Argentina in the Face of Climate Change

Rethinking Development in a Transitioning World

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Energy

December 2024

fundar

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Suggested citation

Aneise, A. J. y Möhle, E. (2024). Argentina in the Face of Climate Change. Rethinking Development in a Transitioning World. Fundar.

Acknowledgments

Agustina Cundari, Azul Schvartzman, Cecilia Nicolini, Daniel Schteingart, Elisa Coghlan, Julieta Zelicovich, Lucas Di Pietro, Luis Panichelli, Matias Gutman, Pablo de la Vega, Pilar Bueno, Rubén Caligari, Tomás Bril Mascarenhas, Victoria Arias Mahiques.

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Acronyms

ABU – Argentina, Brazil, and Uruguay (climate negotiation bloc)

AFOLU – Agriculture, Forestry and Other Land Use

AR6 – Sixth Assessment Report of the IPCC

APS – Announced Pledges Scenario (IEA scenario)

BAU – Business As Usual

BUR – Biennial Update Report (to the UNFCCC)

CAREM – Argentine Small Modular Reactor project

CBAM – Carbon Border Adjustment Mechanism (EU)

CCDR – Country Climate and Development Report (World Bank)

CDM – Clean Development Mechanism

CFI – Federal Council of Investments (Argentina)

COFEMA – Federal Environmental Council (Argentina)

COP – Conference of the Parties (UNFCCC)

CO_2 / CO_2eq / $MtCO_2eq$ – Carbon dioxide / carbon-dioxide equivalent / million tonnes of CO_2 equivalent

ECLAC / CEPAL – Economic Commission for Latin America and the Caribbean

EU – European Union

FLACSO – Latin American Faculty of Social Sciences

FMI / IMF – International Monetary Fund

GDP / PBI – Gross Domestic Product

GHG – Greenhouse Gases

GNL / LNG – Liquefied Natural Gas

GNCC – National Climate Change Cabinet (Argentina)

G20 – Group of Twenty

IEA – International Energy Agency

ILO – International Labour Organization

INDC – Intended Nationally Determined Contribution

INDEC – National Institute of Statistics and Censuses (Argentina)

INTA – National Agricultural Technology Institute (Argentina)

INTI – National Industrial Technology Institute (Argentina)

IPCC – Intergovernmental Panel on Climate Change

LMDC – Like-Minded Developing Countries

MAyDS – Ministry of Environment and Sustainable Development (Argentina)

MWh / GWh / TWh – Megawatt-hour / Gigawatt-hour / Terawatt-hour

NCRE – Non-Conventional Renewable Energy

NDC – Nationally Determined Contribution

NZE – Net Zero Emissions Scenario

NAP / PNA – National Adaptation Plan

PNAyMCC – National Climate Change Adaptation and Mitigation Plan (Argentina)

OPEC+ – Organization of Petroleum Exporting Countries and allies

OECD / OCDE – Organisation for Economic Co-operation and Development

PAHO / WHO – Pan American Health Organization / World Health Organization

PLAC – Local Climate Action Plan

PV – Photovoltaic

R&D – Research and Development

RENABAP – National Registry of Informal Settlements (Argentina)

REPROER – National Registry of Suppliers and Domestic Goods for the Renewable Energy Sector (Argentina)

SAyDS – Secretariat of Environment and Sustainable Development (Argentina)

SMR – Small Modular Reactor

STEPS – Stated Policies Scenario (IEA)

UNCTAD – United Nations Conference on Trade and Development

UNDP / PNUD – United Nations Development Programme

UNEP – United Nations Environment Programme

UNESCO – United Nations Educational, Scientific and Cultural Organization

UNFCCC – United Nations Framework Convention on Climate Change

WTO / OMC – World Trade Organization

Introduction

In Argentina, climate change is often treated as a second- or third-tier issue, largely disconnected from the country's core national priorities. For the federal government, Congress, provincial governments, the private sector, trade unions, and many social organizations, the tree of macroeconomic challenges and day-to-day urgencies obscures the forest of a phenomenon that is reshaping the world.

Global warming is approaching 1.5°C above pre-industrial levels and brings with it a more extreme and unpredictable climate. Heatwaves, droughts, floods, and rising sea levels are no longer projections of a distant future but concrete facts—ever more intense and frequent—that impact ecosystems, economies, infrastructure, and societies. In the effort to adapt to and mitigate climate change, policies, technologies, production dynamics, and social preferences are evolving, transforming the rules and parameters under which a country develops and integrates into the world.

In this scenario, the climate agenda can no longer be limited to the work of isolated public agencies or to occasional mentions in public speeches. Nor is it enough to respond belatedly to extreme events or to incorporate a bit more renewable energy generation. Climate change is a global megatrend—a force that profoundly transforms economies, businesses, and societies—and it compels all actors to reconsider their activities, business schemes, and development models, not only to adapt to the consequences of an increasingly adverse climate but also to meet the imperative of decarbonization.

> Argentina, as a middle-income country that needs to strengthen its productive capacities, generate employment, attract investment, access financing, and take advantage of all possible opportunities to drive its development process, has no margin to avoid this emerging challenge.

The country is highly dependent on the climate due to the importance of its agricultural sector, with a society and infrastructure that are highly vulnerable to the impacts of extreme phenomena, and an economy seeking to consolidate itself as an exporter of hydrocarbons—an industry in global decline. At the same time, it is a member of the G20, contributes just under 1% of global emissions—which places it 20th among the world's largest emitters (OWID, 2024)—and possesses abundant opportunities derived from its mineral resources. Its geographical conditions are optimal for renewable energy, and it has a relatively diversified productive structure with the potential to make strategic bets in promising markets.

Despite the urgency, Argentina has been navigating this transformation without a clear course. This does not mean that there have been no advances: in recent decades, environmental laws have been passed that contributed to the institutionalization of the agenda and to addressing specific problems; public awareness and professional training in this field have grown; specialized state capacities have been consolidated at all levels of government; deforestation has decreased; electricity generation from clean sources has increased; and actors from industry and civil society have become increasingly involved in climate action. However, the implementation of adaptation and mitigation measures lags behind, and the incorporation of climate change as a relevant factor in decision-making remains marginal. There is no coherent state direction to guide the actions of the different interest groups, and thus valuable time for adaptation and the windows of opportunity offered by the transition are being lost.

The arrival of a new national government in 2023, with a reactive perspective toward the environmental agenda—viewing it as excessively interventionist—accentuates this lack of clear direction

on the part of the executive branch. This is particularly dangerous at a time when climate dynamics are accelerating and when it is becoming increasingly urgent to consolidate a strategy that not only responds to the needs of adaptation, mitigation, and green industrialization, but also addresses the overall development model in this new world.

Although the national government is usually the primary arena for coordination and leadership of climate action, in this context it is necessary for other actors and institutions to take decentralized initiatives. While in many cases they will not be able to replace the role of the national state, civil society can play a crucial role in mainstreaming the agenda and raising public awareness, in creating networks of actors, in strengthening state capacities at different levels of government, and in demanding climate action from the private sector. This is especially relevant in Latin American countries, where the weakness of states often means that it is civil society that drives transformation.

This paper seeks to contribute to the construction of transversal climate action, understood not only as adaptation and mitigation of the environmental phenomenon, but also as a repositioning of all actors in the face of a completely different economic and social context. Without disregarding the role of the national state, it also aims to shed light on opportunities for collaboration among other actors. To this end, a qualitative methodology was used, combining the analysis of official documentation and interviews with the review of secondary sources. The resulting document is organized into four parts. The first presents a comprehensive analysis of the global implications of climate change, including climate negotiations, geopolitical changes, and technological advances. The second characterizes the risks and vulnerabilities to which Argentina is exposed due to global warming and the ongoing transition. The third section describes Argentina's situation regarding its position in international climate negotiations, its progress and challenges in adaptation and mitigation policies, and its integration into the green economy, thus suggesting some guidelines for the future.

Climate Change as a Global Megatrend

The progression of climate change[1], its physical impacts, and the mitigation and adaptation actions that its management entails, constitute one of several megatrends driving economic, productive, commercial, and technological transformations around the world (UNCTAD, 2020 ; Hauge, 2023 ; Andreoni & Tregenna, 2020).

Given the pervasive role of fossil energy in the functioning of modern societies, the transition toward a low-carbon economy requires a structural change. At the extremes, some sectors must expand rapidly to increase their production and market share, while others must radically transform or shrink until they disappear. In between, the vast majority of activities face growing environmental demands and a more hostile climate. All these processes occur simultaneously and, at times, in contradiction: the accelerated rise of the green economy[2], strongly driven by states, coexists with a vast array of activities that still depend on fossil resources—often sustained by the very same institutions.

The overlap of these two forces creates a period of "intermediate transition" (Grubert & Hastings-Simon, 2022), in which the fossil-fuel-based energy system coexists with an emerging low-carbon one.

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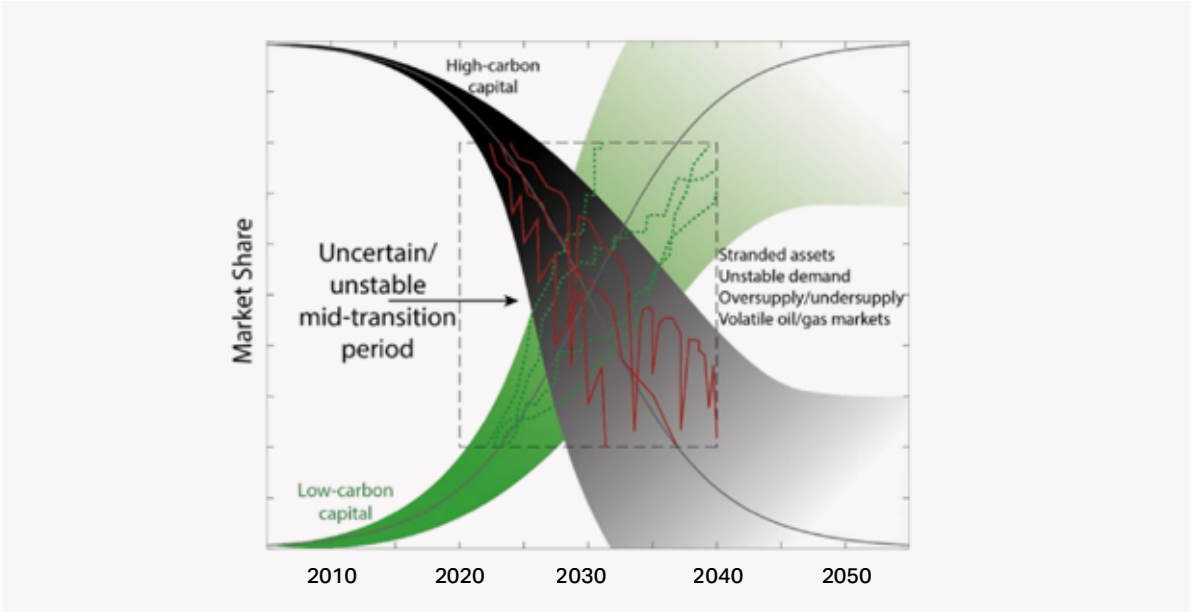
1 While the global environmental crisis encompasses multiple issues, climate change has been the central axis of international discussions and has had a considerable impact on economies, markets, and governance worldwide. For this reason, this paper focuses on that phenomenon.

2 Following Pegels and Altenburg (2020), this paper considers as "green" those economic activities that create products or services and/or employ business practices that reduce the environmental footprint. However, it recognizes the gradations and trade-offs arising from technological choices and the tension among different environmental objectives.

Climate Change as a Global Megatrend

Stylized Representation of the Unstable Mid-Transition Period

Diagram 1



Source: Espagne *et al.*, 2023

At the same time, this transformation unfolds alongside the growing impacts of chronic global warming and the increasing frequency and severity of extreme climate events (Aneise *et al.*, 2024). The interaction between these impacts and the transition process—with its uneven distribution of benefits across sectors and regions—creates an increasingly complex and interconnected landscape of disruption for people, countries, and natural systems (UNEP, 2023). As a result, efforts to integrate the climate dimension into the economic and social spheres are gaining ground, reflected not only in adaptation and mitigation strategies but also in broader development approaches.

The pace of the transition depends largely on the dynamics of technological change and the adoption of new technologies. This "green technological wave" is defined by four key features:

i) it is driven by active government policies aimed at reducing environmental impacts; ii) green technologies are highly diverse, ranging from renewable energy generation and waste management to sustainable mobility and biotechnology, among many others; iii) there is a temporal urgency linked to the need to prevent global warming from reaching critical thresholds; and iv) decisions are made in contexts of high uncertainty (Lema y Perez, 2024). The degree of disruption and instability with which the world moves through this intermediate period will depend on countries' ability to cooperate and coordinate economic, climate, and development policies (Espagne *et al.*, 2023).

These transformations do not occur in a vacuum; rather, they intersect with other global megatrends such as the emergence of disruptive technologies, automation and digitalization, growing geoeconomic competition among countries, and the fragmentation of value chains according to geopolitical proximity (UNCTAD, 2020; Hauge, 2023; Zelicovich *et al.*, 2024). In particular, the COVID-19 pandemic and the conflict between Russia and Ukraine have accelerated these trends and disrupted commodity prices—especially energy—and global supply chains.

This has created a global context that calls on countries to design comprehensive strategies which, by assessing their strengths and weaknesses, enable them to navigate the transition while maximizing benefits and minimizing losses. This holds true for all countries, but especially for those in the

Global South, since the challenges inherent to this period of uncertainty are compounded by those stemming from their own development processes.

Climate negotiations: back-and-forth efforts toward carbon neutrality

The complexity of addressing climate change stems mainly from two factors. On the one hand, mitigation has the characteristics of a global public good[3], which encourages free-riding behavior, discourages unilateral emission reduction commitments, and poses an obstacle to international cooperation (Skodvin, 2023; Barrett & Stavins, 2003). On the other hand, the close link between greenhouse gas (GHG) emissions and economic growth—especially when energy consumption relies on fossil fuels, which accounted for more than 75% of the total in 2023 (Möhle *et al.*, 2024)—creates a tension between improving living standards and ensuring environmental sustainability.

Although this relationship is relatively decoupling in many developed countries thanks to green technologies and efficiency measures (Ritchie, 2024), it remains unclear whether such decoupling can occur globally in absolute terms (IPCC, 202.; Hickel & Kallis, 2019; Ward *et al.*, 2016). In particular, it is uncertain whether the pace of decoupling will be sufficient to meet the targets of the Paris Agreement[4].

This relationship generates persistent tensions in international climate negotiations, especially between developed and developing countries (Skodvin, 2023). The former are primarily responsible for climate change in historical terms, as their early industrialization processes caused the largest share of accumulated GHGs in the atmosphere (Harris, 2003, Aneise *et al.*, 2024). At the same time, they enjoy higher levels of development and accumulated wealth, which place them in a privileged position to advance their own transitions: they have greater resources to adapt infrastructure and production systems to the impacts of climate change and possess the technological and productive capacities to lead in the development and adoption of new technologies.

Recognizing this asymmetry, the principle of common but differentiated responsibilities was adopted[5], under which the first climate treaty—the Kyoto Protocol—was negotiated within the framework of the 1997[6] Conference of the Parties (COP). This agreement established binding emission reduction targets for developed countries, along with mechanisms to promote technology transfer and international cooperation for developing nations.

Although the commitments undertaken had a measurable effect on reducing emissions among countries that ratified the Protocol (Grunewald & Martínez-Zarzoso, 2015 ; Kim, *et al.*, 2020), it ultimately failed to meet its goal. The United States—one of the world's largest GHG emitters—did not ratify the agreement due to concerns over the potential negative economic impact of climate actions and the risk of carbon leakage[7] (Barrett, 1998). This led to the withdrawal of Canada and Japan, undermining the main objective of the treaty: engaging all developed countries in mitigation efforts.

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3 A global public good is one whose benefits extend to all countries, peoples, and generations, and from which no one can be excluded.
4 According to IPCC scenarios, greenhouse gas concentrations should not exceed 465 ppm of CO_2e (range 445–485) to limit warming to 1.5°C, and 505 ppm (470–540) for the 2°C threshold. In 2021, the concentration reached 472 ppm of CO_2e (European Environment Agency, 2024).
5 According to this principle, while all countries share responsibility for climate change, developed nations bear a greater obligation to adopt more ambitious mitigation commitments and to provide financial and technological support to developing countries.
6 The negotiations took place within the United Nations Framework Convention on Climate Change (UNFCCC), established in 1992.
7 This refers to the relocation of highly polluting industries to countries with more lenient environmental regulations.

Climate Change as a Global Megatrend

A new challenge also emerged: the rapid economic growth of emerging economies during the 2000s caused them to surpass many developed nations in emissions, revealing that any mitigation framework excluding them would be insufficient[8].

The failure of the Kyoto Protocol opened a new phase of negotiations that culminated in the 2015 Paris Agreement. Its main difference from Kyoto lies in its approach: it shifted from a "top-down" system—imposing a global emission reduction target with binding, quantifiable goals for developed countries—to a "bottom-up" framework, in which all signatories participate in mitigation efforts but each voluntarily sets its own emission reduction commitments, known as Nationally Determined Contributions (NDCs).

This approach acknowledges the diversity of national circumstances but raises the challenge of assessing whether individual voluntary commitments are fair and sufficient to achieve the Agreement's overarching goal: limiting global temperature rise to 2°C and ideally to 1.5°C.

The ambition of NDCs can be assessed along three dimensions: i) whether commitments are conditional on the availability of financing; ii) whether targets are defined as absolute emission values or as reductions relative to a business-as-usual (BAU) scenario; and iii) whether the objectives cover all sectors of the economy and all types of greenhouse gases. Overall, these variables have tended to increase over time (Table 1).

Evolution of NDC characteristics since the Paris Agreement

Table 1

Characteristics of Nationally Determined Contributions (NDCs)	COP 21 (2015)		COP 28 (2023)*	
	No. of countries	% of GHG emissions	No. of countries	% of GHG emissions
Contain a GHG reduction target	122	85%	148	90%
Include a GHG target covering all emission sectors	55	44%	97	54%
Include a GHG target covering all greenhouse gases listed in the Kyoto Protocol	20	29%	23	30%
Contain elements that are not conditional on international support	108	77%	135	82%
Reduce emissions for 2030 compared to initial NDCs	-	-	81	79%

Note: *Cut-off date: September 26, 2023.
Source: UNEP, 2023.

However, the world remains far from being on track to meet the Paris targets. The commitments made exceed both the 2°C and 1.5°C goals. If countries were to fully implement the unconditional NDCs submitted up to 2023, the projected temperature increase by 2100 would reach 2.9°C above pre-industrial levels[9]. Moreover, the mitigation actions actually implemented fall short of meeting

8 Indeed, by 2012—the year following the first commitment period—global emissions had increased by 44% (OWID, 2023c) compared to 1997 levels, driven primarily by growth in developing countries. In particular, China's rapid economic expansion fueled a surge in primary energy demand, which was met predominantly by fossil sources (77.1%), especially coal.

9 Even if conditional NDCs were fully implemented, the world would still be on a trajectory toward a 2.5°C temperature increase (UNEP, 2023). It is worth noting that every degree matters: even if international targets are exceeded, any effort to reduce greenhouse gas emissions helps mitigate the worsening of the climate crisis. Therefore, failing to meet the Paris Agreement's goals should not lead to abandoning climate ambitions and actions.

even these already insufficient national targets[10]. As a result, global emissions continue to rise (Aneise *et al.*, 2024), and a significant gap persists between the emissions projected for 2030 and the trajectory required to meet the Paris objectives.

Thus, as 2030 approaches—while emissions remain above target and the physical impacts of climate change become increasingly evident—a scenario of more demanding climate governance is expected, along with greater scrutiny of national goals and actions (Srouji *et al.*, 2024)[11].

From cooperation to competition: a new phase of the transition

The implementation of climate commitments and the need to adapt to the impacts of global warming are accelerating a green economic transformation (Lebdioui, 2024), opening opportunities for countries that manage to integrate into emerging value chains (Pegels & Altenburg, 2020). Early movers in the production of green goods and services enjoy an advantageous position internationally, as by the time other countries begin to demand more sustainable products and processes, they have already established themselves as leaders in the field.

This dynamic has led many nations to adopt green industrial policies aimed at actively fostering the early development and diffusion of environmentally friendly technologies (Bril Mascarenhas *et al.*, 2021). The outcomes of these strategies have major implications for economic development—not only through their impact on exports and job creation, but also through their influence on global technological leadership and the resulting geopolitical positioning.

The spearhead of this technological wave has been the electricity generation sector. Although clean sources such as hydropower and nuclear energy already played a significant role in the power mix of many countries[12], the acceleration of decarbonization in the sector has been driven primarily by the deployment of non-conventional renewable energies, particularly solar and wind. With strong government support in both developed countries and China, non-conventional renewables (NCRE)[13] gradually increased their share in the global electricity mix, reaching 16% in 2023[14] (Figure 1).

Thus, although the deployment of renewables has not yet achieved the speed and scale required to meet the Paris Agreement targets, it has become the fastest expansion of a new source of electricity in history (Rangelova & Altieri, 2024).

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10 Although the deployment of renewable energy and clean technologies has steadily advanced—alongside the adoption of energy efficiency measures—these efforts have not yet fully offset the growth in global energy demand or displaced fossil-based generation. Similarly, deforestation controls and reforestation processes have reduced the annual loss of forest area but still contribute significantly to emissions (Our World in Data, 2024). In the same vein, improvements in industrial processes and waste management have not yet achieved absolute reductions in emissions (Our World in Data, 2024).

11 Countries will face growing pressure to raise their commitments, align them with reports such as the Global Stocktake—which measures progress on climate action—and demonstrate credible compliance pathways. The Global Stocktake is a process established under the Paris Agreement and conducted every five years to assess collective progress toward global mitigation, adaptation, and climate finance goals.

12 Hydropower accounted for 17.2% of global electricity generation in 2000, while nuclear energy represented 16.6% (Möhle *et al.*, 2024).

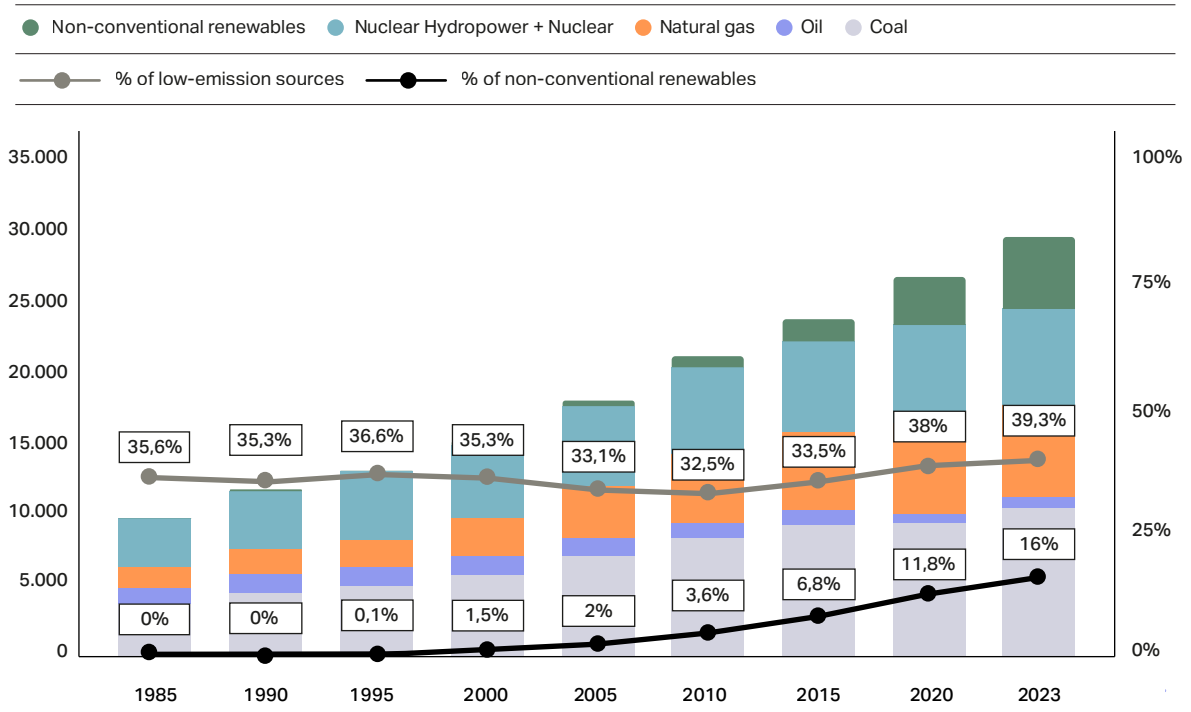
13 This includes wind, solar, modern biofuels, small-scale hydropower, and other renewables such as geothermal, tidal, and solar thermal energy. The calculation excludes hydropower and nuclear energy, which contributed 14% and 9%, respectively.

14 This calculation excludes hydropower and nuclear energy, which contributed 14% and 9%, respectively.

Climate Change as a Global Megatrend

Figure 1

Global electricity generation by source (in TWh, left axis) (in percentage, right axis), 1985–2023



Source: Fundar based on Energy Institute (2023).

This evolution is largely explained by the decline in renewable technology costs—a process in which China played a crucial role. During climate negotiations[15], the country demanded financing and technology transfer to developing nations, which materialized through the Clean Development Mechanism (CDM). This mechanism allowed developed countries to meet part of their emission reduction commitments by investing in mitigation projects in developing countries. China actively pursued investment under this scheme, receiving more than half of all implemented projects. This enabled Chinese firms to develop reverse engineering capabilities[16] (Cui, Liu, Sun & Yu, 2020) and, supported by targeted industrial policies and the scale of its domestic market (UNCDAT, 2023), fostered a virtuous cycle of technological progress, cost reduction, and growing demand for non-conventional renewables (NCRE). China's rise displaced European and U.S. companies that had previously led in photovoltaic and wind technology (Enerdata, 2024), revealing the intensity of competition—even for advanced economies long established in these sectors.

The second technological star of the transition is electromobility. In this field, China also succeeded in dominating the value chain, moving from negligible presence in the automotive industry to global leadership in electric vehicles. It now controls production across nearly all stages of the battery supply chain and, by 2023, accounted for about 60% of global electric vehicle sales (IEA, 2024; Rubio *et al.*, 2024; Baruj *et al.*, 2022). This achievement stems from capabilities accumulated since the 1950s, control over rare earths and strategic minerals, expertise in manufacturing lithium batteries for the IT and consumer electronics industries (Altenburg *et al.*, 2022), and a policy response to growing concerns over air pollution and dependence on hydrocarbon imports (Bian *et al.*, 2024; Schreurs, 2016; Conrad, 2012).

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15 Grouped within the G77 coalition, which includes 133 other developing and emerging countries such as India, Brazil, South Africa, Indonesia, and Argentina, among many others.

16 This is a process that involves analyzing a product, system, or technology to understand its design, functioning, and components—usually with the aim of replicating it.

In 2021, Europe ranked second with 25% of global electric vehicle production, though without dominance across the rest of the value chain. The United States remains a smaller player, accounting for only 10% of global production capacity for electric vehicles and batteries (Figure 2) (IEA, 2023). Among leading firms, China's BYD and the U.S.'s Tesla dominate the market, together representing 35% of global electric vehicle sales (IEA, 2024).

Thus, China has positioned itself as the global leader in clean energy technology manufacturing: it holds at least 60% of global production capacity for most mass-produced technologies—such as solar photovoltaics, wind systems, and batteries—and controls about 40% of electrolyzer manufacturing for hydrogen production (IEA, 2023).

Share in global clean energy technology manufacturing (2021)

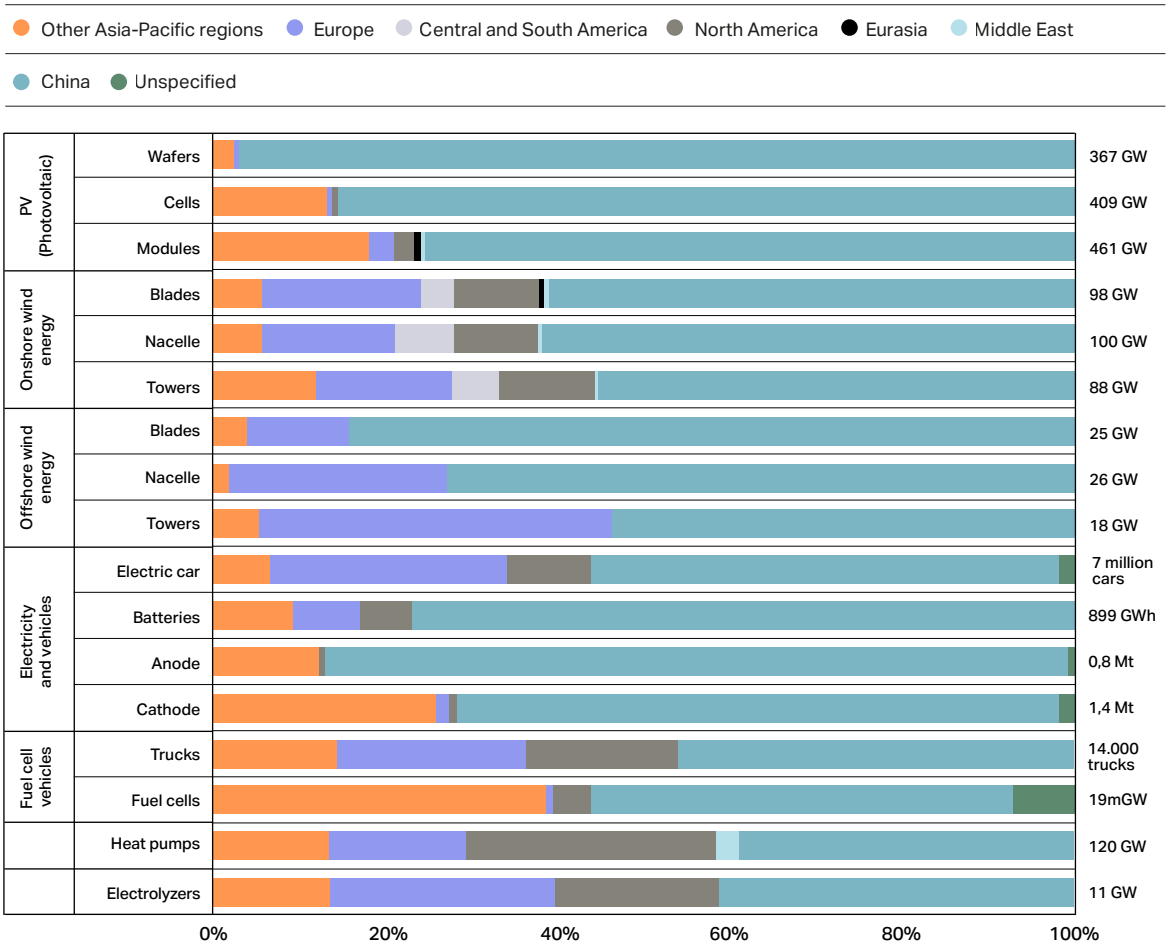


Figure 2

Source: IEA, 2023.

In response to China's growing dominance, the United States and Europe adopted highly ambitious policies—the Inflation Reduction Act[17] (2022) and the Net Zero Industry Act[18] (2024), respectively—to promote their own green industries and compete with the Asian giant.

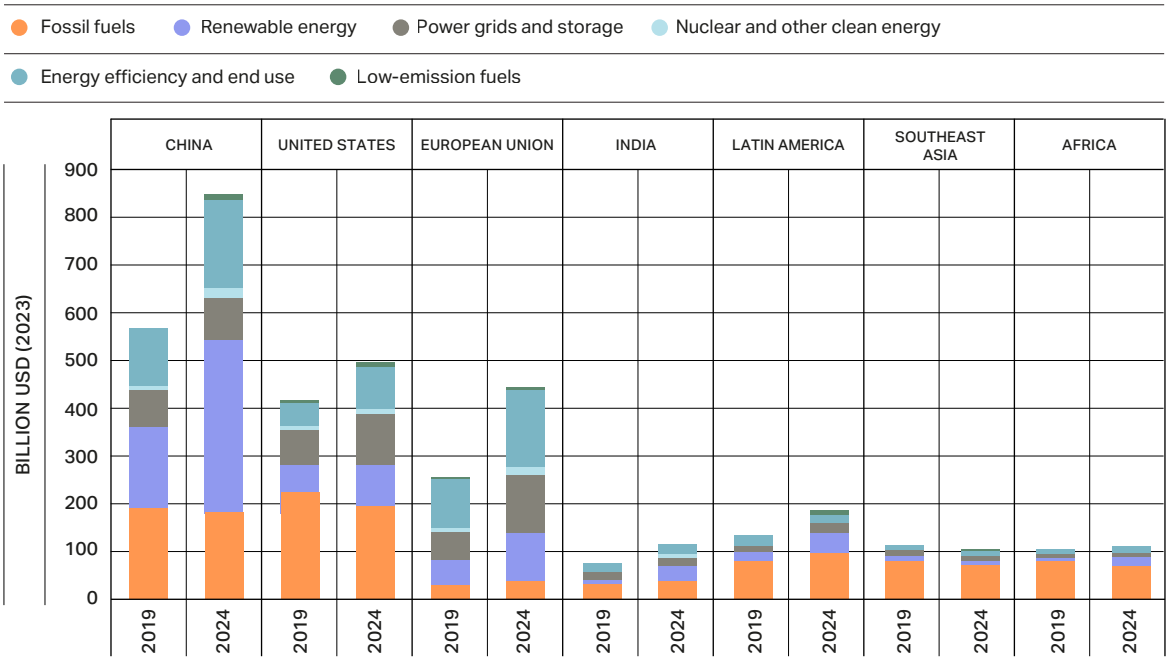
17 The Inflation Reduction Act allocates USD 663 billion through 2033 to programs aimed at accelerating the energy transition and, in particular, boosting domestic production of green technologies.

18 Through the Net Zero Industry Act, the European Union aims to supply 40% of its own clean technology demand by 2030 by implementing subsidies and other incentives for domestic production, in order to strengthen its manufacturing base and enhance competitiveness.

The adoption of these technologies no longer depends solely on manufacturing costs and access but also on the public policies countries implement to compete within these value chains(Schteingart *et al.*, 2024b; Jacobs, 2023). Thus, the transition is increasingly shaped by employment and industrial objectives, which in some cases can accelerate progress by promoting advancement along value chains, but in others may slow it down and increase costs by prioritizing local production over the adoption of already available or more affordable technologies.

Investment in different types of energy in selected countries (2019 and 2024)

Figure 3



Source: Fundar, based on IEA (2024).

Alongside this process, the world remains highly dependent on traditional energy sources. This became particularly evident when the war in Ukraine disrupted global energy markets. In the short term, Europe was the most affected region due to its heavy reliance on imports of Russian natural gas, whose supply was curtailed by the conflict. In response, the region adopted strategies to diversify its energy supply and accelerate decarbonization through the REPowerEU Plan (2022). It also intensified trade relations with close allies such as Norway and the United States, as well as with countries like Qatar, Saudi Arabia, and Azerbaijan—partners that are geopolitically more uncomfortable due to their ties with Russia through OPEC+[19]. Europe's pursuit of energy supply diversification beyond OPEC+, and more broadly the global effort to diversify energy imports, represents an opportunity for hydrocarbon-producing countries (and potentially for future green hydrogen producers) located in regions of low geopolitical conflict.

In the medium and long term, the war in Ukraine underscored the risks associated with heavy dependence on energy imports—particularly in contexts of shocks that drive up prices. This scenario renewed the global quest for energy security, spurring both an increase in renewable energy demand and a reduction in fossil fuel imports. Together, these trends are accelerating the global energy transition (BP, 2023).

19 In 2016, after a severe downturn in the economies of major oil-producing countries, Saudi Arabia and Russia reached an agreement that later led to the creation of OPEC+, enabling them to limit crude oil production and restore prices. This cooperation reshaped the geopolitical landscape for two reasons: i) two historically rival nations began a collaboration that extended beyond the energy sector; and ii) until then, Saudi Arabia had been the United States' most important ally in the region.

Integration from the Global South

Countries that specialize in high-technology products tend to have greater capacity to boost productivity across the broader economy and to export differentiated goods, where competitiveness relies not only on price but also on quality. These products generally have high income elasticity[20], offer better wages, and are more capital-intensive (Hallak & Sivadasan, 2013; CEPAL, 2022). It is therefore unsurprising that countries with stronger technological and innovative capabilities have achieved better integration into green value chains (Bell, 2012; Urban & Nordensvard, 2013). Indeed, so far developed nations and China have captured most of the benefits of this technological wave—in innovation, job creation, and exports—while middle- and low-income countries have largely been left behind[21].

Their efforts to integrate into new green markets occur in contexts marked by limited capacity to implement effective industrial policies, due to fiscal and bureaucratic constraints and pressing social demands competing for public resources. Moreover, many Global South countries lack a sufficiently large domestic market to nurture local capabilities before competing globally (Lebdioui, 2024). They also face additional barriers such as shortages of technical and managerial skills, inadequate infrastructure, and unstable regulatory frameworks that hinder private sector development and weaken the state's capacity to manage public policies effectively (Altenburg, 2011). These factors widen the gap with high-income countries and tend to reinforce the technological divide across the Global South (Aneise *et al.*, 2024).

Nevertheless, the transition toward sustainability and the ongoing geopolitical reconfiguration may open new opportunities for green industrialization in developing countries (CEPAL, 2022; Lema & Pérez, 2024; Lema *et al.*, 2020), through four main dynamics:

1. **Technological revolutions as windows of opportunity:** Each technological revolution creates opportunities for national and regional development (Pérez, 2010). The green transition constitutes a sociotechnical regime shift with far-reaching consequences for wealth creation (Geels *et al.*, 2017). This opens a new window for industrialization in developing countries, which can also leverage their comparative advantage in renewable resources to competitively develop energy-intensive industries (Lebdioui, 2024).

2. **Strategic resource leverage:** The growing global demand for strategic resources from developing countries provides new productive and diplomatic mechanisms to advance their development processes (Lebdioui, 2019, Freytes & O'Farrell, 2021).

3. **Shifts in global economic governance:** Transformations in international economic governance institutions—such as the World Trade Organization (WTO) and the International Monetary Fund (IMF)—are creating space for previously marginalized instruments, such as industrial policy, to regain legitimacy (Zelicovich *et al.*, 2024).

4. **Changing demand patterns:** The ongoing shift in global demand for primary goods—from high-volume, low-price commodities to a broader range of low-volume, high-price products[22] (Pérez, 2010)—opens opportunities for emerging economies to serve more profitable market niches.

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20 This means that as the global economy grows, demand for these types of products increases relatively faster than for less sophisticated ones.

21 While China, the United States, the European Union, Brazil, and India account for 75% of the jobs created by the renewable energy sector, Africa captured only 2.4%, and in Latin America (excluding Brazil) fewer than 500,000 jobs were created (IRENA, 2020). A similar pattern is observed in the distribution of clean technology patents—three quarters of which belong to China, Japan, the United States, and Germany—and in exports, where three countries (China, Germany, and the United States) account for nearly half of all low-carbon technology exports (Lebdioui, 2024).

22 This is particularly evident in the case of food, where increasing environmental awareness among consumers makes them willing to pay higher prices for sustainable products (Ghosh & Shah, 2012).

Global South countries are seeking to seize this opportunity. In most cases, their integration occurs in relatively low-complexity segments of the value chain: Ecuador supplies 90% of the world's balsa wood, a critical component for many wind turbines (Cañadas-Lopez *et al.*, 2019, Dempsey & Long, 2019); Chile and Peru export copper; the Democratic Republic of the Congo, cobalt; and Chile and Argentina, lithium. All of these are key minerals for clean technologies.

While this integration allows these countries to share, to some extent, in the benefits of the green transition—and is particularly relevant for those dependent on hydrocarbon exports—it remains based on static comparative advantages, which risks perpetuating their role as raw material suppliers. This is problematic because it usually entails a subordinate position within global value chains, confined to segments with limited potential to generate spillovers into the local productive and technological fabric (Schteingart, 2023).

Aware of this challenge, many countries are seeking to move up into higher–value-added segments. Morocco began by implementing investment attraction policies in renewable energy aimed at substituting energy imports, later introducing industrial policies to develop capabilities along the value chains of the wind, photovoltaic, and solar thermal industries (Auktor, 2017). Although results remain moderate, the country is positioning itself as the leading player in this sector across the Middle East and North Africa region (Auktor, 2017), successfully attracting investments for renewable parks and component manufacturing plants[23]. In Brazil, these efforts are more consolidated: the BNDES played a crucial role in building the domestic wind turbine industry by providing loans and credit lines below market rates while imposing local content requirements (Hochstetler, 2020). This enabled the creation of 1.2 million jobs across renewable energy value chains (Lebdioui, 2024). Indonesia combined a nickel export ban with policies to promote domestic industry and add value to its mineral exports, thereby entering more complex segments of the electric vehicle value chain (Zelicovich *et al.*, 2024).

Successfully integrating into these more complex segments remains a significant but essential challenge for advancing development processes (Bril Mascarenhas *et al.*, 2020). The context of intense competition and limited resources demands strategic choices and careful assessment of support efforts, weighing the costs and risks of each alternative (Lebdioui, 2020).

Argentina's climate risks

The global context described above requires countries to develop comprehensive strategies to address climate change that acknowledge the multiple challenges of navigating a highly uncertain environment. This entails identifying and quantifying the risks faced and designing flexible responses to strengthen resilience.

Climate-related risks can be grouped into two categories:

1. **Physical risks,** linked to the direct impacts of climate events.

2. **Transition risks,** associated with changes in policies, technology, market dynamics, and social preferences in the shift toward sustainable economies (Semieniuk *et al.*, 2020; Banco Mundial, 2021).

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23 In 2021, the Spanish company Incom established operations in Tangier to manufacture kits for wind turbine construction (ICEX, 2023). In 2024, the Chinese company Aeolon began building an industrial plant for the production of wind turbine blades. The facility is expected to supply Europe, Africa, and the Middle East, with an estimated annual output of 600 blades and the creation of 3,300 jobs (China State Construction, 2024).

Argentina's climate risks

> Argentina faces a considerable set of both physical and transition risks, many of which are tied to its level of development and productive specialization.

The country's export structure is poorly diversified, highly concentrated in primary products and resource-intensive manufactures with low technological content (Schteingart *et al.*, 2024a). At the same time, high levels of social vulnerability—driven by elevated poverty rates and unplanned urbanization (Benitez, Migliore & Trombetta, 2024)—create an especially challenging scenario.

Physical risks

The main climate impacts in Argentina include rising average temperatures, more frequent heat waves, an increase in extreme precipitation and drought events, sea-level rise, and glacier retreat (Aneise *et al.*, 2024; Ministerio de Ambiente & Desarrollo Sostenible, 2022). These phenomena, in turn, lead to more frequent flooding in some regions, declining water availability in others, and greater extent, frequency, and spread of wildfires (Aneise *et al.*, 2024).

One of the most vulnerable sectors to these impacts is agriculture, given its high sensitivity to climatic conditions. Climate variability directly affects yields across most regions and crops, which in turn influences food prices, the trade balance, and fiscal revenues. For example, the 2022/23 drought caused a 2.2% drop in GDP, a loss of USD 3.554 billion in tax revenues (export duties and income tax), and USD 8 billion in exports (Rosario Board of Trade, 2023).

If adaptation measures are not implemented, climate change could reduce yields by up to 10% for sunflower, 30% for maize and wheat, and 50% for soybeans by 2050 (Rozenberg *et al.*, 2021). Moreover, agriculture is among the sectors with the highest water demand, and in contexts of water stress—due to glacier retreat and increased droughts—it competes for the resource with other sectors such as urban consumption and mining (Fonseca, 2019)[24]. This competition has already led to social conflicts, for instance, over the expansion of mining in the province of Mendoza, where water scarcity is already a risk factor (Argentina Productiva 2030, 2023).

These types of risks also constrain access to finance. Declining agricultural performance due to droughts is associated with lower reserve accumulation by the central bank (Bortz & Toftum, 2022), which translates into lower credit ratings from financial rating agencies and, consequently, higher interest rates (Pegels & Altenburg, 2020). This increases governments' borrowing costs and restricts their fiscal space. In addition, higher interest rates lead to credit rationing and higher capital costs for firms, further dampening growth prospects (Kling *et al.*, 2019). In developing countries, which already face limited access to credit, this factor further worsens the situation.

Climate change also affects infrastructure. It is estimated that in a scenario where the frequency of floods doubles, losses of essential assets for Argentina's operations and productivity could increase by 125% (World Bank, 2022). Damage to transport systems and services due to floods could cost Argentine firms an additional USD 4 billion per year (Hallegatte *et al.*, 2019). Conversely, water scarcity threatens both reliable hydropower generation and river transport, affecting agricultural exports—84% of which are shipped through the Hidrovía or the Paraguay, Paraná, and Río de la Plata

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24 In a mining province like San Juan, water consumption by the mining sector is below 1%, while agriculture accounts for more than 80% of total demand. In Chile—where mining activity is much more developed—its water use does not exceed 4% of total societal demand (CEPXXI, 2022).

river systems (World Bank, 2022). Moreover, rising temperatures reduce the performance of thermal power plants and other energy assets, exacerbating the vulnerability of the national energy system.

Higher water demand in a warmer climate will make it difficult to sustain the current 2.1 million hectares of irrigated land, given existing infrastructure and efficiency levels in water use. This puts around 25% of the country's irrigated area at risk, potentially causing annual losses of USD 837 million (World Bank, 2021).

Health and living conditions are also highly vulnerable to climate change impacts. The most significant physical risk is flooding: between 1900 and 2021, floods affected a total of 15 million people (Rozenberg *et al.*, 2021). Informal settlements in Argentina are particularly exposed, with 48% located in flood-prone areas (TECHO, 2024).

Heat waves are also becoming increasingly relevant. Since 1960, their frequency has risen, particularly affecting Patagonia and eastern Argentina, including the Northeast and the eastern Pampas region (Aneise *et al.*, 2024). These events have negative impacts on the health of older adults, children, and people with chronic illnesses; they also affect precarious households lacking access to cooling and worsen working conditions for construction and agricultural workers—sectors largely carried out outdoors (ILO, 2018).

Additionally, high temperatures place extra stress on electricity transmission and distribution networks (Aneise *et al.*, 2024; Ministry of Environment and Sustainable Development, 2022). Temperature, humidity, and precipitation conditions also have cross-cutting consequences for health, as they favor the spread of disease vectors such as dengue—whose transmission potential via Aedes aegypti increased by 54% between 1951–1960 and 2013–2022 in Latin America—and pose risks to food security, especially among low-income families (Hartinger *et al.*, 2024).

Furthermore, desertification and water scarcity reduce the viability of sustaining traditional livelihoods through family farming (Morandi *et al.*, 2020; Saliva, 2024).

Finally, climate change has differentiated impacts on women and gender-diverse groups (UNDP, 2022), primarily due to gender roles related to care responsibilities. This makes them disproportionately affected by health problems and natural disasters (UN Women, 2022).

These impacts are not uniform. An intersectional perspective—which considers how different forms of inequality interact and reinforce one another—shows that climate risks are particularly severe for low-income women and girls, Indigenous women, older adults, LGBTIQ+ people, women and girls with disabilities, migrant women, and those living in rural areas (UN Women, 2022).

Transition risks

Transition risks arise from the deep structural transformations required to move toward sustainable, low-carbon economies. These risks result from the interaction of political, technological, economic, and social dynamics. On the one hand, changes in public policies—such as the introduction of carbon taxes, industrial policies, and incentives for clean technologies—reshape production structures and existing economic conditions. On the other, technological evolution—driven by the accelerated adoption of low-carbon alternatives—displaces traditional industries, transforming value chains and labor markets. At the same time, market dynamics experience tensions due to the introduction of stricter trade regulations and sustainability standards, which encourage the reallocation of resources from carbon-intensive sectors toward more sustainable ones, thereby increasing uncertainty. Added to this is the growing influence of social preferences, with consumers and communities demanding

more responsible and sustainable practices—forcing companies to adapt rapidly to maintain their competitiveness.

The convergence of these dynamics generates disruptions, uncertainty, and significant tensions for all actors involved, underscoring the need for comprehensive and well-planned transition management. **Globally, the sector most exposed to transition risks is fossil fuels.** Given its role in generating global emissions—79% of which came from the energy sector in 2019 (OWID, 2023)—mitigation efforts focus primarily on decarbonizing countries' energy consumption. This process is expected to progressively displace fossil fuels from international markets, affecting the profitability and trade integration of producers worldwide. In Argentina, the hydrocarbon sector represents 5.6% of GDP[25] and plays a key role in exports, accounting for 9.4% of total exports in 2023 (INDEC, 2024a; INDEC, 2024b). This share is also expected to grow due to the exploitation of the Vaca Muerta shale formation, which holds unconventional oil and gas resources equivalent to one and two centuries of domestic consumption, respectively. Developing 50% of the field's potential could yield annual oil and gas exports of around USD 34 billion (Arceo *et al.*, 2022)—equivalent to 41% of Argentina's total goods and services exports in 2023[26].

However, as the decarbonization process is expected to reduce fossil fuel consumption, the outlook for the sector is shaped by the risk that a shrinking market could significantly constrain export potential. While this process may take decades—and its pace remains uncertain—the continued expansion of low-carbon technologies could accelerate the displacement of fossil fuels, inducing price declines due to oversupply (Semieniuk *et al.*, 2020). If fossil fuel producers anticipate that demand will not recover, they may decide to flood the market—a race-to-the-bottom behavior aimed at placing as much production as possible (Sinn, 2008). This would have major implications for producing countries, as only low-cost producers could maintain their production levels, while less competitive ones would be pushed out of the market. The result would be economic losses and stranded assets—fossil fuel investments that fail to recover their costs (Mercure *et al.*, 2018). Such a scenario would pose a significant risk for Argentina's hydrocarbon production, as the country is not only geographically distant from global consumption centers but also has higher costs than the most competitive producers. Moreover, although emerging sectors such as hydrogen and mining are projected to become major "green" export industries, their expected additional revenues—around USD 2.2 billion and USD 16 billion, respectively (Argentina Productiva, 2023)—remain far from sufficient to offset the potential losses from declining hydrocarbon exports.

25 According to INDEC, data correspond to 2023 at current prices.

26 It is important to consider the different roles of oil and natural gas in the energy transition. While oil is expected to have a shorter lifespan—the IEA(2024a), for instance, projects peak demand around 2029/30—natural gas demand is expected to remain significant in the coming decades, driven by incremental demand from developing countries (Arceo *et al.*, 2022). Natural gas, being the fossil fuel with the lowest greenhouse gas emissions, is regarded as an alternative to replace coal in growing economies, particularly in Asia. However, its role as a "transition fuel" is conditioned by two opposing trends: the increase in demand from emerging economies and its gradual substitution by lower-emission energy sources in the developed world (BP, 2023).

Argentina's climate risks

Box 1

How long will Vaca Muerta remain profitable?

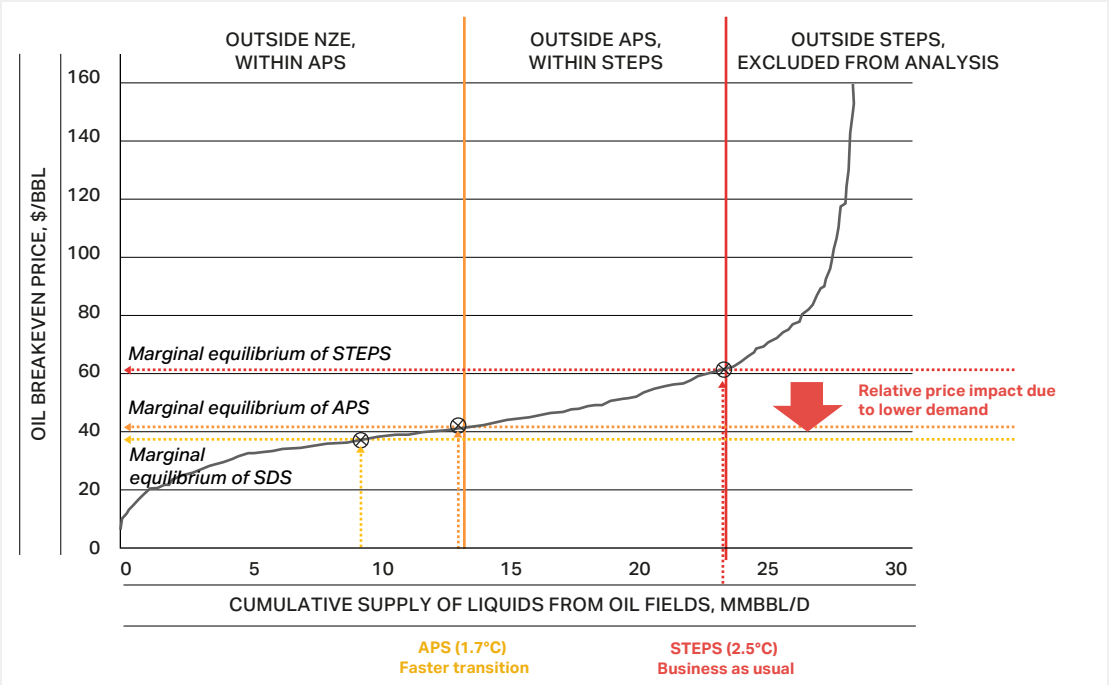
In the context of the transition risks faced by hydrocarbons, one way to assess the level of exposure is through the least-cost methodology. This approach uses energy scenarios—with an associated climate outcome—to identify fossil fuel demand across regions and over time. In Figure 4, these correspond to the International Energy Agency's NZE (Net Zero Emissions), APS (Announced Pledges Scenario), and STEPS (Stated Policies Scenario).

Based on that demand, a cost curve of potential projects is constructed, making it possible to determine the most economical way to meet demand (Science Based Targets, 2020). In this way, it is possible to evaluate what share of potential investment lies in projects that could be financially viable under different transition scenarios, and what share lies in projects that are likely to become unviable, thus carrying higher investment risk.

For example, under the APS scenario, viable projects would be those that can remain profitable with an oil barrel priced at USD 40 (Figure 4).

Figure 4

Illustrative cost curve for global oil projects (Oil barrel breakeven price by cumulative supply from oil fields)



Note: The chart refers to the three energy scenarios of the International Energy Agency. NZE corresponds to net-zero emissions by 2050; APS assumes governments meet their commitments under existing laws and NDCs; and STEPS is consistent with a 2.7°C warming scenario.
Source: Carbon Tracker Methodologies: Oil and Gas Companies (2023).

Box 1

In this context, although Vaca Muerta is a competitive field—with a zero discovery cost[27] and a low operating cost (around USD 3.5–4 per barrel)[28]—capital expenditures are significant and distributed throughout the entire development process, well-by-well. This differs from conventional resources, whose capital costs are usually concentrated at the beginning of operations.

As a result, the exit cost is low: if a company decides to withdraw, it leaves little capital invested, leading to operations that are highly sensitive to fluctuations in demand.

However, a more comprehensive analysis should consider not only the economic cost of fossil fuels (e.g., the price per barrel of oil or per ton of LNG) but also their carbon footprint, which is increasingly linked to sectoral competitiveness. Between 10% and 20% of emissions in the oil and gas industry are fugitive emissions—those released during production and transport stages. These include methane leaks, gas flaring, and emissions from drilling and transportation equipment.

In Argentina, such emissions accounted for 5% of total national emissions in 2020. Therefore, it is crucial to measure and mitigate fugitive emissions in Vaca Muerta[29] to reduce environmental impact, ensure competitiveness in global markets that are increasingly sensitive to environmental performance, and contribute to meeting national climate commitments.

Mining and the agri-food industry also face transition risks. In the case of minerals, while growing global demand creates new opportunities, it also comes with increased scrutiny of the sector's social and environmental impacts. This has led to a proliferation of standards and social and environmental requirements (Dufey & Zamorano, 2023), which can be challenging to meet in weak governance environments (Aneise *et al.*, 2024), thus hindering access to more demanding markets. At the same time, the long-term outlook for these minerals remains dominated by uncertainty and technological disruption risks, given the considerable global R&D efforts to develop alternative technologies that rely on substitute materials[30] (Manley *et al.*, 2022).

The agri-food industry will also need to ensure more sustainable practices throughout its value chain in response to growing scrutiny of the sector's environmental footprint. A clear example is the European Union Regulation on Deforestation-Free Products, which requires proof of how and where goods exported to the EU were produced and ensures that no deforestation occurred on those lands. This regulation covers about 5% of Argentina's export basket (mainly soy and beef products) (Calvo *et al.*, 2024).

Argentina's main industrial export complex—the automotive sector—faces the risks associated with the transition toward electromobility, which will bring disruptive changes in inputs, processes, and final products. This transformation is occurring alongside a shift in the global economic geography of the sector, as China's emergence as a major player has radically reshaped market dynamics. Consequently, this creates both displacement risks and the need for adaptation among many established actors (Rubio *et al.*, 2024). Other industries, such as chemicals and basic materials, while not needing to produce entirely new goods, must still transform their processes to decarbonize. This can be particularly costly in production processes that cannot be electrified (Gomes *et al.*, 2024).

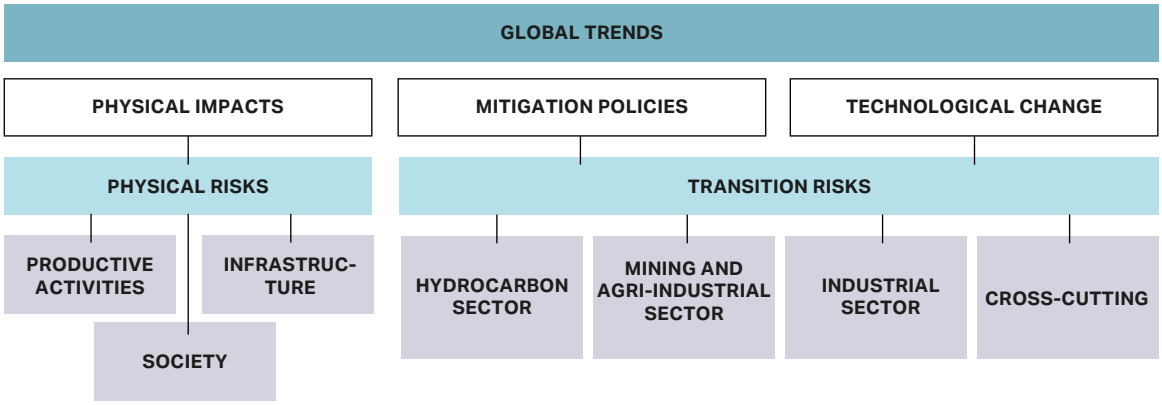
27 Finding costs are the expenses associated with locating and assessing new oil or gas reserves. They include activities such as seismic exploration, exploratory drilling, and geological studies.
28 Interview by Carlos Pagni with Horacio Marín, president of YPF. Available online. Last accessed: June 24, 2024.
29 According to the 2019 Refinement to the IPCC Guidelines for National Greenhouse Gas Inventories, the default emission factors for unconventional hydrocarbons can be several times higher than those for conventional ones if methane capture technologies are not employed.
30 For example, phosphate- or hydrogen-based batteries as alternatives to lithium-ion batteries, or cobalt substitutes in electronics.

There are also cross-cutting risks, stemming from the low technological intensity of Argentina's productive structure compared with that of developed countries. In 2021, 80% of exported goods were primary products and resource-based manufactures, while medium- and high-technology goods represented only 17%[31]. An empirical analysis by Palazzo *et al.* (2021) highlights that green products, which have an average complexity higher than Argentina's current export basket, are far removed from the country's existing productive capabilities—and that Argentina has lost ground in green exports. This not only constrains long-term growth prospects but also creates a challenging starting point for decarbonization and for integration into higher-complexity green value chains (Borrastero & Gómez, 2023).

Moreover, as countries advance in their decarbonization efforts, they seek to avoid being the only ones bearing the costs. To this end, they deploy various mechanisms—from para-tariff regulations to financing restrictions on fossil infrastructure—that impose economic and reputational penalties to pressure others to reduce their emissions as well. Thus, as the world's main consumer markets become increasingly green, economies that remain carbon-intensive face high exposure and competitiveness risks (Lebdioui, 2024).

Climate risks in Argentina

Diagram 2



Four guidelines for a development strategy in the era of climate change

Argentina is a middle-income country with a productive structure of intermediate complexity and a specialization profile strongly oriented toward primary products, with hydrocarbons playing an increasingly prominent role. Its main industrial exports come from the food, automotive, and chemical sectors (Park & Scattolo, 2024).

Furthermore, since 2011, the country has been mired in a prolonged period of economic stagnation that still persists, marked by one of the highest inflation rates in the world over the past 15 years and a rising poverty rate (De la Vega *et al.*, 2020; Schteingart & Sonzogni, 2024; Libman *et al.*, 2024; Tornarolli, 2024).

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31 The classification by Lall (2000) was used, which divides goods into five broad categories according to their technological content: primary products (PP), resource-based manufactures (RBM), low-technology manufactures (LTM), medium-technology manufactures (MTM), and high-technology manufactures (HTM).

Four guidelines for a development strategy in the era of climate change

In terms of climate responsibility, Argentina contributes slightly less than 1% of total global emissions, ranking 20th among the world's largest GHG emitters in 2023 (OWID, 2024), with per capita emissions close to the global average (OWID, 2023a, 2023b). Although not among the main historical contributors to global climate change, Argentina has a non-negligible share and, given its level of relative development, bears a role in global mitigation efforts.

Based on the international context and the country's specific circumstances, it is essential that all actors integrate climate change as a key factor in decision-making. Particularly in scenarios where the national government does not lead or coordinate efforts, the climate action driven by subnational governments, companies, trade unions, and civil society organizations will be crucial. The following section outlines four broad guidelines that should guide these efforts

Build climate action on Argentina's international positioning and commitments

Historically, Argentina has maintained an active role in international climate negotiations, adopting adaptation and mitigation commitments and showing leadership in specific agendas such as adaptation and climate finance. Sustaining this trajectory across all actors is a necessary condition to seize opportunities for private and multilateral financing and to strengthen Argentina's limited but real agency in improving its international positioning.

Argentina's climate diplomacy and negotiation strategy have historically been based on two pillars: the country's general foreign policy orientation set by the Ministry of Foreign Affairs, and the vision and expertise of the technical teams within the national climate authority. Initially, Argentina participated in negotiations as part of the Group of 77 + China and the Like-Minded Developing Countries (LMDC) coalition. These alliances reflected the view of climate action as being at odds with economic development—an attitude reinforced by low domestic demand for climate policy—resulting in a predominantly defensive international stance (Bueno, 2018).

The 2015 change in government marked a shift toward new alliances and a new position on climate change. Argentina left the LMDC and promoted the creation of a new negotiating bloc with Brazil and Uruguay (ABU), based on cooperation in agricultural issues, with an adaptation-centered agenda and a South-oriented rather than Latin American identity (Bueno, 2018)[32]. This shift led to a greater emphasis on mitigation, mirrored in local policies and commitments, while also reaffirming leadership in adaptation and climate finance.

This evolution was enabled by the strengthening of environmental bureaucracy and the accumulation of state capacities, allowing Argentina to sustain a consistent and credible position in climate diplomacy. Such consistency has been key to being recognized as a reliable interlocutor, to capitalize on opportunities emerging from the green transition, and to manage its associated risks.

Among these opportunities, climate finance flows stand out. They are divided into two main sources: Private financing, which depends on market dynamics but can be attracted through high-profile climate initiatives that signal commitment; and Multilateral financing, for which maintaining a stable and constructive stance in climate negotiations facilitates access to resources and participation in the definition of funding criteria and priorities.

32 After Paraguay joined the negotiating group, its name was changed to Grupo Sur (Southern Group).

In contrast, a lack of coherence can erode international credibility, weaken external support, and limit access to funding opportunities. It also hampers institutional capacity-building and reduces the ability to develop competitive project proposals, thereby lowering the chances of securing funds.

The election of Javier Milei introduces a particularly challenging period for Argentina's climate diplomacy. The environmental authority was downgraded from a ministry to an undersecretariat, and climate governance was left without a dedicated institutional structure. Alongside fiscal austerity measures and shrinking public-sector capacity, this has led to a loss of institutional expertise and continuity.

This downgrading aligns with the government's anti-globalist, climate-skeptic rhetoric and rejection of the 2030 Agenda, yet contrasts with its liberal–Western alignment, its stated intention to honor international commitments, and its interest in integration into organizations such as the OECD, where climate and environmental issues are central (OCDE, 2021).

> Argentina thus risks abandoning or ambiguously occupying strategic spaces built over years, losing alliances and capacities, and—most importantly—wasting valuable time for implementing environmental measures.

Experiences from other Global South countries show that, to make the most of limited yet real agency—such as in shaping trade regulations—foreign policy becomes more crucial than ever in designing international insertion strategies.

Institutional mechanisms, international cooperation networks, and multilateral agreements are key components to channel these strategies through diplomacy (Zelicovich *et al.*, 2024). While certain actions are non-transferable responsibilities of the national state, examples such as the U.S. campaign "We Are Still In", where subnational governments, firms, and organizations maintained climate commitments during President Trump's withdrawal from the Paris Agreement (UNFCCC, 2018), illustrate the crucial role of other actors in sustaining momentum.

In Argentina, it will be essential for all stakeholders to align their actions with national commitments and positions, ensuring maximum coherence and continuity.

Prioritize adaptation as a cornerstone of Argentina's climate response

Given Argentina's high economic and social vulnerability, it is essential to prioritize climate adaptation, assign it dedicated funding lines, and make it a cross-cutting axis across other policy areas, particularly urban planning and land-use management.

Adaptation is inherently context-specific, which makes constructing comparable metrics difficult—it depends on the degree of exposure and vulnerability of populations and ecosystems, the nature and intensity of climate events, and the existence of pre-existing laws, programs, and policies (Amaru & Chhetri, 2013). Moreover, adaptation progress is difficult to measure because it often involves assessing non-events—negative impacts that did not occur thanks to successful interventions (Aguilar *et al.*, 2022).

For this reason, establishing Argentina's precise degree of progress in adaptation is more complex than in mitigation. Before 2015, the adaptation agenda had limited political attention and human

resources, largely due to its marginal role under the Kyoto Protocol (1997). However, the progression of global warming and sustained pressure from developing countries—especially the most vulnerable—led to adaptation being elevated in importance under the Paris Agreement, aiming to place it on equal footing with mitigation. Since then, international funds for adaptation in developing countries have been established.

The Paris Agreement had a significant institutional and political impact in Argentina. The Secretariat of Environment and Sustainable Development was elevated to ministerial rank, and the National Climate Change Cabinet (GNCC) was created, consolidating a technical team that brought continuity and rigor to climate governance. This allowed Argentina to meet the Paris requirements on adaptation, including the formulation and periodic updating of National Adaptation Plans (NAPs), which must outline national priorities, support needs, and concrete measures.

In 2022, Argentina published its National Adaptation Plan (PNA), developed jointly by the national government and subnational representatives. Funded by the Green Climate Fund (2020–2021), the plan includes an assessment of climate-related threats, an analysis of key physical risks, and sets adaptation targets for 2030[33]. Although submitted later than expected—given Argentina's leadership role in the international adaptation agenda—this delay reflects the persistent gap between international commitments and effective domestic implementation. This is not unique to Argentina but also affects other developing countries, largely due to the global dominance of mitigation priorities and constraints in institutional capacity and financing.

Adaptation policy implementation in Argentina still depends heavily on international funding derived from climate negotiations—a common phenomenon in developing countries, where state capacity-building for climate resilience often hinges on multilateral projects and technical cooperation. This creates instability, as policy continuity becomes project-dependent and uneven across sectors with available funding (Ryan *et al.*, 2018). Moreover, effective adaptation requires local implementation, as subnational governments hold competences in land-use planning, disaster prevention, and water management. However, provincial and municipal governments face even greater challenges in capacity and access to international financing, limiting design and execution.

Adaptation measures are also costly. The strategic line of Argentina's National Plan for Adaptation and Mitigation to Climate Change (PNAyMCC) focused on "strengthening infrastructure and territorial development to promote adaptation and reduce exposure to climate risks" was estimated at USD 117 billion, covering only 19 of the 28 measures involved. It is therefore crucial to develop specific financing lines and budget allocations dedicated to adaptation actions.

Nevertheless, this effort must be complemented by a continuous search for access to international financing, which would help reinforce and expand national and subnational actions. To strengthen and better target the adaptation agenda, three broad strategic lines should be considered.

First, since many adaptation competences fall under provincial and municipal governments, it is essential to translate the NAP into local plans. In particular, Local Climate Action Plans (PLACs) are strategic planning tools that allow for optimizing the management of technical and financial resources to increase the resilience of cities and communities. In this task, the work of the Argentine Network of Municipalities Facing Climate Change stands out—a coalition of municipalities that promotes the design and implementation of local climate planning and currently includes 306 jurisdictions. The work of institutions such as COFEMA (Federal Environmental Council) and the Federal Investment Council (CFI) is also relevant, serving as spaces for capacity-building and provincial

33 These targets are specified in 34 measures organized across 5 dimensions, which are monitored through a set of quantitative and qualitative indicators (MAyDS, 2022). In addition, the NAP provides an initial assessment of the losses and damages in Argentina caused by extreme climate events.

coordination for the formulation of action plans. Continuing this collaborative effort will be essential for strengthening training across different levels of government and civil society, ultimately improving adaptation governance. In this process, it will be particularly important to allocate specific budgetary resources for adaptation measures, improve capacities to access international financing, advance in methods to measure adaptation progress (Cavazos *et al.*, 2024), and strengthen interjurisdictional dialogue on the issue.

Second, it is important to focus adaptation measures on the most vulnerable territories and populations by strengthening access to basic services and early warning systems, and by developing community-based strategies that increase their ability to respond to climate events. In this task, it will be essential to consider the impacts of climate change on health, the differentiated effects on the lives of women and gender-diverse groups (ILO, 2024), and the needs of the 6,467 informal settlements identified by the National Survey of Informal Settlements (RENABAP). An interesting example of planning in this direction is the National Strategy on Health and Climate Change, published in 2023, and the provincial strategies subsequently developed in Misiones, Neuquén, and Tucumán. These were financed by the Green Climate Fund and made possible through collaboration between the National Ministry of Health and PAHO/WHO. These initiatives demonstrate that a combination of political will, available financing, and intersectoral and multilevel collaboration enables progress in developing adaptation strategies (Hartinger *et al.*, 2024).

Third, it is urgent to reduce the vulnerability of agricultural activity, given its importance for human consumption and its weight in Argentina's export basket and macroeconomic stability. Adapting to climate change and variability must be a priority for the agricultural and agro-industrial sectors. These sectors—marked by heterogeneity and extensive geographic spread—have historically shown a strong capacity for autonomous adaptation to environmental and contextual changes. However, the accelerating pace of climate change now poses new challenges for producers: the need to adapt more quickly, with a long-term perspective, and at a scale that requires collective action to be effective (SAyDS, 2019). In this regard, strategies developed in recent years—such as the National Action Plan on Agriculture and Climate Change (2019) and Mission 6: Adapting Food Production to the Challenges of the 21st Century from the Argentina Productiva Plan (2023)—provide relevant frameworks and lines of action on which to build.

Accelerating the decarbonization process and aligning it with the development trajectory

Although Argentina has formally met its reporting obligations to the UNFCCC on mitigation, it has not yet implemented sustained policies to support these commitments. This could create difficulties for meeting the emission-reduction target established in its NDC, especially in a context of economic growth. Given the increasing international scrutiny and the growing number of trade and financial regulations based on environmental criteria, it is imperative that the country stop postponing the implementation of a clear mitigation policy pathway aligned with its development trajectory.

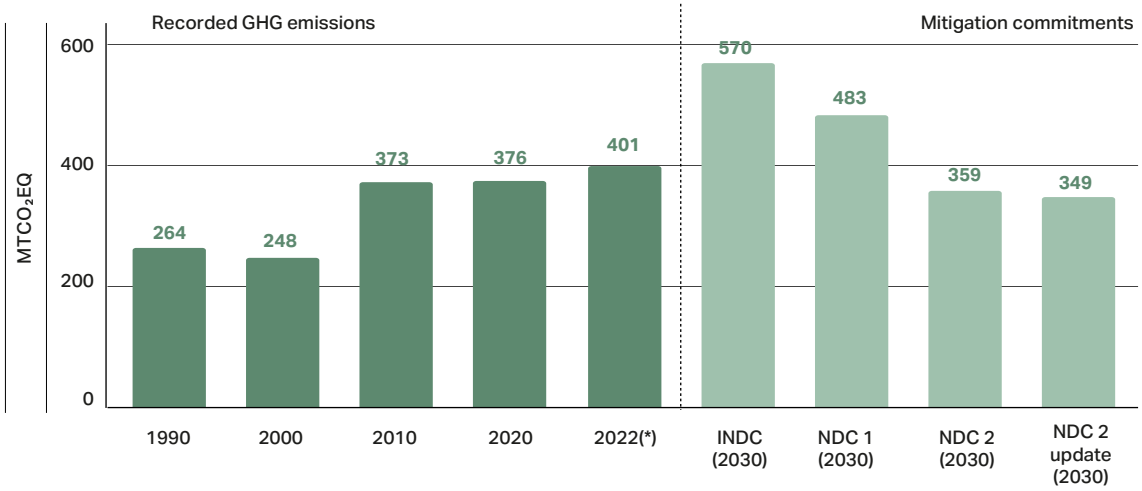
Argentina's mitigation approach emerged largely from its participation in international climate negotiations. These instances often marked the starting point of the domestic climate discussion, leading mitigation to be treated as a response to external demands, rather than as an element integrated early into the national development strategy.

Argentina has formally complied with its reporting obligations to the UNFCCC on mitigation, documenting national climate conditions and adopting emission-reduction commitments through

instruments such as National Communications, Biennial Update Reports (BURs)[34], and national greenhouse gas inventory reports[35]. It also adopted increasingly ambitious mitigation pledges through its NDCs between 2015 and 2021. In October 2015, ahead of COP 21 in Paris, the country submitted its Intended Nationally Determined Contribution (INDC), which later became its first NDC when Argentina ratified the Agreement in September 2016. That same year, during COP 22, Argentina became the first country to update its NDC, establishing an absolute target of not exceeding net emissions of 483 $MtCO_2eq$ in 2030. In December 2020, Argentina submitted its Second NDC, committing to an absolute, unconditional economy-wide target of not exceeding net emissions of 359 $MtCO_2eq$ in 2030. Later, in October 2021, it submitted an update that increased ambition by two percentage points, defining a new absolute target of 349 $MtCO_2eq$ by 2030—27.7% more ambitious than the first NDC of 2016. However, while these increasingly ambitious commitments were being announced, emissions continued to rise—albeit at a slower pace due to the weak economic performance of the period (Figure 5).

Evolution of recorded GHG emissions (1990–2020) and Argentina's unconditional mitigation commitments (to 2030)

Figure 5



(*) This figure comes from the latest GHG inventory, which was not fully available at the time this report was published. It is possible that data for previous years may also change, as each new inventory recalculates earlier figures using the updated methodology.
Source: Fundar, based on World Bank (2022).

To assess the level of ambition of this mitigation commitment, it is necessary to compare it with an appropriate benchmark. One option is to compare Argentina with other countries in the region, since, in general terms, they share similar income levels, productive diversification, energy-mix composition, degree of responsibility for the climate crisis, and level of vulnerability to its impacts[36]. As in Argentina, all of these countries submitted their first NDCs, 29 of them updated their commitments to set more ambitious mitigation targets, and most NDCs include a quantifiable emissions-reduction goal. However, while some countries opted for absolute targets, others rely on a counterfactual BAU scenario to specify their potential emission reductions.

34 BURs serve to update the information provided in the National Communications.
35 These reports focus exclusively on detailing the composition of greenhouse gas emissions.
36 Together, these countries represent only 5% of all global energy-related GHG emissions since 1971 (EIA, 2023). At the same time, climate change will have disproportionate impacts, severely affecting not only their populations—overexposed due to high levels of poverty and vulnerability—but also the main productive activities that sustain the region's income, such as agriculture, livestock, fishing, and tourism (Reyer *et al.*, 2015). Without mitigation measures, more than 17 million people in Latin America and the Caribbean—approximately 2.6% of the population—could be forced into internal displacement within their own countries to avoid these impacts (World Bank, 2022).

Four guidelines for a development strategy in the era of climate change

Comparing emission-reduction targets across countries in the region is methodologically complex. Such an assessment would require contrasting the emissions pledged in each NDC with the emissions projected for 2030 under current policies, and evaluating those commitments in light of what would constitute each country's "fair contribution" to global mitigation. As an analysis of this kind falls outside the scope of this report, an indicative approach is to compare the reduction in emissions that each country must achieve by 2030 relative to its emissions in the same base year. When contrasting the 2030 target with 2018 emissions[37], the data show that while Argentina commits to a 4.64% reduction relative to 2018 emissions, Brazil commits to a 38.11% reduction, Chile to 12.84%, and Colombia to 43.91% (Table 2). Although this comparison seems to indicate that Argentina's target is relatively easy to meet, the country has experienced more than a decade of emissions stagnation. This suggests that—given that its emissions trajectory is closely tied to economic activity (Aneise *et al.*, 2024)—a scenario of economic growth in the coming years would make achieving its NDC significantly more challenging.

Nationally Determined Contributions (NDCs) in Latin America and the Caribbean (selected countries)

Tabla 2

Country	Share of global emissions (2022)[38]	2018 emissions (**)	Type of NDC target	2030 target		Relative NDC reduction (****)	Submission of long-term strategy (LTS)
				Unconditional	Conditional		
Argentina	0,7%	366 Mt CO_2-eq	Absolute	349 Mt CO_2-eq	-	-4,64%	2022
Bolivia	0,2%	114 Mt CO_2-eq (***)	Not quantifiable	-	-	-	-
Brazil	4,2%	1939 Mt CO_2-eq	Absolute	1200 Mt CO_2-eq (50% reduction relative to 2005)	-	-38,11%	-
Chile	0,2%	109 Mt CO_2-eq (*)	Absolute	95 Mt CO_2-eq(*)	-	-12,84%	2021
Colombia	0,5%	302 Mt CO_2-eq	Absolute	169,4 Mt CO_2-eq	-	-43,91%	2021
Ecuador	0,2%	80 Mt CO_2-eq	Based on BAU scenario (Business As Usual)	9% reduction relative to BAU scenario (2025)	11.9% reduction relative to BAU scenario (2025)	-	-
Mexico	1,8%	765 Mt CO_2-eq	Based on BAU scenario (Business As Usual)	35% reduction relative to BAU scenario	40% reduction relative to BAU	-	2016
Paraguay	0,2%	106 Mt CO_2-eq (***)	Based on BAU scenario (Business As Usual)	10% reduction relative to BAU scenario	20% reduction relative to BAU	-	-
Peru	0,3%	181 Mt CO_2-eq	Absolute	208,8 Mt CO_2-eq	179 Mt CO_2-eq	14,92%	-

Table 2

37 This year was selected in order to use a reference year for which official data were available for all countries.
38 OWID (2024). Greenhouse gas emissions include carbon dioxide, methane, and nitrous oxide from all sources, including land-use change. They are measured in tonnes of carbon dioxide equivalent over a 100-year period.

Uruguay	0,1%	45 Mt CO_2-eq (***)	Absolute	40 Mt CO_2-eq (9,267 Mt CO_2 0,818 Mt CH_4 0,032 Mt N_2O)	Additional CO_2-eq reduction: 2,3 Mt (0,96 MtCO_2 0,061 Mt CH_4 0,02 Mt N_2O)		2021

(*) Does not cover the forestry sector. (**) Since the commitments are referenced to different years, 2018 was used as the base year for comparison. Emissions associated with each country's NDC commitment were used as the reference. (***) Data taken from OWID based on Jones, 2023. (****) Although the level of ambition is determined by each country's projected emissions for 2030 under current policies, the comparison with 2018 emission levels serves as an approximate indicator of the magnitude of the reduction each country must undertake.

Source: Fundar, based on UNFCCC (2023), National Greenhouse Gas Inventories, OWID (2024), and the Greenhouse Gas Equivalencies Calculator and Long-term Strategies Portal.

Starting with the publication of the NDC in 2016, the Executive Branch began designing sectoral mitigation plans[39], which were published separately between 2017 and 2019. These plans presented various mitigation policies and included sector-level emission-reduction targets. However, the targets were expressed in terms of "net emissions avoided", omitting each sector's specific contribution to projected 2030 emissions. This information is crucial, as it determines the level of effort required from each sector to meet the NDC targets. This presentation format was not accidental; it resulted from pressure by the agricultural sector, which sought to avoid a reduction in its share of emissions by 2030 (Aneise, 2024).

At the end of 2019, with the passage of the Framework Law on Minimum Standards for Adaptation and Mitigation to Climate Change (Law 27.520), formal mechanisms were established for planning decarbonization measures, and the Executive Branch was given the institutional responsibility to develop and publish a National Plan for Adaptation and Mitigation to Climate Change (PNAyMCC), approved by the Chief of Cabinet of Ministers and coordinated through the GNCC[40]. The role of the Cabinet is to "coordinate, across the various areas of the National Public Administration, the implementation of the PNAyMCC and all related public policies" (Article 7 of Law 27.520).

However, the sectoral plans designed between 2017 and 2019 were never institutionalized[41], as in 2020—following the change in government and the submission of a new NDC—they were removed from the official website of the Ministry of Environment. As a result, between 2020 and 2022 there was no approved, publicly available decarbonization plan.

The period 2020–2023 was marked by conflicts between government ministries (Environment and Energy, or Environment and Agriculture) regarding the decarbonization plan. These conflicts revealed internal disagreements about the mitigation efforts required from each sector (Aneise, 2024) and exposed the absence of a clear strategy for achieving the NDC targets.

Finally, in 2022, with the official publication of the PNAyMCC, the Cabinet released its first formal planning exercise. Although the plan incorporated work previously carried out by the ministries for the 2017–2019 sectoral plans, only 19 out of 141 mitigation-related measures included a quantified emission-reduction target, and sectoral contributions toward 2030 remained unspecified.

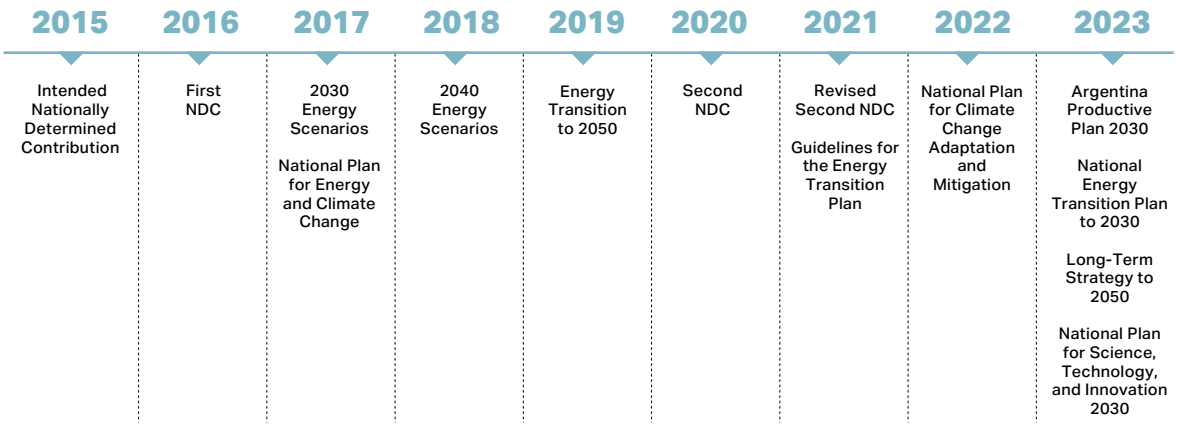
Thus, although the set of plans published by Argentina in response to the climate challenge (see Table 3 in the Annex) reflects a growing engagement of the state—allowing for the consolidation of national technical teams and the creation of institutional structures for policy coordination—this

39 Covering the energy, transport, agriculture, industry, forestry, health, and infrastructure/territory sectors.
40 The GNCC had previously been created by Decree 891/2016 in July 2016.
41 Although the plans were submitted through Resolution 447/2019 before the change in administration, they did not have formal standing, as they had not been approved by the Chief of Cabinet.

production did not lead to successful climate-policy implementation, nor did it succeed in clarifying Argentina's decarbonization pathway toward 2030. The disconnect between the agendas of core government ministries and the climate agenda, combined with resistance from powerful actors in key mitigation sectors, resulted in a misalignment between commitments and the policies implemented.

Diagram 3

Selection of mitigation and adaptation plans and strategies, or those incorporating transition-related topics (2015–2023)



Source: Fundar.

It is important to note that Argentina is not alone in struggling to align its international commitments with the effective implementation of domestic policies. A significant gap persists between countries' 2030 NDC targets and the current global emissions trajectory under existing policy frameworks—this is true for most countries worldwide, including developed ones (UNEP, 2023).

Despite the difficulties faced by all countries—and those specific to Argentina's domestic context—climate-change mitigation is not optional; it is an urgent necessity. Growing international scrutiny, along with evolving trade regulations and environmental standards for production, will increasingly pressure Argentina's mitigation policy. Argentina is not among the world's largest emitters, but as a G20 member, and given the size and relative development level of its economy, its actions do not go unnoticed and carry growing implications for its international relationships.

This context calls on Argentina to move forward with the implementation of mitigation measures. However, as a country of the Global South facing a prolonged period of weak economic performance and pressing social needs, it is crucial that decarbonization efforts support— or at least do not hinder—economic development. The challenge is neither to postpone climate action until the economy improves, nor to pursue decarbonization at any cost, but to adopt a sustainable path that prioritizes growth and inclusion.

Under these premises, four broad guidelines can be proposed to advance a decarbonization process of this kind.

First, it is essential to have a clear mitigation strategy for 2030 that defines the specific contribution of each sector toward meeting the national emissions-reduction target. This requires addressing disagreements among stakeholders and coordinating efforts at both the federal and sectoral levels. The National Climate Change Cabinet (GNCC) is the natural forum for this task: it is established by law, which ensures continuity despite changes in administration; its core purpose is to

integrate the agendas and goals of all government ministries; and, because it operates under the Chief of Cabinet, it is well positioned to lead the articulation and coherence across the multiple agencies involved. Even under the Javier Milei administration—despite Foreign Minister Diana Mondino's statements on Argentina not adhering to the Pact for the Future[42], and despite the government's preference for communication that avoids mentioning climate change—the GNCC convened and emphasized the importance of continuing coordination among "national ministries, subnational jurisdictions, the private sector, civil society, universities, and all entities interested in contributing to this cause" (Chief of Cabinet of Ministers, 2024). In this sense, the Cabinet demonstrates resilience even in the face of a government that is resistant to the climate agenda, showing that it remains an institutional space from which other actors can drive climate action, even without strong leadership from the national government. This is particularly relevant given that a lack of definition in the mitigation strategy—and continued postponement of action—will only increase the need for more drastic and costly measures in the future.

Second, a clear policy direction must be established on issues that are particularly critical, such as the development of hydrocarbon resources. Europe's push to expand its energy supply options beyond OPEC+, and the broader global effort to diversify energy imports, presents a short-term opportunity for hydrocarbon-producing countries located in low-conflict regions to spur economic growth and generate fiscal revenues from extraction. However, the time window for doing so is limited, and a core element of any climate strategy must be the design of an exit pathway that identifies alternatives to replace the sector's role in the economy—especially in oil-producing provinces. In this context, it is essential that the State not bear the full investment risk associated with the sector. While hydrocarbon companies will need to assess their investments in light of transition risks, governments—national, provincial, and municipal—should: (i) thoroughly evaluate public investment in oil and gas infrastructure to avoid creating new sources of carbon lock-in[43] or stranded assets; (ii) foster decarbonization measures; and (iii) plan for a just transition toward a post-fossil future, addressing both the fiscal revenues that will eventually disappear and the jobs and productive ecosystems currently tied to the sector.

Third, the decarbonization of the domestic power system must be accelerated. This will require tackling issues that have seen uneven progress over recent decades: expanding transmission capacity, improving efficiency on both the supply and demand sides, planning the integration of variable renewable energy into the grid, advancing distributed generation, and adapting energy infrastructure to the impacts of climate change. Each level of government has different responsibilities according to its competencies. For example, promoting distributed generation and enforcing building-efficiency measures fall largely to subnational governments, while creating the macroeconomic conditions needed to attract investment, developing high-voltage transmission infrastructure, and running large-scale renewable-generation auctions rest primarily with the national government. Given that the successful implementation of these initiatives can yield economic benefits—and that decarbonizing energy use in export-oriented sectors will increasingly become a commercial requirement—there is a strong alignment of interests that could help accelerate progress in this area.

Lastly, it is essential for all levels of government to build consensus on mitigation policy with actors in the agriculture, livestock, and other land-use sectors (AFOLU), which accounted for 39% of Argentina's GHG emissions in 2018 (MAyDS, 2022b**).** The two most significant sources are enteric fermentation from livestock (15%) and land-use change (19%). Their importance—combined

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42 In September 2024, within the framework of the United Nations, the Pact for the Future was introduced. The pact consists of 56 measures organized under the following thematic pillars: (i) sustainable development and development financing; (ii) international peace and security; (iii) science, technology, innovation, and digital cooperation; (iv) youth and future generations; and (v) the transformation of global governance. The Argentine government chose to distance itself from the Pact.

43 A source of carbon lock-in is an investment, infrastructure, policy, or practice that entrenches or steers the economy toward a high-carbon pathway over the long term. These mechanisms make the transition to cleaner and more sustainable energy systems more difficult due to high costs, institutional inertia, and long asset lifecycles, creating significant barriers to emissions reduction.

with rising requirements in export markets—makes it imperative to accelerate climate action and strengthen traceability measures. Several actions can contribute to this goal: advancing the implementation of the Forest Law, with a focus on curbing illegal deforestation; making progress on land-use planning at the provincial and municipal levels; recognizing land tenure for families currently living in forested areas; promoting circular-economy practices in agricultural production, including the use of bio-inputs and the reuse of biomass residues; improving process traceability through incentives for sustainable-management certifications and product-level carbon-footprint measurements; designing information systems to monitor interventions; and strengthening research and development in priority areas (Mendoza, Villafañe & O'Farrell, 2024; Fundación Avina, INTA & Fundación Bariloche, 2021). An innovative tool in this regard is the ecosystem services payment mechanism, which provides economic compensation for environmental conservation (Arias Mahiques *et al.*, 2024). Specifically for the livestock sector, it is crucial to establish public-private partnerships that promote climate-smart livestock production, taking regional differences into account. This requires adopting technologies and practices that improve efficiency, reduce emissions, and enhance carbon sequestration, alongside evaluation and traceability systems that certify their environmental impact (Cabrini *et al.*, 2024).

Seizing the opportunities created by the green transition to drive economic development

Argentina has significant opportunities to expand and diversify its production and exports as global markets adjust to the shift toward sustainability. These range from exporting LNG and supplying the minerals needed for clean technologies to entering higher–value added segments by leveraging its comparative advantages and existing capabilities. Some of these opportunities will materialize through market forces alone, but others require different levels of government intervention—from ensuring an enabling environment to making targeted bets on sectors deemed strategic.

The most straightforward opportunities of the green transition are linked to Argentina's export specialization in primary products and related manufactures. For example, global demand for minerals such as copper and lithium—both essential for low-carbon technologies—is expected to increase substantially, positioning Argentina to become one of the world's leading exporters of these minerals by 2030[44]. At the same time, food demand in developed countries is becoming more diversified and sophisticated, requiring producers to credibly and consistently demonstrate that their products meet environmental, labor, and production-process standards (Hallak & Tacsir, 2021). This creates opportunities for the agrifood sector to move into less commoditized, higher–value added niches, while also consolidating its presence in traditional markets (Hallak & Tacsir, 2021; Argentina Productiva 2030, 2023; Freytes & O'Farrell, 2021; O'Farrell *et al.*, 2022). In addition, the need to decarbonize sectors that are difficult to electrify is creating space for emerging industries such as hydrogen—particularly green hydrogen, produced using renewable energy. Thanks to Argentina's excellent solar conditions in the north and wind resources in the south, the country is also well positioned to become a net exporter of this energy carrier (Argentina Productiva 2030, 2023; Klump & Enriquez, 2024).

Less directly driven by global demand is the emergence of new high–value added market segments linked to the green technology wave—such as electrolyzers for hydrogen production, lithium batteries, electric vehicles and their components, among many others. This transition offers an opportunity

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44 Argentina's mineral potential positions the country to become the world's second-largest lithium producer by 2030, accounting for at least 20% of global supply (Delbuono, 2023; Argentina Productiva 2030, 2023), and to rank among the top ten copper producers, with roughly 3% of global output (Secretariat of Mining, 2022). Taken together, mining exports could reach an estimated USD 19 billion annually by 2030 (Argentina Productiva 2030, 2023)—more than four times their 2023 level.

for innovation, industrial capability-building, and the diversification of the productive structure toward more complex sectors. Because the development of these industries will require targeted government support, the transition also provides a chance to incorporate gender and territorial equity considerations early on in policy design, taking advantage of the fact that many of these sectors are still nascent or minimally developed.

Overall, this dimension of the transition is particularly relevant for countries like Argentina, which are still seeking to industrialize and move beyond static comparative advantages that lock them into the role of primary commodity exporters. However, the challenges that Global South countries face in integrating into these value chains make it difficult to clearly identify specific opportunities, particularly because they do not arise organically from market signals but rather from deliberate strategic choices—either public or private.

One possible pathway for integration is to build on the momentum generated by demand in natural-resource sectors to move gradually into higher–value added segments within those same value chains (Marin *et al.*, 2013). Biotechnology, for example, leverages the dynamism of Argentina's agrifood sector to drive innovation in products such as genetically modified seeds and bio-based inputs, enabling the creation of firms and exports in a knowledge-intensive industry (O'Farrell *et al.*, 2022). In the mining sector, shifts in global value chains are opening opportunities for the growth of local suppliers (Marin *et al.*, 2013, Murguía *et al.*, 2023), fostering the development of a productive ecosystem that enhances the economy's productivity, reduces dependence on its initial resource endowments, and increases its complexity and diversification (Freytes *et al.*, 2023). In renewable energy, for instance, there is already some degree of capability development: according to INTI's National Registry of Suppliers and Domestic Goods for the Renewable Energy Sector (REPROER), there were 271 domestic supplier firms in 2022 (Argentina Productiva, 2023) that can support the sector's expansion.

All of this requires two key preconditions: on the one hand, the development of sectors such as mining, agriculture, renewables, and green hydrogen, which enable the creation of productive capabilities; and on the other, innovation and technological-development policies that leverage the opportunities provided by the country's resource endowments (Freytes & O'Farrell, 2021; Lebdioui, 2024). In every case, establishing strict socio-environmental governance standards will be critical—both to properly manage physical risks such as water scarcity and environmental incidents, and to ensure meaningful community engagement in project development. This is necessary not only to comply with legal requirements but also to secure the successful implementation of projects (Arias Mahiques *et al.*, 2022).

There will also be cases where the strategic bet lies in building on Argentina's existing industrial capabilities. A clear example is the nuclear sector, where the strategy involves leveraging the strengths of a mature and well-established industry to capture part of the emerging market for small modular reactors (SMRs) through the CAREM project (Caro, 2023). Similarly, highly specialized firms such as IMPSA—experienced in designing and manufacturing hydroelectric, wind, nuclear, and oil-industry equipment—and INVAP—specialized in nuclear technology, space engineering, industrial and medical equipment, environmental monitoring, and telecommunications—represent key national assets. These capabilities can facilitate Argentina's integration into value chains such as green hydrogen, particularly in strategic segments like electrolyzer manufacturing.

In this process, tools such as Green Economic Complexity help identify products and sectors where the country holds competitive advantages, making them valuable resources for determining where to focus government support. They can even reveal less obvious opportunities by providing clear metrics to rank priorities and assess trade-offs, thus enabling more informed and strategic decision-making (Luvini, 2024). According to a study by Palazzo *et al.* (2021), Argentina has opportunities in green products from sectors such as mechanical and electrical equipment, measuring and control instruments, recycling machinery, and waste-management and water- and gas-filtration technologies. The country already possesses relevant productive capabilities in these sectors, which are also well connected to one another—facilitating mutual reinforcement.

Equally important will be the modernization and adaptation of all productive sectors to the new standards of environmental efficiency required by the transition to sustainability. Measures such as improving material and energy efficiency not only reduce the energy intensity and environmental impact of economic activities but also enhance overall competitiveness. At the same time, implementing such measures helps prevent penalties in international trade through mechanisms like the Carbon Border Adjustment Mechanism (CBAM)[45]. Achieving this will require targeted public policies, which may range from market-based instruments—such as emission permits and carbon markets—to technical assistance and dedicated financing lines for the most exposed sectors. In other sectors[46], however, incremental efficiency improvements will not be enough; far more radical adaptation will be necessary due to the scale of exposure to the transition. This is the case for the automotive industry, which must undergo a profound technological transformation driven both by decarbonization imperatives and by the entry of new global players, such as China. The sector is among Argentina's main manufacturing export categories and now faces either a significant risk or a major opportunity to make a "green development leap" through the transition to electromobility. Yet, so far, Argentina has not managed to deploy a clear productive strategy in this area (Rubio *et al.*, 2024)[47].

In all cases, the challenging international context—combined with the Argentine state's limited resources—requires that the strategic bets the country makes be implemented with ambition, but grounded in accurate diagnostics and a clear plan that includes concrete targets and exit strategies.

> It is essential to stop speaking of opportunities in the future tense and start advancing concrete actions in the present.

Breaking the inertia

Building a comprehensive response to climate change from Argentina—one that successfully addresses the four dimensions outlined here international positioning, adaptation, mitigation, and green productive diversification—is an enormous challenge. It requires accelerating the search for a new development model in an international context marked by uncertainty and risk, and within a domestic environment filled with urgent pressures that make long-term planning difficult. Far from serving as an excuse for inaction, these obstacles should underscore the scale of the transformation required and motivate action accordingly.

The connection between climate change and development is becoming increasingly tight. Promoting economic growth is essential, because higher income levels expand the resources available for adaptation, reduce vulnerability to the most harmful impacts of global warming, and strengthen the capacity to implement mitigation policies and green industrial development. At the same time, it is no longer possible to pursue growth and economic development without incorporating adaptation to a harsher climate, the decarbonization of the economy, and an assessment of the opportunities

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45 This mechanism is a regulatory measure of the European Union that places a carbon cost on imports of certain goods, with the aim of leveling the playing field between domestic producers—who are subject to the EU Emissions Trading System—and foreign producers. Its purpose is to prevent "carbon leakage," whereby companies shift production to countries with weaker climate regulations, and to encourage emissions reductions globally.

46 Although the CBAM is initially being implemented only in the EU and there are still less demanding markets elsewhere, the global trend is clearly moving toward decarbonization. Even other jurisdictions, such as the United States, are exploring the possibility of introducing their own CBAM-type mechanisms.

47 Brazil, by contrast, established a new automotive regime in 2024 with sustainability goals and mandatory energy-efficiency requirements for all new vehicles sold in the country (the Green Mobility and Innovation Program, MOVER) (Rubio *et al.*, 2024). And in its Nova Indústria Brasil Plan (2024), the government sets out a sustained strategy for mobility based on biofuels as well as hybrid and electric alternatives.

generated by the green technology wave. In some areas, these processes will move together and reinforce one another; in others, they will come into tension, requiring careful calibration of strategy to maximize opportunities and minimize risks.

A task of such scale and complexity requires clear direction from the state. In particular, each level of government must designate a capable institution—backed by the highest level of political authority—to lead climate action in an interdisciplinary and multilevel manner across all agencies involved in the design, implementation, and evaluation of public policy. However, no governmental effort will be sufficient without the engagement and support of the key actors driving this transition: business associations and producer groups, labor unions, civil-society organizations, and social movements. All of them will, in one way or another, be compelled to respond to the megatrend of climate change—and that response will be stronger if it is planned and coordinated rather than reactive. This does not mean ignoring the many, often conflicting, interests at stake, but rather fostering broad ownership of the challenge posed by the transition so that the search for solutions can be approached proactively.

Annex

Plans and strategies on mitigation, adaptation, or transition-related themes presented by Argentina (selected, 2015–2023)

Table 3

Name	Agency	Year	Summary
Sectoral Plans 2017–2019: • Action Plan on Water, Wetlands, and Climate Change, 2017 • Action Plan on Energy and Climate Change, 2017 • Action Plan on Industry, Mining, and Climate Change, 2017 • Action Plan on Health and Climate Change, 2019 • Action Plan on Ports, Waterways, and Climate Change, 2019 • Action Plan on Transport and Climate Change, 2019 • Action Plan on Housing, Infrastructure, and Climate Change, 2019	Ministry of Environment and Sustainable Development	2017-2019	Sectoral adaptation and mitigation plans, with a diagnostic of each sector and, in many cases, quantifiable measures.
Energy Scenarios 2030	Secretariat of Strategic Energy Planning, Ministry of Energy and Mining	2017	Four scenarios modeled based on different combinations of demand, investment, prices, and productivity.
Energy Scenarios 2030	Undersecretariat of Strategic Planning, Ministry of Economy	2019	Four energy scenarios designed based on demand and investment projections, using the TIMES model to produce inputs for planning.
Roadmaps for the Energy Transition	Secretariat of Energy, Ministry of Economy	2021	Guidelines based on two prospective scenarios for the energy transition through 2030.
National Adaptation and Mitigation Plan for Climate Change	Ministry of Environment, Secretariat of Climate Change, Office of the Cabinet of Ministers	2022	A national framework that integrates the approach of previous sectoral plans while expanding mitigation efforts. It includes sectoral adaptation plans and cross-cutting components such as financing and governance.
Argentina Productiva Plan 2030	Secretariat of Industry, Ministry of Economy	2023	Productive planning at the national level addressing priority sectors for industrial development. It incorporates the role of green industrial policy and the need to link productive policy with climate change mitigation and adaptation.
National Energy Transition 2030	Secretariat of Energy, Ministry of Economy	2023	Guidelines and objectives for the energy transition, modeled with the TIMES-Argentina framework.
Long-Term Strategy to 2050	Secretariat of Climate Change, Office of the Cabinet of Ministers	2023	Lineamientos generales en base al Plan de Adaptación y Mitigación.
National Plan for Science, Technology, and Innovation 2030	Secretariat of Planning and Policies in Science, Technology, and Innovation, Ministry of Science, Technology and Innovation	2023	Strategy addressing 10 national challenges, including sustainable mobility, the energy transition, and sustainable production.

Source: Fundar.

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