future in Latin America and the Caribbean*, International Labour Organization/Inter-American Development Bank, Geneva/Washington, DC, https://publications.iadb.org/publications/english/document/Jobs-in-a-Net-Zero-Emissions-Future-in-Latin-America-and-the-Caribbean.pdf. [121]

sieLAC OLADE (2022), *Sistema de Informacion energetica de Latinoamerica y el Caribe (SieLAC)*, http://sielac.olade.org. [4]

Steiner, A., I. Andersen and Q. Dongyu (2020), *Paraguay demonstrates benefits of forests as a nature-based solution to climate change*, UN-REDD Programme, Geneva, https://www.un-redd.org/news/paraguay-demonstrates-benefits-forests-nature-based-solution-climate-change#:~:text=In%20particular%2C%20Paraguay%20engaged%20in,from%20deforestation%20and%20forest%20degradation. [165]

Stern, J. (2019), *Challenges to the Future of LNG: decarbonisation, affordability and profitability*, Oxford Institute for Energy Studies, Oxford, https://doi.org/10.26889/9781784671464. [22]

Sturzenegger, G. (2021), *The Plastics Pandemic*, Inter-American Development Bank, Washington, DC, https://blogs.iadb.org/agua/en/plastics-pandemic/#_ftnref7. [188]

Tambutti, M. and J. Gómez (eds.) (2020), "The outlook for oceans, seas and marine resources in Latin America and the Caribbean: conservation, sustainable development and climate change mitigation", *Project Documents*, (LC/TS.2020/167), Economic Commission for Latin America and the Caribbean, Santiago, https://repositorio.cepal.org/bitstream/handle/11362/46509/4/S2000911_en.pdf. [77]

Tekman, M. et al. (2022), *Impacts of plastic pollution in the oceans on marine species, biodiversity and ecosystems*, World Wide Fund for Nature Germany, Berlin, https://doi.org/10.5281/zenodo.5898684. [91]

Timilsina, G., I. Curiel and D. Chattopadhyay (2021), "How Much Does Latin America Gain from Enhanced Cross-Border Electricity Trade in the Short Run?", *Policy Research Working Paper*, No. 9692, World Bank, Washington, DC, https://openknowledge.worldbank.org/bitstream/handle/10986/35729/How-Much-Does-Latin-America-Gain-from-Enhanced-Cross-Border-Electricity-Trade-in-the-Short-Run.pdf?sequence=1&isAllowed=y. [7]

UNCTAD (2019), *Costa Rica on course for a vibrant and inclusive blue economy*, United Nations Conference on Trade and Development, Geneva, https://unctad.org/news/costa-rica-course-vibrant-and-inclusive-blue-economy (accessed on 24 August 2022). [85]

UN DESA (2021), 2021 *Energy Statistics Pocketbook*, Statistics Paper, United Nations Publications, New York, https://unstats.un.org/unsd/energystats/pubs/documents/2021pb-web.pdf [208]

UNDP (2022), *The ocean and the blue economy are fundamental to addressing the triple planetary crisis - says UNDP*, United Nations Development Programme, New York, https://www.undp.org/press-releases/ocean-and-blue-economy-are-fundamental-addressing-triple-planetary-crisis%E2%80%94says-undp (accessed on 5 July 2022). [79]

UNDP (2021), *Considerations for integrating Nature-based Solutions into Nationally Determined Contributions: Illustrating the potential through REDD+*, United Nations Development Programme, New York, https://www.undp.org/publications/consideration-integrating-nature-based-solutions-nationally-determined-contributions-illustrating-potential-through-redd. [163]

UNDP (2017), *Circular economy strategies for Lao PDR A metabolic approach to redefine resource efficient and low-carbon development*, https://www.undp.org/sites/g/files/zskgke326/files/publications/undp-lecb-circular-economystrategies-for-laos-pdr-20. [60]

UNEP (2022), *End plastic pollution: Towards an international legally binding instrument*, United Nations Environment Programme, Nairobi, https://wedocs.unep.org/bitstream/handle/20.500.11822/38522/k2200647_-_unep-ea-5-l-23-rev-1_-_advance.pdf?sequence=1&isAllowed=y. [103]

UNEP (2021), *Addressing Single-use Plastic Products Pollution Using a Life Cycle Approach*, United Nations Environment Programme, Nairobi, http://www.unep.org/fr/node/29018. [192]

UNEP (2021), *Circular Economy in Latin America and the Caribbean: A Shared Vision*, United Nations Environment Programme, Nairobi, https://emf.thirdlight.com/link/5fhm4nyvnopb-e44rhq/@/#id=0. [58]

UNEP (2021), *From Pollution to Solution: a global assessment of marine litter and plastic pollution*, United Nations Environment Programme, Nairobi, https://www.unep.org/resources/pollution-solution-global-assessment-marine-litter-and-plastic-pollution. [106]

UNEP (2021), *Las ciudades de América Latina y el Caribe pueden reducir a la mitad su consumo de recursos mientras combaten la pobreza*, United Nations Environment Programme, Nairobi, https://www.unep.org/es/noticias-y-reportajes/comunicado-de-prensa/las-ciudades-de-america-latina-y-el-caribe-pueden#:~:text=%2D%20Si%20impulsan%20una%20transformaci%C3%B3n%20sostenible,de%20las%20Naciones%20Unidas%20para. [187]

UNEP (2021), *Policies, Regulations and Strategies in Latin America and the Caribbean to Prevent Marine Litter and Plastic Waste*, United Nations Environment Programme, Nairobi, https://wedocs.unep.org/bitstream/handle/20.500.11822/34931/Marine_EN.pdf?sequence=1&isAllowed=y. [94]

UNEP (2019), *Zero Carbon Latin America and the Caribbean: The opportunity, cost and benefits of the coupled decarbonization of the power and transport sectors in Latin America and the Caribbean*, United Nations Environment Programme, Office for Latin America and the Carribbean, Panama City, https://wedocs.unep.org/20.500.11822/34532. [2]

UNEP (2018), *Waste Management Outlook for Latin America and the Caribbean*, United Nations Environment Programme, Latin America and the Caribbean Office, Panama City, https://www.unep.org/ietc/resources/publication/waste-management-outlook-latin-america-and-caribbean. [173]

UNEP-WCMC (2022), *Ocean+ Habitats*, [On-line], [insert month/year of the version downloaded]. Available at: habitats.oceanplus.org. [111]

UNESCO (2021), *Science, technology and innovation (database)*, United Nations Educational, Scientific and Cultural Organization, Paris, http://data.uis.unesco.org/Index.aspx?DataSetCode=SCN_DS&lang=en#. [38]

UNESCO (2020), *Custodians of the globe's blue carbon assets*, UNESCO Marine World Heritage, Paris, https://unesdoc.unesco.org/ark:/48223/pf0000375565. [78]

UNIDO (2018), *Cooperación regional en gestión de residuos electrónicos en países de América Latina*, United Nations Industrial Development Organization, Vienna, https://www.unido.org/news/cooperacion-regional-en-gestion-de-residuos-electronicos-en-paises-de-america-latina (accessed on 6 June 2022). [71]

UNWTO/CAF (2021), *UNWTO and CAF Boost Sustainable and Innovative Tourism in Latin America*, World Tourism Organization, Madrid, https://www.unwto.org/news/unwto-and-caf-boost-sustainable-and-innovative-tourism-in-latin-america (accessed on 18 July 2022). [84]

UNWTO/Organization of American States (2018), *El turismo y los Objetivos de Desarrollo Sostenible – Buenas prácticas en las Américas*, United Nations World Tourism Organization/Organization of American States, Madrid/Washington, DC, https://www.e-unwto.org/doi/pdf/10.18111/9789284419937. [198]

USAID (2020), *Ecuador Energy Sector Assessment*, United States Agency for International Development, Washington, DC, https://pdf.usaid.gov/pdf_docs/PA00WQNF.pdf. [9]

Van Hoof et al. (2022), *Metodología para la evaluación de avances en la economía circular en los sectores productivos de América Latina y el Caribe*, Economic Commission for Latin America and the Caribbean, Santiago, https://repositorio.cepal.org/bitstream/handle/11362/47975/S2200477_es.pdf?sequence=1&isAllowed=y. [67]

Vargas, J. (2021), "Recursos hídricos: América Latina y El Caribe al 2050", *iAgua*, Madrid, https://www.iagua.es/blogs/juan-carlos-castro-vargas/recursos-hidricos-america-latina-y-caribe-al-2050-0 (accessed on 17 August 2022). [80]

Vona, F. et al. (2018), "Environmental Regulation and Green Skills: An Empirical Exploration", *Journal of the Association of Environmental and Resource Economists*, Vol. 5/4, pp. 713-753, https://doi.org/10.1086/698859. [116]

Wagner, M. et al. (2022), *Monitoreo regional de los residuos electrónicos para América Latina: resultados de los trece países participantes en el proyecto UNIDO-GEF 5554*, United Nations Industrial Development Organization/Global Environment Facility, Bonn, https://www.unido.org/sites/default/files/files/2022-01/REM_LATAM_2021_ESP_Final_dec_10.pdf. [69]

Watson, C. (2016), *Shock-Responsive Social Protection Systems Research - Working Paper 3: Shock-Responsive Social Protection in the Sahel: Community Perspectives*, Oxford Policy Management, Oxford, https://www.opml.co.uk/files/Publications/a0408-shock-responsive-social-protection-systems/wp3-community-perspectives-sahel-en.pdf?noredirect=1. [151]

WEF (2020), *Latin America and Caribbean Travel & Tourism Competitiviness Landscape Report: Assessing Regional Opportunities and Challenges in the Context of Covid-19*, World Economic Forum, Cologny, Switzerland, https://www.weforum.org/reports/latin-america-and-caribbean-travel-tourism-competitiveness-landscape-report-in-the-context-of-covid-19/. 196]

Willis, W. et al. (2022), *Economic and social effectiveness of carbon pricing schemes to meet Brazilian NDC targets*, Taylor & Francis, https://dx.doi.org/10.1080/14693062.2021.1981212. [125]

Wilmsmeier and Jaimurzina (2017), *Energy Efficiency and Electric-Powered Mobility by River: Sustainable Solutions for Amazonia*, FAL Bulletin, No. 353, Santiago, Economic Commission for Latin America and the Caribbean (ECLAC), https://www.cepal.org/en/publications/41858-en (accessed on 25 July [online] 2022). [31]

World Bank (2021), *Caribbean Regional Oceanscape Project*, World Bank, Washington, DC, https://projects.worldbank.org/en/projects-operations/project-detail/P159653. [107]

World Bank (2020), *Future Foodscapes: Re-imagining Agriculture in Latin America and the Caribbean*, World Bank Group, Washington, DC, http://documents.worldbank.org/curated/en/942381591906970569/Future-Foodscapes-Re-imagining-Agriculture-in-Latin-America-and-the-Caribbean. [169]

World Bank (2012), *Expanding Financing for Biodiversity Conservation: Experiences from Latin America and the Caribbean*, International Bank for Reconstruction and Development/The World Bank, Washington, DC/New York, https://www.worldbank.org/content/dam/Worldbank/document/LAC-Biodiversity-Finance.pdf. [164]

World Bank/ESMAP (2020), *Offshore Wind Technical Potential [database]*, World Bank/Energy Sector Management Assistance Program, Washington, DC, https://energydata.info/dataset/offshore-wind-technical-potential (accessed on 23 July 2022). [88]

World Travel and Tourism Council (2022), *Economic Impact Reports. Latin America and The Caribbean 2022 Annual Research: Key Highlights*, World Travel and Tourism Council, London, https://wttc.org/Research/Economic-Impact. [167]

WRI/IDB (2021), *Nature-Based Solutions in Latin America and The Caribbean: Regional Status and Priorities for Growth*, World Resources Institute/Inter-American Development Bank, Washington, DC, https://files.wri.org/d8/s3fs-public/2021-10/nature-based-solutions-in-latin-america-and-the-caribbean-regional-status-and-priorities-for-growth_1.pdf?VersionId=.3xcu8Ruodnxf5mw9wCUAYgdEK6evOMa. [160]

WWF (2020), *Living Planet Report 2020: Bending the curve of biodiversity loss*, World Wildlife Fund, Gland, Switzerland, https://www.wwf.fr/sites/default/files/doc-2020-09/20200910_Rapport_Living-Planet-Report-2020_ENGLISH_WWF-min.pdf. [157]

Yamaguchi, S. (2018), "International Trade and the Transition to a More Resource Efficient and Circular Economy: A Concept Paper", *Trade and Environment Working Papers – 2018/03*, OECD Publishing, Paris, https://www.oecd.org/environment/waste/policy-highlights-international-trade-and-the-transition-to-a-circular-economy.pdf. [56]

Annex 3.A. Key selected sectors for the green transition

Annex Table 3.A.1. **Nature-based solutions, use of land, and biodiversity and forestry preservation**

Key facts	Relevance for the green transition in LAC
• LAC contains 50% of the world's biodiversity and 23% of the total forest cover (FAO, 2021[154]). • LAC includes six of the ten countries with most tree species in the world (FAO/UNEP, 2020[155]). • The region is host to 8 of the 17 most megadiverse countries on the planet (Rodriguez, Mondaini and Hitschfeld, 2017[156]): ○ Andean-Amazon: Bolivia, Brazil, Colombia, Ecuador, Peru and Venezuela. ○ Central America: Costa Rica and Mexico. • Biodiversity has declined by 94% in LAC since 1975, more than in any other region in the world (WWF, 2020[157]). • Almost 40% of global deforestation fronts are in LAC (Pacheco et al., 2021[158]). • More than 43 million hectares were deforested in LAC between 2004 and 2017 due to fires, livestock production, agriculture, mining and transport (Pacheco et al., 2021[158]).	• Current productive practices contribute to climate change through: ○ Deforestation, desertification and biodiversity loss. ○ GHG emissions from land use change and forestry sectors, which are more than three times larger in LAC than in the rest of the world (19.3% vs. 5.8%) (FAO, 2014[159]). • If properly addressed, nature-based solutions can help protect and restore ecosystems and increase human well-being: ○ Sustainable land and forest management could increase the resilience of ecosystems and societies (WRI/IDB, 2021[160]). ○ Green infrastructure can help preserve ecosystems and promote sustainable urban development and buildings (WRI/IDB, 2021[160]). • Environmental justice principles could contribute to avoiding indigenous communities' relocation and loss of livelihoods.
Policy instruments	**Relevant experiences**
• Implement regulations, such as green certifications, environmental laws and standards, to assign specific budgets to preserve forests and prevent unsustainable land uses (e.g. "Native forest law" in Argentina) (IFPRI, 2021[161]), or encourage public-private collaborations (e.g. concessions for sustainable forest and land management) (OECD, 2020[162]). • Promote participation processes with local communities and civil society organisations (CSOs) to identify needs and increase the legitimacy of policy. • Develop national strategies and promote activities within the United Nations Framework Convention on Climate Change to reduce emissions from deforestation and forest degradation in developing countries (REDD+) to obtain results-based payments (UNDP, 2021[163]).	• **Costa Rica and Mexico:** payments for the Ecosystem Services Programme have allowed small and medium-sized landowners to help conserve land and biodiversity through cash transfers since 1997 (World Bank, 2012[164]). • **Colombia:** the Mosaic Conservation project allowed local communities to work on the restoration and preservation of damaged territories surrounding national parks and protected areas. • **Paraguay:** the National Strategy of Forests for Sustainable Growth (2019) and the national forest monitoring system enabled the quantification of emissions reduction and generated reliable data on changes on forest areas (Steiner, Andersen and Dongyu, 2020[165]). • **Peru:** Public administration contracts targeted to non-governmental organisations and local entities devoted investments of USD 20 million in ten protected areas.

Annex Table 3.A.2. **Sustainable agriculture and livestock**

Key facts	Relevance for the green transition in LAC
• LAC is the major net food-exporting region of the world (17% of the net export value of global agricultural and fish commodities in 2020) (IICA, 2021[166]; OECD, 2021[113]). • The region contains 12% of the world's land currently under cultivation. • The agricultural sector is the second-most polluting sector in LAC (22.9% of all regional GHG emissions), and emissions are rising (Bárcena, 2020[168]). • Agriculture represented 14% of total employment in LAC in 2019.	• Current practices contribute to climate change through: ○ Land degradation: there is accelerated soil erosion, salinisation and loss of soil organic matter, mainly due to widespread monoculture production. ○ Unsustainable demand for resources: agriculture in LAC consumes large and unsustainable amounts of fresh water (World Bank, 2020[169]). ○ Rising GHG emissions: agriculture emissions in LAC increased by 32% between 1990 and 2019, reaching a total of 1.04 Gt CO_2e (Climate Watch, 2020[119]). • Proper policies could help: ○ Preserve ecosystem services and reduce pressure on the environment. ○ Reduce poverty and hunger and create quality formal jobs, particularly in rural areas.
Policy instruments	**Relevant experiences in LAC**
• Implement consensual regulations to: ○ promote sustainable spatial planning (OECD, 2020[162]) ○ establish certifications, environmental laws and standards (IFPRI, 2021[161]) ○ foster public-private agreements to promote the large-scale adoption of climate-smart production processes and technologies, especially in the livestock sector (e.g. *Acuerdos de Producción Limpia* in Chile) (OECD/FAO, 2022[171]) • Allocate resources by: ○ Applying taxes to discourage unsustainable practices (OECD, 2020[162]). ○ Defining charges and fees (OECD, 2020[162]) ○ Redesigning subsidy schemes to discourage the use of pesticides or fossil fuels and promote biodiversity (OECD, 2020[162]). • Invest in technology R&D for better use of resources and green farming practices (e.g. Observatory of Brazilian Agriculture and Livestock).	• **Brazil:** has integrated low-carbon sustainable agriculture and livestock experiences. In 2020, it launched the National Bioinputs Program, a policy to foster the use of bio-based products in agriculture. The Brazilian Association of Carbon-Neutral Meat Producers unites farmers, who are implementing integrated crop-livestock-forestry systems to link sustainable farming, cattle and forestry activities to continue producing high-quality products that have a low carbon footprint. For example, a carbon-neutral beef certification was developed and is already available on a commercial scale (Food Navigator, 2019[172]). • **Ecuador:** the climate-smart livestock farming project allowed an increase in milk production, improved soil quality on 40 000 ha and paid higher wages in the sector, while avoiding 24 000 tonnes of GHG emissions thanks to rotational grazing and pasture compost production. • **Uruguay:** good practices and alternatives to the use of pesticides allowed reduced use of herbicides (by up to 70%) in the soybean production cycle without affecting yields and saving up to USD 40 per cultivated hectare. • **Mexico:** efficient and low-emission technologies in agriculture and agro-industry allowed a total of 1 842 agribusinesses to reduce their net GHG emissions by 6 Mt of CO_2 equivalent and to produce energy from biomass (FAO, 2021[154]).

Annex Table 3.A.3. **Bioeconomy and regenerative food systems**

Key facts	Relevance for the green transition in LAC
• LAC has high potential for biomass production due to the availability of land, adequate soils and water (Rodriguez, Mondaini and Hitschfeld, 2017[156]). • The bioeconomy raises the need for new relationships between agriculture and food, due to the fact that 50% of municipal waste is organic and food consumption waste represents 34% in LAC (UNEP, 2018[173]). • LAC presents advantages in six thematic areas for the development of the bioeconomy: 1) exploitation of biodiversity resources; 2) eco-intensification of agriculture; 3) biotechnology applications; 4) biorefineries and bioproducts; 5) improved efficiency of agrifood chains; and 6) ecosystem services (Aramendis, Rodríguez and Krieger Merico, 2018[174]).	• The bioeconomy can contribute to meeting the challenges of productive diversification and structural change associated with changing the economic dependence on primary commodity producing in agriculture, mining and fossil resources (Rodríguez, Rodrigues and Sotomayor, 2019[175]). • The bioeconomy promotes new production, enabling the development of new products that can be used as inputs in other sectors, such as biomaterials for construction, bio-inputs for agriculture, enzymes for industry and substitutes for petrochemical products. It also helps change consumer behaviour or satisfy new consumer demands (e.g. functional foods, biocosmetics) (Rodríguez, Rodrigues and Sotomayor, 2019[175]). • The bioeconomy is a feasible alternative towards decarbonisation. It provides an adequate framework for the harmonisation of policies required for the implementation of the 2030 Agenda for Sustainable Development (Rodríguez, Rodrigues and Sotomayor, 2019[175]).
Policy instruments	**Relevant experiences in LAC**
• Promote the development of national bioeconomy strategies by: ○ Recognising territorial and landscape specificities, to increase a just distribution of benefits. ○ Creating or adjusting education programmes, technical training and the use of information and communications technology to develop necessary capacities. ○ Focusing on nature-based solutions as an option to harmonise development and ecosystem protection.	• **Brazil**: the Biotec Initiative (2021) prioritises four areas of biotechnology: human health, agriculture, industrial and environment (MCTI, 2021[176]). • **Colombia:** the international bioeconomy mission (2020) aims to provide the grounds to take advantage of biodiversity, and to promote development of an environmentally sustainable agricultural and livestock sector, by adopting a zero food waste approach and promoting advanced technologies in the health sector. • **Uruguay:** the bioeconomy contributed to the COVID-19 recovery, to the advancement of biotechnology and the valorisation of agricultural and agro-industrial products development in the meat and dairy chains (Borges et al., 2021[177]).

Annex Table 3.A.4. **Water management**

Key facts	Relevance for the green transition in LAC
• LAC is host to one-third of the world's freshwater resources. • Cities and productive areas in LAC have high levels of water stress: ○ 166 million people do not have access to a safely managed potable water service (ECLAC, 2022[179]). ○ 46 million do not have basic sanitation facilities (CAF, 2017[178]). ○ Less than 50% of wastewater is adequately treated. ○ A total of 43% of countries in the region report low levels of Integrated Water Resources Management (ECLAC, 2022[179]).	• Access to water is a cornerstone of development and a strong engine for reducing inequalities. It is a key determinant of economic growth, environmental health and social well-being. • Climate change affects water management in multiple ways, including changes in precipitation and therefore in seasonal and annual patterns of floods and droughts, water availability or dilution capacity, while affecting health, economic activities and water-dependent ecosystems (Climate-ADAPT, 2021[180]). • With large parts of the world dependent on rain-fed agriculture, reduction in water availability, coupled with unpredictable changes in rainfall, could affect millions of farm-based livelihoods and jeopardise food security (FAO, 2021[181]).
Policy instruments	**Relevant experiences in LAC**
• Modern water legislation should focus on basin planning, climate change adaptation measures, water conservation and prioritisation of human consumption and water supply over other uses. Energy regulation is required to encourage the establishment and use of renewable energy and efficiency without overexploiting water resources. • Promote nature-based solutions, such as mangroves. Protecting shorelines from storms, lakes storing large water supplies, and floodplains absorbing excess water runoff is a key part of these initiatives. • Address the need for a water transition. Water should be considered a natural asset. The human right to water should be guaranteed and negative externalities reversed, while moving towards circular water management.	• **Peru:** the Lacomes Project provides potable water and sanitation systems, powered by solar energy and built with local materials, in accordance with the dry forest climate (MINAGRI, 2022). • **Mexico:** Isla Urbana is dedicated to contributing to water sustainability in Mexico through rainwater harvesting (Isla Urbana, 2021[182]). • **Uruguay:** CTAGUA is the technological centre for water development in Uruguay, using the internet of things and big data to help companies, technical institutes and universities address the country's main water challenges (CTAGUA, 2022[183]).

Annex Table 3.A.5. **Waste management and plastics**

Key facts	Relevance for the green transition in LAC
• The LAC region produces 541 000 t of municipal waste per day. This figure is projected to grow by 25% by 2050 (UNEP, 2018[173]). • Almost 95% of waste goes to sanitary landfills (52.0%), open dumps (26.8%) or other landfills (16.5%). Only 4.5% is recycled and less than 1% is composted, incinerated or digested anaerobically (Kaza et al., 2018[184]). • In LAC, plastics represent 12.4% of municipal solid waste – the fourth-largest waste stream in the region (Kaza et al., 2018[184]). • A total of 40% of the plastic used in LAC is disposed of after single use (IDB, 2020[185]).	• High GHG emissions: waste and industrial processes are the fourth-largest GHG emissions producer in the region, accounting for 10% of total emissions (ECLAC, 2020[186]). • Unsustainable consumption patterns: urban household material consumption is projected to increase to 25 t per capita in LAC by 2050 (well above the range of 6-8 t per capita of the sustainable scenario established by the UN International Resource Panel) (UNEP, 2021[187]). • High potential to create formal jobs: there are over 1.8 million informal waste pickers in LAC, recovering up to 50% of the material that is recycled (Sturzenegger, 2021[188]). • Plastic waste in the ocean: it is estimated that the ocean contains about 75-199 Mt of plastic waste and the yearly additional inflow could nearly triple by 2040. This threatens ecosystem services that are fundamental to many livelihoods and the blue economy (UNEP, 2021[106]).
Policy instruments	**Relevant experiences in LAC**
• Set ambitious goals as part of co-ordinated strategies to reduce solid waste generation and disposal in landfills while promoting the formalisation of informal recycling workers. • Co-ordinate actions across levels of government and key stakeholders. Cities and local governments tend to be responsible for waste management services. • Support and promote informal businesses and workers operating in circular business models (e.g. repair, refurbishment, remanufacture and recycling) (Circular Economy Coalition of Latin America and the Caribbean, 2022[189]). • Expand plastic bans, which are often narrowly focused on certain types of single-use products (Karasik et al., 2020[190]). • Increase the low price of virgin plastic (Geyer, 2020[95]), and reduce the costs of alternatives (Karasik et al., 2020[190]). • Internalise waste externalities and require producers to take responsibility for waste treatment or disposal (EPR). • Engage in stakeholder consultations (UNEP, 2021[106]). • Combine information instruments with clean-ups and measures that provide convenient alternatives to plastic products (Heidbreder et al., 2019[191]). • Provide incentive schemes to reduce waste production (e.g. pay-as-you-throw system or differentiated tariffs). • Use public procurement to promote sustainable practices in the waste sector. • Generate information and data to monitor total waste streams, their recovery and the use of secondary raw materials in the economy (Kaza et al., 2018[184]).	• Prohibitive regulatory instruments: there are bans on the sale and/or use of single-use plastic products in Chile, Colombia, Panama, Peru and Uruguay, in addition to import bans in highly affected small island states, such as Antigua and Barbuda and Saint Lucia (UNEP, 2021[192]; UNEP, 2021[106]). • Affirmative regulatory instruments: there are obligations for plastic producers in Colombia and Peru to use recycled material, and EPR schemes in Argentina, Brazil, Chile, Colombia and Mexico that provide positive incentives (UNEP, 2021[192]; IDB, 2020[185]). • Economic instruments: examples include exemption of plastic alternatives from import duties in Saint Lucia (UNEP, 2021[192]); a tax on the consumption of plastic bags and single-use plastic products in Colombia; a green tax on polyethylene terephthalate bottles in Ecuador (IDB, 2020[185]); and an environmental protection levy on packaging, as an advanced disposal fee, in Jamaica (UNEP, 2021[106]). "Ecoins" purchasing power parity in Costa Rica rewards recycling with a digital coin that can be exchanged for discount coupons from sponsoring companies (Ecoins, 2022[193]). • Information instruments: examples include the #MenosPlásticoMásVida (#lessplasticmorelife) initiative on responsible plastic consumption in Peru (UNEP, 2021[192]) and Ecuador's permanent campaign Plásticos en el mar… NO MÁS! (No more plastics in the sea) to educate fishermen and associated parties (IDB, 2020[185]). • There are efforts in Chile, Colombia and Peru to recognise informal waste pickers and recyclers and integrate them into formal waste management (Rateau and Tovar, 2019[194]; IDB, 2020[185]).

Annex Table 3.A.6. **Sustainable tourism**

Key facts	Relevance for the green transition in LAC
• In 2021, tourism contributed 6.1% to Latin America's GDP (+26.5% change from 2020) and 13.4% of total jobs (14.25 million), representing an 8% recovery. In the Caribbean, tourism contributed 9.1% of GDP (+36.6% change from 2020) and 13.4% of total jobs (2.35 million), representing a 15.2% increase (World Travel and Tourism Council, 2022[167]). • In 2019, informal employment in tourism reached 63.3% in the region. Individuals under age 24 account for 20.9% of total employment in the sector (ILO, 2021[195]).	• By 2030, CO_2 emissions from tourism corresponding to transport will increase by 25% over 2016 levels (from 1 597 Mt CO_2 to 1 998 Mt CO_2) (World Travel and Tourism Council, 2022[167]). • Potential environmental impacts caused by activities related to tourism (World Economic Forum, 2020[1]) include: ○ Unco-ordinated land use due to rapid urban growth. ○ Destruction of fragile ecosystems. ○ Contamination of bodies of water. ○ Aesthetic deterioration of the landscape and the urban environment. • The tourism sector plays an essential role in realising circularity in the use of plastics. Tourism contributes to plastic pollution through the single use of water bottles, disposable toiletries, plastic bags, bin liners, food packaging and cups. • The tourism sector can contribute directly to the achievement of SDG 8 on decent work and economic growth, SDG 11 on sustainable cities and communities, SDG 12 on responsible consumption and production, SDG 14 on life below water, and SDG 15 on life on land.
Policy instruments	**Relevant experiences in LAC**
• The environmental consequences of tourism are largely associated with a lack of information and unsustainable behavioural patterns. Some key policy instruments used to reduce GHG emissions in the sector in LAC are: ○ Regulatory approaches, e.g. emission standards, bans on toxic substances, and land planning instruments. ○ Communication campaigns to provide information to citizens and enterprises for adequate use and disposal of resources ○ Market-based instruments, e.g. environmental taxes, financing, payment for environmental services, GHG emission trading, green bonuses, public-private partnerships, concessions, and seed capital initiatives (BIOFIN Costa Rica, 2021[197]).	• Sustainable tourism projects: ○ **Guatemala:** in 2015, IMPULSA was created to protect 334 areas (32% of the territory). ○ **Mexico:** tourism development Mayakoba aims to increase biological diversity by preserving and strengthening terrestrial ecosystems, as well as creating aquatic habitats. ○ **Peru:** with the Project of the Tingana Association, inhabitants changed their behaviour from indiscriminate logging, fishing and hunting to ecotourism activities and safeguarding the jungle (UNWTO/Organization of American States, 2018[198]). • Policy guidelines: to promote ecosystem-friendly tourism with minimal impact on the environment and local culture, several LAC countries have developed regulatory framework guidelines. Examples include: ○ **Columbia:** United for the Environment sustainable tourism policy (Ministerio de Industria y Comercio, 2020[199]) ○ **Mexico:** sustainable tourism policy 2030 (Gobierno Federal Sectur, 2020[200]) ○ **Panama:** Sustainable Tourism Master Plan (Ministerio de Ambiente, 2020[201]).

Annex Table 3.A.7. **Sustainable mining**

Key facts	Relevance for the green transition in LAC
• LAC countries are well placed to take advantage of demand for critical minerals during the green transition. Argentina, Bolivia, Brazil, Chile, Mexico and Peru have significant reserves of copper, iron ore, lithium, nickel, magnesium, molybdenum, silver and zinc. • LAC includes the world's biggest copper producer (Chile), the world's biggest silver producer (Mexico), the third-biggest steel producer (Brazil) and the seventh-biggest bauxite producer (Jamaica). • In 2017, a total of 61% of global lithium reserves were in LAC, along with 39% of global copper reserves and 32% of nickel and silver reserves (ECLAC, 2018[28]). • Investments in lithium in 2021 in LAC increased by an average of 117% compared to 2020, reflecting increases of 559% in Chile and 77% in Argentina (S&P Global Market Intelligence, 2022[29]). • The mining sector accounts for 21% of total exports from Peru, 60% from Chile and 46% from Brazil (Pietrobelli and Calzada, 2018[202]).	• The demand for materials associated with a low-carbon transition is projected to grow by 110% by 2060 (from 2015 levels), requiring resource extraction to more than double, reaching 190 Mt per year. • Critical minerals present in LAC are essential inputs for the scaling up of the renewable energy technologies needed for the green transition. Lithium-ion batteries require cobalt, lithium, nickel, manganese; electric vehicles require rare earth elements; solar PV requires cadmium, indium, gallium, selenium, silver and tellurium; wind turbines require rare earth elements; and aluminium and copper are needed across all renewable energy technologies (Dominish, Florin and Teske, 2019[203]). • The development of a sustainable mining sector can be an opportunity for LAC countries to generate substantial revenue from tax and royalties, lead to improved infrastructure, and facilitate uptake of renewable energy generation, creating jobs and generating revenues that could support local investment in education, health care and other community benefits.
Policy instruments	**Relevant experiences in LAC**
• In the development of a sustainable mining sector, address environmental, social and governance risks throughout the value chain – from extraction to end use and recycling – to avoid the environmental damage, fragility, conflict and human rights abuses that have often characterised the mining sector in LAC. • Develop regulatory frameworks that encourage private investment (including related power and transport infrastructure), eliminate corruption, and engage and deliver concrete benefits for local communities throughout the mining life cycle. This could be a catalyst for inclusive development, economic growth and structural transformation of economies. • Use triple and quadruple helix co-ordination to promote innovation in the mining and energy sectors through interaction among mining companies, suppliers, governments, academia and CSOs. • Use geological mapping to help governments understand the extent of endowments of critical minerals and metals, and present geoscience data in an accessible way to attract private-sector investment. • Use the mining sector to support the roll-out of energy access to surrounding communities. The sector can provide anchor electricity offtake in rural areas not covered by the national electricity grid.	• **Chile:** has implemented several policy and investment measures to develop its local lithium value chain. For example, the Ministry of Mining has set out provisions to incentivise downstream industries and clarify existing policies, to encourage public and private investment, and to double lithium carbonate production to 230 000 mt per year by 2023 (Perrine et al., 2020[204]). • **Peru:** developed the Towards a Vision for Mining in Peru in 2030 strategy in 2016. It sets out measures to enhance the economic contribution of mining and emphasises the need to ensure alignment with the SDGs and territorial development priorities (IRP, 2020[205]). • **Chile** and **Mexico:** the two countries are leading the way in the integration of utility-scale renewable energy projects for mines. Notable examples include Antofagasta's 115 MW wind power and Compañía de Acero del Pacífico's 100 MW solar PV projects in Chile, and Industrias Penoles' 180 MW wind power plant in Mexico (Alova, Galina, 2018[206]).