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Executive Summary

Argentina is exposed to a range of climate change impacts that affect its water cycle and by extension, its people, economic sectors, and macroeconomy. Glaciers are melting, reducing water storage and leading to longer periods of water scarcity. This, in turn, worsens competition between the agriculture, water, transport, hydroelectricity generation, and other sectors. Reduced river flows year-round make hydropower production more difficult; infrastructure is being lost to flooding and sea level rise in coastal areas; desertification is accelerating and intensifying; and wildfires becoming more frequent. Floods affect the poorest and most vulnerable populations and droughts cause large macroeconomic losses.

The country’s greenhouse gas (GHG) emissions are spread across many sectors and increasing in most of them, but not in land use change and deforestation. Argentina ranks 22\textsuperscript{nd} among GHG emitters and 14\textsuperscript{th} for methane, which accounted for 23 percent of GHGs in 2018.\textsuperscript{1} Emissions come mostly from energy (51 percent, including 16 percent from energy industries and 13 percent from transport), followed by agriculture, livestock, forestry, and other land use (39 percent), industry (6 percent), and waste (4 percent).\textsuperscript{2} Installed electricity capacity is dominated by natural gas (59 percent), followed by hydropower (25 percent), other renewables (12 percent), and nuclear (4 percent) (table S.1.). Since 2010, reduced deforestation has been key to reduce total emissions by 2 percent, but emissions from other sectors have increased.

This Country Climate and Development Report (CCDR) explores opportunities and identifies trade-offs for aligning Argentina’s growth and poverty reduction policies with its commitments on, and its ability to withstand, climate change. It explores how the country can: reduce its vulnerability to climate shocks through macroeconomic stability, social protection, and targeted investments; seize the benefits of a global decarbonization path to sustain a more robust economic growth; and prioritize and sequence actions that lay the ground for future transformation towards a low-carbon and resilient economy. Given Argentina’s macroeconomic context, this CCDR focuses on win-win policies and investments, which have large co-benefits or can contribute to raising the country’s potential growth while helping to adapt and decarbonize the economy.

Climate change impacts Argentina’s water cycle, with large economic consequences

Floods impact infrastructure and assets, affecting vulnerable people and leading to significant welfare losses. Average annual asset losses due to floods amount to up to $1.4 billion—in purchasing power parity (PPP) 2015—and are concentrated in the Northeastern and Pampas regions. And because poor people are disproportionally affected, these translate into much higher welfare damages (up to $4 billion in PPP 2015) according to the analysis in Rozenberg et al. (2021). A comparison of exposure and poverty incidence indicates that populations in some provinces bear the double burdens of high poverty incidence and flood exposure. First, because those provinces rely heavily on federal fiscal transfers, flooding can cancel out the impact of social spending on poverty mitigation and add pressure

\textsuperscript{1} The GHG ranking includes emissions from land use change and forestry and is based on 2018 data from CAIT, the World Resources Institute’s Climate Data Explorer database. The methane emissions ranking is based on 2018 data from the World Bank’s World Development Indicators database.

\textsuperscript{2} Based on Argentina’s 4\textsuperscript{th} Biennial Update Report, which contains the country’s last (2018) inventory (GoA 2021).
on both provincial and federal budgets. Second, it can affect the economy in the long run, as net damages reduce capital stocks. Without adaptation, the impact of flood damages on GDP would be around 0.5 percent in 2060. And third, floods also affect human capital through increased prevalence of disease and food insecurity, further impacting GDP and welfare.

**More frequent droughts are affecting the agriculture sector, an engine of growth and exports in Argentina, one of the world’s largest agriculture producers.** Agriculture represents 7 percent of gross domestic product (GDP) and agrifood exports are a crucial source of foreign exchange earnings and federal revenues, representing 65 percent of total exports (Lema and Hermo 2019). In Santiago del Estero, Buenos Aires, Entre Ríos, Santa Fe, and Córdoba provinces, a 10 percentage point fall in crop production implies a 0.7 percentage point fall in gross provincial product growth rate (Rozenberg et al. 2021). With the frequency of droughts increasing, ensuring the agriculture sector is resilient to climate change, through climate-smart techniques, drought-resistant crops, and index-based insurance, will be an important contribution to a more stable growth.

**Droughts increase competition for water and affect waterway transport and hydropower production.** Navigability in La Plata Basin, which provides river navigation for about 84 percent of exports, is at risk if climate change keeps reducing river flows and upstream demand pressures continue to rise. In 2021, agrifood business, which uses the Paraná River for transporting products—notably for export—lost $315 million in six months due to the lower level of the river. And in 2021, the severe drought reduced Argentina’s hydropower contribution to electricity generation from 29 percent to almost 17 percent. Thermal generation partially compensated for that loss, leading to an increase in fossil fuel use and higher generation costs. Although wind and solar generation have offset some of the loss of hydropower in recent years, skyrocketing fossil fuel prices in 2022 have exacerbated the drought’s continued impact on electricity generation costs.

**Drought shocks propagate throughout the economy.** Droughts compound macroeconomic crises and can have significant GDP impacts, especially when Argentina’s macroeconomic buffers are low (if fiscal deficits and debt exposure are high, and capital reserve levels are low). The direct impact of the 2018 drought, for example, explained over half of the fall in economic activity that year, exacerbating the economic and financial crisis. Lower corn and soybean yields during the most recent drought (2021/22) cost Argentina approximately $1,440 million in fiscal revenues, $2,665 million in export revenues, and 1 percent of GDP. Under the country’s current economic and fiscal structures, consecutive droughts could reduce GDP by up to 4 percent per year on average by 2050 (Rozenberg et al. 2021).

**Argentina has large opportunities to benefit from decarbonization**

Argentina revised its second Nationally Determined Contribution (NDC2) in November 2021 and is working on a long-term strategy. Its ambition has increased with each submission and NDC2 sets a 349 million tonnes of carbon dioxide equivalent (MtCO₂e) cap for 2030, a level 26% below the first NDC committed in 2016. In 2019, the government adopted its first Climate Change Adaptation and Mitigation National Action Plan—as mandated in the new climate change law—and seven sectoral national plans: for energy, transportation, industry, forestry, agriculture, infrastructure, and health. It is

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4 The Argentine Central Bank attributes the 4% GDP growth rate decline in the second quarter of 2018 largely to a contraction in agricultural production due to drought (Banco Central de la República Argentina 2018).
updating those plans and has announced that it is working towards a carbon neutrality goal for 2050 but has yet to submit a long-term strategy to the United Nations Framework Convention on Climate Change. Combining estimates of potential sectoral reductions, this CCDR shows that Argentina could undertake a path towards net zero for carbon dioxide by 2050 and smaller decreases in emissions from other gases, if it decarbonizes electricity production with increased capacity for renewable energy, electifies transport and other end uses, adopts alternative fuels (such as hydrogen) in hard-to-abate sectors, increases energy efficiency, eliminates deforestation to transform the land use sector into a net carbon sink, and reduces methane emissions from livestock.

As the world is committing to net zero emissions by mid-century, Argentina’s competitiveness could be impacted if it does not implement critical policies that encourage low carbon production, and investment. A significant portion of Argentina’s export markets include countries that are expanding the use of carbon border adjustment mechanisms (CBAMs), negotiated trade agreements that involve environmental provisions, and bans on importing agriculture goods that cannot prove they were produced without deforestation. The demand for some Argentine exports—such as lithium, which is used for batteries in the electromobility industry and for renewable energy storage, and carbon emission reductions, or offsets from forest and soil management—will increase, while demand for other products, such as fossil fuels, will decrease over the medium and long term. At the same time, demand for merchandise traceability will change, with increased requirement for ecolabeling to prove sustainable production.

Argentina’s agriculture sector is a major source of growth and exports, and could be impacted if policies like carbon border adjustments or bans based on deforestation are passed and accepted by the World Trade Organization. As it has been approved by the European Union Parliament, the EU CBAM proposal poses minimal risk to Argentina since the industrial products currently affected are not relevant in its export basket, unless their base is broadened to include agriculture products. Moreover, the proposed EU ban on products that are not deforestation-free could affect up to 4 percent of Argentina’s exports, with impacts concentrated in soybean and beef production. Beef is a flagship product for Argentina, and estimates suggest that, at 100 kilograms of carbon dioxide equivalent per kilogram (kgCO2e/kg), the emissions intensity of its beef production systems is high compared to the global average of 55 kgCO2e/kg, due to the land use change and deforestation associated with extensive production methods (FAO 2013). However, if it continues to control deforestation, Argentina could decrease this risk. Argentina’s preparedness for ecolabeling could also be an advantage: producers already have some expertise in carbon footprints and sustainable forestry labels, and policy support can increase preparedness (Conte Grand and D’Elia 2018). Given the area of the country covered by forest and carbon-rich soil, carbon offsets could also be a source of financing for the agriculture sector.

Argentina’s shale oil and gas reserves could help reduce imports and rebuild foreign reserves, but uncertainty around future energy markets challenges long-term benefits. A net importer of natural gas, Argentina is home to the world’s second shale gas reserves, and has ambitions to become a net exporter. When oil and gas transport capacity from Neuquén Province increases, Argentina will be able to export its shale gas to global markets, leveraging its geographical location between South America’s major economies. However, the price of natural gas is highly volatile, and Argentina’s ability to compete in the global market will depend on its ability to secure stable and competitive contracts.


6  A study done for this CCDR by the team (Conte Grand, Schulz-Antipa, and Rozenberg, 2022) also shows that a U.S. deforestation-free product (DFP) policy would have milder effects, impacting only 0.3% of Argentine exports (mostly for soybeans, less so for cattle and rubber, and much less for wood pulp). Transition risks could increase if oil and fats manufacture were included in the EU-CBAM (when expanded to other products, the EU CBAM could impact up to 3.95% of Argentina’s exports).
to increase shale oil and gas production from the Vaca Muerta reservoir\(^7\) and become a net exporter by 2025. This could be an opportunity to strengthen foreign exchange reserves, with an average trade surplus in oil and gas of around $33 billion per year over 2022–30 (Vidjen 2022).\(^8\) However, global commitments to reach net zero emissions by 2050 create many uncertainties in energy markets that threaten the sector after 2030, potentially limiting the window of opportunity for producing and exporting gas from Vaca Muerta.\(^9\) To hedge against these risks, Argentina can continue to diversify domestic electricity production and consumption away from natural gas and towards zero carbon alternatives, while increasing energy efficiency.

Argentina is rich in renewable energy resources that could power a zero carbon electricity grid. It can decarbonize its electricity sector by exploiting its large potential for hydropower generation and world-class wind and solar resources. The scenario prepared for the second NDC includes 25 percent wind and solar capacity by 2030, combined with increased nuclear to 14 percent and hydropower to 31 percent. Academic and commercial analysts have also constructed scenarios for decarbonizing Argentina’s power sector by 2050 (table S.1). The scenarios prepared by Deloitte for Enel and the one made by the POLEs model (from the Joint Research Center of the European Commission) increase the capacity share of renewables (wind and solar) to 39 and 35 percent in 2030, respectively, and 72 and 81 percent in 2050 respectively. Both scenarios phase out natural gas production capacity by 2045. The country can use this clean electricity production to power electric vehicles, residential heating, and light industries, enabling them to participate in the overall decarbonization of the economy. The Enel scenario also includes 30 gigawatts of battery storage to cover peak demand after 2030, when the share of renewables increases significantly. Argentina’s lithium resources and potential to develop the battery value chain is another advantage in this transition. Finally, renewables can produce green hydrogen for industries that cannot be electrified.

<table>
<thead>
<tr>
<th>Current capacity (% of total)</th>
<th>Plan for 2(^{nd}) NDC (% of total)</th>
<th>POLES model net zero pathway (% of total)</th>
<th>Enel decarbonization scenario (% of total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2021</td>
<td>2030</td>
<td>2030</td>
<td>2050</td>
</tr>
<tr>
<td>Hydro</td>
<td>25</td>
<td>31</td>
<td>23.6</td>
</tr>
<tr>
<td>Thermal</td>
<td>59</td>
<td>30</td>
<td>37.8</td>
</tr>
<tr>
<td>Nuclear</td>
<td>4</td>
<td>14</td>
<td>3.6</td>
</tr>
<tr>
<td>Renewable</td>
<td>12</td>
<td>25</td>
<td>34.9</td>
</tr>
</tbody>
</table>

Source: Data from https://cammesaweb.cammesa.com/informe-anual/ (existing capacity); Kermamidas at al. 2021 https://publications.jrc.ec.europa.eu/repository/ handle/JRC126767 (POLES); Hoja de ruta para la transición energética 2030–2050: analysis by Deloitte presented on October 4, 2022 (Enel scenario)

Lithium and the electric vehicle (EV) value chain can bring economic benefits, especially at provincial level. As a vital input in the production of lithium-ion batteries—used for electromobility and renewable energy storage—decarbonization is increasing demand for, and the price of, lithium. Argentina owns

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\(^7\) Vaca Muerta is the main nonconventional hydrocarbon formation in the Neuquén Basin and exhibits high productivity (close to the best U.S. shale). Argentina has large oil and gas reserves, with Vaca Muerta representing a substantial percentage of those resources. In 2020, it ranked 32\(^{nd}\) in the world and 4\(^{th}\) in Latin America (after Venezuela, Brazil, and Mexico) in terms of proved stock of oil reserves, and 31\(^{st}\) in the world and 2\(^{nd}\) in Latin America, after Venezuela, for gas (BP 2021).

\(^8\) Study on Present Status of the Natural Gas Sector in Argentina, by Gabriela Vidjen for the World Bank, which uses oil prices projected by the World Bank in December 2021.

\(^9\) Welsby et al. (2021) find that 19–27\% of Argentina’s gas could remain unburnable in a net zero world.
22 percent of identified global lithium resources, and while investment and production projects in the lithium-rich provinces of Catamarca, Jujuy, and Salta are at an early stage, the lithium value chain (LVC) could become a growth driver for these provinces and the country, if social and environmental impacts (notably on limited water resources) are addressed early on. According to some forecasts, demand will reach 2.4 million tons of lithium carbonate equivalent in 2030 (400 percent higher than estimated demand for 2022), and by then, Argentina’s lithium supply could meet between 12 (conservative scenario) and 19 (optimistic scenario) percent of global demand, making the country a relevant player in the global energy transition.11 Argentina could be competitive in almost all stages of the value chain, except for midstream components—that is, cathodes—which are mostly produced in Asia.12 By 2030, investment in lithium plants and battery cells and packs could result in a 0.4–0.7 percent GDP increase at national level, a 0.3–0.6 percent increase in tax revenues, and a relatively low 0.2–0.3 percent increase in employment at provincial level. In an optimistic scenario, GDP and fiscal revenues could increase 10 percent, and the impact on employment could reach up to 6.5 percent in Catamarca. Due to Argentina’s large share of the LVC upstream and small share of the downstream, the economic trade-off of exporting raw lithium and importing EVs is not significant; but it could increase in the future. Developing the country’s LVC will be beneficial as Argentina progressively electrifies its transport fleet.

**Actions that place Argentina’s economy on a low-carbon, resilient path may also produce large growth and equity dividends**

Argentina’s response to climate impacts and shocks will require a greater use of: targeted human capital interventions in social protection, health, and education; planning and changes in regulation and incentives; prioritized investments for adaptation and sustainable growth; and macrofiscal reforms and pricing instruments. The priorities identified in this CCDR cover both adaptation and mitigation measures that would promote a more sustainable growth path and embed Argentina’s current climate change commitments. In the conclusion, table S.2 provides a summary of 20 potential actions, based on expected impacts, synergies, and trade-offs with other policies.

**Human capital interventions can protect the population against climate change and transition risks**

Climate change impacts and associated damages, decarbonization potential, and the source of emissions all vary by income group and region. As such, it is important to consider local impacts and the distributional implications of climate shocks and policies. The impacts of climate shocks vary both geographically and by income. For example, the expected changes in temperature are higher in the north of Argentina, which has a high share of vulnerable population. And groups of people living in the same place are exposed in different ways, as flood damage often depends on living conditions, poor people tend to have no income buffers, and some of the benefits received through social protection are invariably lost due to flood impacts (figure S.1a). People’s ability to cope with climate impacts or climate transition also varies depending on local economic activities and jobs. For example, in Patagonia and Cuyo, where

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11 Based on Benchmark Mineral Intelligence. 2022. “Analysis: lithium industry needs $42 billion to meet 2030 demand” (May 13) and calculations from a study by Obaya et al. (2022).

12 A separate study using the Green Complexity Index (Mealy and Teytelboym 2020) confirms that Argentina is competitive in four components of the EV battery value chain.
mining is prevalent, there is a higher share of brown (emissions-intensive) jobs, filled by workers with lower education and income levels who may face more difficulties transitioning to green jobs. Emission sources also differ across the country, depending on the main activity undertaken (figure S.1b).

**FIGURE S.1.** Selected climate development differences, per province

Social protection systems are efficient tools for protecting the poorest against climate change impacts. Cash transfers can be efficient solutions for reducing the welfare impacts of droughts and floods, especially against large, infrequent events. Social protection systems are also key tools for helping the most vulnerable in the population adapt to the slow-onset impacts of climate change. Argentina’s adaptive social protection systems are well established overall (World Bank 2022) but could be improved on three main fronts. First, strengthening information exchange between the country’s social protection system and early warning system, Sistema de Alerta Temprana (SAT), would improve its ability to estimate the vulnerable population at risk of being affected by different types of hazards, and thus improve targeting and secure funding. Second, increasing the volume of technical, human, and financial resources would build government agencies’ response capacity in the face of disaster events and climate change. Advancing these institutions’ geographic information systems may also allow them to expand social protection programs horizontally to reach potential beneficiaries in areas at high risk of disaster. And third, preparing a diagnosis that allows Argentina to formulate a climate change management plan for its social protection sector would help it establish programs to respond to shocks, institutional schemes that allow the adaptation of social protection to the challenges of climate change, and mechanisms that target social spending on vulnerable populations in high-risk areas.
Complementary actions in the education and health sectors can improve adaptation to climate change. Droughts and floods impact human health directly through injury and disease, and indirectly through nutrition. Analysis for this CCDR\textsuperscript{13} shows that extreme temperature already causes a net increase in excess deaths, and that, without adaptation, climate change could increase the death toll. Argentina has a broad system of heat wave alerts—the SAT-TE Calor—which covers the whole country. Evidence from Buenos Aires city shows that people react to heat alerts by avoiding exposure (Rabassa, Conte Grand and García-Witulski 2021) but do not take appropriate action if the warning lasts for several days. Provisions in Argentina’s Health and Climate Change National Action Plan contribute to adaptation—for example, by strengthening the health system against heat waves and cold spells, and making health care facilities more resilient to extreme weather events.\textsuperscript{14} The country already considers heat in energy planning, adapting through an increase in air conditioning. More energy-efficient buildings will be crucial for affordable building temperature control, while promoting environmental education for teachers and students would encourage behavioral change on energy use and adapting to the health impacts of climate change. The recently passed law on environmental education (Law 27621 of 2021) contains actions in that direction.

Retraining policies and citizen engagement would support the green jobs transition and protect workers, as job availability and characteristics are likely to shift during a transition to carbon neutrality by 2050, particularly in the energy and transport sectors. This CCDR analyzes how workers can transition from brown to other jobs, without it negatively impacting their income.\textsuperscript{15} Results suggest that brown jobs make up only 3 percent of total employment, and those working these jobs tend to be younger, and have lower education and income levels than other workers. Green jobs represent about 6 percent of total employment and could increase rapidly.\textsuperscript{16} Some occupations with high transition risks, such as well drillers and borers, have options for transitioning to greener jobs without losing income—for example, by working as insulation workers. Other workers, like truck drivers, could also become insulation workers, but would require more retraining, given the greater differences in tasks. Targeting training programs at growing economic sectors and complementing them with employment support services would help build and refresh soft skills and connect displaced workers to jobs. The government is taking steps in this direction with Fomentar Empleo, a new program to boost employment that includes training and a new digital platform for a labor market information system that offers up-to-date information on vacancies, labor market trends, and skills requirements to ensure that retraining programs are effective. Citizen engagement would help manage social transitions and potential social dislocation for workers who need to retrain and move to find new jobs.

\textsuperscript{13} For this analysis (García-Witulski et al. 2022), the team used daily mortality data provided by the Argentine Ministry of Health to the Human Development World Bank Group (WBG) team in the Argentina office.

\textsuperscript{14} Two recent resolutions (2956/2021 and 555/2021) institutionalize the link between health and climate.

\textsuperscript{15} For green jobs, we draw on the O*NET green occupations classifications, mapping these through to Argentina’s national occupational classification system, the Clasificador Nacional de Ocupaciones (CNO) used by the household survey (Encuesta Permanente de Hogares, EPH). We mapped brown jobs with a list of emissions-intensive jobs from a U.S. study (Vona et al. 2018). Following Mealy, del Rio-Chanona and Farmer (2018), the team worked with the Argentine Institute of Statistics and Censuses, Instituto Nacional de Estadísticas y Censos (INDEC) and the WBG Equitable Growth, Finance and Institutions team in the Argentina office to create a crosswalk between the International Standard Classification of Occupations’ 4-digit codes and CNO classifications using a text mining approach (Arakaki et al. 2022).

\textsuperscript{16} Work for this CCDR on energy efficiency policies also finds that, in the short run, changing to solar-generated energy distribution and more efficient household appliances could create 10,000 and 25,000 new jobs, respectively.
Planning and investments in the water sector can reduce climate risks

More effective use of planning and land use management tools could reduce exposure to floods. Limited urban planning instruments and weak intergovernmental coordination have contributed to urban sprawl and informal settlements of vulnerable populations in flood zones. By 2017, roughly 18 percent of the population was subject to a housing and habitat deficit; at the same time, peri-urban settlements of low-income communities—from La Matanza in Buenos Aires Province to Resistencia in the Chaco Region—are often built in flood-prone areas (World Bank 2017). To promote sustainable and efficient spatial development, Argentina could: develop land use plans that incorporate climate change considerations, particularly related to flood risk; reform urban regulations and land use restrictions that are contributing to low-density and informal development; and strengthen the capacity of municipalities and provinces to adapt legal frameworks that facilitate and enforce land management.

Water storage, irrigation, and deepening of waterways are immediate priorities for water security. The World Bank’s ‘Argentina Water Security Diagnostic’ identifies $96.9 billion in priority investments for water security by 2030 (World Bank 2021). These include improving sanitation and safe water services, increasing storage infrastructure, rehabilitating and improving drainage systems, developing complementary irrigation for rainfed crops, expanding the implementation of green infrastructure for flood and drought mitigation, and deepening the Paraná-Paraguay waterway to limit drought impacts on waterway transportation. If implemented together, these investments could increase GDP by 2.7 percent a year by 2030, compared to a scenario without them. The investment rate is low in Argentina, contributing to the country’s low level of capital stock, and such investments could boost potential growth. Large storage infrastructure is the most labor-intensive; it is also least dependent on imported goods. Waterway upgrading, which has a high net return, could be executed through an extended or newly let set of concession contracts, with little dependence from public financing.

Supporting innovation and changing incentives can help the agriculture sector address its vulnerability to climate change and reduce emissions

Transforming the agrifood sector can help it maintain its competitiveness and reduce its vulnerability to drought and emissions. Despite past successes in the agrifood sector, accelerating the uptake of climate-smart agriculture can help increase productivity and reduce both vulnerability to droughts and emissions in the sector. Drought-resistant crops, coupled with efficient irrigation systems, can reduce yield losses from droughts. There are also major opportunities for reducing carbon emissions and increasing carbon sequestration in livestock, soils, and value chains. In the livestock sector, giving farmers access to training and financing to help them improve pasture quality, animal health, and grazing management could reduce both CO₂ and methane emissions. The widespread adoption of sustainable soil management practices could also mitigate national agricultural emissions. Finally, energy-efficient cold chains and storage can reduce food loss and waste, energy use, and therefore emissions, while also promoting inclusive value chains. Despite that potential, Argentina’s Agriculture and Climate Change National Action Plan does not include emissions reductions from livestock and only expects a minimal reduction in sector emissions through crop rotation, which represents less than 2 percent emissions reduction.17

17 Through Law 27287/16, Argentina has a system to integrate risks in territorial planning that includes guidelines for municipalities to develop risk maps. There are also national government-led capacity-building activities to build those maps. But only a few cities—such as Resistencia, Santa Fe, Rosario, La Plata, and Buenos Aires—have been able to build geographical information systems to make informed decisions to limit housing development and informal settlements based on climate change risks.

18 If fully implemented, the aggregate increase in annual GDP compared with business as usual is 2.7% or about $15 billion a year (World Bank 2021).
of all emissions. The main policy priorities to encourage these actions are: public support for research and development (linking up agricultural research with industrial or biotech research); restructuring technology transfer and public extension by creating interaction spaces with private sector facilitators to promote adoption; improving access to finance for adopting and investing in human capital; and fiscal incentives for adopting climate-smart techniques.

Although deforestation is decreasing, there is room to improve existing regulations. Argentina has large forest resources, but deforestation—mostly driven by the expansion of agriculture land (particularly for beef production) and forest fires—is historically high, and higher than the South American average (Mónaco et al. 2022). While increased livestock efficiency can reduce the need for land, it is unlikely to be enough without additional policies to prevent deforestation. Since 2009, Argentine provinces have been required to develop land use maps showing different conservation levels. The National Forest Law also institutes a payment for environmental services, offering monetary incentives to landholders based on forest conservation. Although this law has reduced deforestation, differences in local government capacity and land prices have led to large discrepancies in the success of its implementation, for example across the Chaco region. While some efforts are focused on avoiding deforestation, there is also potential to invest in reforestation and soil conservation, to generate negative emissions to sell as carbon offsets or raise money through international green financial markets.

A combination of planning, regulations, and price incentives can deeply transform the energy sector to make it more robust to a changing world

Designing a consistent plan for the energy sector can help Argentina reach carbon neutrality and improve resilience. Such a plan could include the relationships between electricity production, oil and gas extraction, and transport electrification (and thereby, domestic demand for lithium). As part of this plan, it is important to assess investment needs for a low-carbon and resilient electricity sector that can meet growing demand for electric mobility, and to consider both the impacts of climate change—such as an increase in air conditioning use due to increased heat—and the relationship between electricity production and water management.

Implementing short-term, no-regret options for energy efficiency can help reduce emissions. The energy efficiency options in the residential, commercial, manufacturing, and public sectors presented in the sectoral climate national action plans could reduce emissions by approximately 64 MtCO₂e by 2030. The most impactful actions in terms of avoided emissions are in the residential and transportation sectors, while the highest monetary savings per tonne of carbon dioxide are in manufacturing and buildings lighting. Many actions could improve energy efficiency in buildings, but the most urgent are strengthening regulations for new buildings and implementing efficiency standards for appliances and heating systems.

19 Conservation levels are: high or red (no land use change allowed); medium or yellow (only sustainably managed land use activities); and low or green (land use change is permitted).
21 Based on the National Plan for Energy Efficiency in Argentina (PlanEEAr) (GFA et al. 2021). Note that an analysis in this CCDR estimates that changes in lighting would reduce emissions but have a negative impact on both activity and employment (Romero et al. 2022).
Scaling up renewable energy investments would help reduce demand for fossil fuels. Although there is potential to increase hydropower generation—with some estimates putting the levels of hydrology to be exploited for power or mixed-use water sources at three times the current exploitation levels—this is not without climate risks, which need to be carefully assessed.\textsuperscript{22} Rather, other renewables, such as wind and solar, offer the most promising investment options to increase electricity generation capacity and make the system more resilient. Argentina has world-class potential for wind and solar energy, and a 2015 law establishes that 20 percent of its electricity consumption should be generated from renewable sources by 2025. Under Plan RenovAR,\textsuperscript{23} the government enacted a series of public bids to install capacity for energy generation through renewables, with the winners gaining fiscal benefits. If all the submitted projects had been finished, the country’s installed capacity for wind energy would have multiplied by almost 18 and solar by 132 times between 2016 and 2021. Although investments slowed down due to financing and trade constraints, they can be revived when the macroeconomic context improves and if the government provides the right incentives. Not only could this strategy be compatible with a flattening or decrease in domestic demand for natural gas to maximize exports; it could also power new promising sectors such as green hydrogen and green ammonia and help decarbonize transport through electrification.

Including transport decarbonization in the strategy would bring many co-benefits. The transport sector is responsible for 13 percent of Argentina’s total emissions. Of these, 90.9 percent are from road transport, and 45 percent from freight. Around 92 percent of Argentina’s freight flows (mostly grains and mining products) are moved by road. Policy measures that improve the efficiency of logistic activities—that is, urban consolidation centers, rail access infrastructure, and energy efficiency packages—can greatly contribute to reducing GHG emissions (Pons et al. 2022); but they cannot deliver a reduction in GHG emissions in line with a net zero target on their own. A net zero pathway requires a significant uptake of low-carbon technologies, such as second-generation biofuels for trucks and electricity for lighter vehicles. A modal shift towards rail and waterway transport can also help reduce emissions from freight. The 2019 Transport and Climate Change National Action Plan identifies deepening the inland waterway as a key mitigation measure that would allow for greater use of vessels’ hold capacity, reducing the number of trips required to transport merchandise and therefore the use of fossil fuels. All these actions help increase the efficiency of the transport system and reduce both accidents and air pollution, with significant health-related costs. These measures are also likely to be acceptable for truck unions, since they would require fleet renovation but no change to the number of jobs or hours worked.

Incentives for adopting electric mobility—including investments in charging infrastructure—would boost the decarbonization of transport. Electromobility is a feasible and effective decarbonization option for urban freight deliveries and private passenger cars; it also goes hand-in-hand with decarbonizing electricity generation. In 2021, the government introduced a new electric mobility bill, currently being discussed in Congress, which would ban the sale of internal combustion engine vehicles by 2041. The government expects that increased demand for EVs would reposition and expand the domestic production of automobiles, creating 21,000 new manufacturing jobs. Upscaling electrification will require downtime charging points, which tend to rely on private investments, but public funding may be required to kick-start the deployment of opportunity charging and fast charging stations. A recent

\textsuperscript{22} https://www.energiaestrategica.com/la-potencia-instalada-de-energia-hidroelectrica-representa-apenas-el-30-por-ciento-del-potencial-de-argentina./

\textsuperscript{23} There are other incentives under the Renewable Energy Development Fund, Fondo para el Desarrollo de Energías Renovables (FODER) and the Renewable Energy Futures Market, Mercado a Término de Energía Eléctrica de Fuente Renovable (MATER).
World Bank study concludes that EV penetration is driven by the availability of charging infrastructure, as this mitigates consumers’ anxiety about vehicle range ability (Li et al. 2021). As such, investing in charging infrastructure has a bigger impact on EV sales than consumer purchase subsidies. Business models under development in frontrunner countries show that concessional finance can also stimulate private investment in charging infrastructure and, once a large share of the fleet is electric, private investment can take the lead and secure good returns. However, the subsidized and frozen (despite inflation) electricity tariff favored by Argentina in the last few years reduces the incentives for electricity distributors to move into deploying charging infrastructure.

**Macrosocial reforms and international financing can create the enabling conditions for successful adaptation and mitigation**

Addressing macroeconomic imbalances will create the conditions for the stronger public and private investments required for structural change towards a more resilient and low-carbon economy. Solving macroeconomic imbalances in a lasting way will restore investors’ confidence. This, in turn, will incentivize private investment, which has been low for many years. As in other countries, Argentina’s private sector will play a decisive role in accelerating the transition towards a low-carbon economy and adopting adaptation measures that will make its productive structure more resilient to climate change. Creating a business-friendly environment to unleash private sector investment and innovation will accelerate the transition towards a low-carbon economy and lift Argentina’s growth potential.

**Energy subsidies and carbon tax reforms can provide the right incentives for an orderly and just transition.** Argentina is one of 46 countries that apply carbon pricing, approved at $10 per tonne of carbon dioxide equivalent (tCO₂e) in 2017. As of 2022, given the exchange rate depreciation, its carbon tax rates are near $5/tCO₂e. The tax covers only around 20 percent of total emissions, since direct emissions from natural gas, agriculture, land use, and industrial processes are exempt. It also coexists with energy subsidies, which operate in the opposite direction and impose a burden on the fiscal accounts. The government is taking steps to progressively reduce subsidies by increasing wholesale prices and eliminating subsidies to consumers that are in the highest income decile. Alongside a fossil fuel subsidy reform, a higher carbon tax could help raise fiscal revenues and provide the right signal to the private sector on decarbonization goals, thus triggering private investments in decarbonization.

As described below, the revenues from a carbon tax can be used to compensate the poorest 40 percent and ensure the reform benefits the poorest.

**The country can use part of the revenue from that tax to ensure the lowest income deciles benefit.** Simulations show that in the absence of recycling carbon tax revenues by reducing other taxes, upgrading the carbon tax and eliminating energy subsidies could imply a transitory reduction of 1 percent of GDP (and 0.5 percent in the long term), through a strong reaction of consumption. However, the final impact of such a tax will depend on how the government uses the additional resources raised. Results show that recycling 25 percent of these revenues, targeted to the bottom 40 percent of the income distribution, would protect those deciles from the erosion of purchasing power created by the carbon tax. Using the remaining 75 percent for public investment would increase GDP by 3.6 percent by 2050 compared to the baseline (Araujo et al., 2022).

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24 To avoid imposing an extra burden on private companies, Argentina could simplify its complex tax system as it phases out fossil fuel subsidies.
Some climate action can be financed through international public and private donor finance, carbon markets, and results-based sustainability-linked borrowing. While most climate actions identified in this CCDR can generate large benefits for the private sector and the Argentina economy (like investments in lithium or electric vehicles), others might require international public and private funds to help cover some of the costs (for example, actions to reduce deforestation or reduce methane emissions from livestock). Concessional funding or de-risking instruments, including blended finance, are required to remove barriers to public and private investments in climate action, and for investments that are not yet commercially viable, such as new, unproven climate-smart technologies. International carbon markets can be a source of results-based funding for sovereigns and SOEs engaging in activities that reduce GHG emissions, as well as for the private sector in general. Sustainability-linked bonds and loans can also provide a reliable source of financing that is paired with a results-based discounts (or penalties) for meeting (or not) pre-agreed objectives. International transfers can also support the economic costs of a low-carbon transition, in line with the principle of common but differentiated responsibilities.

Conclusion: priority actions

Argentina’s reliance on natural capital contributes to the country’s vulnerability to climate change through agriculture and hydropower and to low-carbon transitions through the oil and gas industry. It also presents opportunities for growth. The country has potential to design an inclusive, resilient, and low-carbon growth model if it harnesses its comparative advantages in climate-smart agriculture, lithium and EV batteries, and renewable energy while increasing productivity through water security.

Given its macroeconomic context, prioritizing climate policies that are compatible with, or can contribute to, raising Argentina’s potential growth, while also considering poverty and distribution, is vital. The actions identified in this CCDR and summarized in table S.2 avoid irreversible pathways and are prioritized based on their development benefits and urgency. A next step will be to assess these actions together in a macroeconomic framework to evaluate the fiscal and growth impacts.
### TABLE S.2. Climate and development-linked priorities for Argentina

<table>
<thead>
<tr>
<th>Broad priorities</th>
<th>Benefits for adaptation</th>
<th>Benefits for mitigation</th>
<th>Link to other policies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Macrofiscal reforms and price incentives</strong></td>
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<td></td>
</tr>
<tr>
<td>1. Gradually eliminate energy subsidies and carbon taxes considering recycling of carbon revenues to protect the poorest while creating buffers to face climate shocks</td>
<td>High</td>
<td>High</td>
<td>Macroeconomy, poverty</td>
</tr>
<tr>
<td>2. Develop and implement price incentives for low-carbon technologies in transport: new generation biofuels, green hydrogen, EVs*</td>
<td></td>
<td>High</td>
<td>Energy, agriculture, industry</td>
</tr>
<tr>
<td>3. Strengthen public systems and private mechanisms for payments for ecosystem services to mitigate deforestation</td>
<td>Medium</td>
<td></td>
<td>Poverty</td>
</tr>
<tr>
<td><strong>Human capital interventions</strong></td>
<td></td>
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<td></td>
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<tr>
<td>4. Better connect social protection systems with risk monitoring systems for resilience to climate shocks</td>
<td>Medium</td>
<td>Medium</td>
<td></td>
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<tr>
<td>5. Education reforms to change behaviors towards low emissions consumption and awareness of climate risks (e.g., environmental education law)</td>
<td>Medium</td>
<td></td>
<td>Education</td>
</tr>
<tr>
<td>6. Develop retraining policies and adapt social support policies to consider the green jobs transition</td>
<td>Medium</td>
<td></td>
<td>Macroeconomy, poverty</td>
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<tr>
<td><strong>Planning, regulations, incentives</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>7. Design a medium-term sustainable energy plan</td>
<td>High</td>
<td>High</td>
<td>Transport, water, macrofiscal reforms</td>
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<tr>
<td>8. Improve data and modeling for water resource management</td>
<td>High</td>
<td></td>
<td>Transport, energy, agriculture</td>
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<tr>
<td>9. Design a decarbonization plan for the agriculture sector, to reduce methane emissions from livestock, and reduce deforestation in the Chaco</td>
<td>High</td>
<td></td>
<td>Forestry</td>
</tr>
<tr>
<td>10. Foster conditions for renewable energy investments through more favorable tariffs and regulations</td>
<td>High</td>
<td></td>
<td></td>
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<tr>
<td>11. Create incentives (and actions to increase awareness) for energy efficiency improvements in buildings and appliances**</td>
<td>Medium</td>
<td></td>
<td>Macroeconomy, energy</td>
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<tr>
<td>12. Increase public support and private sector mobilization for innovations in climate-smart agriculture</td>
<td>High</td>
<td>High</td>
<td>Macroeconomy (trade), health and poverty (food security)</td>
</tr>
<tr>
<td>13. Continue to develop the lithium value chain, increasing knowledge on opportunities for forward and backward linkages and evaluating the social and environmental impacts of lithium mining</td>
<td>Medium</td>
<td></td>
<td>Macroeconomy, transport</td>
</tr>
<tr>
<td>Broad priorities</td>
<td>Benefits for adaptation</td>
<td>Benefits for mitigation</td>
<td>Link to other policies</td>
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<td>---------------------------------------------------------------------------------</td>
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<tr>
<td>14. Improve transport logistics for value chains*, urban consolidation center,</td>
<td>Medium</td>
<td>Medium</td>
<td>Agriculture</td>
</tr>
<tr>
<td>improved rail access, energy efficiency in transport</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>15. Continue improving the quality of GHG inventories and develop emission factors</td>
<td>Medium</td>
<td>Medium</td>
<td>Industry</td>
</tr>
<tr>
<td>that the private sector can use in carbon intensity accounting</td>
<td></td>
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</tbody>
</table>

**Investments**

<table>
<thead>
<tr>
<th>Investments</th>
<th>Benefits for adaptation</th>
<th>Benefits for mitigation</th>
<th>Link to other policies</th>
</tr>
</thead>
<tbody>
<tr>
<td>16. Invest in water storage infrastructure</td>
<td>High</td>
<td></td>
<td>Agriculture</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Opportunity cost of public funds</td>
</tr>
<tr>
<td>17. Deepen waterways</td>
<td>High</td>
<td>Medium</td>
<td>Lower transport costs and emissions</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Political economy issues around road transport</td>
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<tr>
<td>18. Continue investing in transmission infrastructure to connect renewable</td>
<td>Medium</td>
<td>High</td>
<td>Opportunity cost of public funds</td>
</tr>
<tr>
<td>energy to the grid</td>
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<td></td>
<td></td>
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<tr>
<td>19. Invest in EV charging infrastructure</td>
<td>High</td>
<td></td>
<td>Energy</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Opportunity cost of public funds</td>
</tr>
<tr>
<td>20. Invest in green infrastructure for flood mitigation, together with increased capacity for urban planning</td>
<td>High</td>
<td></td>
<td>Health, poverty</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Opportunity cost of public funds</td>
</tr>
</tbody>
</table>

Source: World Bank staff calculations, based on the results of this CCDR.
Note: * We undertook detailed analysis for only two value chains: soybeans for the whole country and diary/milk for the Buenos Aires metropolitan area. Those results could be scaled to other sectors. ** We undertook detailed analysis for some actions, including changes in lighting, household appliances and distributed generation from solar panels.
References


