



The turning point

A new economic climate
in South America

May 2022



Foreword

Over the past century, South America's economies have benefited substantially from fossil-fueled industrialization and carbon-intensive agricultural expansion. This has led to the false belief that economic growth and poverty alleviation is incompatible with meaningful climate action.

However, this path is no longer viable for a sustainable and prosperous society. Rising temperatures, and thus changes in climate patterns, will rapidly translate into economic and commercial losses; directly impacting our land, our infrastructure, and most importantly, our people.

The pandemic we are living through has only reinforced this awareness. As a global society, we saw our systems tested by COVID-19 and we saw some of them fail. This has been a wake-up call, an opportunity to reset and consider the actions we need to take to protect the shared infrastructure and societal systems on which we rely.

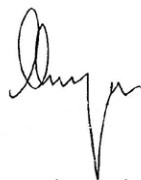
Climate change will similarly disrupt our supply chains, test our institutions, and create deep changes in society. Damages caused by climate crises are already being strongly felt in South America, causing loss of lives, destruction of urban infrastructure, imbalance of natural ecosystems, and hopelessness. But there is another way.

This report from the Deloitte Economics Institute shows a feasible, coordinated, and phased decarbonization pathway that leads to new growth for South America. The analysis starts by accounting for the costs of global climate change within South America's growth projections and compares that to the potential economic benefit to the region if the world achieves net-zero by mid-century.

In South American countries, where different cultures, inequalities, and contradictions mark local societies, this transformation period is likely to be complex. Where regional leaders can make a choice is in identifying the opportunities of the change, innovating ahead of the needs, and collaborating to achieve systemic results.

Transitions are always challenging but reversing climate change is a global imperative. We now must work together—governments, businesses, NGOs—to develop and implement the kind of innovative solutions this time requires.

It is up to each of us to decide if we are bold enough to help lead the way.



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Key insights



Key insights

From the increasing frequency of extreme weather events to the warnings from scientific community, the climate imperative is now clear: If we do not act to curb climate change this decade, every industry, region, and community will feel the severe consequences of that choice.

Yet most economic models still don't depict the significant—and growing—costs of climate change on the economy. This means decision-makers are not able to fully assess the consequences of their choices because the traditional models seem to imply that the status quo is somehow the less costly choice for economies. It's time to change that assumption.

In this report, the Deloitte Economics Institute (the "Institute") presents a new way to think about South America's economic future, based on scenario analysis from Deloitte's Regional Climate Integrated Assessment Computable General Equilibrium Model (D.Climate).

By explicitly accounting for the impacts of climate change on future productivity, economic output, and growth, Deloitte's framework sheds light on two pressing questions in the climate policy debate: First, "What would be the economic costs of climate inaction for South America?" and "What are the economic benefits of limiting global warming to close to 1.5°C for South America?" The results also show how decarbonization can help South America reduce climate-related risk, transform its regional economy, and achieve long-term growth. The following summarizes the key insights from this analysis.



If the world doesn't achieve net-zero by mid-century, South America will be among the worst-affected regions of the world.

Without global action, carbon emissions and temperatures will continue to rise¹ to 3°C by the end of the century. In this world, South America would lose 12% of GDP—or US\$2 trillion—in 2070 alone. A loss of this scale is more than the current economy of Brazil. This prospect threatens to worsen the extreme social and economic inequalities that already exist in most countries in the region.

However, the risks are not just environmental. South America's economies have worked hard to build global prominence through the export of primary resources and manufactured goods. Progress to date could be rapidly undone as key export markets commit to net-zero targets and greater scrutiny is placed on supply chains.




Unchecked climate change will create a long-term drag on economic growth in South America.

By 2070, unchecked climate change could create approximately US\$17 trillion in total economic losses to the South American region (in present value terms),² according to Deloitte's analysis. In this climate-damaged future economy modeled by Deloitte, there could also be 18 million fewer jobs available in South America's economies in 2070, diminishing the region's long-term economic prospects.

Not only would the economic loss be severe, but the composition and quality of long-term growth would also change, threatening South America's progress toward diversifying its economies beyond natural resources. Over the next 50 years, services, manufacturing, retail, and tourism could incur the greatest losses to economic activity due to climate change. Together, these industries currently account for just over 80% of employment in the region.

The public and private service sectors are particularly exposed to heat stress and human health impacts from climate. Over the next 50 years, unchecked climate change would reduce South America's services gross value added by US\$7.1 trillion in net present value terms. Extreme weather events and damaged physical capital would reduce South America's manufacturing output by US\$3.5 trillion by 2070. The retail and tourism industry could also experience a loss of US\$2.3 trillion by 2070.



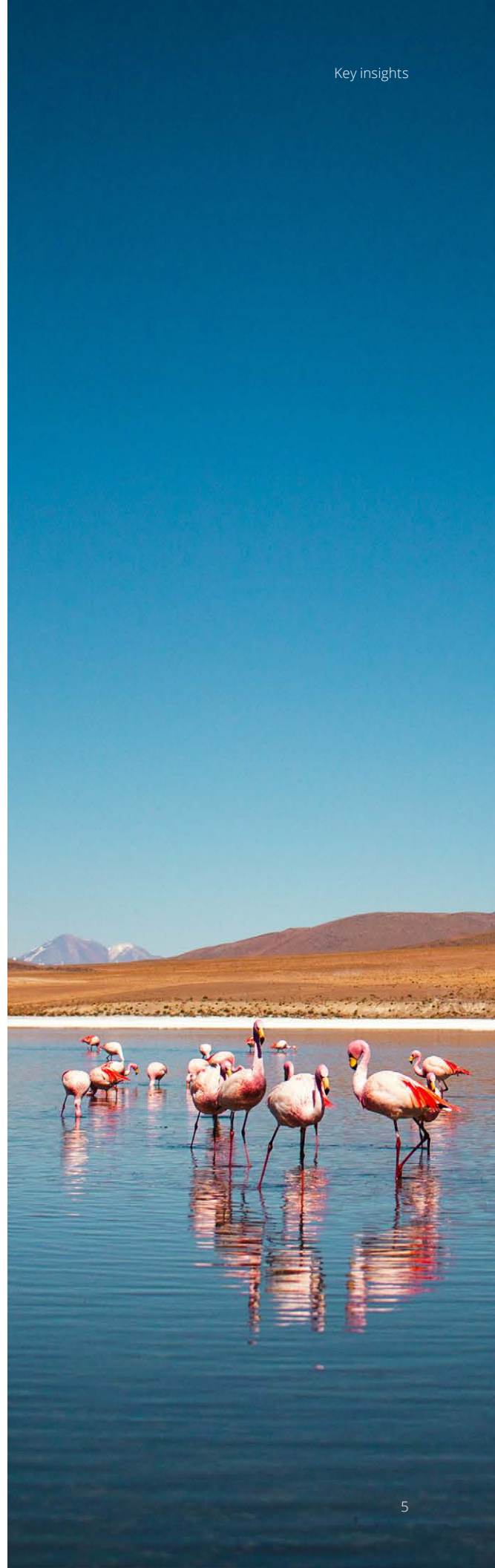
Rapid decarbonization in South America and across the global economy, could both limit the worst effects of climate change and bring an economic turning point.

Reducing South America's emissions profile will incur significant transformation costs, but if the region starts making bold climate plays now, it can leverage existing skills and supply chain connections to create a path to a prosperous, low-emissions future. The turning point concept demonstrates that by choosing transition, countries and industries could see dividends in terms of avoided costs from climate damage in the form of new industries and technologies.

The upside of decarbonization could be significant. By 2030, clean energy industries could see rapid growth, creating new job pathways for workers from fossil fuel-reliant industries. Mining jobs could also expand as demand for critical metals, such as lithium and copper, rise in response to increasing global electrification.

By 2045, South America could reach its critical juncture, achieving almost 90% decarbonization across the region, and preventing a future of “locked-in” warming. From this point forward, the region’s net transition costs would start decreasing each year, moving the economy closer to a low-emissions future, thanks to growth in advanced clean manufacturing and sophisticated service-based offerings. From the mid-2060s, South America would reach its turning point—where the economic gains of decarbonization are greater than the costs.

By 2070 the region could have 2 million more jobs than it otherwise would in a climate-damaged, emissions-intensive world. (This is primarily driven by avoided climate damages.) The net benefit of the transition could grow to 1% of GDP by 2070—US\$150 billion—a benefit that could increase with each subsequent year.



Transforming the region’s economies would require a significant commitment of leadership, time, resources, and coordination.

Because the region’s economies have long been tied to carbon-intensive agriculture, land use, and fossil fuels, South America’s transformation would likely take place over a longer timeframe than the other regions modeled by Deloitte.³ To balance the region’s economic development needs with decarbonization, it is vital for South American nations to start planning now to transition to a low-emissions future.

Part of this shift will require the region to adapt key export industries as the world shifts away from fossil fuels. Those countries and industries that are well-positioned for the global low-carbon transition are likely to benefit, but the modeling suggests these shifts will pose an overall challenge to the regional economy as a whole.

Bold climate action in the short term will also need to be reinforced by an enduring commitment to a low-carbon future. With the dedication of South America’s leaders, businesses, and communities, the region can substantially reduce its climate risk, and transform its transition costs into a US\$150 billion annual gain that delivers equitable and sustainable growth.

This map represents the geographical scope of the analysis. The discussion is presenting the macroeconomic view of inaction relative to action on climate change for the region—the bird’s-eye view of the region as a whole—important regional variation in impacts and opportunities will be the subject of future work. South America includes Brazil, Argentina, Colombia, Chile, Peru, Ecuador, Bolivia, Paraguay, Uruguay, Venezuela, Guyana, Suriname, Falkland Islands, and French Guiana.

FIGURE 1. South America – definition of modeled region



Source: Deloitte Economics Institute.

Key terms

There are a number of references and terms in this report, which are defined within this context as follows:

Climate change: Changes in the regional and global climate brought about by increased greenhouse gas (GHG) concentrations in the atmosphere.

Turning point: The economic point where the benefits of decarbonization start to offset the combined costs of “locked-in” climate change and the costs to transition the economy to net-zero.

Net-zero emissions: A state in which GHG emissions from human activities are balanced by the emissions taken out of the atmosphere. The technical definition of this concept can be found in the technical appendix.

Close to 1.5°C world: This pathway describes a net-zero economy by 2050 in which global average warming is limited to well below 2°C and as close to 1.5°C as possible, compared with preindustrial levels.

Around 3°C world: An economic scenario that relates to a pathway of climate inaction, where the implied temperature change is 3°C above preindustrial levels toward the end of the century.

Representative Concentration Pathway (RCP): A GHG concentration (not emissions) trajectory adopted by the Intergovernmental Panel on Climate Change (IPCC).

Shared Socioeconomic Pathway (SSP): A set of pathways adopted by the IPCC Sixth Assessment that explore how the global economy, society, and demographics might change over the next century.

Clean energy and electricity: Clean electricity includes solar, wind, nuclear, hydropower, and geothermal production technologies. Zero-emission hydrogen and bioenergy are combined with clean electricity to be described as clean energy.

Conventional energy and electricity: Includes coal, oil, and gas as fuels and energy production as well as their use in electricity production. Carbon capture, use, and storage is not separately modeled.

Economics for a new climate



Economics for a new climate

Notes on the analysis

As global average temperatures continue to rise, climate-related disasters such as storms, droughts, wildfires, and floods will become increasingly disruptive to business and increasingly expensive to mitigate. Yet most economic projections today still reflect an assumption that the economy can continue to grow the way it traditionally has: by generating GDP growth through carbon-intensive means of production. In the face of the climate science, it's time to consider the full costs of the emissions-intensive system of production on the economy.

In this report, the Deloitte Economics Institute presents a new economic baseline that demonstrates the impact unchecked climate change could have on South America's regional economy and its main industries. The analysis is based on results from Deloitte's D.Climate model, which explicitly accounts for the impact of climate change on future productivity, economic output, and growth. (For more information about the model, please refer to the accompanying technical appendix.)

While there are many uncertainties that come with modeling a 50-year horizon, the results in this report are not intended as an economic forecast, but rather an analysis of two comparative scenarios, designed to answer: "What if?"

This analysis is consistent with, and reflects, the latest climate science and incorporates leading economic modeling techniques. Like all models, there are simplifications. The macroeconomic analysis here looks at the trends of change and does not focus on nonlinearities and potential climate tipping points. It is also not a model of South American political processes, nor firm-level decision-making. That said, the research provides a critical corrective to the discourse, and can be used by leaders to make better-informed decisions about the costs of climate inaction (Scenario A) and action (Scenario B).

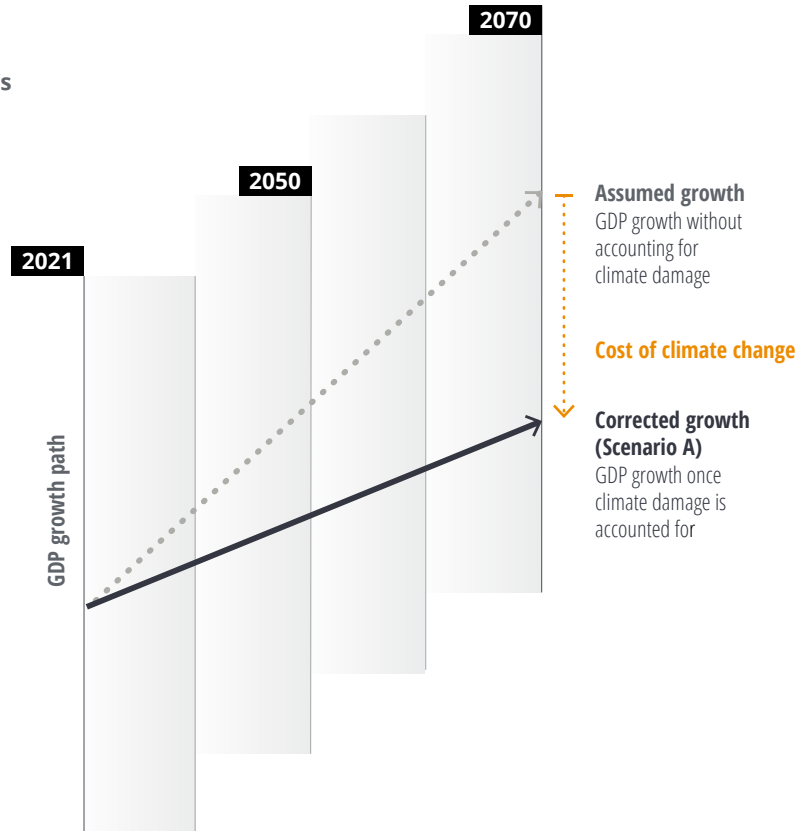
Scenario A

What would be the economic costs of climate inaction for South America?

This economic path represents a future with a higher rate of global greenhouse gas (GHG) emissions, where there are no significant additional mitigation efforts, and the global average temperature increases to near 3°C by 2100. This scenario reflects a widely adopted set of emissions, economic, and population assumptions, referred to as SSP2-6.0. The results of this scenario are presented as a deviation—a comparison to a world in which climate change didn't exist.

With this trajectory as the new baseline outlook for the region's growth, Deloitte then looked at what could happen if South America—in concert with the world—decarbonizes its economy.

FIGURE 2. The impact of accounting for climate change on South America's growth path



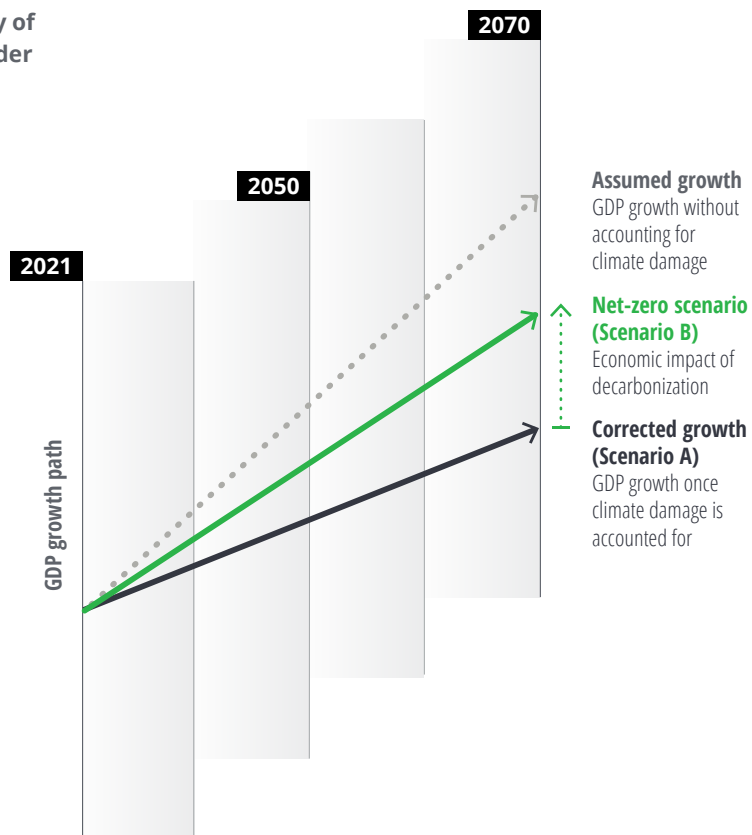
Source: Deloitte Economics Institute.

Scenario B

What are the economic benefits of limiting global warming to close to 1.5°C for South America?

The net-zero economic path depicted below reflects a sequencing of efforts—by government, business, and citizens—to achieve global net-zero emissions by 2050. This scenario limits warming to as close to 1.5°C as possible—well below 2°C. The results of this close-to-1.5°C world scenario (Scenario B) is presented as a deviation from the 3°C world pathway (Scenario A).

FIGURE 3. The opportunity of new economic growth under a net-zero scenario



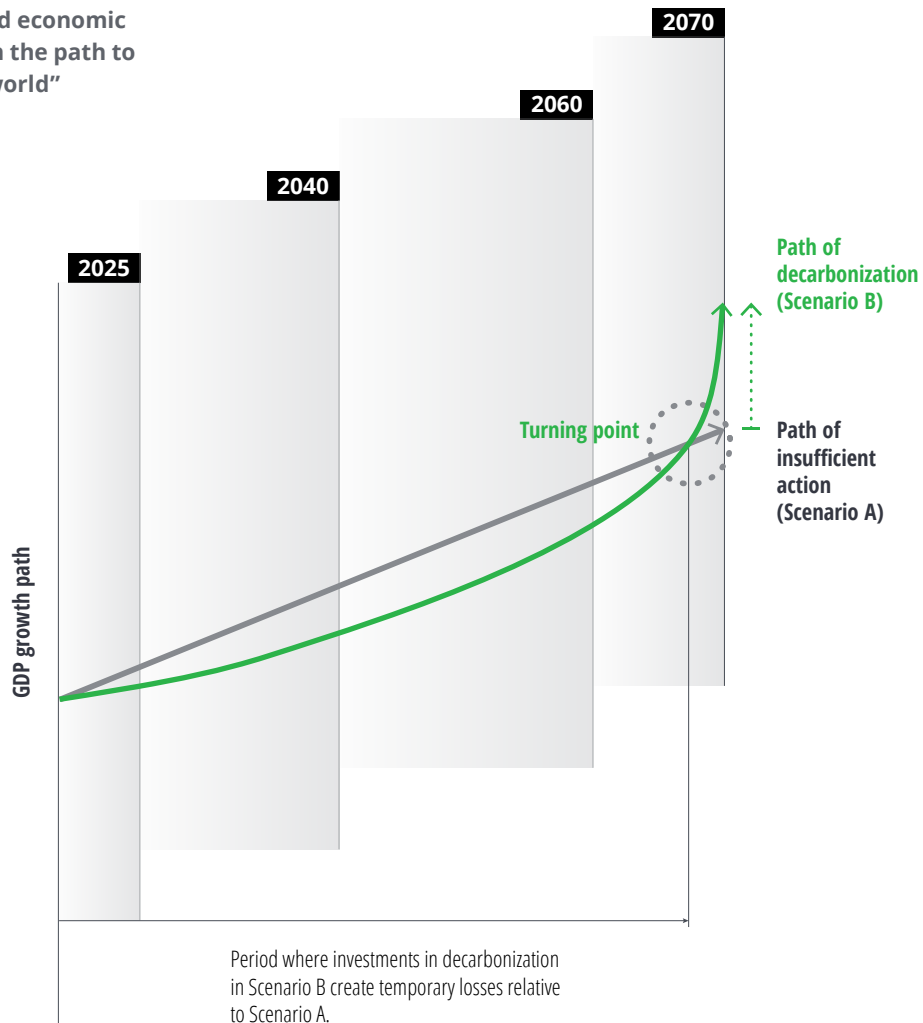
Source: Deloitte Economics Institute.

Modeling the turning point for South America

In addition to demonstrating the size of the opportunity for South America, the modeling also identifies the moment when the net gains from transforming to a low-emissions economy outweigh the cost to change. This net gain to the economy is what we call the turning point.

The following illustration shows a rapid and coordinated path to net-zero, which begins with a period of structural adjustment, as South America initiates an industrial and economic transformation.

FIGURE 4. Modeled economic growth to 2070 on the path to a “close to 1.5°C world”



The numbers included in the modeling reflect both the costs and the benefits associated with the transition.

Costs:

- The inevitable costs—to the economy as it moves away from emissions-intensive activity.
- The cost to the economy from global warming of at least 1.5°C, even with strong global action to reach net-zero by 2050.

Benefits:

- The benefit of avoiding costs from limiting global warming, instead of reaching around a 3°C increase in global average temperatures.
- The benefit of a more productive and modern economy, where consumer demand is met and industry preferences have changed.

Modeling climate change impacts in South America

To quantify its conclusions, the Deloitte Economics Institute modeled the economic impacts of a changing climate on long-term economic growth using the following process:

1

The model projects economic output (as measured by GDP) with emissions reflecting a combined Shared Socioeconomic Pathway (SSP)–Representative Concentration Pathway (RCP) scenario, SSP2-6.0, to the year 2100.⁴ The socioeconomic pathway, SSP2, is the “middle of the road” among five broad narratives of future socioeconomic development that are conventional in climate change modeling. The climate scenario, RCP6.0, is an emissions pathway without significant additional mitigation efforts (a baseline scenario).⁵ This results in a projected emissions-intensive global economy.⁶

2

Increased atmospheric GHGs cause average global surface temperatures to continue rising above preindustrial levels. In the SSP2-6.0 baseline scenario, global average temperatures increase more than 3°C above preindustrial levels by the end of the century, according to the Model for the Assessment of Greenhouse Gas Induced Climate Change (MAGICC).⁷ (Note that present-day temperatures have already risen more than 1.0°C above preindustrial levels.)

Modeling climate change impacts in South America

3

Warming causes the climate to change and results in physical damage to the factors of production. The Deloitte model includes six types of economic damage, regionalized to the climate, industry, and workforce structure of each defined geography in South America. These damages capture the trend or chronic impacts of global mean surface temperature increases. Deloitte's approach does not explicitly model individual acute economic shocks driven by extreme climatic events, such as natural disasters, although these are implicitly captured in an increasing trend of climate change damage.

4

The damage to the factors of production is distributed across the economy, impacting GDP. Any change in emissions (and, correspondingly, temperatures) over time results in a change to these impacts and their interactions. The economy impacts the climate, and the climate impacts the economy.

5

The key variables of time, global average temperatures, and the nature of economic output across industry structures combine to offer alternative baseline views of economic growth. Specific scenario analysis is then conducted, referencing a baseline that includes climate change damage. Scenarios can also include policy actions that either reduce or increase emissions and global average temperatures relative to the current SSP2-6.0 baseline view.

This modeling framework involves significant research on climate and economic impacts across South America, which are used as inputs for Deloitte's D.Climate model (refer to the technical appendix for more detail).

The costs of climate inaction



The costs of climate inaction

South America is already feeling the physical impacts of climate change, which have become even more noticeable in recent years. Since the beginning of the pandemic, several major heat waves and droughts have hit central South America, stretching from the Peruvian Amazon to southeastern Brazil. The flow of Paraguay River in the southern Amazon and the Pantanal shrank its lowest levels in half a century, due to severe drought. The southern Amazon experienced its most active fire year in 2020. The Andes have now lost the largest proportion of its ice compared to any other mountain region in the world.

Peru's glaciers shrank by a third from 2000 to 2016.⁸

While heat and drought have plagued some areas, others have been afflicted by flash floods and landslides. In February 2020, Sao Paulo recorded the wettest month in 77 years, with almost double the normal average rainfall.⁹ Between October 2020 and February 2021, for example, almost 300 people lost their lives in Brazil, due to flooding from historically high rainfall.

Based on existing levels of warming, climate science predicts the next 50 years will bring similar extreme weather events, but they will be more intense, and they will occur more frequently. To understand how these types of environmental events could impact South America's economy, Deloitte modeled six impact channels, namely: heat stress, capital damage, tourism expenditure flows, lost agricultural land due to sea level rise, agricultural yield changes, and human health.

Climate change will harm the drivers of economic growth

To demonstrate the impact climate change could have on the economy, we incorporated regional climate data into the following economic factors. These factors would suffer climate damages in a 3°C world, which would impact future GDP growth.

FIGURE 5. Economic impact associated with climate change



Heat stress
Lost labor productivity
from extreme heat



Sea level rise
Lost productive land, both
agricultural and urban



Damaged capital
Stalling productivity
and investment



Human health
Increased incidence of
disease and mortality



Lost tourism
Disrupted flow of
global currency



Agriculture loss
Reduced agricultural
yields from changing
climate patterns

Source: Deloitte Economics Institute.

Without sufficient global action on climate change, South America would be one of the worst-affected regions in the world,¹⁰ generating total economic losses of approximately US\$17 trillion in present-value terms¹¹ by 2070. As temperatures rise, these losses would continue to mount rapidly.

South America's key engine for growth—agriculture—is likely to struggle: By the end of the century, the region could lose up to 21% of its arable land due to climate change and population growth.¹² Growing competitive pressure for food and first-generation bioenergy exports would further exacerbate resource scarcity constraints. In a climate-damaged economy, productive capital and knowledge would be diverted to managing health, mitigating harm, and repairing climate damages rather than new value-adding innovations and infrastructure. This resulting reduction in productivity and lack of new investment would create significant losses to standards of living and well-being.

These impacts would all be headwinds to growth. Over the next five decades to 2070, the region's economies would experience an average loss of 5% to GDP per year relative to trajectories that do not account for climate impacts.¹³ In the year 2070, a climate-damaged South America could lose 12% of GDP—or US\$2 trillion. A loss of output at this scale is equivalent to the current economy of Brazil.¹⁴ In this smaller, climate-damaged economy, employment opportunities would also dwindle. In 2070 alone, there could be nearly 18 million fewer job opportunities—almost 9% of jobs—in South America due to climate-related damages.¹⁵



\$17 trillion

lost from the South American economy

Note: Present value GDP loss to 2070 due to climate change inaction.

Growth with consequences

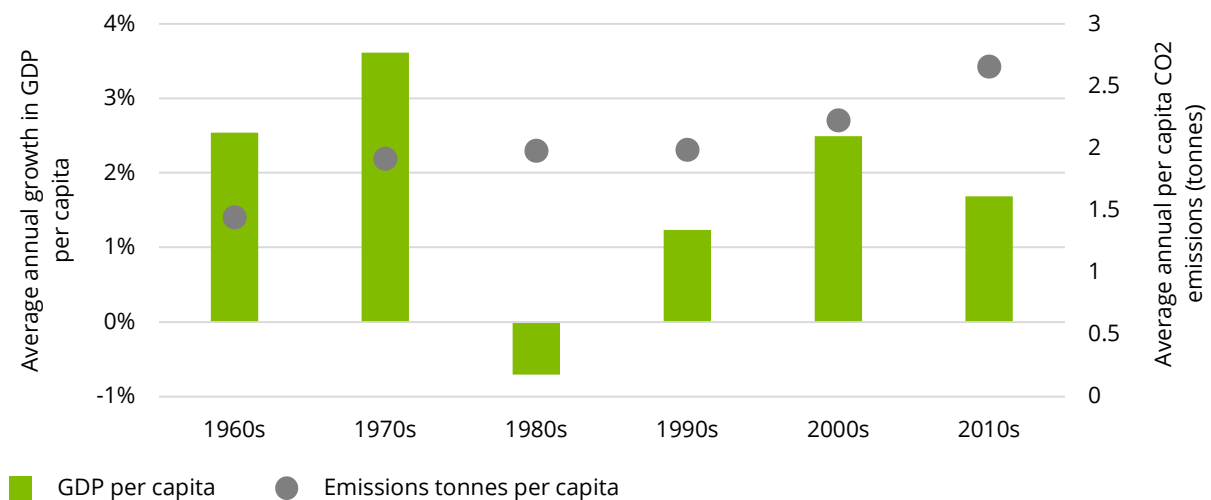
Over the past century, South America's economies have benefited from a land rich with minerals, raw materials, and temperate climates. Capitalizing on its access to vast agricultural, oil, gas, and mineral resources, South America's economic growth has historically been driven by natural resource extraction (agriculture, mining, and energy), as well as in energy-intensive manufacturing.¹⁶ Major economies, such as Brazil, Argentina, Venezuela, and Chile, have been built on the success of resource-based industries and are progressively transitioning into service-based sectors, which now make up the majority of employment across South America.

Yet South America's economic growth has not been a smooth journey. The boom and bust of commodity- and resource-based economies can be seen in South America's modern economic history. Cutting through these ups and downs, however, is a gradual trend toward prosperity over the past 50 years. Along with this increased prosperity and a growing middle class, the region's emissions-per-capita have also grown.

Today, South America accounts for 6% of world carbon emissions.¹⁷ More than half of South America's emissions are from agriculture, land use, land use change, and forestry (LULUCF) activities. This is significant compared to the rest of the world, of which less than 15% of emissions are from agricultural and LULUCF sources.¹⁸

Brazil (South America's largest economy and emitter), is currently the largest contributor of land use and land use change net carbon emissions worldwide, representing 17 to 29% of the global total.¹⁹ Home to the world's largest rainforest, the Amazon has played a vital role as a global carbon sink. However, harvesting timber resources and clearing for agricultural expansion has led to around 15% of the Amazon being cleared since the 1970s.²⁰ Deforestation and climate change have now turned parts of the Amazon into a carbon source.²¹

FIGURE 6. Trends in per capita GDP growth and emissions



Note: Per capita GDP growth to 2014, per capita emissions to 2018. Emissions data excludes LULUCF emissions.
 Source: Deloitte Economics Institute analysis of World Bank data.

Substantial losses to industries, companies, and workers

The impacts of a changing climate will be felt across all South American industries, but over the next 50 years, the three industries in South America expected to incur the greatest climate-related losses are services, manufacturing, and retail and tourism. Together, these industries currently account for about 80% of employment in the region.

In industries that rely on people power, such as the service and manufacturing sectors, extreme heat would decrease comfort and reduce the number of hours in which work can be done. Difficulties in traveling and physical limits to undertaking even normal tasks would all undermine labor productivity. Deloitte estimates that in 2070 alone, these three industries would experience a loss in the value added to GDP of more than US\$1.5 trillion as a result of climate change.

In our model, the distribution of climate damage would put South America’s transition from a natural resource extraction economy to a services-based one at risk. Over the next 50 years, unchecked climate change would reduce South America’s services gross value added by US\$7.1 trillion in net present value terms. In the year 2070 alone, almost 9 million jobs would be displaced.

Climate change also threatens one of South America’s key pillars of economic development, manufacturing. Extreme weather events and global pressure for low-emission energy would reduce South America’s manufacturing GVA by US\$3.5 trillion by 2070. This projected loss of economic potential in this sector is equivalent to the region’s total current GDP.²²

The region’s burgeoning outdoor tourism sector would also be hit hard. From hikers climbing the peaks of Machu Picchu to families strolling the Copacabana beach, visitors looking for outdoor adventures are likely to be discouraged by rising temperatures, which could impact a wide range of adjacent businesses as tourist numbers plummet. Deloitte estimates that by 2070, the retail and tourism industry could experience a loss of US\$2.3 trillion in present value terms. This would see more than 3 million jobs lost in 2070 alone.

Industry	GDP impact 2021–2070 (\$ billion, net present value)
Services	-7,100
Manufacturing	-3,500
Retail and tourism	-2,300
Construction	-1,300
Agriculture	-800
Transport	-700
Resources	-500
Conventional energy	-300
Water and utilities	-200
Clean energy	-100

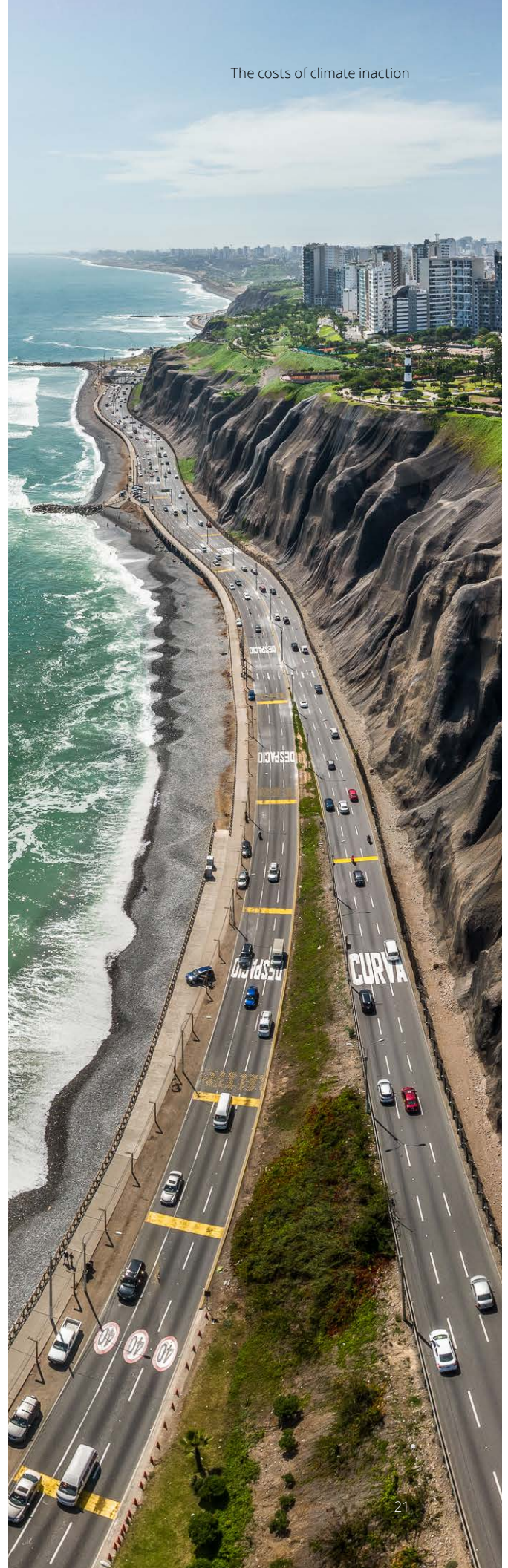
Note: Numbers may not add up due to rounding.

Source: Deloitte Economics Institute.

Social and systemic and costs

Every region and community in South America will feel the effects of climate change, but some will be more adversely affected than others. Although economic growth has allowed socioeconomic conditions to improve, high levels of income inequality persist across South America's economies,²³ and more frequent and intense extreme weather events are expected to have a greater impact on those in poverty.²⁴ By 2030, climate change will reduce the agricultural productivity, threatening the food security of the poorest populations, particularly in the northeast of Brazil and parts of the Andean region.²⁵

The economic risks are not just physical. South America's economies have worked hard to build global prominence through the export of primary resources and manufactured goods. Progress to date could be rapidly undone as key export markets, including United States, China, Netherlands, and Japan, commit to net-zero targets and place greater scrutiny on their supply chains. Trade and investment flows globally mean that the direct impacts of physical climate change in South America will be compounded by the economic effects of physical climate change damage in other parts of the world. Many South American multinationals will have exposure to climate risks in other parts of the world.



Economic dividends of action

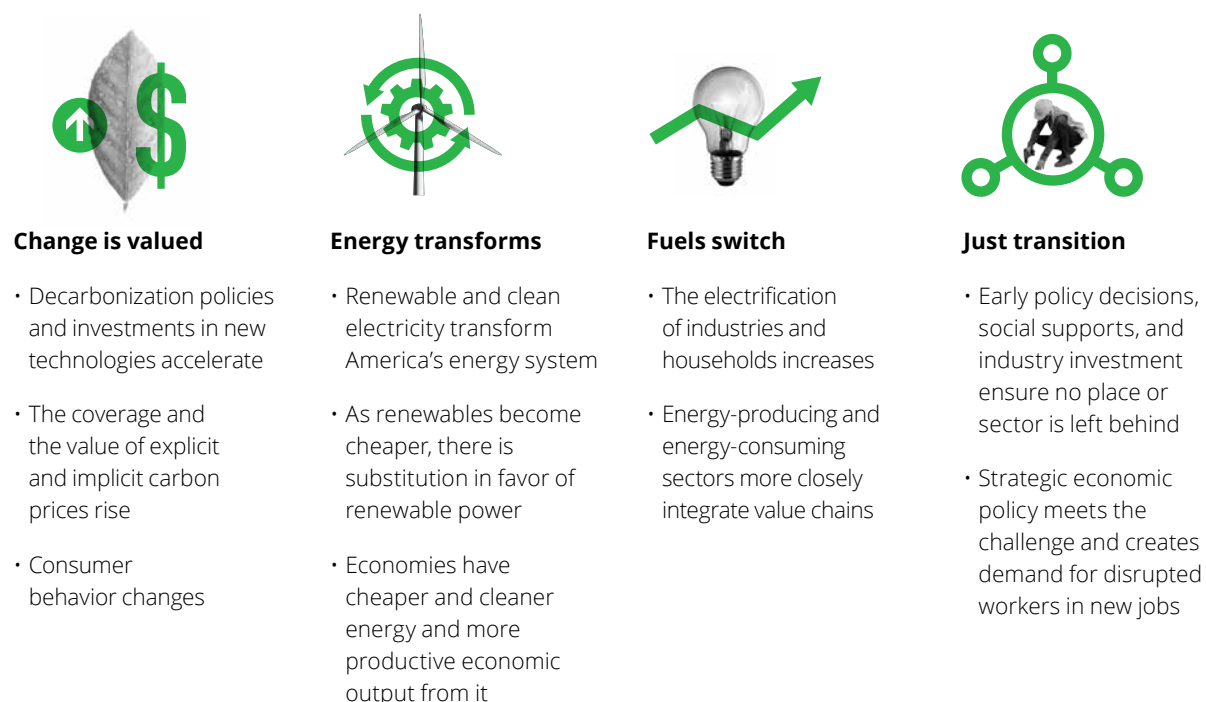


Economic dividends of action

The economic costs of climate change are sobering, but they are not inevitable. While some degree of global temperature rise is already “locked-in” due to historical emissions, there is still an opportunity for South America to change course and avert the worst impacts of an altered climate.

The D.Climate model of a “close to 1.5°C world” incorporates a number of levers that could create a path to growth in a low-emissions future. If South America—in concert with the world—accounts for climate damage and increases its ambition to act, it would create an impetus to change. That price signal could then accelerate decarbonization across all economic systems. Energy systems could rapidly transform, and conventional fuels could become increasingly uncompetitive due to technological improvements. As this transition takes place, governments could invest in creating jobs and economic opportunity alongside industry to minimize the disruption. See the technical appendix for more details on the mechanisms that drive decarbonization to reach South America’s turning point.

FIGURE 7. The drivers of economic change from decarbonization in a “close to 1.5°C world”



Source: Deloitte Economics Institute, D.Climate model.

Relative to other regions, South America's transformation occurs over a longer timeframe,²⁶ due to the need for South America to strike the right balance right between decarbonization and economic development. As the world shifts away from fossil fuels, South America will be driven to adapt key export industries. The global transition to net-zero is likely to benefit certain South American countries and industries that are well-positioned to capitalize on these shifts. The modeling suggests, however, that competitive dynamics in transition to a new low-carbon global economy will pose challenges for the region's economy-as-a-whole. The region also faces "locked-in" damages of climate change even under close to 1.5°C of warming.

Despite the challenges and costs of the transition, the upside to decarbonization is significant. With the right structures in place, the clean energy industries could see early and rapid growth, adding an average 100,000 workers per year by 2030. Beginning in 2068, when South America reaches its turning point, the economic benefits of decarbonization would start to outweigh the costs. Even by the mid-2060s though, the net positive economic gains could start to appear as the region nears the completion of its economic transformation. In 2070, South America's net benefit of transition could grow to 1% of GDP, or US\$150 billion (relative to a 3°C world), a benefit that would grow with every subsequent year. This opportunity is about 1.5 times the size of the current Ecuadorian economy.²⁷



Note: *South America's GDP gain in a decarbonized 1.5°C world of 2070

Beyond 2070, South America's economy and people would realize the dividends of the investment in decarbonization, driven by limiting the extent and costs of future climate change damage. In a transformed economy, South America could have 2 million more jobs than it otherwise would in a climate-damaged world, a trajectory that would bring new economic opportunities and greater standards of living.

Efforts to reduce energy emissions are progressing in South America. Suriname is one of only two countries globally to have already realized net-zero emissions, thanks to their large forest cover and relatively small population.²⁸ In 2019, over 80% of Brazil's electricity was supplied by renewables, primarily through hydropower (64%) and biofuel (9%).²⁹ Other economies, including Peru and Chile, have agreed to a goal of 70% renewable electricity by 2030.³⁰ Chile is the most progressed, with a target to peak emissions by 2025 and a 2050 net-zero target currently proposed for legislation.³¹ All other nations are in talks but are yet to legislate net-zero targets.

Phases of decarbonization



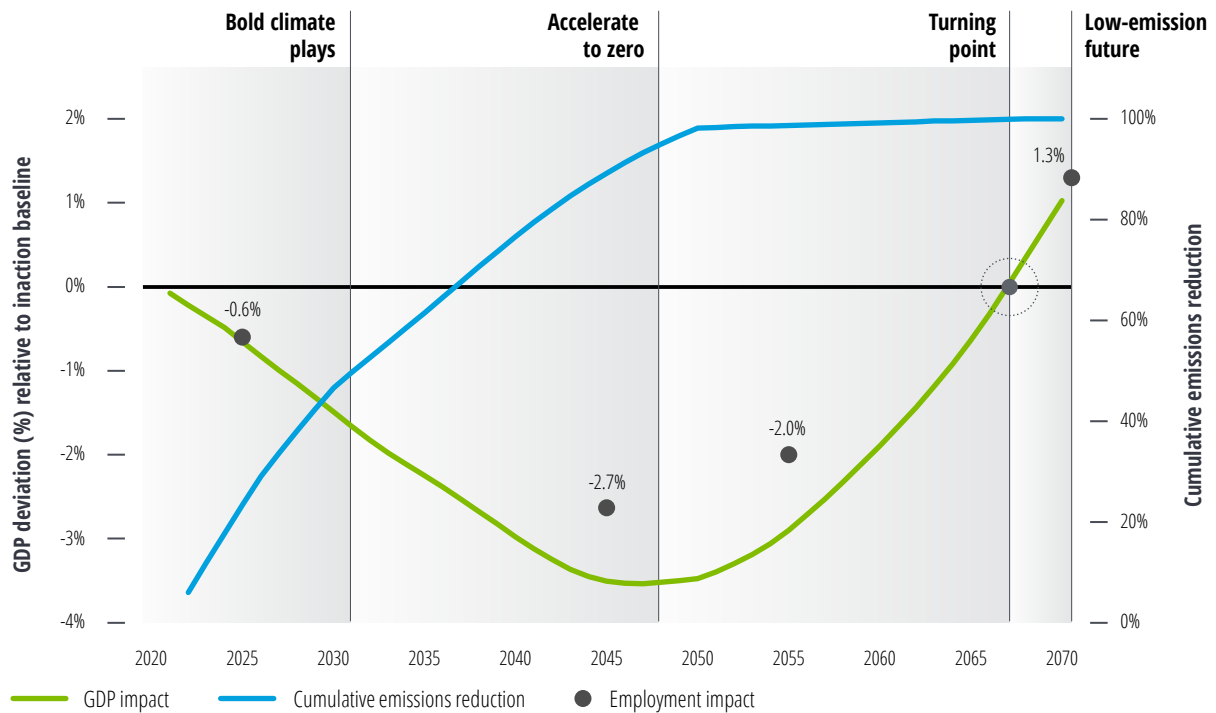
Phases of decarbonization

How South America could achieve a low-carbon system transformation by 2050

Because South America’s economies have long been tied to carbon-intensive agriculture, land use, and fossil fuels, its transformation to a low-emission economy would be less straightforward than other modeled regions, but the price of inaction would be far greater. The Deloitte-modeled path for South America’s turning point shows how the timing and sequencing of effort can offset the investment costs by creating positive returns in the capital and technologies. To aid the interpretation of the

modeling results, we have outlined four phases of structural economic change—bold climate plays, accelerate to zero, moving toward the turning point, and a low-emission future—each representing the economic interaction of the choices, investments, and technological and industrial changes that create a new low-emission economy. These phases summarize the subregional transitions playing out at different speeds, but all toward a common goal of net-zero by 2050.

FIGURE 8. Deviation in GDP relative to a world of inaction and cumulative emissions reduction from 2020 achieved

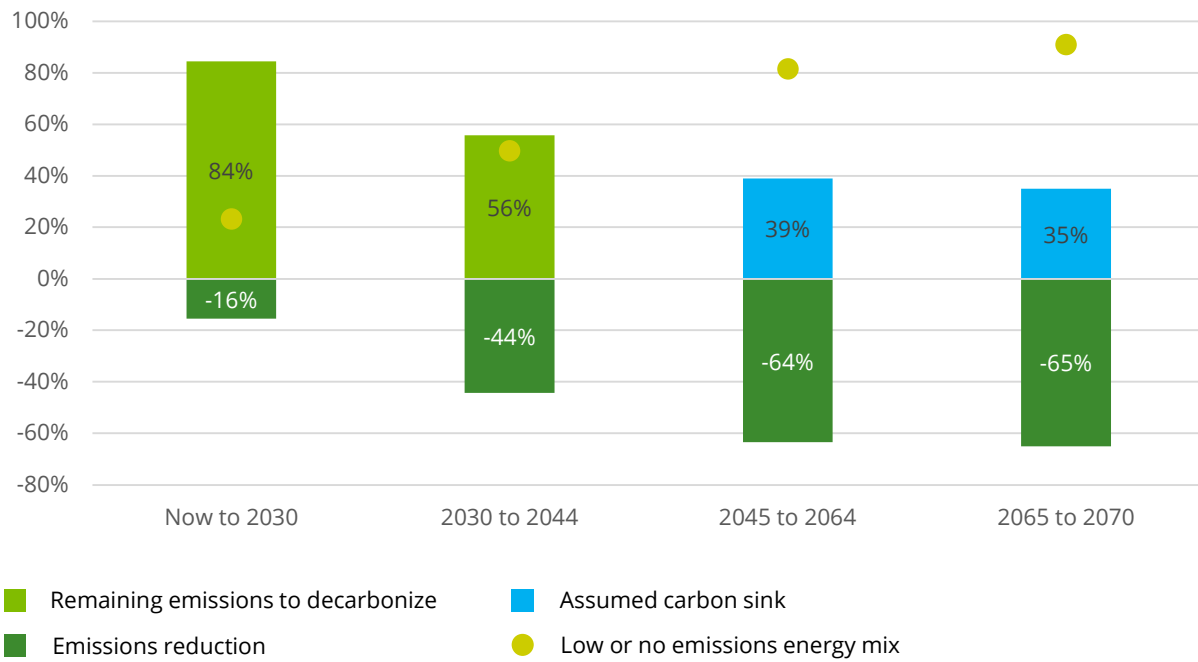


Source: Deloitte Economics Institute.

According to the Deloitte-modeled scenario, clean energy (primarily renewables such as hydro, wind, and solar) underpin the early and rapid transition, which would include the significant expansion of modern bioenergy and “green” hydrogen to support

harder-to-abate industries.³² This transition—from the renewable shift in electricity generation to the electrification of industrial and other processes—takes time but results in 100% clean electricity as soon as 2045.

FIGURE 9. South America’s emission profile and energy mix



Source: Deloitte Economics Institute.

Bold climate plays from 2021 to 2030

The next decade sets the stage for rapid decarbonization. The decisions by government, regulators, business, industry, and consumers could reinforce initial progress and create the market conditions to deliver decarbonization at pace and scale. This is also the decade when innovation, investment, and research and development will be required to deploy the requisite technologies to achieve reductions after 2030.

Carbon neutrality goals for 2050 would need to be legislated across South America's nations, pushing Brazil's current net-zero target a decade earlier than currently in discussion. Detailed plans to limit temperature rise in line with the Paris Agreement would need to be established. Policy levers could expand on existing carbon tax and emissions trading systems in Chile and Colombia to all of South America's economies. International climate action, such as carbon borders tariffs and the threat of agricultural moratoria, would likely put pressure on South America's key export markets to decarbonize. As a result, carbon prices are expected to rise, making clean technology investment attractive to private finance, and pushing supply chains to transform.

Clean energy could create early benefits

The electricity generation sector could undergo a significant transformation during this initial period. Renewable energy already makes over a third of South America's total energy supply, primarily through hydroelectricity and biofuel.³³ Expansion of solar and wind generation, paired with adoption of battery and pumped hydroelectricity storage and increasing electrification of infrastructure, will allow deeper penetration of clean electricity generation technology across South America's economies.

Significant investment into electricity transmission and storage could further allow South America's economies to tap into cheap renewable resources, such as solar power in western Chile and wind in

northeast Brazil.³⁴ Mining jobs could also initially expand as demand for critical metals in the energy transition, such as lithium and copper, rises in response to increasing global electrification.

Rapid expansion in the biofuel sector would also be supported by an emerging green hydrogen industry. This creates pathways for workers from more fossil fuel-reliant industries, such as conventional electricity generation, coal mining, and oil and gas extraction. This minimizes the net impact on employment losses and gains—a critical goal of a smooth transition.

Agriculture would also benefit as a sector that is both harder-to-abate, and leverages opportunities to offset emissions in other sectors. The driving force of South America's past agricultural successes (particularly cattle farming) would likely shift dramatically to meet changing consumer demands. Preference for low-carbon alternatives would continue to expand South America's crop and horticultural industries, with a focus on sustainable native produce such as potatoes, nuts, and avocados, while providing carbon sequestration benefits.

The path to a low-emissions economy is assumed to be supported by widespread adoption of sustainable land use practices and rapid restoration of South America's vast carbon sink. In the mid-2010s, South America's emissions from land use change and forestry fell by more than half compared to the previous decade, thanks to stricter enforcement of illegal deforestation, as well as international pressure on unsustainable agricultural processes.³⁵ However, more recent leniency on illegal deforestation has started to reverse that progress, causing emissions from land use change and forestry emissions to rise again over the past several years.³⁶

The impact of this first decade of rapid decarbonization on South America's economy would be marginal, but coordinated and rapid transition could prevent extreme disruption to the growth trajectory. Compared to a path of inaction, GDP would be 1% lower on average even as the pace of change accelerates.



Accelerate to zero from 2031 to 2045

This next period would be a critical juncture for preventing a “locked-in” higher emissions pathway for South America, as the hardest shifts in industrial policy, energy systems, and consumer behavior get underway. Because many of the tough decisions would have already been made, this period would center on meeting of the interim targets agreed to in the early 2020s. This is also a decade when South America’s economies, businesses, and industries would realign and begin to see the consequences of bold climate plays, with different industries and regions transforming at different paces. The ongoing structural change means few industries would realize net economic gains during this phase of coordinated change. South America’s overall economy would continue to grow, albeit at a slower rate than it would if the region does not decarbonize (Scenario A).

Toward the end of the period, the forestry industry could show signs of improvement as thousands of jobs are saved from the damages that would have occurred on a 3°C pathway. By now, price signals could be embedded in carbon markets to incentivize preserving trees for their carbon sequestration potential, outweighing the commercial gains from unsustainable timber harvesting or land clearing. All the while economic growth in clean energy and metal mining sectors could be surging ahead.

This would be offset by all other sectors, which would face transition pressures from shifting demands away from emissions-intensive processes. Traditional resource sectors—oil and gas—would continue to decline. Compared to a world of climate inaction, manufacturing, utilities, and construction are also likely to grapple with the costs of transformation and deteriorating competitiveness in the global market. This could have broader implications for the region, and for the service and retail sectors, which would also likely experience reductions in output, consistent with a relatively smaller economy.

By 2045 almost 90% of South America’s economies would have decarbonized, contributing to the world limiting warming to close to 1.5°C. The region’s commitment to this goal can keep it on a more sustainable and ultimately more prosperous economic path.

Moving toward the turning point from 2046 to 2065

Once the critical decarbonization adjustments in industry are made complete, the cost of new low-emission technologies would start decreasing, and the signs of economic gains would begin to appear. These efforts would also ensure that global warming remains on a path as close to 1.5°C—and well below 2°C.

The relative economic losses from the transition would begin to recede during the two decades of this phase. Low-emissions systems within and between countries would start to strengthen, accelerating the transition past the most economically challenging point. From 2046, the net transition costs would decrease each year, moving the economy closer to its turning point and low-emissions future.

For the most emissions-intensive sectors, the worst would be over. Manufacturing and utilities industries would be the first to see the benefits of the transition benefits exceed the transition costs. They could lead the way in closing the gaps, achieving positive employment gains by 2058. If the automotive industry embraces electric vehicles, steel manufacturers could invest in green hydrogen-based iron reduction processes. With the emergence of advanced clean technology, manufacturing could scale up low-emissions production significantly to meet local and global demands. By 2065, there could be more than 600,000 additional jobs in manufacturing and utilities compared to a scenario of climate inaction.

Productivity gains and investment in low-emissions manufacturing and utilities would start to flow through to other parts of the economy, with construction, transport, and the services and retail sectors achieving net gains by the end of the period.



A low-emission future from 2065

A low-emission future would benefit South America by offering new sources of economic growth. After South America reaches its turning point in 2068, the region would be at net-zero emissions, the economy would see net economic gains and the transformed systems of production could now keep global average warming to around 1.5°C by the end of the century. The region's economic structures would be radically transformed, underpinned by a series of interconnected, low-emission systems spanning energy, mobility, manufacturing, and food and land use.

Starting in 2066, employment gains would turn positive, continuing to rise toward the end of the century, adding more than 2 million additional jobs in 2070. These outcomes would be a product of both the direct economic benefits of decarbonization and the avoided costs of unmitigated climate change.

The energy mix would be dominated by low- or zero-emission sources across every market, with green hydrogen and negative emissions solutions, both natural and technological, playing prominent roles. Notably, manufacturing, services, and agricultural industries would now be rapidly gaining economic dividends from global decarbonization.

This vision of lasting prosperity will only be realized once South America's economic and ecological systems are truly harmonized. Bold climate action in the short term must be reinforced by an enduring commitment to a low-carbon future. With the dedication of South America's political leaders, businesses, and communities, South American societies can ensure their long-term economic growth path is equitable and sustainable.

New economic potential



New economic potential

Coordinated action will be critical to the long-term economic growth of South America, and Deloitte's modeling shows it can be done. What some may deem to be an impending catastrophic loss can be turned into a US\$150 billion annual gain within the lifetime of children born today. The benefits of rapid and coordinated transformation to South America's societies will be far-reaching.

South America can leverage existing skills and supply chain connections to support rapid decarbonization. Advanced clean manufacturing and sophisticated service-based offerings are some of the low-carbon opportunities that can enable South America's export markets to grow and diversify beyond primary resources and agriculture.

Tapping into South America's vast wind and solar resources, coupled with increasing electrification of energy systems, will provide affordable and secure energy supply. This has already been demonstrated by the large-scale adoption of hydroelectricity and bioenergy over recent decades, which has supported fuel security by reducing reliance on high-cost imported fossil fuels.

A new economic climate not only emphasizes the quantity of economic growth, but also its quality. Protecting and reforesting the Amazon will not only restore one of the world's vital carbon sinks, but also sustain the planet's most biodiverse ecosystem. This act alone would generate important commercial and social gains. As prices in carbon markets rise, carbon sequestration can become a valued industry alongside agriculture and forestry. Preserving the Amazon's natural amenity and indigenous culture would ensure deep traditions and diverse ecosystems can be enjoyed by future generations to come.

At the moment, South America's efforts fall short of what is needed. Although most of the countries in the region have put forward emissions-reduction pledges, they are seen to be insufficiently ambitious to achieve the goals of the Paris Agreement.³⁷ However, across all countries energy use, oil, and natural gas continue to dominate, and reliance on hydropower leaves energy systems vulnerable to changing rainfall patterns.

Brazil, which accounts for almost half of South America's emissions, is also not on track to meet its emissions reduction targets of 37% by 2025 and 43% by 2030.³⁸ In fact, a recent revision to its base year (2005) emissions has resulted in a relaxation in the total emissions reduction required under their existing targets.³⁹ Deforestation, a key source of emissions, is also on the rise.⁴⁰

Time is of the essence. Policy and investment decisions made in the next few years will largely shape the economy and climate that South America and the world will inherit. This narrow window makes it even more important to understand the economics of a warming world and incorporate it into decision-making that addresses the multiple market failures of climate change. Our recent experiences of increasingly frequent natural disasters—wildfires, droughts, floods and record-breaking heat waves—are devastating reminders of what these choices, our choices, will mean for us all.

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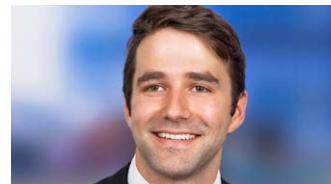
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