Climate Action Tracker

Scaling up climate action

Key opportunities for transitioning to a zero emissions society

FULL REPORT

CAT Scaling Up Climate Action series

ARGENTINA

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NEW CLIMATE INSTITUTE

CLIMATE ANALYTICS

CAT Scaling Up Climate Action series

The Climate Action Tracker (CAT) strives to support enhancing climate action in the context of the Paris Agreement implementation. This analysis contributes to future revisions of mitigation targets, and aims at spurring an increase in climate mitigation actions, to close the gap between current emissions projections and required Paris-compatible pathways.

As part of this, we have been researching the potential for countries to scale up climate action in different focus areas. The analysis in this report is relevant to Parties considering revisions to their Nationally Determined Contributions (NDCs) to be submitted under the Paris Agreement by 2020 or thereafter, and also to their submission of long-term low greenhouse gas development plans, also due by 2020.

The result is our **Scaling Up Climate Action** country series, which identifies options for increased sectoral action that would move a country towards a pathway compatible with the Paris Agreement's long-term temperature limit and estimates the impact of those actions on emissions and other benefits.

The first round of our analysis covers **South Africa**, the **European Union**, **Indonesia**, **Turkey**, **Argentina**, and **Australia**.

The consistent method and similar structure for all six reports allows for country-specific insights, while enabling a cross-country comparison to draw general research findings and lessons learnt on global potentials.

Executive summary

Introduction and objectives

Under the Paris Agreement, governments have committed to limiting temperature increase to well below 2°C above pre-industrial levels and pursuing efforts to limit it to 1.5°C. Current efforts are insufficient: aggregate mitigation targets, according to Climate Action Tracker (CAT) estimates, result in global warming of about 3.0°C. Implementation of the targets is falling short: greenhouse gas (GHG) emissions under implemented policies will lead to an estimated warming of around 3.3°C.

To stay below the globally agreed limit, the IPCC Special Report on 1.5℃ finds that an increase in effort is required to peak global GHG emissions as soon as possible, reduce CO_2 emissions to net-zero around 2050 and total GHG emissions shortly thereafter.

In recent years, measures to reduce GHG emissions have, in many cases, become more attractive to policy makers and private investors, both because of falling technology costs, as well as increased awareness for other benefits, such as air quality improvements and job creation in low-carbon-oriented sectors.

We no longer live in a world where climate change mitigation is a burden per se, but where it is increasingly becoming the most feasible option when considering all socio-economic aspects. For cost-efficient global mitigation, it will be essential to make those mitigation actions accessible to, and overcome remaining barriers in, all countries.

This report, the third country assessment in the Climate Action Tracker's Scaling Up Climate Action Series, analyses areas where Argentina could accelerate its climate action. The report illustrates GHG emission reductions from such actions, along with other benefits.

Our analysis starts with an in-depth review of Argentina's current policy framework and sectoral developments, and compares them with the comprehensive policy packages and the progress of the kind of sector indicators required under Paris-compatible pathways.

It then focuses on three areas we have identified with potential to increase mitigation efforts: electricity supply, land-based passenger and freight transport, and residential buildings. We selected these areas based on their share of GHG emissions and national and local circumstances. The CAT emphasises that other sectors must take similarly ambitious actions to decrease economy-wide emissions in line with the Paris Agreement.

It identifies different options of accelerated climate action in each sector, informed by insights from three different scenario categories: (1) National scenarios, (2) Scenarios applying sectoral best-in-class levels, and (3) 1.5°C Paris Agreement compatible scenarios, the results of which have all been compared to the common baseline of the Current Development Scenario (4).

	Scenario categories	Definitions
1	NATIONAL SCENARIOS	Scenarios based on national research and country-specific studies
2	BEST IN CLASS SCENARIOS	Scenarios based on practices implemented by regional or international frontrunners
3	1.5°C PARIS AGREEMENT COMPATIBLE SCENARIOS	Scenarios based on sectoral developments in line with the Paris Agreement's temperature limit.
4	CURRENT DEVELOPMENT SCENARIO	Baseline scenario used for comparison purposes. The scenario is based on the continuation of current trends and policies until 2050.

KEY FINDINGS

- Scaling up climate action in Argentina's electricity supply, its residential buildings sector, and land-based passenger and freight transport can reduce greenhouse gas emissions by up to 94% below 2014 levels in these areas by 2050. Together, these sectors account for around 40% of Argentina's 2014 emissions.
- Actions in these areas alone would reduce economy-wide emissions by 7% below 2014 levels by 2050, equivalent to 38% below a Current Development Scenario by 2050. However, while the three focus areas will almost fully decarbonise under a Paris Agreement- compatible scenario, Argentina will still need to take additional action in other sectors such as agriculture and land-use sectors in order to decrease economy-wide emissions by mid-century in line with the Paris Agreement's temperature limit.
- Research from Argentinian researchers and other stakeholders indicates that large-scale expansion of renewable energy could reduce GHG emissions from electricity generation by up to 80% below 2014 emissions levels by 2040. Some of these scenarios explicitly consider Paris Agreement aligned sector developments in the Argentinian context.
- A fully decarbonised electricity sector is critical for enabling low-carbon electrification trends in land-based passenger and freight transport as well as residential housing to get in line with the Paris Agreement temperature limit. Given its rich natural endowment of renewable resources and ambitious 2025 renewable expansion targets, if it strengthens policy efforts to ensure it achieves these targets, Argentina could become a global frontrunner in achieving a successful energy transition.
- There is huge potential to accelerate climate action by decarbonising key energy demand sectors such as land-based passenger and freight transport and residential housing, for example by shifting modes of transport and increasing electric and zero-emission mobility. Under our Paris Agreement- compatible scenario, those sectors' emissions decrease by 94% below 2014 and by 88% below 2014, respectively, by mid-century. This would foster benefits for sustainable development goals by reducing pollution and promoting modern housing.
- Transitioning towards a low-carbon, renewables-based electricity supply by 2030 is likely to support more domestic employment opportunities in Argentina compared to the Current Development Scenario, where the majority of capacity additions are fuelled by natural gas. This energy transition provides jobs in technologies and sectors that are more likely to form the core of future electricity supply, both in Argentina and globally.
- If Argentina, building on already ongoing activities, considerably ratcheted up its 2030 target and scaled up action to be consistent with the Paris Agreement, it will achieve a wide range of benefits, such as low-carbon-oriented employment generation and support of sustainable development goals by reducing the adverse pollution effects and promotion of modern housing facilities.
- The CAT sees significant risks in Argentina's planned development of large-scale gas extraction and export infrastructure. Those investments could cause a lock-in in high-emissive energy supply. Heavy reliance and infrastructure investments in natural gas may also hamper decarbonisation efforts in demand sectors such as transport and buildings.

Sector transitions towards zero-carbon

In Argentina, there is vast potential to scale up climate action, especially in the three main focus areas of this study. Increasing climate action now would initiate technically feasible sectoral transitions towards a zero-emissions society while directly benefitting Argentina's sustainable development agenda.

Our findings confirm that decarbonisation efforts consistent with the Paris Agreement temperature goal for the selected sectors in Argentina are beneficial and can build on ongoing efforts. They would significantly reduce GHG emissions and foster co-benefits such as low-carbon-oriented employment generation, support sustainable development goals by reducing the adverse pollution effects of conventional modes of transport and electricity generation, and promote modern housing facilities.

Electricity supply

Scaling up climate action in the Argentinian electricity supply sector can trigger emission reductions for all scenario below a Current Development Scenario by 2050. Our findings highlight that under most of the ambitious scenarios proposed by Argentinian institutions and stakeholders, GHG emissions for electricity generation in Argentina could be reduced by up to 87% below the Current Development Scenario by 2040. These findings emphasise the vast opportunities to initiate a transition towards a zero-carbon electricity supply sector in Argentina.

These ambitious scenarios developed by national institutions and stakeholders would be in line with a 1.5°C Paris Agreement compatible pathway to 2040. Our analysis shows that Argentina can become an international frontrunner in ambitious energy transitions if it scales up domestic climate action in line with scenarios developed by national research and stakeholder institutions. However, in order to follow such pathways, Argentina would still need to take further action beyond currently implemented policies and targets to fully decarbonise its electricity supply sector by 2050 (Climate Analytics, 2019).

Scaling up climate action in the electricity supply sector through a sustained development of renewable energy technologies would generate significant socio-economic benefits and directly enable Argentina to progress towards national sustainable developments goals (SDG). Such benefits include access to affordable, reliable, sustainable and modern energy for all (SDG 7) or making cities and human settlements inclusive, safe, resilient and sustainable (SDG 11).

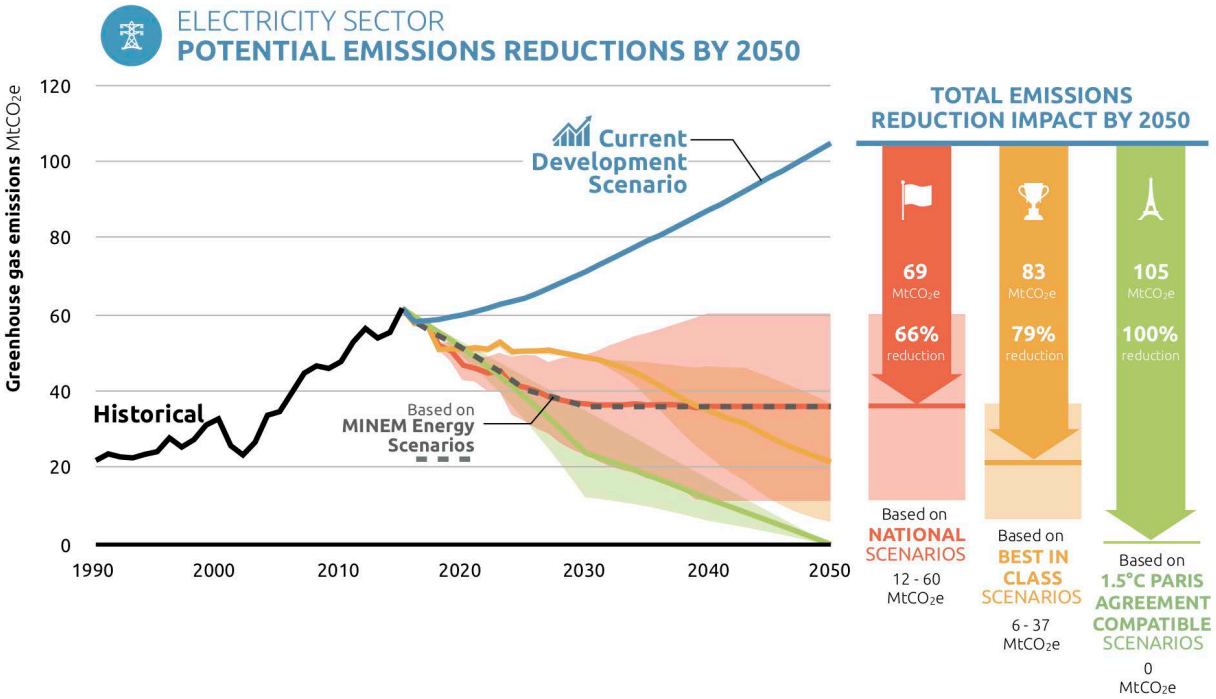


Figure 1: Overview of sectoral emission pathways under current policies and different levels of accelerated climate action in the Argentinian electricity supply. The forecasted electricity demand considers accelerated climate action in the Argentinian residential buildings sector, along with the land-based passenger and freight transport sector. The CAT PROSPECTS Argentina scenario evaluation tool has estimated all historical emission calculations and sectoral projections towards 2050. For this reason, historical emission levels might differ from the latest inventory data.

Land-based passenger and freight transport

The recent upward trends of GHG emissions from the transport sector in Argentina highlights the need to accelerate action to fully decarbonise this sector by mid-century to be compatible with the Paris Agreement. Our analysis on accelerating climate action in the transport sector focuses on land-based passenger and freight transport, with a particular emphasis on the impact of transitioning towards zero-emission cars, buses and trucks.

The Paris Agreement-compatible sectoral trajectories almost fully decarbonise Argentina's passenger and freight transport sector on land by 2050. This requires a substantial modal shift for passenger and freight transport, introducing zero-emission vehicles, buses, and trucks, and a tightening of CO_2 fuel economy standards for new personal vehicles. It would fully decarbonise Argentina's passenger and freight transport sector by mid-century - and would also require the electricity supply sector to be fully decarbonised by 2050 in line with the Paris Agreement temperature goal. The electrification of transport and a modal shift away from fossil-based vehicles reduces adverse effects of air and noise pollution and their harmful effects on health. This directly promotes provision of healthy lives and well-being for all ages (SDG 3).

Implementing policy actions proposed by national researchers and other national stakeholders for the transport sector stabilises emissions from land-based passenger and freight transport at 2015 emissions levels by 2030, followed by a decrease in average emission levels by 2050. Suggested measures include an uptake of electric mobility to achieve a 60% share of electric vehicles in the total car fleet by 2040, and the bus fleet being fully electric (Beljansky, Katz, Alberio, & Barbarán, 2018). While such actions constitute an important starting point to initiate the transition towards low-carbon transport, Argentina will still need to take on more ambitious policy measures to reverse emissions trends and embark on a Paris Agreement-compatible trajectory.

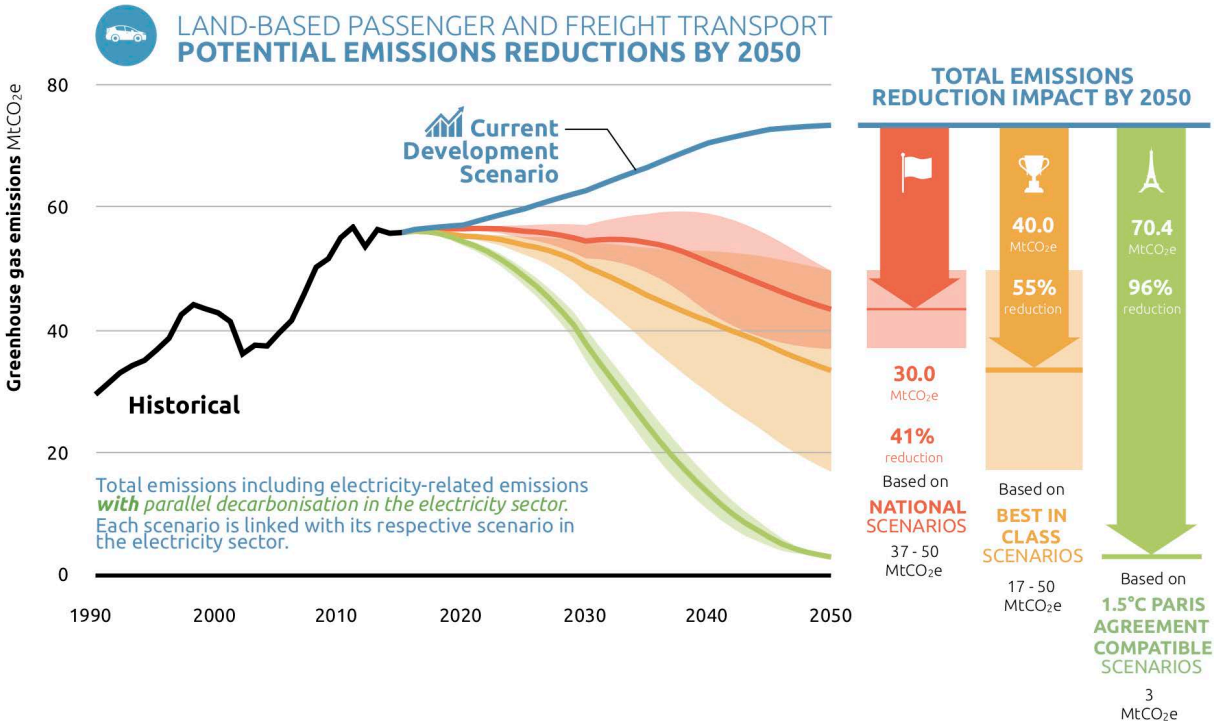


Figure 2: Overview of sectoral emission pathways under current policies and different levels of accelerated climate action in the land-based passenger and freight transport. Data includes electricity related emissions. The CAT PROSPECTS Argentina scenario evaluation tool has estimated all historical emission calculations and sectoral projections towards 2050. For this reason, historical emission levels might differ from the latest inventory data.

Residential buildings

Energy efficiency gains through tightened building codes, increased rates of thermal retrofits, electrification of water/space heating, and more efficient appliances can almost fully decarbonise the Argentinian residential buildings sector by mid-century. These efforts again critically depend on the electricity supply sector decarbonising in line with the Paris Agreement temperature goal. This residential building sector transition entails key opportunities to advance socially just housing, while generating local employment and attenuating the adverse health effects of inappropriate housing.

Even without any further climate action in the electricity supply sector beyond current levels, the abovementioned policies in Argentina's residential buildings sector could still reduce emissions by up to 31% below today's levels by 2050.

Measures in the residential buildings sector proposed by national researchers and other national stakeholders can already drive ambitious mitigation. Such proposed measures include increasing the thermal retrofit rates of existing buildings by 2% annually, with a 50% energy efficiency improvement by 2020 (Beljansky et al., 2018); or a 90% market share of heat pumps of all heating appliance being sold by 2030 as specified in the National Action Plan on Energy and Climate Change (MAyDS & MINEM, 2017). Such measures closely align with action international frontrunner countries are implementing, and would bring Argentina close to a low-carbon transition of the residential housing sector if implemented.

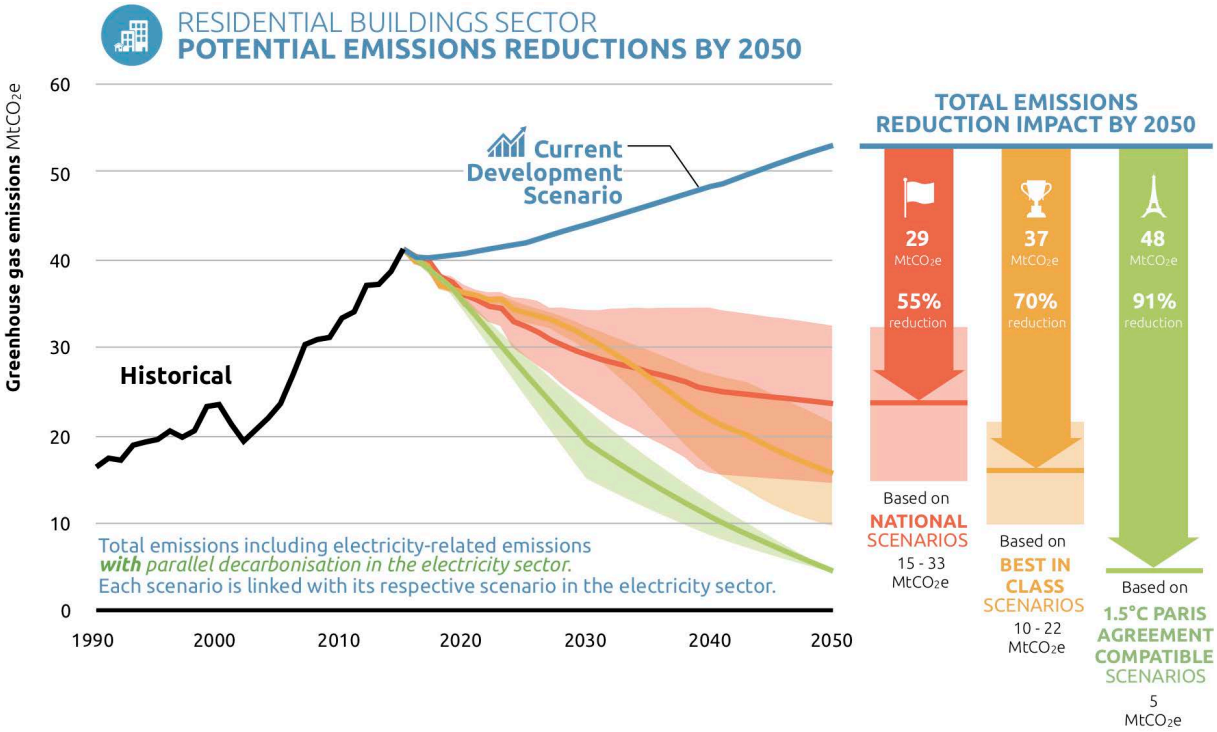


Figure 3: Overview of sectoral emission pathways under current policies and different levels of accelerated climate action in the residential buildings sector, including electricity-related emissions and parallel decarbonisation actions according to the respective scenario categories in the Argentinian electricity supply sector. The CAT PROSPECTS Argentina scenario evaluation tool has estimated all historical emission calculations and sectoral projections towards 2050. For this reason, historical emission levels might differ from the latest inventory data.

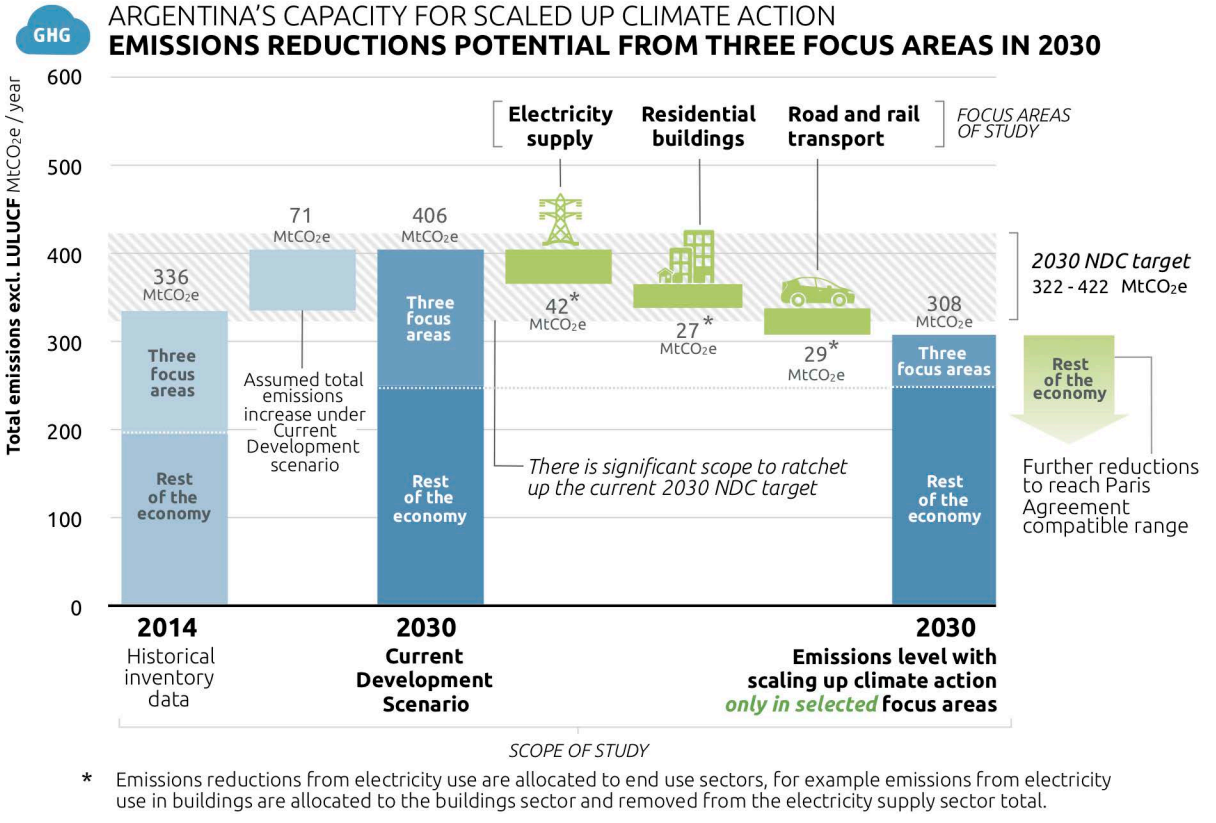
The social, economic and health-related benefits of social housing enable Argentina to promote its sustainable development agenda, particularly on inclusive, resilient and sustainable human settlements and cities (SDG 11), increasing well-being and general health (SDG 3) and ensuring access to affordable, reliable, sustainable and modern energy for all (SDG 7) through renewable-based alternatives in the residential sector (e.g. solar panels on residential buildings).

Accelerated climate action and Argentina's emission reduction target

Accelerated climate action in line with the Paris compatible scenarios in the three sectors would allow Argentina to overachieve its unconditional and conditional target of limiting emissions to 322 $MtCO_2e$ by 2030.

The Climate Action Tracker's country assessment rates Argentina's current mitigation target "Highly Insufficient". If Argentina were to increase its ambition by making its conditional target unconditional, the Climate Action Tracker would upgrade its rating to "Insufficient" instead of the current "highly insufficient" rating. To be compatible with the Paris Agreement, the target would need to decrease emissions further - to below 205 $MtCO_2e$.

An important conclusion from these findings is that it is beneficial for Argentina to considerably ratchet up its 2030 target to be consistent with the Paris Agreement. Increased climate action will achieve a wide range of benefits, while they can build on already ongoing activities. Argentina will have to scale up action considerably in the electricity sector as well as in both the buildings and transport sectors.

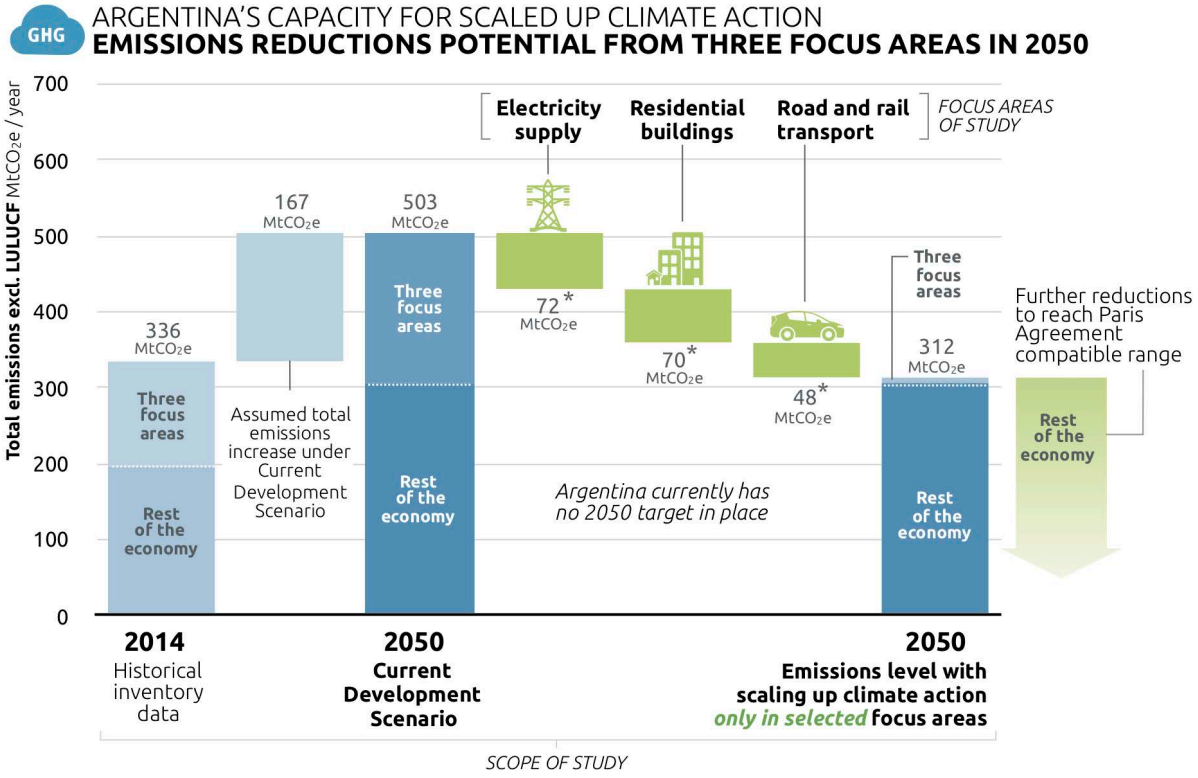


* Emissions reductions from electricity use are allocated to end use sectors, for example emissions from electricity use in buildings are allocated to the buildings sector and removed from the electricity supply sector total.

Figure 4: Overview of total emission levels (excl. LULUCF) under historical inventory data in 2014 (left bar), under a Current Development Scenario in 2030 (middle bar), and most ambitious levels of accelerated climate action by 2030 in the electricity supply, the residential buildings sector, and land-based passenger and freight transport (right bar). All electricity-related emission reductions from the residential buildings and transport sectors are allocated as emissions reductions under these two end-use sectors.

Scaling up climate action in Argentina's electricity supply, residential buildings sector, and land-based passenger and freight transport alone can reduce Argentina's total greenhouse gas emissions by up to 7% below 2014 levels (excluding LULUCF) by 2050. Our analysis also shows that these three sectors can be fully decarbonised by 2050.

When determining its long-term strategy by mid-century, Argentina can consider these identified mitigation potentials for the three focus sectors in line with the Paris Agreement's temperature target. It will need to implement more ambitious and stringent policies to initiate and steer these sectoral transformations.



* Emissions reductions from electricity use are allocated to end use sectors, for example emissions from electricity use in buildings are allocated to the buildings sector and removed from the electricity supply sector total.

Figure 5: Overview of total emission levels (excl. LULUCF) under historical inventory data in 2014 (left bar), under a Current Development Scenario in 2050 (middle bar), and most ambitious levels of accelerated climate action by 2050 in the electricity supply, the residential buildings sector, and land-based passenger and freight transport (right bar). All electricity-related emission reductions from the residential buildings and transport sectors are allocated as emissions reductions under these two end-use sectors.

If it does so, Argentina can become a regional and international frontrunner in successfully transitioning its energy supply and demand sectors, while benefiting from a wide range of socio-economic benefits such as sustainable employment generation, reduced levels of dangerous air pollution, and socially just housing.

Our findings emphasise that Argentina will still need to undertake additional mitigation actions in all other remaining sectors to align its economy-wide emissions pathway with the Paris Agreement's temperature limit, particularly in the agriculture and forestry sectors.

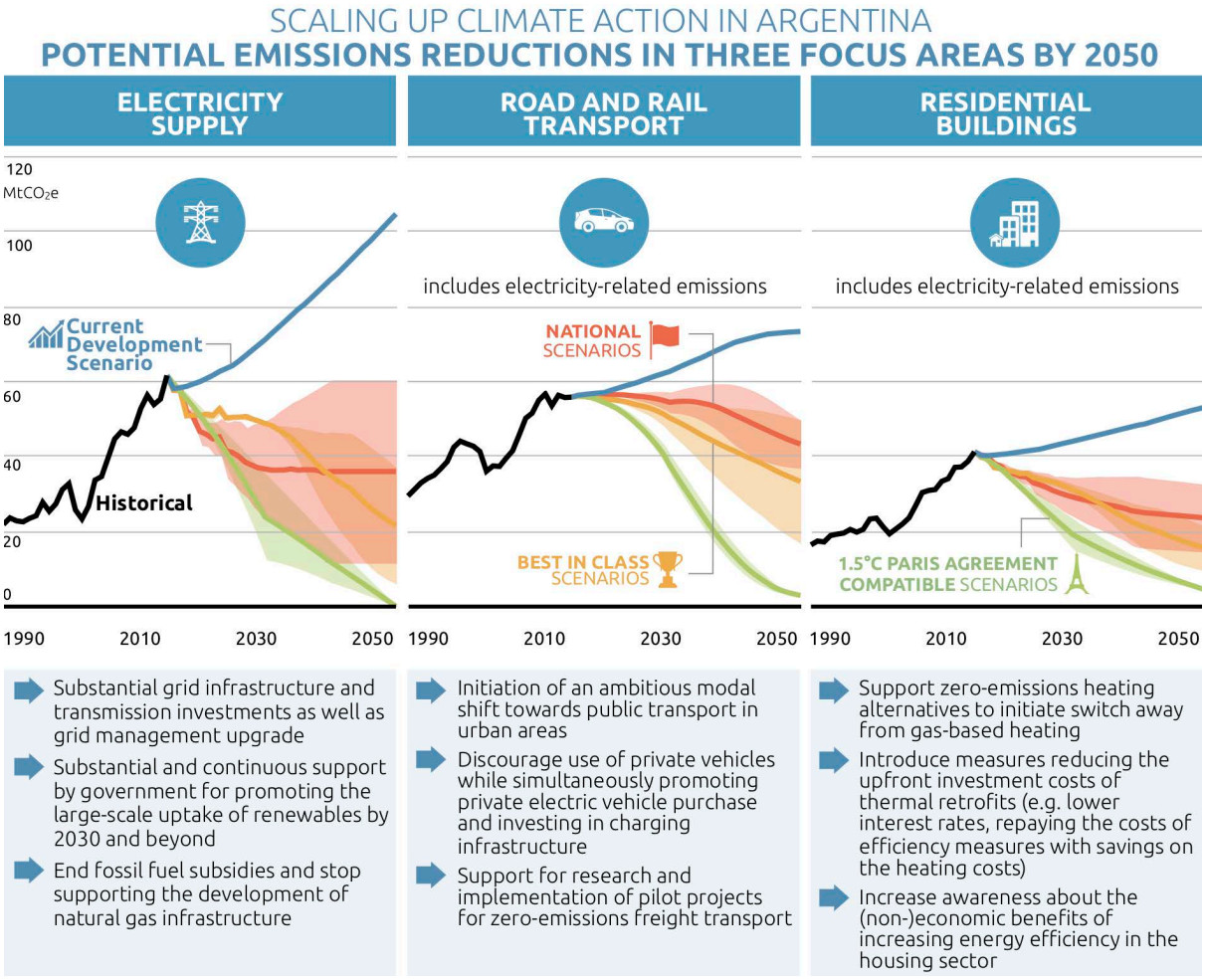


Figure 6: Overview of emissions levels under different scenarios for the three focus areas. All electricity-related emissions in the sector-specific scenario graphs for the residential buildings sector (middle graph) and passenger and freight transport sector on land (right graph) include electricity-related emissions under these two end-use sectors.

The status of sectoral transitions: opportunities for accelerating climate action

The transitions towards zero-emissions in the Argentinian electricity supply, land-based passenger and freight transport, and residential buildings sectors have shown different levels of progress.

While the electricity supply sector is most advanced with ambitious 2025 targets for renewables and limited remaining coal capacity in operation, to fully implement its targets, Argentina must make a policy shift away from supporting natural gas infrastructure to achieve a transition to full decarbonisation. Actions in the transport and building sectors are also lagging.

Table 1 is an overview of this study's evaluation for the three sectors compared with sector-specific benchmarks. These benchmarks represent the most important short-term steps for limiting global warming to 1.5°C identified by the Climate Action Tracker (Kuramochi et al., 2017). The full results of this analysis for all sectors are detailed in the full report.

Table 1: Summary table for sectoral policy activity and gap analysis in Argentina for the electricity supply, land-based passenger and freight transport, and residential building sectors. 1.5°C compatible benchmarks relate to most important short-term steps for limiting global warming to 1.5°C identified by the Climate Action Tracker (Kuramochi et al., 2017). Percentages in the first column indicate the share of national GHG emissions in 2014, calculated based on the 2nd Biennial Update Report of 2017 including LULUCF (Government of Argentina, 2017b).

Sector	1.5 °C-consistent benchmark	Overall evaluation based on policy activity and gap analysis	Policy rating
Electricity supply sector (12% of GHG emissions, incl. LULUCF)	*Sustain the global average growth of renewables and other zero and low-carbon power until 2025 to reach 100% by 2050*	• Share of electricity generation from low-carbon technologies (incl. hydro and nuclear) projected to decrease from 36% in 2018 (CAMMESA, 2019b) to 31% in 2030 under current policy projections (CAT, 2018). • Additional actions are needed to deploy non-conventional [1] renewables in line with the Secretariat of Energy's targets of a 20% share of non-conventional renewables by 2025 and 25% by 2030. Assuming the target's full implementation, the share of low-carbon electricity generation (incl. hydro and nuclear projections) reach levels of 55-62% by 2025 and 62-69% by 2030 (MINEM, 2017). • Policy instruments are in place to support the uptake of non-conventional renewables (e.g. auction policies), but recent delays in commissioned renewables projects might slow down the average growth of installed renewables capacity until 2025. • The Energy Secretariat has declared it will double oil and gas production within five years for both international exports and domestic energy supply generation (Energy Secretariat, 2018). This support for natural gas in electricity generation, incl. production-related subsidies and tax benefits, puts the power sector's full decarbonisation by mid-century in doubt. • The Argentinian government has successfully reduced some consumption and production related fossil fuel subsidies in recent years (OECD/IEA, 2019), but direct financial support for natural gas consumption and production continue.	Ambitious Plan
	No new coal plants, reduce emissions from coal power by at least 30% by 2025	• As of 2019 Argentina only operates a single coal plant with an already prolonged lifetime. A 240 MW power plant is under construction, but construction has been paused and the start of operation remains unclear as of August 2019 (Energy Secretariat, 2018). • The government's direct support of renewables and natural gas aims for a complete coal phase-out in Argentina (MAyDS & MINEM, 2017), which should be relatively easy considering the currently low share in 2019 (<2%). • No policy to formally phase out all coal fired generation exists.	Partially Transitioned
Transport sector on land (14% of GHG emissions, incl. LULUCF)	*Last fossil fuel car sold before 2035*	• Transport sector emissions forecast to increase by almost 50% by 2030 compared to 2014 levels under a business-as-usual scenario (MAyDS & MINTRAN, 2017). • Participation of EVs in car fleet remains negligibly small with few existing policies to incentivise their uptake. • Several short-term measures in place such as higher levels of biofuel blending, inclusion of flex fuel vehicles and actions to increase efficiency but limited expected impact of these measures in terms of emission reductions and sustainability concerns of biofuel production. • The transport action plan suggests a share of at least 30% of electric buses in public urban transport by 2030 in Buenos Aires City and Province (MAyDS & MINTRAN, 2017).	Getting Started

1 The term non-conventional renewable energy is a term broadly used in Latin America to refer to the generation of electricity from renewable sources different than large hydro, which is predominant in the region. The term comprises wind, solar, biomass, small hydro (run-of-the-river), tidal and geothermal energy.

Residential buildings sector (8% of GHG emissions, incl. LULUCF)	*All new buildings fossil free and near zero energy by 2020*	• Sustainable housing manual and labelling scheme in place, which applies standards to all new buildings financed or co-financed by the Secretariat of Housing. However, no policy framework for buildings financed by private actors to be fossil free by 2020 or shortly thereafter. • Mandatory efficiency guidelines exist for design and construction of social housing. • A voluntary certification system for energy efficient buildings is in place, but no implementation of strict building efficiency standards foreseeable. • Labelling system and minimum performance standards for appliances are in place, but do not significantly reduce sector emissions.	
	Increase building renovation rates from <1% to 3% by 2020	• No wide-scope strategy or policies in place to enhance energy performance of existing buildings apart from soft loans available for thermal renovation of existing social housing buildings stock. • Major challenges remain to undertake extensive renovations of existing residential buildings (e.g. lack of financial resources and subsidised costs for gas that hinder the economic viability of building renovations). • Argentina has progressed in gradually reducing subsidies in end-user tariffs for natural gas, but remaining subsidies and the difference in price for technological change hinder the consumers' shift to heat pumps.	

Co-benefits of upscaled climate action: employment

Accelerated climate action in Argentina can generate significant socio-economic co-benefits that help promote the national sustainable development agenda. These include low and high-skilled employment in low-carbon-oriented sectors, a reduction in adverse health impacts from air pollution, and increased participation and social justice in mobility and housing.

These co-benefits would directly enable Argentina to progress towards key national sustainable developments goals (SDG) such as ensuring access to affordable, reliable, sustainable and modern energy for all (SDG 7) or making cities and human settlements inclusive, safe, resilient and sustainable (SDG 11).

For example, the study's findings on employment generation in low carbon-oriented sectors from scaled up climate action in electricity generation (see below) support Argentina's aim to promote inclusive and sustainable economic growth, full and productive employment, and decent work for all as anchored in SDG 8.

The findings emphasise the employment potential of accelerated climate action in the electricity generation sector, particularly in low-carbon-oriented fields. This study's quantification of employment impacts indicates that scenarios heavily relying on renewable capacity additions all support more jobs compared to the Current Development Scenario, where the majority of capacity additions are fuelled by natural gas.

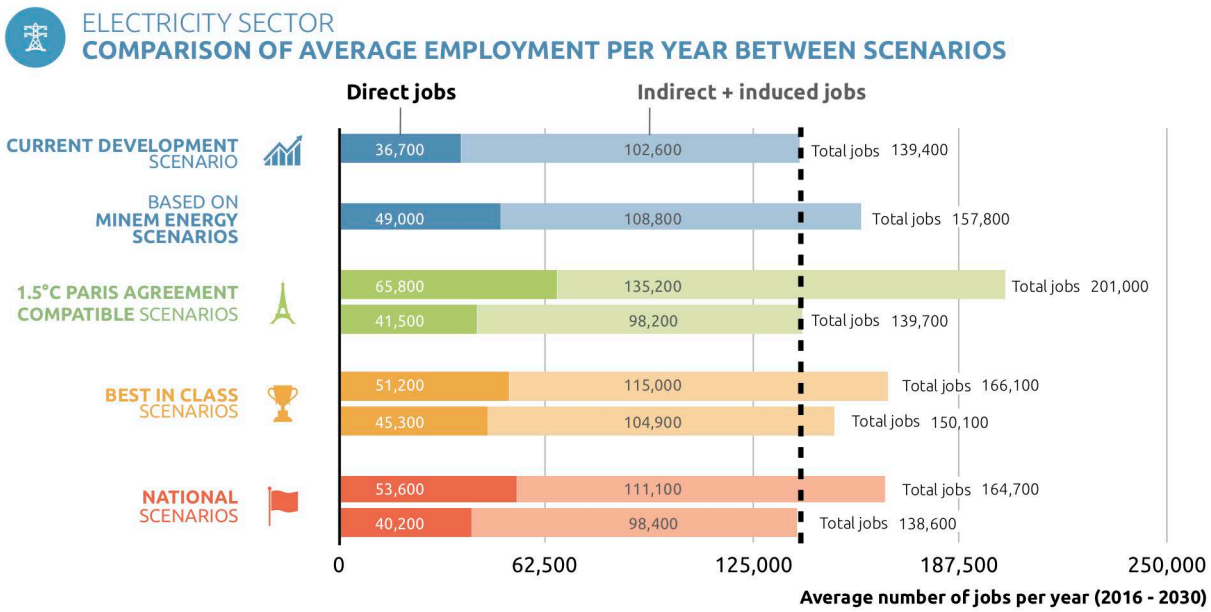


Figure 7: Average direct employment per year between 2016–2030 and average total employment per year between 2016-2030 in Argentina for different electricity generation scenarios. Employment impacts are estimated with the Economic Impact Model for Electricity Supply (EIM-ES).

Under the Current Development Scenario, approximately 37,000 people a year, on average, are directly employed in developing new electricity supply capacity and operating and maintaining both existing and new capacity over the period of 2016–2030. We estimate these investments would stimulate a further 103,000 indirect and induced jobs a year, on average, such as jobs in cement production for the concrete foundations of wind turbines.

1.5°C Paris Agreement Compatible scenarios support up to 29,000 directs jobs per year more than Current Development Scenario. The estimated employment impact across all other scenarios is at least as high as under the Current Development Scenario. They range between approximately 40–66,000 direct jobs a year and a further 98–135,000 jobs when considering the wider indirect and induced impacts of the investments.

Employment in electricity supply sector scenarios with accelerated renewables deployment is focused in the construction and manufacturing sectors and increasingly in the development and operation of renewable energy sources, notably hydropower, solar PV and onshore wind.

Jobs supported by these technologies grow over time and will continue to be needed well after 2030 as the electricity generation sector moves towards full decarbonisation. These jobs are in technologies and sectors that are more likely to form the core of future electricity supply, both in Argentina and globally.

In the Current Development Scenario, gas-fired generation technologies – both combined and open cycle plants - support a large share of jobs. Jobs in the extraction sector – to mainly supply natural gas – account for approximately 45% of total jobs during the 2020's (see Figure 8, see top left chart).

The additional jobs in fossil fuel production and fossil fuel-based electricity generation in the Current Development Scenario are not in line with Argentina's commitment to decarbonising its economy in line with the Paris Agreement's temperature target. Further investment in the natural gas sector in the coming years could create short-lived employment opportunities, but this risks leading to structural unemployment over the medium-term if stringent global climate policy phases out natural gas use and a domestic labour force that is ill-prepared to support the expansion of renewables required to deliver on the commitments of the Paris Agreement.

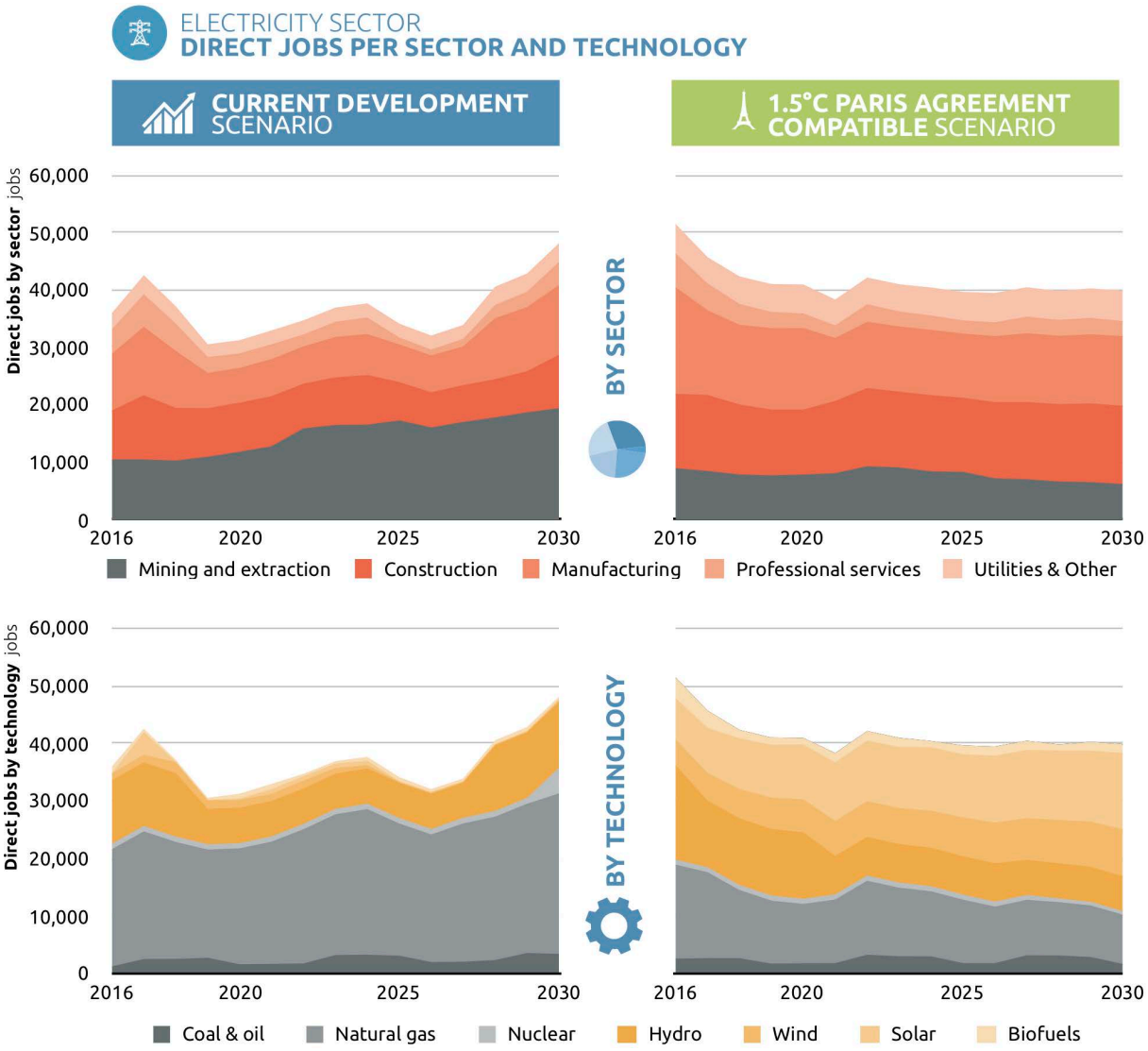


Figure 8: 'Direct jobs per employment sector' and 'Direct jobs per generation technology' between 2016-2030 for the Current Development Scenario (CDS) (graphs on left) and the 1.5°C Paris Agreement compatible scenario for the Argentinian electricity supply sector (graphs on right). Direct employment estimates reflect energy supply sector investments linked to planning, construction, the manufacturing of component parts, operating (including fuel supply such as coal mining, where relevant) and maintaining power plants.

In the lower bound 1.5°C Paris Agreement compatible scenario, the mining and extraction sector accounts for less than 20% of jobs between 2016 and 2030 (see Figure 8, right hand side). Instead, employment opportunities are focused in the construction and manufacturing sectors and increasingly in the development and operation of renewable energy sources, notably hydropower, solar PV and onshore wind. The higher number of jobs supported in the construction and manufacturing sectors in the 1.5°C Paris Agreement compatible scenario more than outweighs the reduction in employment opportunities in the extraction sector, compared to the Current Development Scenario.

These findings emphasise how accelerating climate action in the electricity generation sector has the potential to support higher overall employment. They also highlight the need for Argentina to avoid investing in skills and jobs in the gas industry, which are incompatible with delivering the Paris Agreement. This could lead to structural issues in the Argentinian labour market, which is typically accompanied by social problems and costly retraining of workers.

A well-managed transition should start now by reducing the incentives to join the natural gas sector and could be delivered via the usual turnover of the workforce, in combination with increasing opportunities to develop skills in future-proof technologies.

Abbreviations

AGEERA	Argentinian Electricity Generators association
AGUEERA	Argentinian Association of Large Electricity Consumers
ATM	Air Traffic Management
CACME	Argentinian Committee of the World Energy Council
CADER	Argentinian Chamber of Renewable Energy
CAPEC	Advisory Council on Energy Policy of the Province of Cordoba
CAT	Climate Action Tracker
CCS	Carbon Capture and Storage
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
EIM-ES	Economic Impact Model for Electricity Supply
EV	Electric vehicles
FAEE	Fondo Argentino de Eficiencia Energética
FARN	Environment and Natural Resources Foundation
FEP	Political Ecology Forum
FODIS	Distributed Renewable Generation Fund
FVS	Wild Life Foundation
GDP	Gross Domestic Product
GHG	Greenhouse gas
GloMEEP	Global Maritime Energy Efficiency Partnerships
GNC	Gas Natural Comprimido
ICAO	Carbon Offsetting and Reduction Scheme for International Aviation
IMO	International Maritime Organization
IPCC	International Panel of Climate Change
LED	Light-emitting diode
LPG	Liquefied Petroleum Gas
LULUCF	Land use, land-use change, and forestry
MEPS	Minimum Energy Performance Standards
MINEM	Ministerio de Energía y Minería de la República Argentina
NOA	Region Noroeste Argentino
PERMER	Renewable Energy in Rural Markets
PLAE	Efficient Public Lighting Plan
PNMT	National Mitigation Transport Plan
PROBIOMASA	Proyecto para la promoción de la energía derivada de biomasa
PRONUREE	National Programme for a Rational and Efficient Use of Energy
PROUREE	Energy Efficiency Programme in Public Buildings
RES	Renewable Energy Share
SAyDS	Secretariat of Environment and Sustainable Development
SDG	Sustainable Development Goal

Contents

Introduction

Background and objectives

Under the Paris Agreement, governments have committed to limiting temperature increase to well below 2°C above pre-industrial levels and pursuing efforts to limit it to 1.5°C. Current efforts are insufficient: aggregate mitigation targets, according to Climate Action Tracker (CAT) estimates, result in global warming of about 3.0°C (Climate Action Tracker, 2018e). Implementation of the targets is falling short, with greenhouse gas (GHG) emissions under implemented policies leading to an estimated warming of around 3.3°C.

To stay below the globally agreed limit, the IPCC Special Report on 1.5℃ finds that an increase in efforts is required to peak global GHG emissions as soon as possible, reduce CO_2 emissions to net-zero around 2050 and total GHG emissions shortly thereafter (IPCC, 2018).

In recent years, measures to reduce GHG emissions have, in many cases, become more attractive to policy makers and private investors, both because of falling technology costs, as well as increased awareness for other benefits, such as air quality improvements and employment benefits in low-carbon-oriented sectors.

We no longer live in a world where climate change mitigation is a burden per se, but where it increasingly becomes the most feasible option when considering all socio-economic aspects. For cost-efficient global mitigation, it will be essential to make those mitigation actions accessible to and overcome remaining barriers in all countries.

This report, the fourth country assessment in the Climate Action Tracker's Scaling Up Climate Action Series, analyses areas where Argentina could accelerate its climate action. The report illustrates GHG emissions reductions from such actions, along with other benefits.

Approach

The analysis starts with an in-depth review of Argentina's current policy framework and sectoral developments, comparing them with the comprehensive policy packages and the progress of the kind of sector indicators required under Paris-compatible pathways.

The report then focuses on three areas we have identified with promising potential to increase mitigation efforts, also considering national and even local circumstances: electricity supply, land-based passenger and freight transport, and residential buildings.

For these areas, we research different pathways which go beyond current efforts, explain the feasibility of such increased action, and quantify resulting emission reductions and employment benefits. We consider three types of scenarios: (1) Outputs from national research institutions analysing alternative scenarios to current government projections (Beljansky et al., 2018), (2) Paris-compatible benchmarks from international sources such as the IPCC Special Report on 1.5°C (IPCC, 2018) or the CAT's report on short-term steps (Kuramochi et al., 2017), and (3) Best-in-class levels from regional or global frontrunners (Fekete et al., 2015; Roelfsema et al., 2018).

The external scenarios provide trajectories of sectoral indicators, for example for the share of renewable energy. For the quantification of sectoral and total emission trajectories until 2050, the Scaling Up Climate Action series uses the CAT's PROSPECTS scenario evaluation tool. To estimate domestic employment impacts of different electricity supply sector development, we use a spreadsheet-based economic model developed by NewClimate Institute under the "Ambition to Action" project, the Economic Impact Model for Electricity Supply (EIM-ES).

A methodological annex presenting the tools' methodologies and key assumptions for data filling can be accessed under **climateactiontracker.org/publications/scalingup/methodology**.

1 Context for scaling up climate action in Argentina

While the scientific community is continuously highlighting severe risks related to anthropogenic climate change based on recent academic findings, the translation into actionable policies to effectively combat climate change in Argentina and globally remains inadequate. National analysis suggests that climate change has multiple adverse effects for Argentina, including a significant increase in surface temperatures that already took place between 1960-2010 (most pronounced in the Patagonian region), changes in seasonal rainfall patterns, and melting glaciers (Secretariat of Environment and Sustainable Development, 2015). It is likely that Argentina will be disproportionally affected by anthropogenic climate change in comparison to expected global impacts.

The IPCC Special Report on 1.5°C finds that limiting warming to 1.5°C will reduce the impacts on vulnerable populations and ecosystems in the South American region, compared to 2°C warming (IPCC, 2018). Furthermore, the report finds that the energy transition that is required to limit warming to this level will have significant benefits for access to clean and affordable energy, and for poverty eradication — both sustainable development goals.

Argentina is one of the few countries that has already strengthened its emission reduction targets in its revised NDC of 2016. The revised NDC of 2016 includes both an unconditional and a conditional absolute emissions reduction target for 2030. The unconditional target limits GHG emissions to 483 $MtCO_2e/a$ (including LULUCF) by 2030 (Government of Argentina, 2016). Conditional to a provision of international finance, support in technology transfer and capacity building, the conditional target limits emissions to 369 $MtCO_2e/a$ (including LULUCF) by 2030 (Government of Argentina, 2016). It remains uncertain whether Argentina will resubmit any further updated NDC in 2020.

Despite the NDC revision of 2016 and clear progress in domestic policy action (Climate Action Tracker, 2018e), the Climate Action Tracker rates Argentina's NDC as "Highly insufficient". The rating indicates that Argentina's climate commitment in 2030 is not consistent with holding warming below 2°C, let alone limiting it to 1.5°C as required to achieve the Paris Agreement, and is instead consistent with warming between 3-4°C (Climate Action Tracker, 2018b). This implies that more ambitious climate policy across all sectors is required.

Argentina's strategy to address climate change includes the restructuring of its institutional framework to coordinate planning and implementation across demand and supply sectors. The National Cabinet of Climate Change that was established in 2016 (Presidential Decree 891/2016) gathers all secretariats and ministers relevant for climate policy planning and implementation. The Cabinet develops climate change policies across vertical and horizontal governance levels and creates awareness on the importance of mitigation and adaptation in the domestic context.

The government, together with the different enforcement authorities, is preparing national climate change adaptation and mitigation plans for all sectors, foreseen to be published throughout 2019. The national action plans present sectoral strategies for the implementation of mitigation and adaptation measures that aim to strengthen Argentina's climate achnge commitments. As of June 2019, national action plans for energy, transport and forestry have already been published while other plans such as for agriculture, industry and infrastructure are foreseen to be published throughout 2019. These plans will be complemented by an integrated National Response Plan to Climate Change.

The Argentinian government places a strong emphasis on the joint development of renewable energies while improving energy efficiency in demand sectors. Relevant policy documents include the renewable energy law, the establishment of an auction programme for large-scale renewable deployment (RenovAr), and the declaration of energy efficiency as a national priority. These policies have the potential to initiate required transformations towards low-emission pathways for some sectors if adequately implemented and regularly revised in the future. Further efforts will be necessary to fully decarbonise the Argentinian economy.

One of main barriers for ambitious transformation towards a low-emission economy in Argentina remains the government's plans to support the development of natural gas, make natural gas Argentina's main source of energy, and develop the gas industry as a basis for future exports. The expansion plans for natural gas could lock Argentina's energy supply sector into a fossil-dependent pathway that is not compatible with the Paris Agreement temperature target. This support for natural gas could also directly impact mitigation efforts in other demand sectors. Support for natural gas exploitation could incentivise end-users in the transport, buildings, and industry sectors to continue using gas-based technologies and appliances and disincentivise the shift to low-carbon alternatives (see further explanations in Box 1).

Box 1 Natural gas and the global transition to a decarbonised world

Different scenarios project widely varying shares of natural gas in the global primary energy mix until 2060 (Rogelj et al., 2018).

Various factors play a role in the future development of gas demand. On the one hand, displacing coal electricity generation has become a pressing need and gas appears as a potential environmentally friendlier option - depending on fugitive emissions. In many least developed countries, gas is often chosen as the fuel to satisfy rapidly increasing electricity demand. Gas demand outside the electricity sector is driven mostly by industry and buildings sectors. Gas demand in the near future increases most in Europe and Asia (BNEF, 2018). On the other hand, the demand for gas will decrease if the industry, buildings and transport sectors move to electricity as the main final energy carrier in line with Paris compatible scenarios and pursue further energy efficiency improvements.

The IPCC report on 1.5°C suggests that gas consumption in the electricity sector should decrease to 8% in 2050, and that all remaining gas plants should be equipped with carbon capture and storage (Rogelj et al., 2018). The IEA's Beyond 2°C Scenario considers the use of natural gas in power plants, but only marginally - around 4% of electricity generation in 2060 (IEA, 2017a). In the Sustainable Development Scenario, which exceeds the Paris temperature limit, natural gas demand will grow by 15% from today's levels and plateau at around 25% of the total primary energy demand in 2040 (IEA, 2017d). In Greenpeace's Advanced [R]evolution Scenario, natural gas is not used for energy purposes by 2050 at all (Teske, Sawyer, & Schäfer, 2015). A transition role for natural gas in the power sector would have to rely on carbon capture and storage (CCS), which is increasingly unlikely to be able to compete with renewable energy due to incomplete capture rates, no observed cost improvements and more limited co-benefits (Schaeffer, Fuentes Hutfilter, Brecha, Fyson, & Hare, 2019).

The Climate Action Tracker emphasises that continued large-scale investments in the gas sector create the risk of breaching the Paris Agreement's temperature limit and will result in stranded assets (Climate Action Tracker, 2017). This contains severe risks for economies heavily relying on natural gas in the long-term, both from an economic as well as climate policy perspective. In addition, heavy reliance and infrastructure investments in natural gas further hamper decarbonisation efforts in demand sectors such as transport and buildings. A domestic focus on natural gas might instead promote gas-based solutions that are not considered compatible with the Paris Agreement in the long-term.

The export orientation of agriculture and future shale gas exploitation can be bottlenecks for Argentina's transition to a low-emission economy. The importance of agricultural and (expected) shale gas exports in the Argentinian economy guides the development of national strategies with significant implications in Argentina's position on climate change. The cost-benefit analyses supporting these export-focused plans ought to consider risks associated with a global economy aligning with the Paris Agreement temperature goal. This would entail switching to a low-meat diet and renewable-based energy systems. Argentina's current exports plans, and hence economy, face significant risks under such forecasted developments.

Argentina's rich low-carbon sources of energy provide opportunities to develop a low-emission economy in line with the Paris Agreement's temperature target. The abundant availability of renewable resources allows for the decarbonisation of the power sector. An area that can potentially grow to be an interesting opportunity for Argentina is the development of renewable-based hydrogen infrastructure. Renewable-based hydrogen can contribute to decarbonising end-use sectors and might open-up new export markets. The development of future markets for hydrogen remains uncertain today. If demand for hydrogen, for example as a seasonal storage would increase, a gradual shift towards renewable-based hydrogen exports can convert the export risks of a global Paris-aligned economy into opportunities for Argentina.

Table 2: Overview of existing and planned overarching climate change policies in Argentina

GHG OVERARCHING CLIMATE CHANGE POLICIES OF ARGENTINA				
Changing activity	**Energy efficiency**	**Renewables**	**Nuclear or CCS or fuel switch**	**Non-energy**
Climate Strategy ▪ National Response Plan to Climate Change (planned for 2019)				
GHG reduction target ▪ Nationally Determined Contribution (NDC) (revised in 2016)				
Coordinating body for climate change ▪ National Climate Change Cabinet (2016)				
Support for low-emission R&D (none)				
	National energy efficiency target ▪ National Energy Efficiency Plan - PNEEA (under development)	**National renewable energy target** (none) *Law 27.191 on renewable energy (2015) is covered under the policy overview table for the electricity and heating supply sector in Section 2.1*		

No policies currently exist and a similar policy gap exists in all other countries

No policies currently exist however Argentina could adopt policies from other countries

Existing and planned policies in Argentina

2 Overview of national climate policy actions and gaps

This chapter provides a comprehensive overview of existing and planned climate policies at the national level in Argentina. The first part provides an overview of all existing climate change mitigation policies and their implementation status across sectors. The second part identifies gaps in existing policies compared to what would be required for a Paris Agreement-compatible pathway. The policy ambition analysis assesses how implemented policies compare to the most important short-term steps for limiting global warming to 1.5°C compared to pre-industrial levels, as identified by the Climate Action Tracker (Kuramochi et al., 2017). We compare policy progress to actionable benchmarks in each sector and rate it according to a qualitative policy rating (see Box 2 below).

The policy ambition analysis compares historical and projected developments under current policies to the global indicators without any further adjustments to country-specific circumstances, such as for example the respective capabilities of countries. The policy ambition analysis provides an indication of the degree to which current trends in each sector align with required steps on a global level and presents a standardised approach for all countries analysed in the CAT Scaling Up Climate Action series. The in-depth analysis in Section 4 addresses country-specific circumstances in Argentina and considerations for different sectors.

Box 2 Qualitative policy rating for sectoral transition to zero-emissions society

The qualitative analysis of policy activity and its ambition results in a rating for each sector. The rating aims to reflect the sector's current transition state towards 1.5°C Paris Agreement compatibility. For this purpose, the rating accounts for existing sectoral long-term strategies and/or policies, their status of implementation, as well as the general state of transition of the sector under analysis.

Transitions to a zero emissions society

Qualative rating categories for the progress on transitioning various sectors towards complete economy-wide decarbonisation

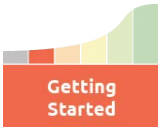
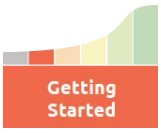
No Action	Getting Started	Ambitous Plan	Picking up Speed	Partially Transitioned	Fully Transitioned
Climate strategy or climate actions not existing in that sector or fossil fuel intensive business-as-usual	General, unspecific strategy and/or some scattered policies but no comprehensive sector-level action	Ambitious long-term goal or sector policies, but limited detailed strategy and/or implementation of policies	Ambitious long-term strategy and/or sector policies, significant trend change but not yet towards zero emissions	Transition taken for parts of the sector, but plan or implementation for the rest missing	Moving towards zero emissions in all parts of the sector

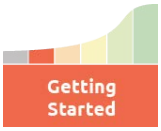
Key findings of policy activity and policy ambition analysis

Table 3 summarises the key findings of the policy activity and gap analysis for each of the sectors and the respective sectoral benchmarks. The qualitative rating evaluates the current sectoral status in transitioning to 1.5°C Paris Agreement compatibility.

Table 3: Summary table for sectoral policy activity and gap analysis in Argentina

Sector	1.5 °C-consistent benchmark	Overall evaluation based on policy activity and gap analysis	Policy rating
Electricity and heat sector	Sustain the global average growth of renewables and other zero and low-carbon power until 2025 to reach 100% by 2050	• The share of electricity generation from low-carbon technologies (incl. hydro and nuclear) is projected to decrease from 36% in 2018 (CAMMESA, 2019b) to 31% in 2030 under current policy projections assuming no further RE capacity additions beyond RenovAr auctioning rounds 1, 1.5, and 2 (CAT, 2018). The share of renewable electricity generation (incl. hydro) is projected to decrease from 31% in 2017 to 26% in 2030 (CAT, 2018). • Additional actions are needed to deploy non-conventional renewables in line with MINEM's ambitious targets of 20% share of non-conventional renewables by 2025 and 25% by 2030 (compared to <1% in 2015). Assuming the target's full implementation, the share of low-carbon electricity generation (incl. hydro and nuclear) would reach levels of 55-62% by 2025 and 62-69% by 2030 (MINEM, 2017). • Policy instruments are in place to support the uptake of non-hydro renewables (e.g. auction policies for renewables), but recent delays in commissioned renewables projects could slow down the average growth of installed renewables capacity until 2025. • The Energy Secretariat has declared its intention to double oil and gas production within 5 years for both international exports and domestic energy supply (Energy Secretariat, 2018). The support for natural gas in electricity generation, including subsidies for gas producers in the Vaca Muerta and tax benefits, puts into question the decarbonisation of the electricity sector by mid-century. • The Argentinian government has successfully reduced some consumption and production related subsidies in recent years (OECD/IEA, 2019), but direct financial support for natural gas consumption and production remains.	
	No new coal plants, reduce emissions from coal power by at least 30% by 2025	• Argentina operates a single coal plant with an already prolonged lifetime as of 2019. A 240 MW power plant is under construction, but construction has been paused and the start of operation remains unclear as of August 2019 (Energy Secretariat, 2018). • The government's direct support of renewables and natural gas aims for a complete coal phase out in Argentina (MAyDS & MINEM, 2017), which should be relatively easy to achieve given the low share of coal in electricity generation as of 2019 (<2%). Given the additional coal plant under construction, Argentina will need to implement an early retirement to phase-out coal by 2050. • No policy exists to formally implement a full phase out of coal fired plants.	

Transport sector	Last fossil fuel car sold before 2035	• Transport sector emissions are forecasted to increase by almost 50% by 2030 compared to 2014 levels under a business-as-usual scenario (MAyDS & MINTRAN, 2017) • There is a negligible participation of EVs in the car fleet and no existing policies in place to incentivise their uptake. • Several short-term measures are in place such as higher levels of biofuel blending, inclusion of flex fuel vehicles and actions to increase efficiency, but the expected impact of these measures in terms of emission reductions is limited. There are also sustainability concerns for biofuel production. • The transport action plan suggests a share of at least 30% of electric buses in public urban transport by 2030 in Buenos Aires City and Province (MAyDS & MINTRAN, 2017).	
	Aviation and shipping: Develop and agree on a 1.5°C compatible vision	• There is expected threefold increase of aviation emissions over the period between 2016 and 2030 under current policies in Argentina. • Argentina engages in ICAO's initiatives to reduce aviation emissions but has indicated no intention to participate in ICAO's CORSIA carbon offsetting scheme. • There are no strategies or policies in place for sustainable maritime shipping.	
Buildings sector	All new buildings fossil free and near zero energy by 2020	• A sustainable housing manual and labelling scheme are in place, which applies first-ever standards to all new buildings financed or co-financed by the Secretariat of Housing. No policy framework to be fossil free by 2020 or shortly thereafter is in place for buildings financed by private actors. • There are mandatory efficiency guidelines in the design and construction of social housing • Voluntary certification for energy efficient buildings is in place, but no implementation of strict building efficiency standards is foreseeable. • A labelling system and minimum performance standards are in place for appliances, but these do not significantly reduce emissions.	
	Increase building renovation rates from <1% to 3% by 2020	• No comprehensive strategy or policies are in place to enhance the energy performance of existing buildings, apart from soft loans for thermal renovation of existing social housing. • There are major challenges to undertake extensive renovations of existing residential buildings (e.g. lack of financial resources and subsidised costs of electricity and gas that hinder the economic viability of building renovations) • Progress has taken place in reducing subsidies in end-user tariffs for natural gas, but remaining subsidies and higher costs hinder the shift to heat pumps.	
Industry sector	All new installations in emissions-intensive sectors are low-carbon after 2020, maximise material efficiency	• No projections are available on the emissions intensity of industry, but limited impact is expected from existing policies to encourage energy efficiency and renewable electricity consumption of SMEs. The government is developing an action plan in the industry sector to foster renewables and efficiency in the industry sector. • No legally binding efficiency standards or regulation are in place, and there is limited financial support through the Fondo Argentino de Eficiencia Energética (FAEE) for deploying low-carbon technologies • No large-scale commercial CCS deployment is technologically and financially feasible in the near-future.	

LULUCF	Reduce emissions from forestry and other land use to 95% below 2010 by 2030, stop net deforestation by 2025	• Deforestation remains an issue given the current regulatory framework and due to pressure from agriculture • Commercial forest plantations are growing and certain policy developments promote reforestation such Law 27.487 to support investments in forests (previously Law 25.080)	
Commercial Agriculture	Keep emissions in 2020 at or below current levels, establish and disseminate regional best practice, ramp up research	• Emissions are projected to increase due to increasing agricultural production (particularly for export) • Activities around climate smart agriculture are underway, however but there is no comprehensive policy framework. Some of the measures under consideration include increasing the efficiency of livestock production and recovering degraded lands (National Cabinet of Climate Change, 2019). • The emissions intensity of agricultural production has decreased over the last two decades, due to improved farming methods and economies of scale. This is driven by the need for efficient production practices to remain competitive on the global market.	

2.1 Electricity and heating supply sector

Fossil fuel-based generation dominates electricity supply in Argentina accounting for 64% of the total generation in 2017. Of this, 90% is generated by natural gas, 8% by liquid fuels (diesel and fuel oil), and a marginal 2% by coal (CAMMESA, 2019b). Electricity generation from hydropower represented 29% of the generation mix in the same year, followed by 5% from nuclear and less than 2% from non-conventional renewable sources (i.e., biomass, wind and solar).

GHG emissions from the electricity supply sector account for approximately 12% of the total emissions in 2014 (incl. LULUCF) (Ministry of Environment and Sustainable Development, 2017a). Given the prominence of hydropower in the generation mix, the electricity emissions intensity and total emissions of the sector vary, depending on the availability and seasonal changes in hydro resources. For instance, in 2008, a dry year, emissions in the electricity sector were slightly higher than in 2010, despite higher demand in 2010. The combination of increasing electricity demand and the commissioning of additional fuel-based plants in the generation mix since 2005 - mainly natural gas-based technologies - resulted in a 61% increase in emissions in the electricity sector between 2005 and 2014.

Argentina does not operate district heating. Most heating in Argentina is generated with household gas boilers (Gastiarena, Fazzini, Prieto, & Gil, 2017) . Therefore, this section focuses on electricity supply.

Table 4 summarises Argentina's progress on the most important steps to decarbonise the electricity supply sector.

Table 4: Progress on the most important steps in the electricity supply sector to limit temperature increase to 1.5°C

Sector	1.5 °C-consistent benchmark	Projection(s) under current policies	Gap assessment (qualitative)	Policy rating
Electricity and heat sector	Sustain the global average growth of renewables and other zero and low carbon power until 2025 to reach 100% by 2050	• The share of electricity generation from low-carbon technologies is projected to decrease from 35% in 2017 to 32% in 2030 under current policy projections assuming no further RE capacity additions beyond RenovAr auctioning rounds 1, 1.5, and 2 (CAT, 2018). Additional actions need to be taken to achieve the share of low-carbon electricity supply set in the national targets. • Under current policies, the share of renewable electricity generation (incl. hydro) is projected to decrease from the current 31% in 2017 to 29% in 2025 and 26% in 2030 (CAT, 2018). • Nuclear generation capacity in the pipeline is projected to remain constant, 4% in 2017 and 5% in 2030 (CAT, 2018) • Supported by Law 27.191, the conditional target puts forward an extension of the current non-hydro renewables target from 20% by 2025 to 25% by 2030 as part of the MINEM scenarios (MINEM, 2017)	+ Increasing political will to support an accelerated increase of renewables + Policy instrument in place to initiate uptake of renewables in line with renewable targets (envisioned growth of non-conventional renewables from 2.5% of total electricity consumption in 2018 to 12% in 2019). + Uptake of renewable generation encouraged at different scales: from large-scale renewable projects to decentralised electricity generation at residential level + Grid expansion initiatives planned from 2019 onwards are expected to remove barriers that support a further deployment of renewables - Renewable projects are facing major delays due to financial difficulties and grid-related limitations. Large-scale renewable auctions suspended until grid limitations are resolved. - Government shows strong support for natural gas in electricity generation through subsidies and tax benefits, which place doubt about higher shares of renewables and the full decarbonisation of the power sector by mid-century or shortly thereafter. - Additional actions are needed to achieve the share of renewables-based electricity supply (excl. hydro) set in the targets.	
	No new coal plants commissioned, reduce emissions from coal power by at least 30% by 2025	• Argentina operates only a single coal plant in 2019 with an already prolonged lifetime • Last coal plant commissioned in 2007 being is still under construction, but construction has been paused and the start of operation remains unclear as of August 2019 (Energy Secretariat, 2018). • Coal share in the electricity mix expected to decrease considerably by 2030	+ Government's support of renewables and natural gas could lead to a full phase out of coal from the electricity mix + Share of coal in total power generation is currently low (<2%), making a coal phase-out relatively easy to manage - No policy exists to formally phase out coal fired plants - The only operating coal-fired plant has gone through several refurbishments, which has postponed its decommissioning	

2.1.1 Actionable benchmarks in electricity and heat sector

The Climate Action Tracker (CAT) has identified two short-term global benchmarks for the electricity sector to limit warming to 1.5°C (Kuramochi et al., 2017):

- Sustain the growth rates of renewables and other zero and low-carbon power until 2025 and reach a 100% share of decarbonised electricity generation by 2050.
- No new coal capacity to come online as of 2017, and emissions from coal combustion need to decrease by at least 30% by 2025. A more recent CAT publication supports this direction, and suggests reducing the use of coal in electricity by two-thirds between 2020–2030 and phase out coal globally by 2050 (Climate Action Tracker, 2018c). This is in line with the IPCC Special Report on 1.5°C (IPCC, 2018).

The following gap analysis compares historical and projected developments in the Argentinian electricity and heat sector to these global benchmarks. It uses the global benchmarks to allow for comparison between countries in the CAT Scaling Up Climate Action country series. The in-depth analysis in the following chapters addresses country-specific circumstances.

2.1.2 Recent policy developments

In December 2015, the Argentinian government declared a state of emergency for the electricity sector after years of underinvestment, leading to insufficient supply during peak times and frequent electricity cuts. The government has since sought to increase and diversify the installed power capacity, upgrade grid infrastructure, and rationalise consumption by phasing out subsidies in electricity tariffs (FARN, 2018). This has come with plans to develop low-carbon electricity sources. In 2015, the government approved a new renewable energy law and initiated a tender programme to install large-scale renewable energy plants (RenovAr). In 2017, the government passed a law approving net-metering for distributed renewable energy generation.

Table 5 provides a comprehensive overview of the implemented and planned climate policies in the electricity and heat supply sector. The paragraphs below the table provide further detail on key policies.

While Argentina published its first law on renewable energy in 2006 (Law 26190/2006) establishing fiscal incentives to drive the uptake of non-conventional renewables[2], major progress to develop renewable energy beyond large hydropower has only occurred over the course of the past few years. In 2015, the Argentinian government issued a new renewable energy law — **Law 27.191** (Gobierno de Argentina, 2015b) — that adapted the regulatory framework to incentivise the development of renewable electricity generation (excl. large hydropower). As a result, wind power installed capacity increased from 28 MW in 2007 to 227 MW in 2017 (IRENA, 2018a). Law 27.191 also sets targets of an 8% share of renewables in electricity consumption by the end of 2017 and a 20% share by the end of 2025. Argentina did not reach the target set for 2017, as renewable power generation represented 2% of total consumption in that year.

The renewable energy legislation also stipulates that all large-scale consumers must comply with the renewable electricity targets. They can either do so by purchasing renewable energy on the wholesale market or by signing third-party power purchase agreements (PPAs) with renewable energy producers. **Resolution 281-E/2017** (Ministry of Energy and Mining, 2017a) further enables bilateral agreements between energy producers and large-scale consumers (with a power demand greater than 300 kW) through a long-term market of renewable energy (**MATER**) and prioritises the dispatch of renewable generation in case of curtailments due to transmission network congestions.

The **RenovAr programme** is the government's central policy instrument under Law 27.191 to reach renewable targets by organising centralised auctions designed to contract new electricity generation capacity from renewable sources. The RenovAr programme and the significant cost reductions in renewable technologies in the region (IRENA, 2018b) have triggered the interest of investors, reflected in 147 projects awarded between 2016 and 2018 in three rounds of auctions — RenovAr rounds 1, 1.5 and 2 — for a total contracted renewable energy capacity to 4.5 GW (Ministry of Energy and Mining Argentina, 2018). Wind and solar technologies predominate in the capacity acquired through the three auctions with 2.5 GW and 1.7 GW, respectively. The remaining 0.3 GW is distributed among biomass, biogas and small hydro (<50 MW).

2 The term non-conventional renewable energy is a term broadly used in Latin America to refer to the generation of electricity from renewable sources other than large hydro, which is predominant in the region. The term comprises wind, solar, biomass, small hydro (run-of-the-river), tidal and geothermal energy.

Table 5: Overview of existing and planned climate change policies in the electricity and heat sector in Argentina

OVERVIEW OF EXISTING, PLANNED AND POTENTIAL CLIMATE CHANGE POLICIES FOR THE ELECTRICITY AND HEAT SECTOR IN ARGENTINA				
Changing Activity	**Energy efficiency**	**Renewables**	**Nuclear or CCS or fuel switch**	**Non-energy**
	Support for highly efficient power plants ▪ Energy efficiency incentives for thermal power plants (Resolution SEE 287/2017) (2017)	**Renewable energy target for electricity sector** ▪ Law 27.191 on renewable energy (2015)	**CCS support scheme** (none)	
	Reduction obligation schemes (none)	**Support scheme for renewables** ▪ Law 27.191 on renewable energy (2015) ▪ Argentina Renewable Energy Auctions - RenovAr Programme (2016-ongoing) ▪ PPAs available for renewables. Resolution 202/16 (2016) ▪ Long-term renewable energy market (MATER). Resolution 281-E/2017 (2017) ▪ Law 27.424 on net-metering for distributed generation (2017). Regulation and implementation are specified in the decree 986/2018 ▪ Project for Renewable Energy in Rural Markets (PERMER) Phase II (2015) ▪ PROBIOMASA: Project for the Promotion of Energy from Biomass Argentina (2013)		
		Grid infrastructure development ▪ Grid expansion tenders, 2019 (Resolution 81/2019)		
		Sustainability standards for biomass use (none)		
Overarching carbon pricing scheme or emissions limit (none)				
Energy and other taxes ▪ Tax reform on fuel consumption ("carbon tax") - Law 27.430 (2017)				
Fossil fuel subsidies ▪ Thermal capacity auctions (two rounds: Resolutions SEE 021/2016, SEE 287/2017) ▪ Subsidies to non-conventional gas (Resolution 46/2017, Resolution 74/2016) ▪ Natural gas exempted from fuel and CO_2 taxes Law 27.430 (2017)				

No policies currently exist and a similar policy gap exists in all other countries

No policies currently exist however Argentina could adopt policies from other countries

Existing and planned policies in Argentina

In addition to RenovAr, two other policy instruments of lower impact facilitate the development of non-conventional renewables: third-party PPAs (**Resolution 202/16**) and the long-term renewable energy market (**MATER, Resolution 281-E/2017**) (Ministry of Energy and Mining, 2016a, 2017a). Third-party PPAs have enabled the contracting of ten projects totalling 500 MW of renewable capacity by the end of 2018. The long-term renewable energy market has enabled the contracting of 41 projects, totalling 1.6 GW of renewable capacity.

Law 27.191 further establishes fiscal incentives for renewable energy investments, including exemptions from import duties, VAT refunds, accelerated depreciation, exemption from dividend tax, and tax rebates for producers including local components in their installations. The Law also created FODER, a trust fund for the development of renewable energy, providing loans and payment guarantees to project developers jointly with additional World Bank guarantees.

In addition to fostering the development of large-scale renewable generation, Argentina is planning to develop distributed, small-scale renewables. A **law on distributed renewable energy generation (Law 27.424)** was passed in December 2017 to encourage net-metering for SMEs and residential consumers (Government of Argentina, 2017a). The regulation and implementation of the law are specified in the decree 986/2018 published in November 2018 (Gobierno de Argentina, 2018b).

As response to the emergency status of the electricity sector declared in 2015, the government organised **two tenders for thermal generation** (combined cycle turbines and cogeneration plants), although no distinct policy programme like the RenovAr for renewables has been established. In the first thermal tender, under **Resolution SEE 021/2016** (Secretaría de Energía Eléctrica Argentina, 2016), the Ministry of Energy[3] contracted 29 thermal electricity projects adding up a total capacity of 3.1 GW. In the second thermal tender, under **Resolution SEE 287/2017** (Secretaría de Energía Eléctrica Argentina, 2017), the ministry selected nine additional thermal generation projects that sum a total capacity of 1.3 GW from combined cycle and cogeneration plants (Gubinelli, 2017). Due to concerns about fuel availability, the resolution requires all contracted projects to be flexible to operate on two different types of fossil fuels (Ministry of Energy and Mining, 2016d). By 2020, the government aims to install an additional 5 GW of thermal capacity in total (Gubinelli, 2017).

The **Gas Plan Framework (Resolution 46/2017, Resolution 74/2016**) defines natural gas subsidies that aim to stimulate investments in the production of shale gas through fracking (Ministerio de Energía y Minería Argentina, 2016, 2017). The framework mainly addresses the commercial development of Vaca Muerta shale gas reserve of oil and gas. In the first quarter of 2018 alone, the government distributed around 150 million USD out of this programme. Currently, this direct subsidy remains the only one in place for the production of fossil fuels (FARN, 2018).

In order to deal with the shortfall of fossil fuel supply that contributed to the state of emergency in the electricity sector in 2015, Law 26.028 exempted all liquid fossil fuels intended for electricity generation from taxation between 2005 and 2015. The government later removed these exemptions with the **Tax Law 27.430** (Ministerío de Justicia y Derechos Humanos, 2017) amendment in 2017 by reintroducing taxes on liquid fossil fuels and on carbon emissions for all fossil fuels sold in the country. While an initial proposal for a carbon tax with a price of 25 USD/tCO_2, the current carbon tax applied to each type of fuel is calculated on the basis of a carbon price of 10 USD/tCO_2 (FARN, 2018). Nevertheless, this tax excludes natural gas produced through fracking, which adds to the economic benefits provided by the new Gas Plan Framework 46/2017 (FARN, 2018).

Argentina's energy plan is heavily centred around the development of oil and natural gas production (Energy Secretariat, 2018). Despite progress on renewable energy through RenovAr, continued support for natural gas indicates that fossil fuels will retain strong participation in the electricity supply sector.

Argentina does not have any specific targets on the adoption of renewable energy for heating and cooling.

3 After a restructuration in the government in the second half of 2018, the Ministry of Energy became Government Secretariat of Energy under the umbrella of the Ministry of Treasury.

2.1.3 Comparison of recent developments and projections to benchmarks

2.1.3.1 **Actionable indicator #1**: Growth of renewables and other zero and low-carbon power

Assuming full implementation of current targets, **Argentina will experience a significant growth of renewable energy and zero-carbon technologies in the generation mix in the near to medium-term future**. In addition to the high contribution of hydro power, the 2025 renewables target aims for 20% of electricity to be generated from non-conventional renewable sources, mainly wind and solar. National energy plans assume the extension of renewable targets and additional nuclear capacity installed between 2025-2030 (MINEM, 2017). However, considering installed capacities and projects in the pipeline, Argentina will not meet its 2025 renewable target (CAT, 2018). Climate Action Tracker analysis indicates that Argentina would reach about a 7% share of renewable electricity generation in 2025 under a *"Capacities underway"* scenario, which assumes that all renewable capacity procured in the first rounds of RenovAr are installed before 2025 but no additional rounds are held due to grid limitations.

The high historical shares of low-carbon electricity generation in Argentina, ranging from 30% to 40%, reflect the high participation of hydropower in Argentina's electricity mix. Compared to 1990-2005 levels, these shares have however been decreasing due to the additional fossil-fuelled generation (mainly natural gas) contracted to meet the increasing electricity demand (see Figure 9 below).

The **2025 and 2030 Energy Scenarios** published by the Secretariat of Energy and Mining (MINEM) give an indication of the planned generation and additional capacities for different technologies. The energy scenarios assume full implementation of the renewable target by 2025 defined in Law 27.191, as well as a subsequent extension of the target for 2030, i.e. 20% share of non-conventional renewables by 2025 and 25% by 2030. Under these assumptions, the share of low-carbon electricity generation, including hydro and nuclear projections, would reach levels of 55-62% by 2025 and 62-69% by 2030 (MINEM, 2017).

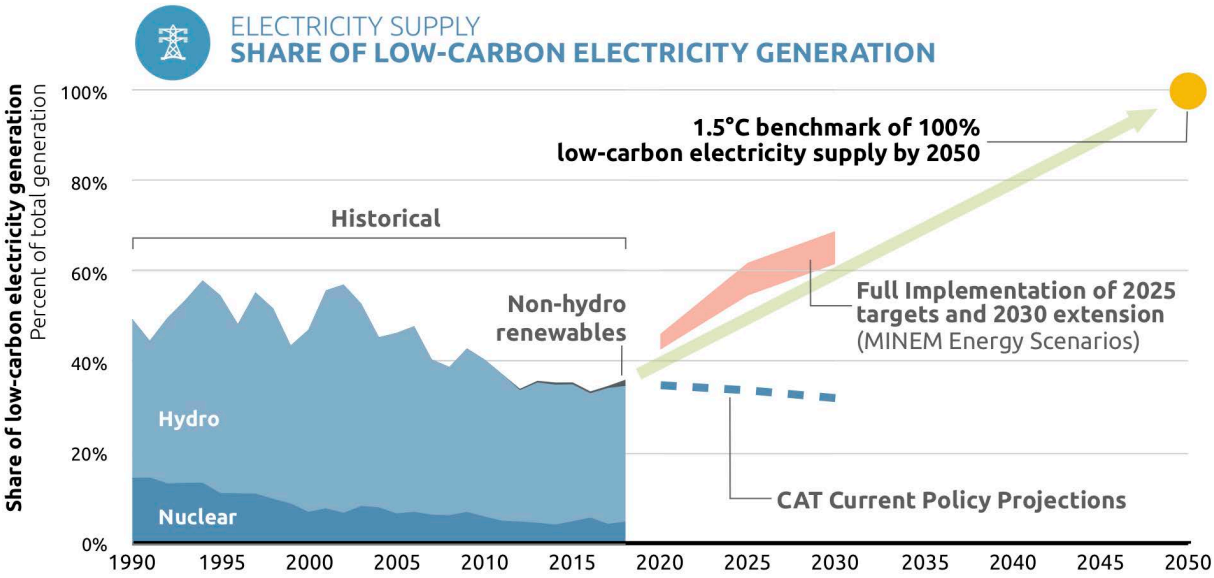


Figure 9: Historical share of low-carbon electricity generation in Argentina between 1990-2018 (CAMMESA, 2019b) *and current development projections of low carbon electricity generation until 2030 (CAT, 2018).*

The full achievement of the targets, as assumed by the MINEM scenarios, require significant additional efforts to accelerate the growth of renewables by 2025 and 2030 (see Figure 9). The efforts to support a substantial uptake of renewables (mainly non-hydro) need to escalate beyond 2030 targets to bring Argentina on a transition pathway to 100% low-carbon power generation by mid-century. The major challenges in this transition remain the government's strong support for natural gas, the grid limitation to integrate high shares of variable renewables

and diminishing trust by investors due to difficult financing conditions for project developers given Argentina's current economic instability (El Pais, 2019).

Growth in renewable electricity generation

As of 2018, non-conventional renewable resources generated around 2.5% of the total electricity demand[4] (CAMMESA, 2019a), clearly missing the intended target of 8% for the same year. However, estimates from the Ministry of Energy indicate an increase to 12% by the end of 2019 (Energía Estratégica, 2018). The expectations for 2019 enable Argentina to return to a pathway achieving the 2025 target. The expected steep increase in the share of renewables is largely justified by the additional capacity auctioned in the three rounds of the RenovAr programme, which are planned to start operations between 2018 and 2020.

Despite the success of the first three rounds of RenovAr auctions in substantially deploying renewable generation in Argentina, the fourth auction for large-scale renewables was suspended in mid-2018 and will not take place before 2020 (Bellini, 2018). The main reasons for suspending the auction are the difficult financing conditions for project developers and the connection limitations at high voltage levels in the transmission network preventing the installation of additional large-scale renewable plants in the system. The economic crisis has had consequences on investor trust and the cost of capital, jeopardising required investments in the sector. The financial difficulties have discouraged the government to carry out the fourth auction in 2019, have put projects already awarded at risk and delayed their commercial operating date (Bellato, 2018).

Shortly after the suspension of the auction the Secretariat of Energy announced a "mini-RenovAr" Round 3 to auction another 400 MW of capacity in 2019. Contrary to previous rounds, this one would target smaller scale projects from 0.5 to 10 MW that can feed electricity to the medium voltage grid (Gubinelli, 2018). The "mini-RenovAr" would likely encourage the development of distributed renewable generation in Argentina. Most of these projects will start operations between 2019-2020, helping to achieve the 2025 target.

The government currently aims to expand the transmission grid by means of centrally organised tenders (Resolution 81/2019) (Ministry of Housing, 2019). The Secretariat of Energy launched a tender process in March 2019 to build a high voltage transmission line connecting the west of the country, where generation capacity from solar and shale gas is expected to expand in the future, to the main the main load centre near Buenos Aires. The launch of this tender in March 2019 is a second attempt after the first call was pushed back in 2018 due to economic instability.

Binational agreements between neighbouring countries can support the integration of renewables in the South American region and partly alleviate bottlenecks in transmission within individual countries. However, commercial agreements and regulatory harmonisation between countries remain challenging (IRENA, 2019). Argentina's current power exchange with neighbouring countries is limited compared to its interconnection capacities. The exchange with Uruguay remains limited due to commercial reasons while the power exchange with Brazil is restricted by two power systems not being technically synchronised (i.e. the systems have different frequencies). In addition, Argentina's main wind resources are in the South, where binational links to neighbouring countries are even more limited. Grid limitations to transfer electricity to major load centres in the North of Argentina remain a major challenge.

Considering such limitations and their impact on restricting the development of renewables in the Argentinian power system, **the latest Current Development Scenario projections of the Climate Action Tracker (CAT) estimates a 29% share of renewable by 2025,** of which only a 7% share corresponds to renewables excluding hydro.

If financial and grid-related challenges are resolved and the Argentinian government carries out an accelerated deployment of renewables over time to meet the targets in 2025, as assumed in the *Energy Scenarios* 2030 by the Secretariat of Energy and Mining (MINEM), Argentina could

4 The deployment of new renewable plants throughout the year, mainly from past additions under RenovAr porgramme, contributed to reach the highest share of renewables at the end of the year (excl. large hydro). Renewable sources covered 4.5% of the electricity demand in December 2018 (CAMMESA, 2019a).

achieve 46-51% share of renewables in 2025 and 49-54% in 2030 (MINEM, 2017)[5]. Assuming the full installation of RenovAr-awarded projects and a full implementation of targets, Argentina would experience a year-to-year growth rate in installed renewables capacity of over 20% until 2020 and between 5-10% between 2025-2030. MINEM's energy projections do not consider further additions of large-scale hydro capacity beyond current projects in the pipeline (3 GW by 2030). Due to the increase in electricity demand and the priority given to non-hydro renewables, the share of hydro generation is expected to drop from 30% in 2017 to around 24-29% in 2030.

While planned renewable targets present an ambitious scenario for the future energy sector, significant additional efforts are needed to accelerate the growth of renewables and achieve the share of low-carbon electricity supply presented in *Energy Scenarios 2030* by MINEM. These scenarios suggest that between 9.6 GW–11.5 GW of additional wind power and 3.7 GW–5.8 GW of solar will be required to meet the renewable targets (MINEM, 2017). Such additions could not be transported with the current transmission grid infrastructure, limiting the achievement of renewable target to a maximum of 10% of electricity generation (MAyDS & MINEM, 2017).

Regardless of whether the renewable targets are met or not, **the full decarbonisation of the Argentinian energy sector by mid-century in accordance with a 1.5°C compatible trajectory requires continued efforts to accelerate the deployment of renewable capacity and moving away from supporting the expansion of fossil fuels**. The deployment of renewables beyond 2030 could be hampered by the government's strong support for natural gas and the intended exploitation of the shale gas reserves that would increase the electricity generation from natural gas (Energy Secretariat, 2018). Moreover, there currently exists no legislatively binding renewables target beyond 2025. The 2030 Energy Scenarios published by MINEM estimate an increase of 7.2-11.2 GW in thermal installed capacity, most of it coming from natural gas. The current support to natural gas and the energy plans to turn this fossil fuel into the main energy source suggest that this trend will continue beyond 2030.

Growth of other zero and low-carbon technologies

Regarding other low-carbon technologies, no plans or targets exist for any additional nuclear capacity beyond current projects in the pipeline. According to MINEM's 2030 energy sector scenarios, an additional 2 GW of nuclear capacity by 2030 would lead to a considerable increase in the share of nuclear from 5% in 2018 (CAMMESA, 2019b) to 13%-15% in 2030. However, the procurement of additional nuclear capacity remains uncertain.

Argentina has not developed any regulatory framework or roadmap for the application of CCS in the short, medium or long-term. A limited number of national studies assess theoretical potentials and main challenges of CCS in Argentina (Dublo, 2015; Secretariat of Environment and Sustainable Development, 2015). The CAT considers a large-scale application of CCS in the electricity supply sector not to be technologically and financially feasible in Argentina.

Argentina has not developed any regulatory framework or roadmap for the application of bioenergy with carbon capture and storage (BECCS) in the electricity supply sector in the short, medium or long-term.

2.1.3.2 **Actionable indicator #2**: Reduce emissions from coal power plants

The participation of coal in the electricity mix remains marginal. Argentina operates only a single coal-fired power plant since more than sixty years ago, which has gone through several refurbishments increasing its capacity, prolonging its lifetime and allowing its operation with other fuels such as oil and natural gas. The electricity output of this plant based on coal was less than 2% of total generation in 2017 (CAMMESA, 2018).

In 2007, Rio Turbio (240 MW) was the second coal-fired plant to be contracted. The first unit of this plant, Rio Turbio I (120 MW), was expected to start operations in 2015, followed by a second

5 These scenarios differ in their assumptions on electricity demand growth rates depending on efficiency measures, which is reflected in a range of renewables penetration. However, both scenarios assume the same share of VRE, which is the full implementation of the renewable targets (excl. hydro).

unit with same installed capacity in 2018. After more than two years of construction being on hold and major cost overruns, the government has rescinded the construction contract of the power plant in 2018. As of February 2019, neither of the two units has been installed and the construction has been put on hold with major uncertainties about future developments.[6]

Even though there is no distinct policy to phase out coal-fired plants, the participation of coal in the generation mix is likely to decrease in the future. On the one hand, there are no plans to expand the capacity beyond what is in the pipeline since more than a decade ago. On the other hand, more efficient gas-fired generation and renewables are expected to come online, both receiving support from the government. These technologies are expected to displace all coal from the generation mix by 2030 (MINEM, 2017).

Whilst Law 27.430 imposes a tax on CO_2, increasing the production costs for power plants operating on coal, the resources that are expected to cover most of the electricity needs of the country, i.e., natural gas, are exempt of this tax. The discrepancy in carbon tax and the support to natural gas production and renewables signal the government's intention to structure it generation mix around these resources, excluding coal-fired power generation.

The economic conditions and government preference for other resources will likely displace coal from the generation mix, making the transition towards a coal-free electricity both feasible and relatively smooth. Given these circumstances, Argentina could be coal-free by 2020 or shortly thereafter and join the Powering Past Coal Alliance (PPCA), provided it shelves the coal plant under construction and retires the plant under operation.

2.1.4 Conclusion

The high participation of hydropower enables Argentina to have an electricity system that is already partially decarbonised. The transition towards increased decarbonisation of the sector started in 2015 with policies to promote non-hydro renewables. The government's aims to increase the uptake of renewables other than hydropower by means of policy instruments such as the RenovAR programme. Current policy projections estimate that Argentina would not meet its non-hydro renewable targets by 2025. Total low-carbon electricity generation is expected to represent about 34% of total annual generation by 2025 and 32% by 2030 (CAT, 2018). Assuming Argentina's targets are fully implemented and relevant barriers in the energy sector are removed, low-carbon shares could reach levels between 55-62% by 2025 and 62-69% by 2030 (MINEM, 2017). This would reflect an ambitious transition towards higher shares of renewables. The comparison of these ranges against the intermediate benchmarks presented in the IPPC report[7] indicates that Argentina is on a right pathway by 2030 if the targets are met. Despite this intended increase in renewable capacity in the next years, the further development of renewables and the effective achievement of the targets by 2025 remain at risk due to grid congestion and financial risks faced by project developers.

Despite a substantial growth of renewables in the short and medium-term, Argentina has no specific sectoral plan or target to reach the required 100% share of low-carbon electricity generation by 2050 to be in line with the Paris Agreement temperature target. In fact, latest energy sector plans from the Secretariat of Energy (Energy Secretariat, 2018) and the support to natural gas indicate that the government aims to make this fuel the main energy source in the country. Under these conditions, a full decarbonisation of the power system by mid-century is unlikely, unless Argentina decreases its gas consumption soon and avoids building up significant additional fossil fuel infrastructure.

Argentina is in a position to smoothly phase out coal well before 2020 or shortly thereafter given the limited role of coal in the electricity mix, CO_2 taxes on coal, and the support for more efficient technologies. The use of CCS technology in fuel-based generation (mainly

6 The contract to finalise the construction of the plant has not been adjudicated to any party (neither public nor private) and starting operation date remains unclear. The latest update of the National Energy Plan removed this plant from the scheduled future entrance of electricity generation projects (Energy Secretariat, 2018).

7 The IPPC report defines the interquartile range for no or low overshoot as 47-65% of renewable shares in electricity by 2030 (IPCC, 2018).

natural gas) is currently economically unviable in Argentina and only a few techno-economic studies have been carried out to assess its potential.

2.2 Transport sector

The transport sector emitted about 15% of Argentina's total direct GHG emissions including LULUCF in 2014 (Ministry of Environment and Sustainable Development, 2017a). Between 2005 and 2014, total transport emissions increased by more than 30% from 43 $MtCO_2e/yr$ in 2005 to 57 $MtCO_2e/yr$ in 2014. Road transport, representing 90% of all transport related emissions in 2014, constitutes the most important source of transport-related emissions by far, accounting for 14% of Argentina's total GHG emissions in 2014 (Ministry of Environment and Sustainable Development, 2017a). Road transport emissions are distributed equally between passenger vehicles and trucks (see Figure 10).

Table 6 summarises Argentina's progress on most important steps to decarbonise the transport sector in line with the Paris Agreement temperature target.

Table 6: Progress on the most important steps in the transport sector to limit temperature increase to 1.5°C

Sector	1.5 °C-consistent benchmark	Projection(s) under current policies	Gap assessment (qualitative)	Policy rating
 Transport sector	Last fossil fuel car sold before 2035	• Transport sector emissions forecasted to increase by almost 50% by 2030 compared to 2014 levels under a business-as-usual scenario (MAyDS & MINTRAN, 2017) • Negligible participation of EV in car fleet with projections of 0.3% share by 2025 and 1.5% by 2030 (MINEM, 2017)	+ Several minor demand-side efficiency policies are in place that aim to reduce emissions in the transport sector +/- Substantial growth of biofuels driven by higher blending mandates. However, there are sustainability concerns regarding the impact of biofuel production on LULUCF. +/- Moderate overall impact expected from proposed mitigation actions in the National Mitigation Plan: reaching an annual emission reduction of up to 7,6% in 2030 if all measures would be implemented. - No overarching 1.5°C compatible vision for the transport sector - Marginal uptake of EV with low coverage in transport sector policies to incentivise their uptake - Tax exemptions for CNG and LPG encourage the continued use of fossil fuels for vehicles	
	Aviation and shipping: Develop and agree on a 1.5°C compatible vision	• Expected threefold increase of aviation related emissions over the period between 2016 and 2030 under currently implemented policies • As a member of the IMO and ICAO, Argentina promotes emission reductions through the adoption of mitigation measures in maritime shipping and aviation (e.g. fuel substitution, regulations and energy-efficiency measures). • No projections available for maritime shipping in Argentina	+ Efficiency measures in both sectors expected to optimise fuel consumption and reduce emissions per passenger + The National Administration of Civil Aviation adopted the international regulation for the monitoring of CO_2 emissions on international flights within the CORSIA framework - Existing plans to modernise airport infrastructure, flexible use of airspace measure and increased air routes and frequency aim to substantially increase air traffic - Mitigation actions presented in the National Mitigation Plan would only marginal reduce aviation-related emissions by 2030	

2.2.1 Actionable benchmarks in transport sector

The Climate Action Tracker (CAT) has identified two short-term global benchmarks for the transport sector to limit warming to 1.5°C (Kuramochi et al., 2017):

- The last fossil car needs to be sold before 2035 to achieve car fleets with 100% zero-emission cars by 2050.
- A 1.5°C compatible vision for the aviation and shipping sectors needs to be developed and agreed upon.

Additionally, freight transport needs to decarbonise: freight trucks need to be nearly fully decarbonised by around 2050 (Climate Action Tracker, 2018c).

With the findings from the IPCC report on achieving net-zero CO_2 emissions around 2050 and the rapid uptake of electric vehicles in the last years in mind, this analysis decides to strengthen the benchmark for the vehicle sales to a fully 100% zero-emissions car stock by 2050, meaning the last fossil car needs to be sold before 2035.

The following gap analysis compares historical and projected developments in the Argentinian transport sector to these global benchmarks without any further adjustment to allow for a comparison between countries. Country-specific circumstances will be addressed in the in-depth analysis on scaling up climate action in the following chapters. Please refer to Kuramochi et al. (2017) for a more detailed explanation on each indicator.

2.2.2 Recent policy developments

Argentina has implemented some climate strategies and policies in the transport sector, primarily to develop biofuels, promote public transportation, reduce emissions from freight transport and remove fuel subsidies.

Table 7 provides an overview of the implemented and planned sectoral climate policies.

More than 90% of the emissions in the transport sector in Argentina stem from road transport in 2014, of which half comes from passenger vehicles (e.g. cars, SUVs, motorcycles, buses), 46% from light freight trucks, and the remaining share from heavy trucks (Ministerio de Ambiente y Desarrollo Sustentable, 2017).

As a result, most of the existing and planned mitigation policies in the transport sector target emissions from road transport, particularly freight transport. The main policies include renewing truck fleets, increasing the emission performance of trucks, a greater use of biofuels and shifting to alternative transport modes (i.e. rail).

In order to address the emissions from light-duty trucks, the Ministry of Transport has established a financing programme to incentivise the **renewal and expansion of the truck fleet**. The programme provides credits to companies and citizens to buy new, more efficient freight vehicles (**Decree 494/2012**) (Gobierno de Argentina, 2012). The financial benefits of this measure were extended to inter-urban passenger vehicles.

Intended as an energy efficiency measure, the Ministry of Transport approved **Resolution 19/2016** in 2016 that sets the speed limit for all trucks to 90 km/h (Ministry of Transport, 2016). In 2017, the Sub-Secretariat of Energy Efficiency prepared and published the first standard to measure CO_2 emissions and fuel consumption of light-duty vehicles (IRAM/AITA 10274-1). Subsequently, **Resolution 191-E/2017** established an obligation for vehicle traders to inform customers about such standards, providing inputs to implement an **energy efficiency labelling** system in the transport sector (Subsecretaria de Ahorro y Eficiencia Energetica, 2017).

Table 7: Overview of existing and planned climate change policies in the transport sector in Argentina

OVERVIEW OF EXISTING AND PLANNED CLIMATE CHANGE POLICIES FOR THE TRANSPORT SECTOR IN ARGENTINA				
Changing Activity	**Energy efficiency**	**Renewables**	**Modal switch**	**Non-energy**
Urban planning and infrastructure investment to minimise transport needs ▪ Law 27.132 on expanding and improving the railway system (2015)	**Minimum energy/emissions performance standards or support for energy efficient for light duty vehicles** ▪ Fuel performance and CO_2 emissions labelling for light-duty vehicles (2017)	**Biofuel target** ▪ Law 26.093 on biofuels (2006, amended by Resolution 37/2016)	**Support for modal share switch** ▪ National Mitigation Plan in Transport Sector (2017) – incl. development of train freight transport and Bus Rapid Transit systems ▪ Integrated Plan of Works for the Network of Metropolitan Trains (2016)	
	Minimum energy/emissions performance standards or support for energy efficient for heavy duty vehicles ▪ Decree 494/2012 on incentives to renew the truck fleet (2012) ▪ Smart Transportation Programme (2018)	**Support schemes for biofuels** ▪ National Programme for Biofuels (2004) - Resolution 1156/04	**E-mobility programme** ▪ Reduced import tariffs for EVs (Decree 331/2017 and 51/2018) ▪ Inclusion of EV in the regulation (Decree 32/2018)	
		Sustainability standards for biomass use (none)		
Tax on fuel and/or emissions ▪ Tax reform on fuel consumption ("carbon tax") - Law 27.430 (2017)				
Fossil fuel subsidies ▪ Law 27.430 (2017) on tax exemption for GNC and LPG for vehicle use ▪ Law 27.209 (2015) on tax exemptions for gasoline and diesel (regional discrimination)				

No policies currently exist and a similar policy gap exists in all other countries

No policies currently exist however Argentina could adopt policies from other countries

Existing and planned policies in Argentina

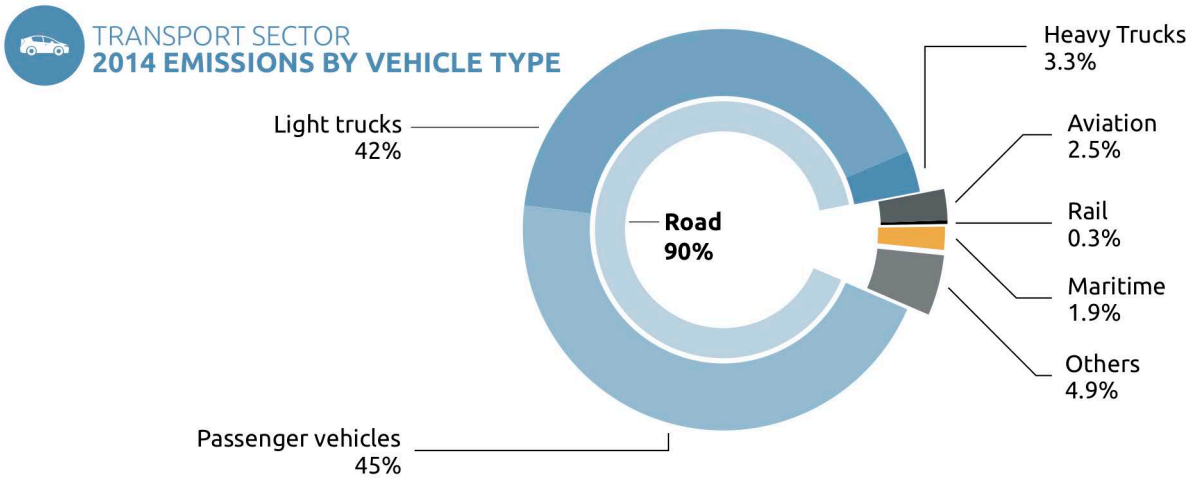


Figure 10: Emissions distribution in transport sector in 2014 (Ministerio de Ambiente y Desarrollo Sustentable, 2017). Passenger vehicles include cars (private and taxis), buses (urban and inter urban) and motorbikes. Both heavy and light trucks are included in freight transport.

The **Smart Transportation Programme (Resolution 1075/2016)** promotes energy efficiency in the transport sector with demand-oriented measures to reduce fuel consumption in freight transport (Comisión Nacional de Regulación del Transporte de Argentina, 2016). The programme is based on voluntary participation and close collaboration between the public and private sectors for the execution of the strategy, which covers, among others, speed control, capacity building, intermodal transportation, efficient use of freight space, logistics and equipment improvement. The programme raises awareness on the positive impacts of efficiency measures through capacity building and educational measures.

In 2014, less than 4% of all freight was transported by rail and close to 93% was transported by road (MAyDS & MINTRAN, 2017). In 2015, the government enacted **Law 27.132** (Gobierno de Argentina, 2015a) which declares that the increase in rail transport (including for freight transport) is a matter of national importance. The Law reinstated the national railway company Argentinian Railways (Ferrocariles Argentinos) and opened access to third-party operators on the railway network. In June 2018 the government took further steps to facilitate access to new private freight transport operators and is planning large-scale investments in railways (enel Subte, 2018). At the same time, the government is however also promoting road infrastructure that could undermine sectoral climate goals, e.g. through the 'Plan Vial Federal', which aims to build an additional 7,500 km of roads and highways.

In 2004, the Ministry of Agriculture created the **National Programme for Biofuels (Resolution 1156/04)**, which defines objectives to promote the use of biofuels as an alternative to fossil fuels (Secretaría de Agricultura - Argentina, 2004). A central part of the programme is to support rural development in the execution of biofuels projects (biodiesel and bioethanol). The **Biofuels Law 26.093**, in force since 2006, promotes the use and production of biofuels through blending mandates and fiscal incentives for biofuel producers (Ministry of Justice and Human Rights, 2006). The law initially set a blending mandate of 5% for ethanol in gasoline and 7% for biodiesel in diesel. The blending mandate for ethanol progressively increased to 10% in 2014 and to 12% in April 2016 with **Resolution 37/2016** (Ministry of Energy and Mining, 2016b). The blending mandate for biodiesel is currently at 10% as established in 2014 with **Resolution 44/2014** (Ministerio de Ambiente y Desarrollo Sustentable, 2017). These blending mandates triggered an exponential growth of the Argentinian biofuel industry, becoming the largest soybean-based biodiesel exporter worldwide in only six years (FARN, 2013).

Argentina is slowly advancing in setting up a policy framework that incentivises the development and use of electric vehicles (EV). In 2018, the Ministry of Transport — in coordination with the Environment, Energy and Industry ministries — modified the National Transit Law (Law 24.449) in order to include electric vehicles in the regulatory framework (**Decree 32/2018**) (Gobierno de Argentina, 2018a). The modifications aim to enable the manufacturing, trading and transit of EV in urban areas. In May 2017, **Decree 331/2017** significantly reduced the tariffs of electric vehicles to encourage the import of up to six thousand electric vehicles in the three following years (Gobierno de Argentina, 2017). **Decree 51/2018** eliminates the import duty rate on electric buses destinated for pilot projects.

The tax reform (**Law 27.430**), in force since 2018, defines a new tax structure to fuels consisting of a fixed tax on the production and imports of liquid fuels and a carbon tax (Ministerío de Justicia y Derechos Humanos, 2017). Gasolines and diesel used to supply the transport sector are included among the taxable fuels but biofuels are exempt.

Several policies continue to support the use of fossil fuel in the transport sector. **Law 27.430** exempts natural gas from fuel taxation and, including tax exemptions for compressed natural gas (CNG) and liquified petroleum gas (LPG) that are particularly relevant for the transport sector. These exemptions are aligned with the government's efforts to support the consumption and shift towards natural gas across sectors. Moreover, the tax reform makes a geographical discrimination on liquid taxes for transport. Gasolines and diesel fuels are tax-exempt in a few influence regions in the west and south of the country, where most of the oil and gas resources are located. These exemptions can be perceived as subsidies that incentivise fossil fuel consumption in the sector and diminishes the impact of energy efficiency measures in the transport sector.

2.2.3 Comparison of recent developments and projections to benchmarks

2.2.3.1 **Actionable indicator No.3:** Last fossil fuel car sold before 2035

Given the current policy framework, Argentina is unlikely to move to zero-emission vehicles before 2035. Argentina does not have a comprehensive Paris-compatible policy framework or vision in place aiming to fully decarbonise the car fleet. Under a business-as-usual scenario, the National Mitigation Plan in the Transport sector (PNMT) projects a 45% increase in GHG emissions in 2030 compared to 2014 levels (MAyDS & MINTRAN, 2017), representing a similar increase as between 1990-2014 (see Figure 11). The dotted line in Figure 11 illustrates the emissions projections if mitigation actions in the PNMT such as vehicle renewals and efficient freight transportation were implemented. These projections suggest that these measures alone will not steer the sector to meet the 2035 benchmark without more ambitious decarbonisation policies promoting fossil-free cars.

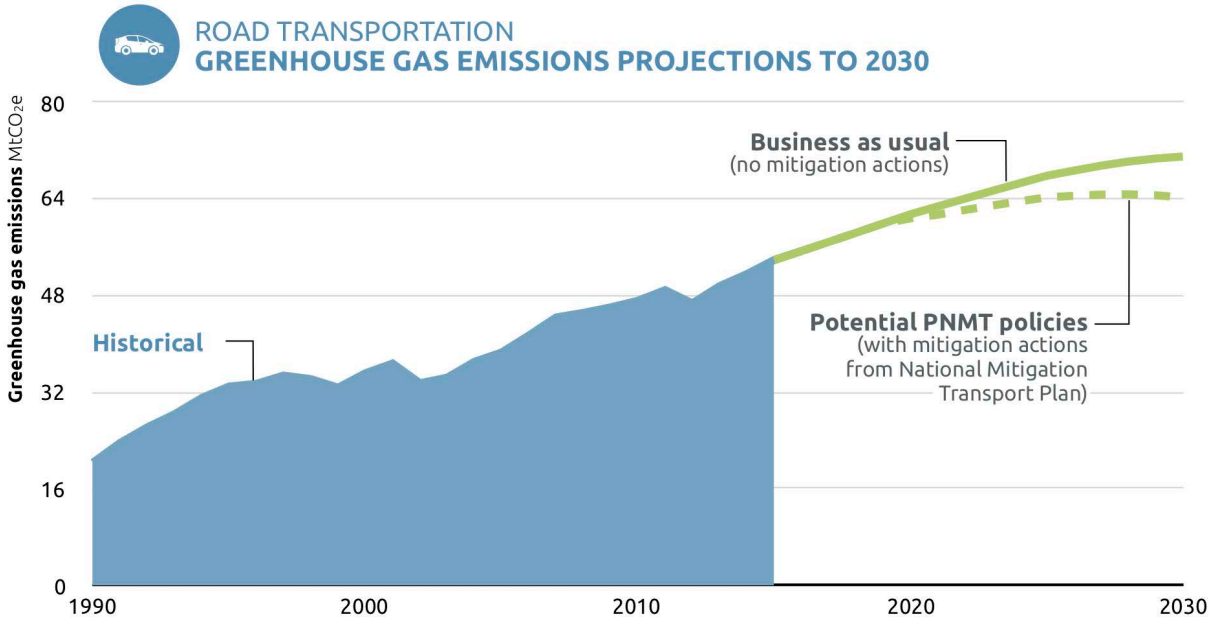


Figure 11: Historical GHG emissions from road transport for 1990-2014 (Ministry of Environment and Sustainable Development, 2017a) *and GHG emissions projections for 2014-2030 under a business-as-usual scenario and a scenario assuming full implementation of mitigation actions from the National Mitigation Transport Plan* (Secretariat of Environment and Sustainable Development, 2015)

The Argentinian government has implemented a few initial measures to transition away from fossil fuel cars, such as promoting the use biofuels and lowering import tariffs for electric vehicles. Figure 12 depicts the growth of biofuels in the transport sector after the implementation of the biofuel blending mandates since 2010. The share of biofuels and electricity in the transport sector is expected to increase further due to the continued support for the biofuel industry in Argentina and the increasing number of electric vehicles. The accelerated growth of biofuel industry rise sustainability concerns.

The National Energy Action Plan sets a 20% blending target of biodiesel in liquid fuels for buses and the incorporation of flex-fuel technologies for gasoline-based cars by 2030 (Ministry of Energy of Argentina, 2017). The accelerated growth of the biofuel industry however raises sustainability concerns related to food security, forestry protection and land use (see Box 3). According to the National Energy Plan, the mentioned measures will lead to additional emissions reductions of 0.5 $MtCO_2e$ /yr in 2025 and 1.03 $MtCO_2e$ /yr in 2030.

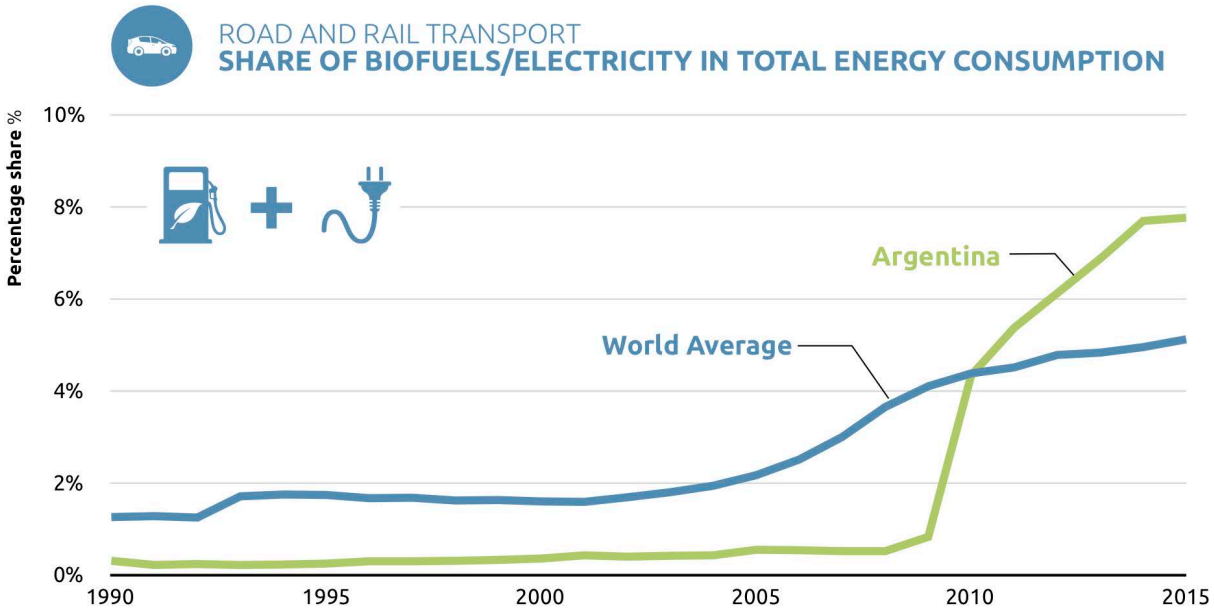


Figure 12: Share of biofuels/electricity in total energy consumption in the transport sector (road and rail) in Argentina between 1990-2015 (Climate Action Tracker, 2019)

When it comes to EVs, the 2030 energy scenarios of the Secretariat of Energy expect the sale of EVs in total vehicle sale to rise from the current 0% to 3% by 2025, 12% by 2030 and 50% by 2050. This increase in sales would lead to the share of EV in the car fleet to increase to 0.3% in 2025 and 1.5% in 2030 (MINEM, 2017).

At the city level, the administration of Buenos Aires has launched a Clean Mobility Plan that involves several pilot projects using electric taxis and buses for public transportation (Ministry of Transport Argentina, 2018). The mobility plan aims for 30% of electric buses and 35% of electric taxis by 2035 (Ministry of Environment and Sustainable Development, 2017b). A total of 220 chargers are to be installed in fuel filling stations by 2019 (Energia Estrategica, 2017). Worldwide development of EV technologies will likely support the deployment of electric vehicles in Argentina. The regulatory framework and infrastructure, both in the transport and power sectors, should be adapted to accommodate this development.

Box 3 Sustainability considerations related to the development of biofuel production in Argentina

Soybeans are the main input to produce biodiesel in Argentina. The production of biodiesel in Argentina grew from nearly 700 thousand tons in 2008 to over 2.8 million tons in 2017 (Energy Secretariat, 2019). The enforcement of biofuel blending mandates (Law 26.093) led to the development of an internal market since 2010. External demand, mainly from the United States and the European Union, further spurred the production of biodiesel: around 60% of biodiesel production as of today is destined for exports.

In 2017, around 8% of the total soybean production went to produce biodiesel. The surging demand and high international prices increased the soybean production to a point where soybean crops now cover more than half of the country's agricultural areas (see Figure 13, right graph).

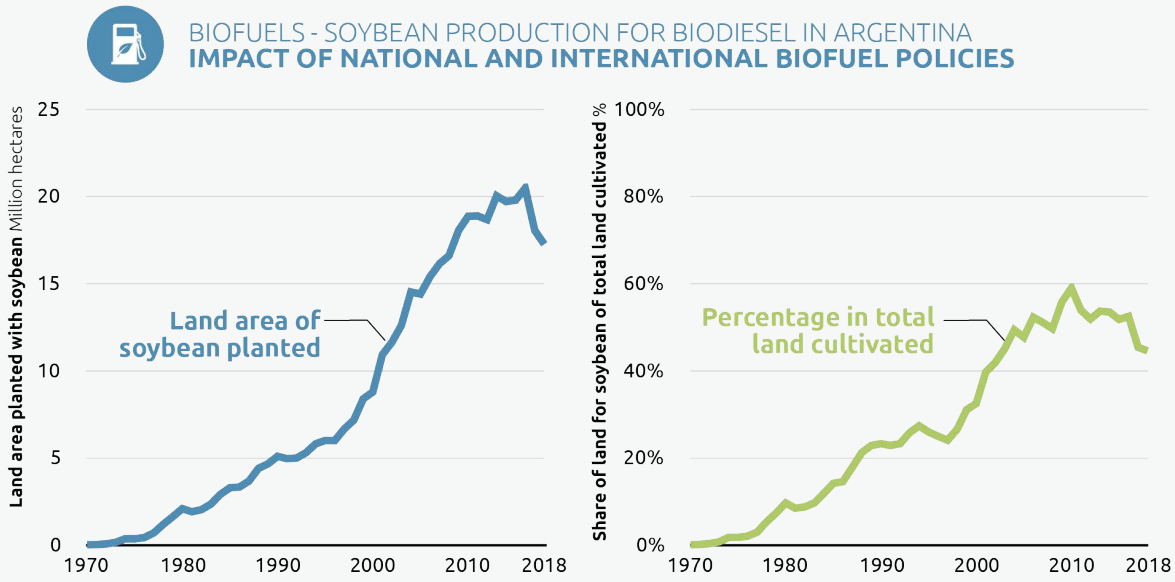


Figure 13: Soybean crops sown and their share in total cultivated area (Agro-industry Secretariat, 2018)

The rapid growth of soybean production in Argentina has raised sustainability concerns, especially due to deforestation. The territorial expansion of soybean crops plantations has encroached land areas that were originally not designated for agricultural purposes. In order to counteract these developments, Law 26.331 of 2007 defines minimum budgets for the protection, restoration and conservation of native forestry. Despite the prohibition of deforestation stipulated in the law, there has been a steady trend towards a reduction in forest area. in recent decades. Since 2002 the area of native forests has been reducing at a rate of 1.2% per year (SAyDS, 2012).

Policies to increase soybean-based biodiesel should take into consideration the environmental impact of the entire value chain in the production of the biofuel. This includes analysis of the impacts it has on natural resources, land use and deforestation.

Freight transport

As of 2015, the freight vehicle fleet in Argentina consisted of around 270,000 heavy-duty trucks and more than 2.5 million light-duty vehicles. Old diesel-powered trucks in use over 40 years are responsible for one third of total road transport emissions, even though they only account for less than 5% of the car fleet (Ministerio de Ambiente y Desarrollo Sustentable, 2017). The PNMT includes various mitigation actions to reduce emissions from freight transport, which represent almost 60% of the accumulated emission reductions in the transport sector between 2011-2030, leading to more than 5% emissions reductions compared to the business-as-usual scenario in 2030 in the transport sector (MAyDS & MINTRAN, 2017). The most significant measures in the PNMT are the modal shift towards train freight transport and capacity building for drivers to reduce fuel consumption.

Freight transport emissions could further decrease if the plans to rise the biofuel blending mandates are implemented, especially for biodiesel. Argentina currently has no policies supporting the deployment of electric or other zero-emission vehicles for freight transport. Current policies and plans are not enough to steer freight transport to meet the 2035 benchmark without more ambitious decarbonisation policies.

2.2.3.2 **Actionable indicator No.4:** Develop a 1.5°C compatible vision in aviation and shipping

Aviation

Argentina does not have a 1.5°C compatible strategy in the aviation sector. Argentina expects the number of air passengers to double by end 2019 compared to 2016 levels and most recent projections forecast a threefold increase of aviation-related emission between 2016 and 2030 (MAyDS & MINTRAN, 2017). With 1.4 $MtCO_2$, the emissions from domestic aviation contribute to around 2.5% of transport sector emissions in 2014 (Ministry of Environment and Sustainable Development, 2017a). The modernisation of commercial aviation, one of the mitigation measures in the PNMT, has contributed a mere 0.1% to the total emission savings of the mitigation measures evaluated (Ministry of Environment and Sustainable Development, 2017b).

As a member state of ICAO, Argentina submitted a State Action Plan in 2013 with mitigation measures for the aviation sector, including aircraft fleet renewal, the development of alternative sustainable fuels and improved air traffic management (Administración Nacional de Aviación Civil, 2014). The State Action Plan does not quantify the emission reduction impact of these measures nor does it include a timeline for their implementation.

In March 2019, the Argentinian National Administration for Civil Aviation adopted Resolution 204/2019 on the international regulation for monitoring CO_2 emissions from international flights within ICAO's Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) (Administración Nacional de Aviación Civil, 2019).

The mitigation actions outlined in the National Transport Plan focus on fuel efficiency and reducing the emissions intensity per passenger, with measures including newer planes with higher efficiency standards, operation practices that increase the efficiency in fuel consumption, improvements in air traffic and modernisation of airport infrastructure. Emissions from aviation are expected to increase in the future as a result of intensified air traffic (see Figure 14). Savings from planned mitigation measures only marginally reduce aviation-related emissions by 2030.

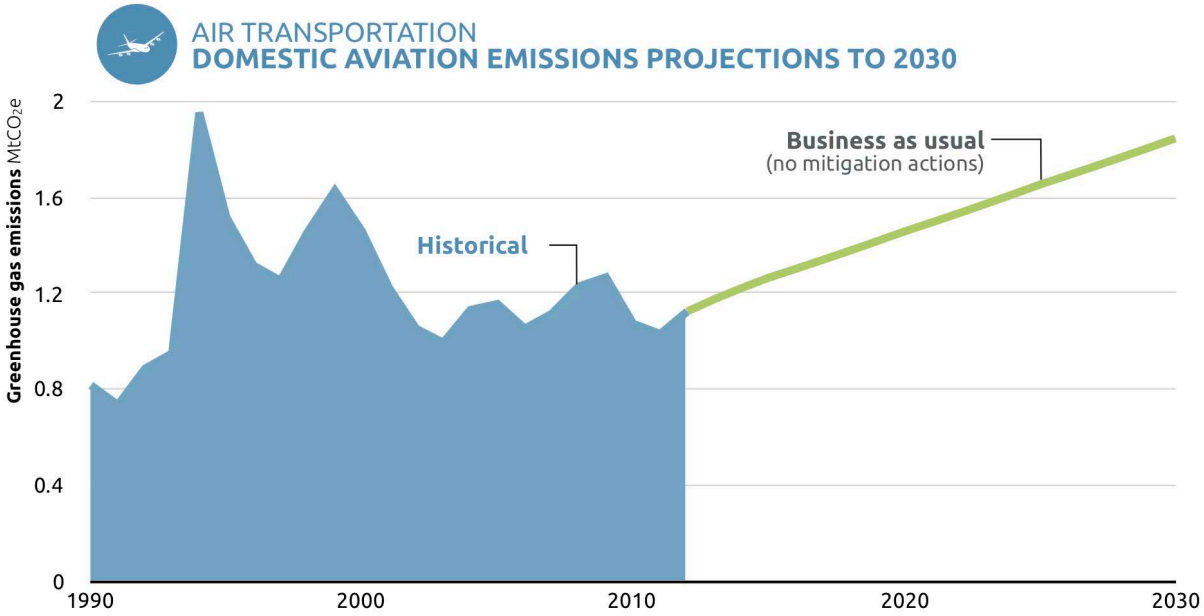


Figure 14: Historical GHG emissions from domestic aviation for the period of 1990-2012 (Ministry of Environment and Sustainable Development, 2017a) and projections for the period 2012-2030 (Secretariat of Environment and Sustainable Development, 2015). The projections are based on an indicative modelling exercise in preparation for the 3rd National Communication using 1996 IPCC Guidelines. Please note that this indicative modelling exercise is not official information submitted by Argentina to the UNFCCC; it uses 1996 IPPC Guidelines and differs from latest official inventory data prepared using 2006 IPCC Guidelines.

Maritime shipping

Maritime shipping represented less than 2% of transport sector emissions in 2014 (Ministry of Environment and Sustainable Development, 2017a). There is no strategy or policies in place to mitigate maritime shipping emissions in Argentina. Argentina is a member of the International Maritime Organization (IMO), which promotes emission reductions through the following measures (IMO, 2017):

i. Adoption of regulations to address the emission of air pollutants from ships
ii. Adoption of mandatory energy-efficiency measures to reduce emissions of greenhouse gases from international shipping
iii. Global capacity-building projects to support the implementation of those regulations and encourage innovation and technology transfer

There is limited information about Argentina's involvement in these different work streams and whether these initiatives could reduce emissions from maritime transport and fishing. Argentina is one of the ten pilot countries in the Global Maritime Energy Efficiency Partnerships (GloMEEP) programme that supports the uptake of energy efficiency measures in maritime shipping. GloMEEP supports pilot countries to implement measures through legal, policy and institutional reforms, awareness raising and the establishment of PPP agreements to encourage technology transfer.

2.2.4 Conclusion

Argentina is not expected no meet either of the two actionable benchmarks in the transport sector. The National Transport Plan presents a set of mitigation actions focused on fleet renewal, demand-oriented efficiency and shifting to alternative transport modes. These measures aim to reduce emissions in the period 2014-2030 by around 4% compared to a business-as-usual scenario, reaching a maximum yearly mitigation impact of 7.6% in 2030. However, the National Transport Plan does not provide a comprehensive 1.5°C compatible vision.

Implemented policies such as blending mandates for biofuels are expected to have a limited impact on moving towards a 1.5° compatible vision of the sector, even though Argentina is considerably above global average in terms of its share of biofuels in transport energy consumption. Additionally, these policies must assess the impacts of large-scale biofuels production on food security, forestry protection and emissions from land use.

The electrification of transport in parallel to a decreasing fossil share in electricity generation will support the long-term decarbonisation of the sector. The National Transport Plan recognises a modal shift towards more extensive use of rail transport as one of the most impactful measures to decarbonise the sector. However, further efforts are needed to complement this measure, especially related to the use of electric vehicles in passenger road transportation.

2.3 Buildings sector

In 2014, direct emissions in the buildings sector, caused by fuel combustion in residential and commercial sectors but excluding emissions related to electricity consumption, represented 9% (~34 $MtCO_2e$) of Argentina's total GHG emissions, including LULUCF (Ministry of Environment and Sustainable Development, 2017a). These emissions increased by more than 70% between 1990 and 2014. More than half of the direct emissions in the buildings sector correspond to the combustion of natural gas to heat residential buildings. The residential buildings sector alone accounted for almost 8% of total national emissions in 2014 (Ministry of Environment and Sustainable Development, 2017a).

Table 8 summarises Argentina's progress on the most important steps to decarbonise the buildings sector to limit temperature increase to 1.5°C.

Table 8: Progress on the most important steps in the buildings sector to limit temperature increase to 1.5°C

Sector	1.5 °C-consistent benchmark	Projection(s) under current policies	Gap assessment (qualitative)	Policy rating
Buildings sector	All new buildings fossil free and near zero energy by 2020	• No specific projections available for new buildings • An indicative modelling exercise in preparation of the 3rd National Communication using 1996 IPCC Guidelines suggests an 85% emission increase in the sector between 2012 and 2030[8]	+ Energy labelling and minimum performance standards for appliances in place but expected to have limited impact in reducing sector emissions + *Sustainable Housing Manual* and labelling scheme in place. The standards established in the manual will be applied to all new buildings financed or co-financed by the Secretariat of Housing + Mandatory energy efficiency guidelines in the design and construction of social housing + Policies to encourage the generation and self-consumption of electricity from renewable sources in place +/- Efficiency labelling of residential buildings is not mandatory, and no net-zero building project has been announced as of February 2019. Voluntary certification in place to add value and encourage the deployment of energy efficient buildings. - Current policy framework does not encourage all new buildings to be fossil free by 2020 - Energy labelling of residential heating appliances that run on natural gas (largest source of consumption) is only voluntary - Natural gas is still subsidised for residential consumers - Buildings emissions intensity per capita increased considerably in the last decade, which is not in line with a Paris compatible pathway	
	Increase building renovation rates from <1% to 3% by 2020	• No specific projections available for renovation rates • An indicative modelling exercise in preparation for the 3rd National Communication using 1996 IPCC Guidelines suggests an 85% emission increase in the sector between 2012 and 2030[9]	+ Renovation of the social housing buildings stock supported with soft credits - No strategy to enhance the energy performance of existing buildings - Major challenges to undertake extensive renovations of residential buildings - Subsidies for natural gas and other factors hinder a shift to heat pumps	

2.3.1 Actionable benchmarks in the buildings sector

The Climate Action Tracker (CAT) has identified two short-term global benchmarks for the buildings sector to limit warming to 1.5°C (Kuramochi et al., 2017):

- All new buildings ought to be fossil-free and near zero energy by 2020.
- The annual retrofit rates of existing building stock need to increase from less than 1% in 2015 to 5% by 2020 for OECD countries and 3% by 2020 for non-OECD countries.

The following gap analysis compares historical and projected developments in the Argentinian buildings sector to these global benchmarks without any further adjustment to allow for

8 Please note that this indicative modelling exercise is not official information submitted by Argentina to the UNFCCC; it uses 1996 IPPC Guidelines and differs from latest official inventory data prepared using 2006 IPCC Guidelines.

9 Please note that this indicative modelling exercise is not official information submitted by Argentina to the UNFCCC; it uses 1996 IPPC Guidelines and differs from latest official inventory data prepared using 2006 IPCC Guidelines.

comparison between countries. Country specific circumstances will be addressed in the in-depth analysis on scaling up climate action in the following chapters. Please refer to Kuramochi et al. (2017) for a more detailed explanation on each indicator.

2.3.2 Recent policy developments

Argentina has implemented some climate strategies and policies in the buildings sector. Table 9 provides a comprehensive overview of the implemented and planned sectoral climate policies.

Table 9: Overview of existing and planned climate change policies in the buildings sector in Argentina

<table>
<tr><th colspan="5">OVERVIEW OF EXISTING, PLANNED AND POTENTIAL CLIMATE CHANGE POLICIES FOR THE BUILDINGS SECTOR IN ARGENTINA</th></tr>
<tr><th>Changing Activity</th><th>Energy efficiency</th><th>Renewables</th><th>Nuclear or CCS or fuel switch</th><th>Non-energy</th></tr>
<tr><td>Urban planning strategies
(none)</td><td>Building codes and standards and fiscal/financial incentives for low-emissions choices
▪ Energy Efficiency in Public Buildings (2007)
▪ Energy Efficiency and Renewable Energy in Social Housing - Resolution 423/23 (SAyDS, 2018a) (2018)</td><td>Support scheme for heating and cooling
▪ Law 27-424: Distributed generation from renewable sources (2018)
▪ Regulation of solar thermal heaters (Resolution 520/2018) (2018)
▪ Use of thermal solar thermal energy in social housing (bill)</td><td></td><td></td></tr>
<tr><td></td><td>Minimum energy performance and equipment standards for appliances
▪ Resolution 319/99 setting up an energy labelling scheme for appliances (1999, amended various times)
▪ National Programme for a Rational and Efficient Use of Energy - PRONUREE (2007)
▪ Law 26.473 prohibiting the sale of incandescent light bulbs (2010)
▪ Efficient Public Lighting Plan (Resolution 84-E/2017)
▪ Law 13.059 (province of Buenos Aires) which promotes thermal insulation of all private and public buildings for human use.
▪ Law 4458 (City of Buenos Aires): establishes thermal air-conditioning regulations in the construction of buildings</td><td>Support scheme for hot water and cooking
▪ Use of thermal solar thermal energy in social housing (bill)</td><td></td><td></td></tr>
<tr><td></td><td></td><td>Sustainability standards for biomass use
(none)</td><td></td><td></td></tr>
<tr><td colspan="4">Energy and other taxes
▪ Tax reform on fuel consumption (“carbon tax”) - Law 27.430 (2017)</td><td></td></tr>
<tr><td colspan="4">Fossil fuel subsidies
• Funds that subsidise the consumption of natural gas and LPG at residential level (Laws 25.565 and 26.020)</td><td></td></tr>
</table>

No policies currently exist and a similar policy gap exists in all other countries

No policies currently exist however Argentina could adopt policies from other countries

Existing and planned policies in Argentina

There is to date no comprehensive policy or sector strategy to reduce emissions in the buildings sector in Argentina. However, the government has taken steps to reduce emissions through energy efficiency measures such as energy labelling and energy performance standards. Until

recently, energy subsidies (including subsidies for gas and electricity consumption) were high and few incentives were in place to encourage a switch to renewable sources of energy.

Major building regulations and codes

Under **Decree 140/2007** (Ministry of Justice and Human Rights, 2007), the government declared the rational and efficient use of energy to be a matter of national interest and created the **National Programme for a Rational and Efficient Use of Energy (PRONUREE)**. The PRONUREE objective is to set a framework for an efficient use of energy across sectors, including industry, buildings, and transport. For buildings, the decree introduces the **Energy Efficiency Programme in Public Buildings (PROUREE)**, which defines actions, regulations and codes in public buildings at the national level. The programme aims to reduce energy consumption in public buildings by changing consumption behaviours, mainly regarding the use of air conditioning.

The PRONUREE programme also sets up **voluntary energy labelling for buildings** to categorise residential buildings based on their energy consumption (Ministerio de Energía y Minería, 2018). Energy labelling enables consumers to take energy efficiency into consideration when selling and purchasing a house. The objective of the labelling scheme is to set a norm to quantify energy efficiency in households that promotes investment and development of efficiency measures at the residential level. The government has set up pilot projects, starting with the city of Rosario in 2017, that aim to validate the efficiency norms to apply them as public policies at national level. Legislation related to the construction of buildings falls under the jurisdiction of municipalities, which underscores the relevance of these pilot projects at a city level.

In particular, Buenos Aires' codes set parameters in terms of thermal isolation in the construction of buildings (MAyDS & MINEM, 2017), looking for a reduction of energy consumption highly driven by heating fuelled with natural gas. The fact that Buenos Aires building codes are a reference for many other cities highlights their relevance at a country level.

The *Sustainable Housing Manual* provides guidelines to support the sustainable construction and energy efficiency in residential buildings and neighbourhoods developed as part of the National Housing Plan (MIOPV, MSAyDS, & Secretaria de Energia, 2019). Similarly, social housing in Argentina is regulated with a set of norms for minimum efficiency standards in design, construction and equipment.

In 2018, the government launched the project **Energy Efficiency and Renewable Energy in Social Housing (Resolution 423/18)** to reduce GHG emissions by decreasing energy consumption in social housing (Ministry of Environment and Sustainable Development of Argentina, 2018). The project plans to build 128 houses between 2019 and 2020 that are expected to consume 32% less energy compared to previous reference houses (SAyDS, 2018b). Additionally, a bill to promote solar water heaters as part of the social housing programme is under discussion (Cámara de Diputados, 2018).

Policies to encourage the use of renewables in the building sector are limited. In 2017 the government issued **Law 27.424** (Government of Argentina, 2017a) to encourage small-scale electricity users (residential and commercial) to produce their own energy with renewable resources. Self-consumption of electricity is encouraged through a net-metring structure, in which consumers can sell their excess electricity generated with renewable sources to the grid. These incentives are implemented by means of the Distributed Renewable Generation Fund (FODIS), which facilitates loans, lower interest rates, and encourages R&D.

For consumers not connected to the national grid, the Ministry of Energy and Mining has implemented a strategy to electrify off-grid households with renewable energy with the **Renewable Energy in Rural Markets (PERMER)** project since 2016, mainly for solar panels and wind turbines.

While the Argentinian government has made significant progress on reducing consumption and production-related subsidies in recent years (OECD/IEA, 2019), there are still subsidies for the

use and production of natural gas. After declaring a state of emergency in the power sector in 2015, the government started to increase electricity tariffs for consumers. After three years of periodic increases of the electricity tariffs, the subsidies have decreased from 90% in 2015 to 30% in May 2018. Some changes have been implemented for natural gas tariffs as well (Clarin, 2018). Only socioeconomically vulnerable groups still benefit from highly subsidised tariffs. The **Laws 25.565 and 26.020** establish subsidies for residential consumers of natural gas and LPG (Government of Argentina, 2002, 2005). maintaining government spending for natural gas subsidies relatively high (OECD/IEA, 2019). In addition, the new incentive programme for tight gas and shale gas producers in the Vaca Muerta formation provides continued support for natural gas exploration until at least 2021.

Appliances

One of the first energy efficiency policies in the buildings sector was established in **Resolution 319/99** (Secretary of Industry, Commerce and Mining, 1999)**,** which sets up an energy labelling scheme for domestic appliances. This policy still forms the basis for the current labelling scheme, although it has since been amended various times. The government has complemented the labelling scheme and the guidelines defined in **PRONUREE** with **Minimum Energy Performance Standards (MEPS)** for appliances. The list of appliances for which both mandatory labelling and MEPS are applicable includes fridges and freezers, air conditioners, washing machines and incandescent lamps. A second set of appliances is subject to mandatory labelling but not to MEPS, including TVs, microwaves and electric water heaters. Finally, only voluntary labelling is applied to a third set, including non-electric heating appliances (Secretaría de Energia, 2018).

Under **Law 26.473** (Government of Argentina, 2008), the Argentinian government has forbidden the import and commercialisation of incandescent lamps for residential use since 2011. The objective is to achieve 100% of residential lighting with LED technology by 2030 (MAyDS & MINEM, 2017). **Resolution 84-E/2017** (Ministry of Energy and Mining, 2017b) established an **Efficient Public Lighting Plan (PLAE)** to install more efficient technologies (i.e. LED) in public buildings. It is estimated that this measure could lead to a 50% savings with respect to the current electricity consumption for lighting in public buildings.

The National Action Plan on Energy and Climate Change considers tightening the energy performance standard so that 70% of the domestic appliances have the highest efficiency ratings (i.e. A3+ and A5+) by 2030. Specifically regarding water heaters, the non-binding target considers the implementation of a minimum efficiency standard "A" for new water heaters starting from 2019, reaching a 100% of heaters meeting this standard by 2030 (MAyDS & MINEM, 2017).

The Argentinian government has placed a special emphasis on soft policy measures to promote energy efficiency, particularly through education. The sub-Secretariat of Renewable Energy and Energy Efficiency has published a National Strategy for Education on Energy Efficiency. One of the key goals is to include training on energy efficiency at all levels of compulsory education in Argentina and to promote training on energy efficiency in relevant university-level studies.

2.3.3 Comparison of recent developments and projections to benchmarks

2.3.3.1 **Actionable indicator No.5:** All new buildings fossil free and near zero energy by 2020

Argentina is unlikely to meet the benchmark of all new buildings being fossil free and near zero energy by 2020, although progress has been made in terms of energy efficiency. Argentina prioritises energy efficiency measures as key drivers to reduce the GHG emissions in the building sector. The *Sustainable Housing Manual* constitutes a first step to establish guidelines encouraging new buildings (co-)financed by the Secretariat of Housing to reduce GHG emissions thanks to more efficient design, construction and use of public housing. However, the

manual's scope does not cover all new buildings and does not specify the level of ambition regarding its implementation.

An indicative modelling exercise in preparation of the 3rd National Communication using 1996 IPCC Guidelines suggests a continuous increase of GHG emissions in the residential sector between 2012-2030 and reduction opportunities from demand-side measures as shown in Figure 15, mainly through the adoption of heat pumps and more efficient water heating tanks (Secretariat of Environment and Sustainable Development, 2015). However, considering the increase in emissions in residential and commercial building sectors since 1990 these measures alone will not steer the sector to meet the benchmark by 2020 and beyond without more ambitious buildings sector policies promoting fossil-free and near-zero energy buildings.

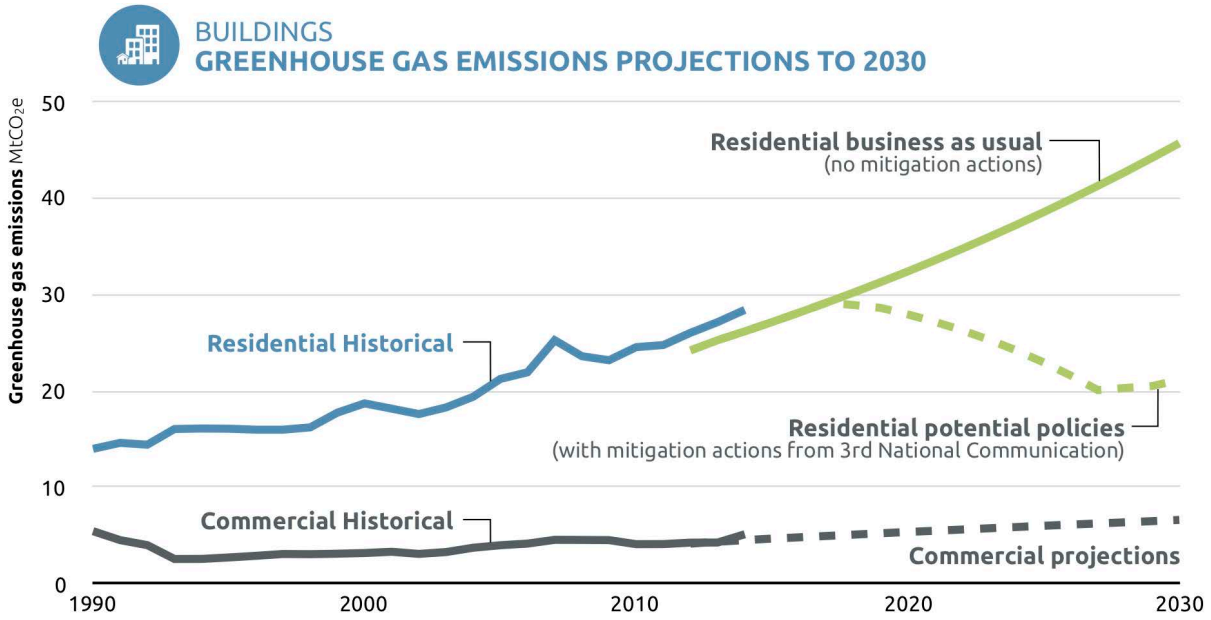


Figure 15: Historical GHG emissions in the residential and commercial buildings sectors for 1990-2014 (Ministry of Environment and Sustainable Development, 2017a) *and GHG emissions projections for 2012-2030 with 2012 as a reference year* (Secretariat of Environment and Sustainable Development, 2015). *The projections are based on an indicative modelling exercise in preparation of the 3rd National Communication using 1996 IPCC Guidelines. Please note that this indicative modelling exercise is not official information submitted by Argentina to the UNFCCC; it uses 1996 IPPC Guidelines and differs from latest official inventory data prepared using 2006 IPCC Guidelines.*

The building emissions intensity per capita in Argentina, incl. electricity-related emissions, increased by 45% between 2004 and 2014 and reached 1.04 tCO_2e/cap in 2014 (see left graph in Figure 16). This increase occurred after a period with relatively stable emission levels of around 0.65 tCO_2e/cap between 1990 and 2003. This can be partially explained by an increasing number of households in the country leading to higher energy consumption per capita in the residential housing sector. Figure 16 (right graph) displays the residential construction activity to illustrate the correlation with increasing building emissions intensity per capita. Despite these recent developments, Argentina currently remains below the Paris-compatible benchmark of maximum 1.1 tCO_2e/cap emissions intensity by 2020 (Wouters et al., 2016). However, a continuation of the increasing trend in the last decade could move Argentina away from this benchmark by 2020 and thereafter if no further climate actions will be adopted in the sector.

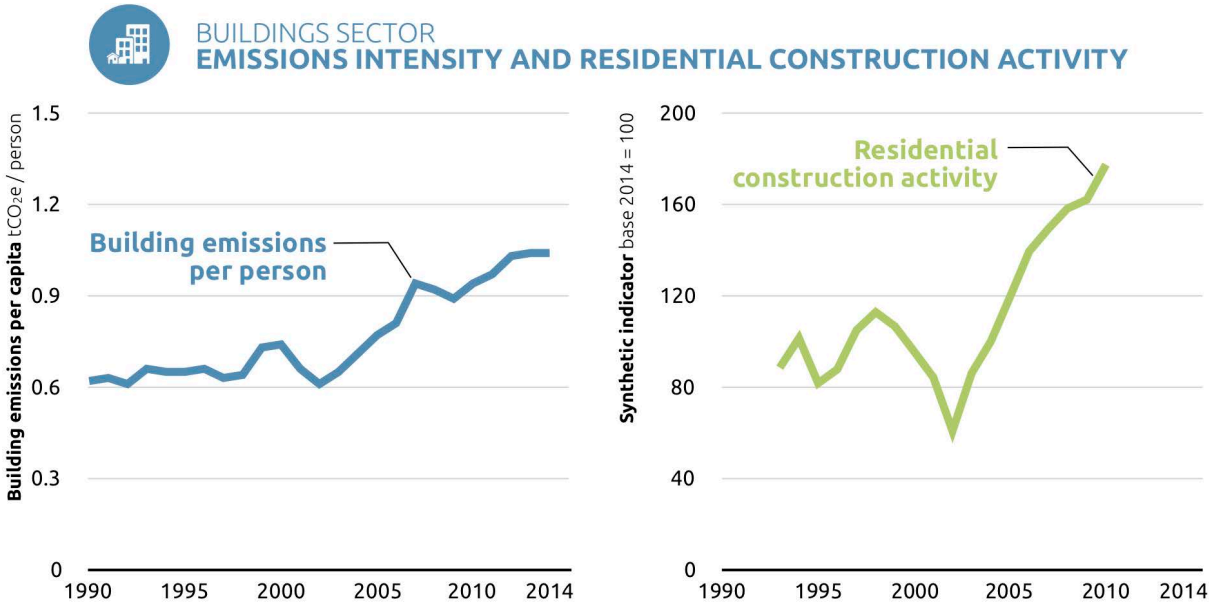


Figure 16: Buildings emissions intensity per capita in the residential building sector for 1990-2014 (left graph), including emissions from electricity and heat consumption allocated to residential buildings sector (Ministry of Environment and Sustainable Development, 2017a) *and synthetic indicator for residential construction activity in residential sector for 1990-2015 (right graph) (IERIC, 2016).*

Argentina has no broader regulatory framework or roadmap to trigger the construction of fossil free and near zero energy buildings. Currently, the construction of sustainable buildings in Argentina is mostly driven by social housing programmes that follow energy efficiency standards and voluntary certification that encourages the private sector to engage in efficient buildings. The learnings from both policy initiatives can provide insights for a future regulatory framework for housing and buildings.

As the sector is a high consumer of energy, mainly from natural gas, the combination of electrification of several appliances and an increasing participation of low-carbon technologies for electricity generation present great potential to meet the target of net zero buildings. This is however unlikely to occur by 2020 considering the lack of policies.

2.3.3.2 **Actionable indicator No.6:** Increase building renovation rates from <1 to 3% by 2020 for non-OECD countries

Argentina will very likely miss the benchmark to increase building renovation rates up to 5%/year by 2020. Beyond government efforts to implement energy efficiency measures in targeted buildings (e.g. public buildings), further regulation and incentives are required to extend the scope of policies to residential buildings.

Experts suggest that deep improvements measures, such as thermal isolation of residential buildings, are some of the most impactful actions to improve energy efficiency in the buildings sector in Argentina, and consequently reduce GHG emissions (Gil & Prieto, 2013).

At a national level, renovation in buildings is mainly supported with a soft credits programme for the acquisition of efficient materials for social housing. The main challenges for thermal isolation are the lack of financial resources to undertake national-wide actions in the sector and the subsidised prices of electricity and natural gas that make savings from renovation measures insufficient to justify their costs (MAyDS & MINEM, 2017). While the Argentinian government has made significant progress on reducing consumption and production-related subsidies in recent years (OECD/IEA, 2019), there are still subsidies for the use and production of natural gas

There is no broader strategy or policy package to enhance the energy performance of buildings beyond individual measures such as the labelling scheme, educational initiatives and policies in

public buildings and social housing. Most notably, there is no building code at a national level and there are no financial incentives in place to encourage renovating houses to more efficient standards.

2.3.4 Conclusion

The use of more efficient appliances by themselves will not enable Argentina to keep below a Paris-compatible pathway of maximum 1.1 tCO2e/cap emissions intensity in 2020 and thereafter. The building sector in Argentina has made some progress in terms of energy efficiency, most of it driven by minimum performance standards for appliances.

Policies in the building sector in Argentina do not include measures with greater and longer-term impact such as electrification or renovation of existing buildings, which are needed to achieve the larger mitigation potential of the sector. By including the issue of sustainable construction as part of agenda in the national planning, Argentina has made improvements in the construction guidelines for new buildings. Renovation of existing buildings and mandatory guidelines to construct zero-energy buildings after 2020 are still missing.

Argentina faces significant challenges to conduct a large-scale renovation of the building stock. The electrification of the building sector in parallel with a decreasing fossil share in electricity generation will support the long-term decarbonisation the building sector.

2.4 Industry sector

In 2014, Argentina's direct emissions from the industry sector (i.e. emissions from industrial processes and fossil fuel combustion in the sector but excluding emissions related to electricity consumption) were responsible for 10% of total emissions, including LULUCF. Between 1990 and 2014, direct GHG emissions from industry in Argentina increased from 24 $MtCO_2e$ to 38 $MtCO_2e$ (Ministry of Environment and Sustainable Development, 2017a). Over this period, activity-related GHG emissions increased by 74%, while energy-related emissions increased by 43%. The largest share of emissions in the sector (38%) was produced by the iron and steel industry. The industry sector is the smallest contributor to energy-related emissions. Table 10 summarises Argentina's progress on the most important steps to decarbonise the industry sector.

Table 10: Progress on the most important steps in the industry sector to limit temperature increase to 1.5°C

Sector	1.5 °C-consistent benchmark	Projection(s) under current policies	Gap assessment (qualitative)	Policy rating
Industry sector	All new installations in emissions-intensive sectors are low-carbon after 2020, maximise material efficiency	An indicative modelling exercise in preparation of the 3rd National Communication using 1996 IPCC Guidelines suggests that energy-related GHG emissions in the industry sector are expected to increase by 74% in 2030 compared to 2012 levels under a BAU scenario (Secretariat of Environment and Sustainable Development, 2015)	+ Policies to encourage generation and self-consumption of electricity from renewable generation are in place for small industries + Some minor support programmes exist to encourage energy efficiency in small and medium companies - No legally binding efficiency standards or regulation and limited financial support through Fondo Argentino de Eficiencia Energética (FAEE) for deployment of low-carbon technologies - Significant technical and economic challenges to electrify heat-intensive industries - No commercial CCS deployment technologically and financially feasible on a large-scale in the nearby future	

2.4.1 Actionable benchmarks in industry sector

The Climate Action Tracker (CAT) has identified two short-term global benchmarks for the industry sector to limit warming to 1.5°C (Kuramochi et al., 2017):

- All new installations in emissions-intensive sectors need to be zero or low-carbon after 2020 such as zero-carbon steelmaking technologies, including carbon capture and storage (CCS) and material efficiency needs to be maximised.

The following gap analysis compares historical and projected developments in the Argentinian industry sector to this global benchmark without any further adjustment to allow for comparison between countries under analysis. Country specific circumstances will be addressed in the in-depth analysis on scaling up climate action in the following chapters. Please refer to Kuramochi et al. (2017) for a more detailed explanation on each indicator.

2.4.2 Recent policy developments

As of May 2019, Argentina is developing a strategy and supporting policies in the industry sector to strengthen its position on climate change commitments (Ministry of Production and Labor, 2019). Energy efficiency-related measures, circular economy and renewable power generation for industry are some of the few policies currently in place. Table 11 provides an overview of implemented policies that foster the development towards a low-carbon industry in Argentina.

The Argentinian government has promoted policies to develop renewable energies and foster energy efficiency in the industry sector. One of the most significant policies is the renewable quota in the **Renewable Energy Law 27.191** (Gobierno de Argentina, 2015b), which mandates all large-scale electricity users to comply with the national renewable energy targets (8% by 2018 and 20% by 2025). As mentioned in the section on electricity and heating, these users can either do so by purchasing electricity from the wholesale market or by signing third-party power purchase agreements with independent renewable energy producers. The modalities of this measure are laid out in **Resolutions 202/16** and **281-E/2017** (Ministry of Energy and Mining, 2016a, 2017a)**.**

In order to encourage small electricity users (including small-scale industries) to produce their own energy from renewable resources, the government passed a Law in 2017 (**Law 27.424)** to enable net-metering with electricity from renewables (Government of Argentina, 2017a).

In addition to promoting renewable energies in the industry sector, the Ministry of Energy has also sought to promote energy efficiency, although to date only a few policies and programmes are in place. One of these is the **Argentinian Fund for Energy Efficiency (FAEE)**, which among others provides funds for small and medium-size enterprises to perform energy audits and acquire more efficient technologies. The fund is currently under restructuring (MINEM, 2018a).

While subsidies for electricity consumption have significantly decreased over the past few years for all small and medium-sized consumers, the government granted new subsidies to large-scale users in 2017. The **Joint Resolution 1-E/2017** put forward by the Ministries of Energy and Industry grants certain large electricity users in energy-intensive industries a discount of up to 20% on electricity prices for a consumption of up to 15 GWh. The discount is valid until the end of 2019 (Ministry of Energy and Mining, Ministry of Industry, 2017). According to this resolution, new gas project developers (that submitted projects by 30 June 2017) can benefit from a guaranteed price of 7 USD/MMBtu until the end of 2018 (Ministry of Energy and Mining, 2016c; Télam, 2016).

At the same time, the Argentinian Ministry of Energy seeks to promote energy management systems for industrial companies. According to **Provision 3/2018** (Ministry of Energy and Mining, 2018), companies that benefit from reduced electricity prices under Resolution 1-E/2017 will have to implement the ISO norm 50001 on energy management systems. These companies would for example have to develop a plan of action for energy management, establish targets for energy performance, and define indicators to monitor progress.

Table 11: Overview of existing and planned climate change policies in the industry sector in Argentina

OVERVIEW OF EXISTING, PLANNED AND POTENTIAL CLIMATE CHANGE POLICIES FOR THE INDUSTRY SECTOR IN ARGENTINA				
Changing Activity	**Energy efficiency**	**Renewables**	**CCS or fuel switch**	**Non-energy**
Strategy for material efficiency (none) *The Industrial National Action Plan (currently under development) includes a measure on Circular Economy.*	**Support for energy efficiency in industrial production** ▪ National Programme for a Rational and Efficient Use of Energy – PRONUREE (2007) ▪ Provision 3/2018 (2018, as part of Joint Resolution 1-E/2017) ▪ Energy efficiency bill, incl. the Industry sector (under development)	**Support schemes for renewables** ▪ Law 27.191 on renewable energy (2015) ▪ PPAs available for renewables. Resolution 202/16 (2016) ▪ Long-term renewable energy market (MATER). Resolution 281-E/2017 (2017) ▪ Law 27-424: Distributed generation through renewable sources (2018)	**CCS support scheme** (none)	**Landfill methane reduction** (none)
	Energy reporting and audits ▪ Argentinian Fund for Energy Efficiency ▪ Provision 3/2018 (2018, as part of Joint Resolution 1-E/2017)	**Sustainability standards for biomass use** (none)		**Incentives to reduce CH4 from oil and gas production** (none)
	Minimum energy performance and equipment standards (none)			**Incentives to reduce N2O from industrial processes** (none)
				Incentives to reduce fluorinated gases (none)
Overarching carbon pricing scheme or emissions limit (none)				
Energy and other taxes ▪ Tax reform on fuel consumption ("carbon tax") - Law 27.430 (2017)				
Financial Support Schemes for Sustainable Development (none)				
No fossil fuel subsidies ▪ Resolution 74/2016 - Stimulus Program for New Natural Gas Projects (2016)				

No policies currently exist and a similar policy gap exists in all other countries

No policies currently exist however Argentina could adopt policies from other countries

Existing and planned policies in Argentina

2.4.3 Comparison of recent developments and projections to benchmark

2.4.3.1 **Actionable indicator No.7:** All new installations in emissions-intensive sectors are low-carbon after 2020, maximise material efficiency

Argentina is unlikely to meet the benchmark that all manufacturing capacity installed from 2020 onwards is to be low-carbon due to a lack of binding policies that impose energy efficiency in the industry sector. Energy efficiency measures in the industry sector is limited to voluntary private sector initiatives and funding from the government to use more efficient technologies. However, there are no minimum efficiency requirements in the industry sector that guide new installations to be low-carbon after 2020.

As of 2014, energy-related GHG emissions in the industry sector has increased by 43% compared to 1990 levels (Ministry of Environment and Sustainable Development, 2017a). An indicative modelling exercise in preparation of the 3rd National Communication using 1996 IPCC Guidelines suggests a steeper increase of GHG emissions between 2012-2030 if no mitigation policies are implemented. Supply-side policies such as the substitution of carbon-intensive fuels (e.g. coal, oil) for natural gas or biomass when possible could smoothen the escalation of GHG emissions in the future as shown in Figure 17 (Ministry of Environment and Sustainable Development, 2017a; Ministry of Production and Labor, 2019). However, this measure alone will not steer the sector to meet the benchmark by 2020 and beyond without more ambitious sector policies promoting low-carbon industry installations.

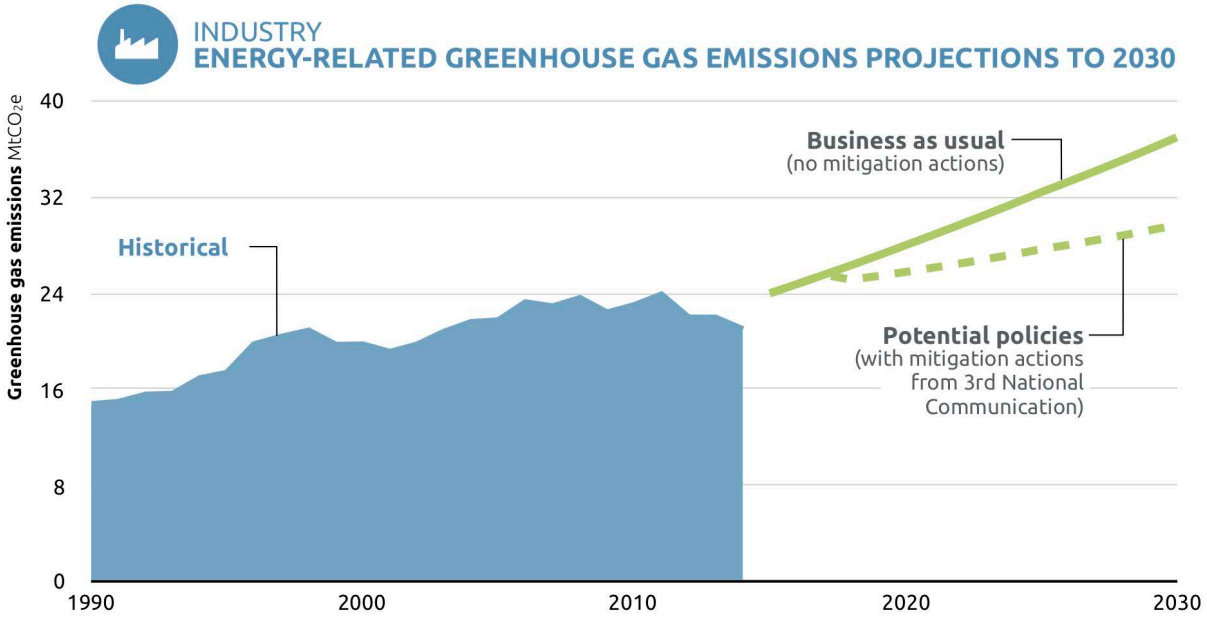


Figure 17: Historical energy-related GHG emissions in the industry sector for the period 1990-2014 (Ministry of Environment and Sustainable Development, 2017a) and projections for the period 2015-2030 (Secretariat of Environment and Sustainable Development, 2015). The projections are based on an indicative modelling exercise in preparation for the 3rd National Communication using 1996 IPCC Guidelines. Please note that this indicative modelling exercise is not official information submitted by Argentina to the UNFCCC; it uses 1996 IPPC Guidelines and differs from latest official inventory data prepared using 2006 IPCC Guidelines.

The climate change action plan in the industry sector, currently under development by the Secretariat of Environment and Sustainable Development (SAyDS) and the Ministry of Production and Labour, suggests a reduction in GHG emissions by 6.4 $MtCO_2e$ in 2030, which could increase to 9.3 $MtCO_2e$ if additional technological and financing support is received (Ministry of Production and Labor, 2019). The mitigation measures addressed in the action plan include energy efficiency, the development of renewable energy, gas capture and circular economy.

Industry emissions intensity in Argentina has been stable over the last two decades as shown in Figure 18. The stable participation of the industry sector in the national economy — accounting from 17% to 19% of the GDP in the last 15 years (Indec, 2018) — and the few policies in the sector suggest that no drastic changes in the direction of Paris compatibility are expected in the industry emissions intensity unless energy supply is significantly decarbonised. Nonetheless, the potential to reach a cleaner energy supply in the power sector presents opportunities to decarbonise electricity-intensive industries. Heat-intensive industries can seize these opportunities once technical challenges to provide industrial heat through electrification are overcome, which is unlikely to occur before 2020.

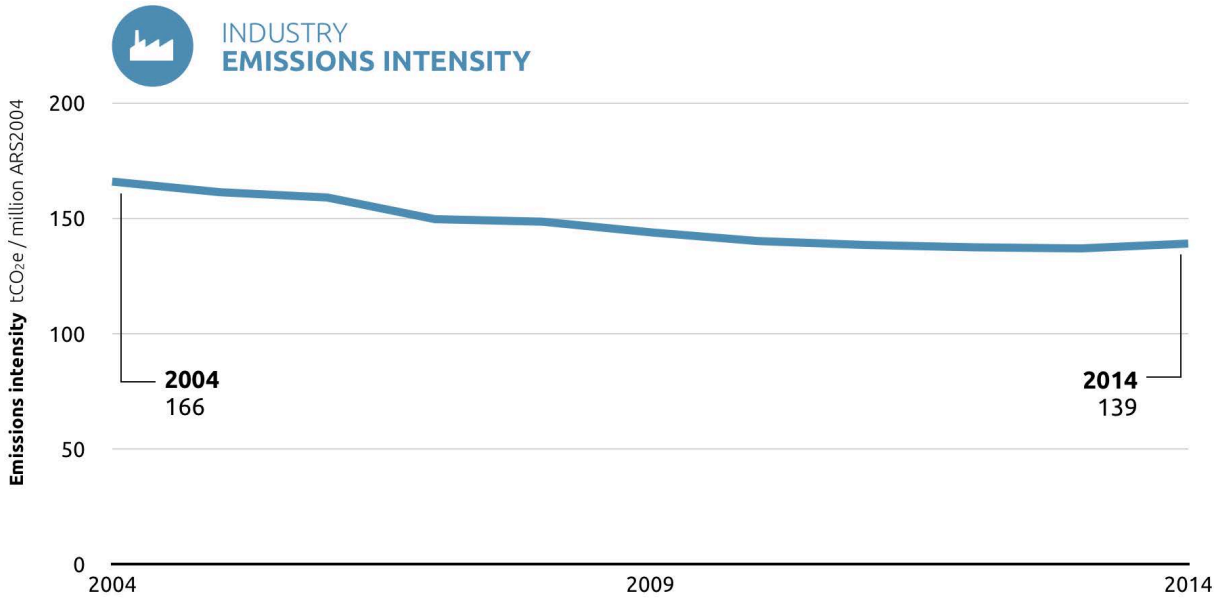


Figure 18: Industry emissions intensity in Argentina for 2004-2014 (tCO2/ million Argentinian pesos at 2014 level), with industry emissions including the following categories: Electricity-related emissions in industry sector (1.A.1.a), fuel combustion in industries (1.A.2), Industrial processes (2) and industrial water waste (4.D.2) (Ministry of Environment and Sustainable Development, 2017a)

2.4.4 Conclusion

Argentina lacks binding policies that guide the industry sector to be compatible with the 1.5°C benchmark of only having zero and low-carbon installations in emissions intensive sectors after 2020 and maximising material efficiency in industrial processes. As of end of 2018, no legislation had been adopted that makes the deployment of low-carbon technologies mandatory. Beside policies and economic incentives supporting energy efficiency measures and use of renewable energy, Argentina has not implemented minimum energy performance standards in the industry sector. The use of CCS technology in the industry sector has not been included in development plans due to its economic and technological unfeasibility.

Argentina has the potential to decarbonise electricity-intensive industries by leveraging a cleaner power supply in the next decade. The subsidies in the electricity tariff for industrial consumers is so far the only incentive to increase electricity use instead of fossil fuel use in the sector. However, heat-intensive industries such as iron and steel are responsible for most of the emissions in the industry sector (Ministry of Environment and Sustainable Development, 2017a). These industries face major challenges to electrify their processes, hindering their decarbonisation potential.

2.5 Agriculture and forestry

The agriculture and forestry sectors are of huge importance in Argentina, both for the economy as well as in terms of GHG emissions (39.2% share in total emission in 2014 according to the GHG inventory) (Ministry of Environment and Sustainable Development, 2017a). The contribution in terms of value added to the GDP has decreased over the last decade and is at about 5% today, above world average of 3.5% (World Bank, 2018). On the other hand the land area used for agriculture has increased to above 54% in Argentina (World Bank, 2018). Agricultural products are a critical export good, particularly emission-intensive beef. Argentina is working on increasing forest plantations for commercial use. This report covers regulation and policies related to the use of biofuels in the transport sector section (see Section 0).

Table 12 summarises Argentina's progress on the most important steps to decarbonise the LULUCF and commercial agriculture sectors to limit temperature to 1.5°C.

Table 12: Argentina's progress on the most important steps in the LULUCF and commercial agriculture sectors to limit temperature increase to 1.5°C

Sector	1.5 °C-consistent benchmark	Projection(s) under current policies	Gap assessment (qualitative)	Policy rating
LULUCF	Reduce emissions from forestry and other land use to 95% below 2010 by 2030, stop net deforestation by 2025	• An indicative modelling exercise in preparation of the 3rd National Communication using 1996 IPCC Guidelines suggests that projected emissions in 2030 from land use sector lead to a reduction of 68% below 2010[10]	- Deforestation remains an issue in part due to pressure from agriculture + Commercial forest plantations growing and certain policy developments to promote reforestation such Law 27.487 to support investments in forests (previously law 25.080)	
Commercial Agriculture	Keep emissions in 2020 at or below current levels, establish and disseminate regional best practice, ramp up research	• Emissions projected to increase due to increasing agricultural production (for export). • An indicative modelling exercise in preparation of the 3rd National Communication using 1996 IPCC Guidelines suggests an emission increase in the sector by 34% between 2012 and 2030[11]	+ There are activities around climate smart agriculture and crop rotation, but there is no comprehensive policy framework +/- Emissions intensity of agricultural production has decreased over the last two decades, due to improved farming methods but also economies of scale. This is driven by the need to use most efficient production practices to remain competitive on the global market.	

2.5.1 Actionable benchmarks in agriculture and forestry

The Climate Action Tracker (CAT) has identified two short-term global benchmarks for the agriculture and forestry sector to limit warming to 1.5°C (Kuramochi et al., 2017):

- Emissions from forestry and other land use needs to be reduced to 95% below 2010 by 2030 and a stop of net deforestation to be achieved by 2025.
- Emissions from commercial agriculture in 2020 need to be kept at or below current levels with the simultaneous establishment and dissemination of regional best practice and a ramp up of research.

The following gap analysis compares historical and projected developments in the Argentinian LULUCF and commercial agriculture sectors to these global benchmarks without any further adjustment to allow for comparison between countries under analysis. Country-specific circumstances will be addressed in the in-depth analysis on scaling up climate action in the

10 Please note that this indicative modelling exercise is not official information submitted by Argentina to the UNFCCC; it uses 1996 IPPC Guidelines and differs from latest official inventory data prepared using 2006 IPCC Guidelines.

11 Please note that this indicative modelling exercise is not official information submitted by Argentina to the UNFCCC; it uses 1996 IPPC Guidelines and differs from latest official inventory data prepared using 2006 IPCC Guidelines.

following chapters. Please refer to Kuramochi et al. (2017) for a more detailed explanation on each indicator.

2.5.2 Recent policy developments

Argentina has few climate strategies and policies in the agriculture and forestry sectors, and these have been implemented to a variable degree. Table 13 provides an overview of the implemented and planned sectoral climate policies with the potential to affect GHG emissions directly.

Table 13: Overview of existing and planned climate change policies in the agriculture and forestry sector in Argentina

OVERVIEW OF EXISTING and PLANNED CLIMATE CHANGE POLICIES FOR THE AGRICULTURE AND FORESTRY SECTORS IN ARGENTINA				
Changing Activity	**Energy efficiency**	**Renewables**	**Nuclear or CCS or fuel switch**	**Non-energy**
Standards and support for sustainable agricultural practices and use of agricultural products ▪ Resolution 174/2018 – National Programme for Good Agricultural Practices in Fruit and Vegetable Products (2018) ▪ Resolution 120/2011 -- National Programme on Smart Agriculture (2011) ▪ Good Practices Network (Red de Buenas Prácticas Agrícolas) - Public/private initiative to define and support good practice ▪ Decrete 246/2019 -- National plan for avoidance of food losses and waste (2019) ▪ PROBIOMASA – Project for the promotion of bioenergy (2013)				
Incentives to reduce CO_2 emissions from agriculture ▪ Law 26.562 – Law for minimum environmental protection budgets to control [agricultural] burning activities (2009)				
Incentives to reduce CH_4 emissions from agriculture (none)				
Incentives to reduce N_2O emissions from agriculture (none)				
Incentives to reduce deforestation or support for afforestation/reforestation ▪ Law 26.331 - Minimum Budgets for Environmental Protection of Native Forests – *Ley de Bosque Nativo* (2007) ▪ Law 27.487 (superseding Law 25.080) – Promotion of forestry activities and reforestation ▪ ForestAR 2030 Argentina (2018, revised in 2019) – Sustainable forestry strategy for 2030				

No policies currently exist and a similar policy gap exists in all other countries

No policies currently exist however Argentina could adopt policies from other countries

Existing and planned policies in Argentina

The agriculture and forestry sectors are two of the highest emitting sectors. An indicative modelling exercise in preparation of the 3rd National Communication using 1996 IPCC Guidelines suggests that emissions from agriculture alone are expected to make up 40% of total annual GHG emissions by 2030.

The most recent document setting out an overview of climate policy priorities in the forestry sector is the **Forests and Climate Change Action Plan** (Ministry of Environment and Sustainable Development of Argentina, 2019). The document does not set out a strategy but indicates the actions the government intends to take and develop over the following years, namely conservation, restoration and recovery, sustainable forest management and silvopastoral activities, avoided deforestation and prevention of forest fires.

In terms of concrete policy measures there are a few laws that aim to reduce deforestation and protect existing forestry. They primarily target native forestry; according to the 2014 Biennial Update Report emissions from deforestation of native forests represent close to 16% of total emissions.

The most important of these laws is **Law 26.331** on Minimum Budgets for Environmental Protection of Native Forests (also known as the "Law of Native Forests"), which defines budgets for conserving and restoring native forests and requires each province to categorise forests depending on their value in terms of conservation (Government of Argentina, 2007). The law also establishes the **National fund for enriching and conserving native forests** that disburses funds to provinces that protect native forests. However, the law has only been partial implemented. For example between 2010 and 2015, only 8.5% of the total targeted budget for the conservation of native forests was spent (Fundación Vida Silvestre, n.d.). In 2018 the Ministry of Environment and Sustainable Development published a **National plan for the restoration of native forests** that also falls under Law 26.331, with the proposed target to restore 20,000 ha of native forest annually until 2030 (Ministry of Environment and Sustainable Development, 2018).

Argentina has also recently implemented the law on forest (**Law 25.080**, extended and revised in January 2019 by **Law 27.487**) as well as the ForestAR programme to support investments in forest cultivation (Government of Argentina, 2018). To prevent forest degradation due to agricultural burning, the Argentinian government issued **Law 26.562** setting minimum budgets to protect endangered forests (Ministry of Environment Argentina, 2009).

The National Agriculture and Climate Change Plan provides an overarching direction for the implementation of the NDC, also for agriculture, with three main mitigation areas: Increase the forested area, improve the balance of crops, and use biomass as an energy source. Further measures are under review (Republic of Argentina, 2019). Law 27.487/Law 25.080 support the first measure, the PROBIOMASA programme supports the third measure. There are a few more measures and policies promoting sustainable agriculture with climate benefits, for example the **National Programme for Good Agricultural Practices in Fruit and Vegetable Products** (Ministry of Agroindustry, 2018) or **Resolution 120/2011**, with which Argentina established the Programme for Smart Agriculture (Ministry of Agriculture Livestock and Fishing, 2011). Climate smart agricultural practices are in some cases already used by farmers, particularly no-tillage is wide spread (World Bank, CIAT, & CATIE, 2014).

2.5.3 Comparison of recent developments and projections to benchmarks

2.5.3.1 **Actionable indicator No.8:** Reduce emissions from forestry and other land use to 95% below 2010 by 2030, stop net deforestation by the 2020s

Emissions from the land use sector in Argentina peaked in 2010. An indicative modelling exercise in preparation of the 3rd National Communication using 1996 IPCC Guidelines suggests that projected emissions from the sector lead to a reduction of 68% below 2010 by 2030 (Secretariat of Environment and Sustainable Development, 2015), and thus meet the Paris-compatible benchmark of reducing emissions to 95% below 2010. However, data uncertainty is particularly high in this sector. The data source mentioned above uses 2012 as the base year. More recent inventory data already shows a faster than expected decline in the sector's emissions between 2012 and 2014, driven by a decrease in deforestation. If this trend continues over a longer period, Argentina could still meet the benchmark.

The share of forests of total land area has decreased continuously from about 13% in 1990 to about 10% in 2016. The data also reveals that an increasing share of the remaining forest land is commercial plantations (FAOSTAT, 2018). According to the National Forests and Climate Change Action Plan, the annual deforestation rate has however decreased from 242.000 ha in 1990 to 185.606 ha in 2014; particularly the decrease of deforestation in recent years is also driven by the implementation of Law 26.331 (Ministry of Environment and Sustainable Development of Argentina, 2019).

Remaining areas of natural forests are protected under legislation outlined above, but issues with illegal logging persists. The expansion of pastures and commercial agriculture is one cause of deforestation in Argentina. A large share of the new agricultural land is used for growing soy

for animal feed (FAO, 2016). The National Forests and Climate Change Action Plan mentions the expansion of agriculture in general as a reason for deforestation and degradation of forests, along with population growth and urban expansion, the lack of valuation of social and environmental services of forests and forest fires (Ministry of Environment and Sustainable Development of Argentina, 2019).

Argentina has increased forest plantations for commercial use (Política Forestal Argentina, 2018). However, the commercial plantations for timber production cannot fully balance the loss of natural forest area in terms of emissions, nor in terms of other environmental services, such as biodiversity.

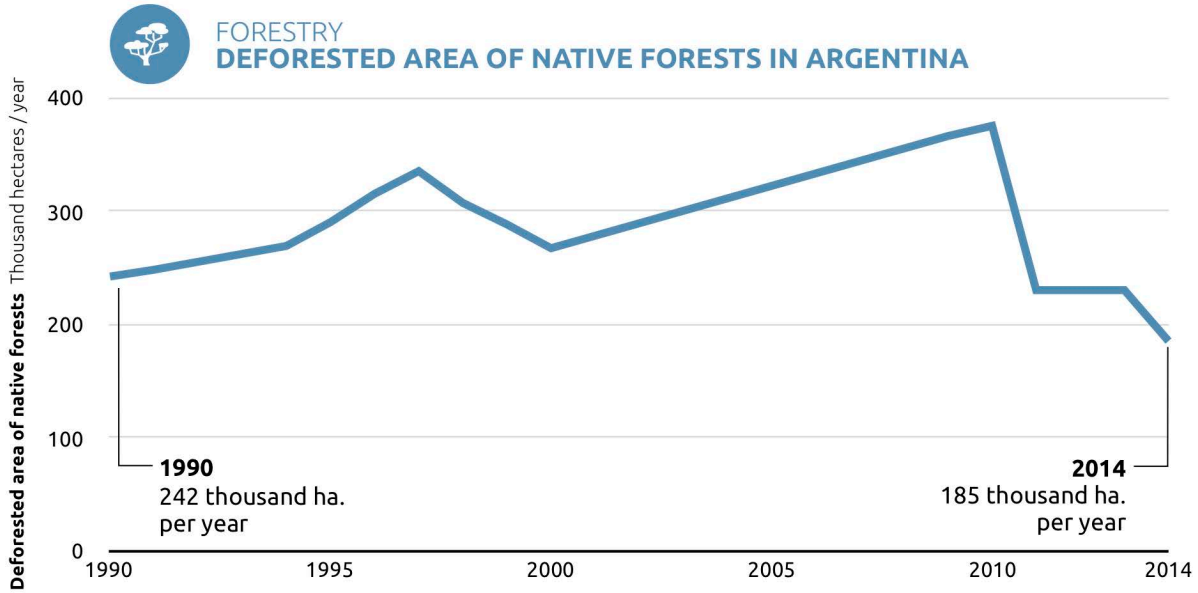


Figure 19: Deforested area of native forests (in thousand hectares per year) in Argentina between 1990-2014 (Ministry of Environment and Sustainable Development of Argentina, 2019)

2.5.3.2 **Actionable indicator No.9:** Keep emissions in 2020 at or below current levels, establish and disseminate regional best practice, ramp up research

An indicative modelling exercise in preparation of the 3rd National Communication using 1996 IPCC Guidelines suggests that emissions from agriculture are set to increase further (Secretariat of Environment and Sustainable Development, 2015). The main driver of this development is the targeted increase in agricultural production, especially meat, soy and wheat destined for export. Domestic meat consumption is projected to remain stable at levels more than double the world average (Climate Action Tracker, 2018a).

If the world moved to a 1.5°C pathway, meat consumption globally would decrease drastically, also implying reduced exports from Argentina (FAO, 2017) and reduced domestic meat consumption. A switch to healthier and low-emissions diets in line with the Paris temperature goal would entail shifting consumption patterns towards more plant-based diets (Climate Action Tracker, 2018g). Recent analysis shows that on a global level healthy diets by 2050 will require substantial dietary shifts, including a greater than 50% reduction in global consumption of unhealthy foods such as red meat (Willett et al., 2019). Some countries such as China and The Netherlands recently started introducing guidelines to encourage a shift towards more sustainable, plant-based diets (Climate Action Tracker, 2018g). More countries could follow suit soon. Argentina and other countries with an agricultural sector reliant on meat export will have to proactively address these expected changes in global consumption.

Historical emissions intensity has slightly declined since 1990, but has remained mostly stable since 2005 (Climate Action Tracker, 2018a). Some climate smart agricultural activities are already in place and crop rotation is increasingly used. No comprehensive policy package is in place to

initiative a trend shift to decarbonise the sector at this point in time. Argentina will however soon publish its National Agriculture and Climate Change Action Plan, which will include climate change mitigation and adaptation measures (Republic of Argentina, 2019).

2.5.4 Conclusion

The agriculture and forestry sectors are essential to the Argentinian industry and economy. Argentina is increasingly considering climate change and other environmental impacts in its policy making for these sectors. The National Agriculture and the National Forest Climate Action Plans outline main pillars for mitigation and adaptation. The complete halt of deforestation and the transformation of the agriculture sector into a fully sustainable system require additional policies and strong enforcement. This is essential for Argentina not only for environmental reasons, but also to guarantee long-term stability for economic activities in the sectors.

One specific area of concern lies in the impact of cattle ranching. The area needed for grazing and production of animal feed puts stress on forests and is reason for other environmental and social concerns. Exports of agricultural products play an important role in this context. For example, beef exports are expected to further grow in the future (OECD, 2017). However, if the world moved to a Paris compatible pathway, this would also imply a reduction of meat consumption globally.

3 Selection of focus areas for analysis on scaling up climate action

The report prioritises three areas for in-depth analysis of scaling up climate action in Argentina: the electricity supply sector, land-based passenger and freight transport, and the residential buildings sector. This section explains the reasoning for looking further into these three areas, considering the Argentinian national context and country-specific circumstances. Note that the selection of these areas does not indicate that less mitigation action is needed in all other remaining sectors. Relevant literature in the field and most recent emission scenarios clearly indicate that all sectors need to maximise their efforts for 1.5°C Paris Agreement compatibility (Kuramochi et al., 2017). The selection of focus areas for scaling up climate action is based on the following criteria combined with expert judgement by the authors.

i. **GHG emissions:** The relevance of the (sub-)sector in terms of historical and projected future GHG emissions
ii. **Existing gap**: The existing gap between currently implemented and planned policies and 1.5°C compatible benchmark(s)
iii. **Potential for scaling up climate action:** The potential for enhancing climate action given local and global sectoral developments (e.g. decreasing prices for RE technologies, CCS capacities, pending investment in infrastructure)
iv. **Priority in the national discourse:** Priority of the respective (sub-)sector in the national discourse or opportunities to enhance climate action due to recent social, political, or economic developments
v. **Overlaps with other sectors:** The overlap between the (sub-)sector and other sectors relevant for long-term decarbonisation (e.g. CO_2-neutral electricity sector in parallel to electrification trends in the transport or buildings sector
vi. **Co-benefits potential and sustainable development goals:** Potential to realise co-benefits of scaling up climate action in a given country context (e.g. local job development through ambitious renewables deployment or reduction in urban air pollution due to modal shift away from combustion engines) and to link climate action to the country's sustainable development goals

The following sections provide explanation for each sector's selection, also considering the technical feasibility of the research for the sectors (e.g., data availability as a limiting factor).

While this report focuses on the energy sector transition, the agriculture and LULUCF sectors remain outside the scope of this analysis given the availability of data and currently limited coverage in the PROSPECTS Argentina scenario evaluation tool. Given their economic relevance and high emissions levels, additional research will be required to determine sustainable long-term pathways for these sectors. Such pathways ought to consider shifting consumptions patterns worldwide towards more plant-based, healthier and more sustainable diets (Climate Action Tracker, 2018g; Willett et al., 2019).

3.1 Electricity supply sector

This report analyses the Argentinian electricity sector in-depth as the sector scores high on the abovementioned criteria **all abovementioned criteria**. A successful transition towards a zero-emission society requires transformational changes in Argentina's electricity generation, especially because the sector is strongly linked to other demand sectors.

i. **GHG emissions**: The electricity supply sector accounts for around 22% of energy-related emissions in 2014 and 12% of total emissions including LULUCF (Ministry of Environment and Sustainable Development, 2017a). The annual emissions intensity changes from year to year responding to the availability of hydro resources. Gas-based electricity generation remains the main source of emissions in the power sector. The Argentinian government intends to install additional gas capacity in the nearby future and to further

develop the shale gas industry to become the main energy source for national energy supply and exports.

ii. **Existing gap**: While planned targets present an ambitious scenario for the future electricity supply sector, accelerating the growth of renewables requires significant additional efforts. Current targets aim to achieve 20% and 25% of renewables shares (excl. hydro) by 2025 and 2030, respectively. Currently implemented actions would only lead to a 7% renewable share by 2025 (excl. hydro) (CAT, 2018). This lack in progress prevents Argentina from achieving its medium-term targets and is inconsistent with a 1.5°C Paris Agreement compatible emission trajectory for the electricity sector.

iii. **Potential for scaling up climate action**: The Argentinian electricity supply sector shows significant potential for scaling up climate action in the short, medium, and long-term. Excellent conditions for renewables instalments in Argentina (especially for wind and solar technologies in the southern and western part of the country, respectively), sharp cost decreases for renewable technologies globally and domestically, and opportunities for local economic development and job creation constitute promising opportunities for accelerated deployment of renewables. For instance, the RenovAr auction policy has already been successful in driving down average renewable energy costs over the course of three bidding rounds (MINEM, 2018b).

iv. **Priority in the national discourse**: The long-term energy planning for Argentina remains subject to intense cross-sectoral discussions. The discovery of abundant gas reserves in Vaca Muerta and the Government's clear intention to exploit them, drive the discussion on the role of natural gas in the electricity sector and the achievement of existing renewable targets. The socio-economic implications of a power supply sector that is either based on natural gas or renewable energy critically influence public discourse and policy making.

v. **Overlaps with other sectors**: The decarbonisation of the electricity supply sector is needed to successfully undertake ambitious low-carbon electrification efforts in other sectors of the economy. Electrification trends that are vital for successful sectoral transitions in other sectors, such as an increase of electricity mobility in the transport sector, depend on future low-emission electricity supply to effectively reduce overall GHG emissions (Kuramochi et al., 2017).

vi. **Co-benefits potential and sustainable development goals:** The transition towards a predominantly renewables-based electricity generation sector offers significant potential to generate co-benefits. The most significant potentials for co-benefits include job growth in the renewables sector, sustainable local industrial development and innovation, and a reduction of air pollution. Due to the distributed character of renewables, their development also contributes to the progress of regional and rural economies, often affected by high levels of unemployment. The deployment of distributed low-scale renewable technologies also contributes to Argentina's sustainable development goals such as promoting access to affordable, reliable, sustainable and modern energy for all (SDG 7).

3.2 Land-based passenger and freight transport

Land-based passenger and freight transport accounts for 90% of all transport related emissions in Argentina in 2014. This sub-sector has been chosen for in-depth analysis as the sector scores high on **GHG emissions, potential for scaling up climate action**, **existing gap** and **co-benefits potential**. Emissions from the Argentinian road transport sector have been increasing steadily in recent years, which increased the gap to a Paris Agreement compatible emissions pathway. At the same time, novel technological alternatives offer new opportunities for emissions reduction.

i. **GHG emissions:** The road transport sector is the largest source of energy-related emissions and was responsible for more than 26% of energy emissions in 2014 (Ministry of Environment and Sustainable Development, 2017a). Road transport emissions are evenly distributed between passenger and freight transport.

ii. **Existing gap:** Increasing emissions from land-based passenger and freight transport show that currently implemented policies fail to effectively reduce transport-related

emissions. Road transport-related emissions increased by almost 40% between 2004-2014. Decarbonising the road transport sector requires an accelerated uptake of zero-emissions cars, buses, and trucks; an increase of public transport; and substantial modal shifts for both passenger and freight transport. An indicative modelling exercise in preparation of the 3rd National Communication using 1996 IPCC Guidelines suggests that future emissions will significantly increase under the policies that are currently implemented (Secretariat of Environment and Sustainable Development, 2015).

iii. **Potential for scaling up climate action**: Significant cost reductions for batteries and other technological developments pave the way to decarbonise the transport sector through electric mobility (IRENA, 2017). Similarly, an expected cost decrease of hydrogen production will substantiate the shift towards other low-emission transport solutions in passenger and freight transport (Tractebel, 2017).

iv. **Overlap with other sectors:** How electrification trends in the transport sector and the decarbonisation of the electricity supply sector might interact on national and local levels is subject to ongoing academic. While the sustainable electrification of transport relies on zero-carbon electricity generation to effectively reduce emissions, a large electric vehicle fleet may potentially facilitate high renewable energy penetration of the electricity supply sector by serving as a large battery storage.

v. **Co-benefits potential and sustainable development goals**: Interventions in the transport sector that aim to realise an integrated transport planning have multiple co-benefits for public health, life quality and social and economic development. Integrated transport planning and electrified mobility can particularly reduce congestion, severe accidents, and air pollution (Day et al., 2018). The reduction of air pollution can in turn reduce rates of cardiovascular disease, cancer, diabetes and chronic respiratory disease. These co-benefits help Argentina achieve its sustainable development goal, for example SDG 3's provision of healthy lives and well-being for all ages.

3.3 Residential buildings sector

The Argentinian residential buildings sector has been chosen for in-depth analysis as the sector scores high on **existing gap**, **potential to scale up climate action**, and **co-benefits potential**.

i. **GHG emissions:** The residential sector is responsible for 23% of total energy consumption (MINEM, 2016) and 15% of Argentina's total emissions in 2014, including direct energy-related emissions, waste-related emissions and indirect emissions from electricity consumption (Ministry of Environment and Sustainable Development, 2017a). An indicative modelling exercise in preparation of the 3rd National Communication using 1996 IPCC Guidelines suggests that emissions in residential buildings are expected to further increase (Secretariat of Environment and Sustainable Development, 2015).

ii. **Existing gap**: Current policies are not sufficient to enable a transition of the Argentinian residential buildings sector in line with a 1.5°C Paris Agreement compatible emission trajectory (see Section 2 for detailed explanation). Direct energy-related emissions in the residential sector increased by about 46% between 2004-2014 under currently implemented policies (Ministry of Environment and Sustainable Development, 2017a).

iii. **Potential for scaling up climate action**: The consumption of natural gas, mainly for heating and cooking purposes, is responsible for more than half of the total emissions in the residential sector in 2014, including waste-related and indirect emissions from electricity consumption (Ministry of Environment and Sustainable Development, 2017a). Residential buildings can accelerate climate action in the next decades through electrification (e.g. large deployment of heat pumps or induction cooking) and energy efficiency measures, both on the national as well as municipal level. Higher standards for energy performance of newly constructed buildings and higher thermal renovation rates of existing residential buildings stock provide further avenues to accelerate climate action.

iv. **Priority in the national discourse:** Recent policy developments in the residential buildings sector suggest that some first initiatives towards low-carbon residential housing are being prepared. This relates to the introduction of energy efficiency

measures — such as PRONUREE and the *Sustainable Housing Manual* (MIOPV et al., 2019) — and the support for distributed renewable electricity generation in the residential sector (Law 27.424).

v. **Co-benefits potential and sustainable development goals:**

- **Social housing:** Social housing and the transition to low-emission buildings initiatives offer great synergies to achieve several social, health, and economic benefits while initiating the transition towards a low-emission residential buildings sector. These co-benefits directly contribute to a range of sustainable development goals, particularly to make cities and human settlements inclusive, safe, resilient and sustainable (SDG 11).
- **Economic savings and job creation:** In the context of Argentina's economic stagnation, accelerated climate action in the residential buildings sector offers opportunities for job creation and local economic development, which is linked to retrofitting and new construction of green and low-emission residential buildings. Such positive effects on both low and high-skilled employment and on local economic development support Argentina's development agenda in terms of employment (SDG 8) and on improving the quality of education, skills development and innovation (SGD 9).

4 Scenario analysis of scaling up climate action in Argentina

This section presents detailed analysis of emission reduction potentials and selected co-benefits with enhanced climate action in three focus areas: **electricity supply, passenger transport** and the **residential buildings sector.** The quantification of emission reduction potentials and the respective co-benefits covers three different scenario categories presented in the following section. This approach allows for a comparison of sectoral emission trajectories and potentials for achieving mitigation co-benefits with different sets of indicator values, informed by recent research in the field. The comparison further identifies overlaps or gaps between Argentina's sectoral emission trajectories and a) the sectoral transformations required to reach the Paris Agreement's mitigation targets, b) other sector transformation case studies from international frontrunners, and c) alternate scenarios considering the specific national context. Where different analyses are available, some scenario categories present a range of indicator values, represented by an upper and lower bound.

1.5°C Paris Agreement compatible benchmarks

The **scenario category of '1.5°C Paris Agreement compatible benchmarks'** identifies sectoral indicator values that are in line with a 1.5°C compatible sectoral emission trajectory. Where available, these indicator values are country-specific benchmarks (e.g. country-specific RES indicator values for different points in time until 2050). When country-specific benchmarks are not available, the indicator values represent global average levels or levels from countries/regions/cities with similar characteristics. This scenario analysis enhances the general understanding about the national sectoral transitions needed to be in line with the most ambitious end of the Paris Agreement's temperature target.

Applying best-in-class level(s)

The **scenario category 'Applying sectoral best-in-class level(s)'** identifies indicator values from international and regional climate action frontrunner(s) in the respective (sub-)sector. The absolute indicator level(s) or growth rate(s) from such reference cases are applied to historical national developments in each of the selected sectors. These scenarios illustrate the impact of replicating sectoral transitions achieved by international frontrunners in the respective national context. This approach might only partially account for differences in economic, political, and geographical circumstances between the international or regional frontrunners and the countries under analysis.

National scenarios

The **scenario category 'National scenarios'** applies sectoral indicator levels from research conducted by national research institutions or governmental agencies of the respective country under analysis. Such analysis could include least-cost scenarios, analysis on the general potentials for (sub-)sectoral transformation or long-term strategies/sectoral plans proposed by national governments or non-state actors. This scenario category aims to illustrates the sectoral emissions abatement potentials informed by national studies that consider the country-specific circumstances.

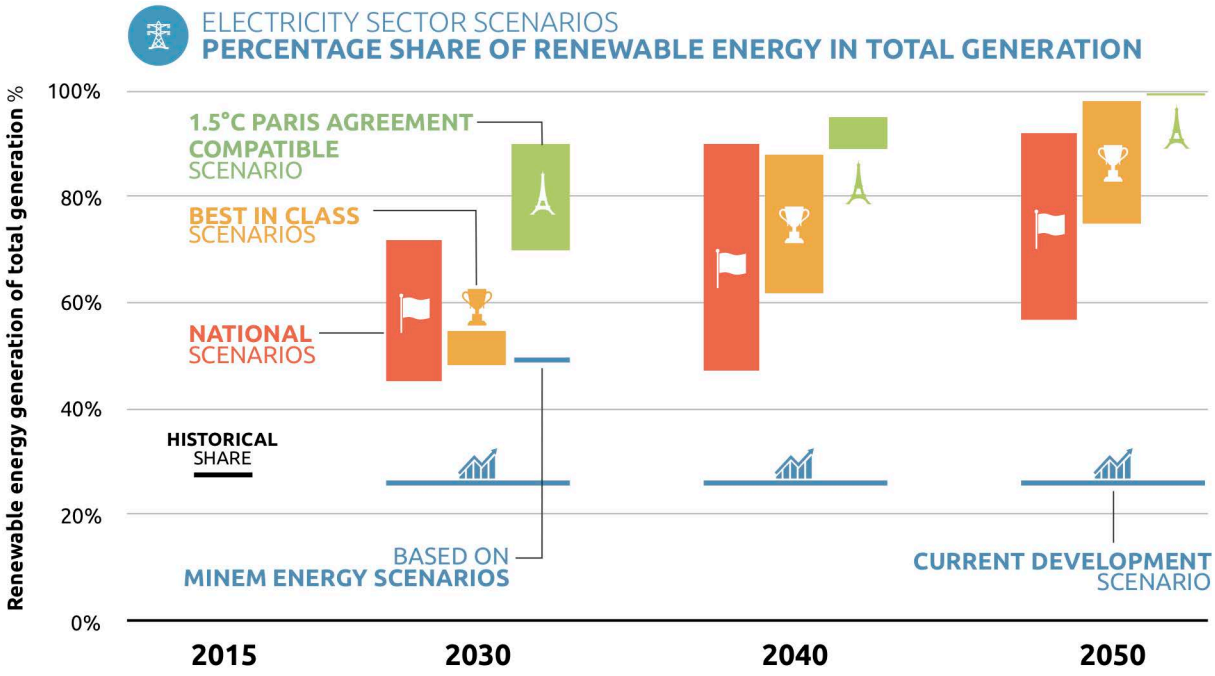
4.1 Electricity supply sector

Scaling up climate action in the Argentinian electricity supply sector can trigger emission reductions for all scenario below a Current Development Scenario by 2050. Our findings highlight that under most of the ambitious scenarios proposed by Argentinian institutions and stakeholders, GHG emissions for electricity generation in Argentina could be reduced by up to 87% below the Current Development Scenario by 2040. These findings emphasise the vast opportunities to initiate a transition towards a zero-carbon electricity supply sector in Argentina.

These ambitious scenarios developed by national institutions and stakeholders would be in line with a 1.5°C Paris Agreement compatible pathway to 2040. Our analysis shows that Argentina can become an international frontrunner in ambitious energy transitions if it scales up domestic climate action in line with scenarios developed by national research and stakeholder institutions. However, in order to follow such pathways, Argentina would still need to take further action beyond currently implemented policies and targets to fully decarbonise its electricity supply sector by 2050 (Climate Analytics, 2019).

Table 14 provides an overview of the results from scaling up climate action in the Argentinian electricity supply sector. The upper graph presents the renewable energy indicator values as ranges for the for each of the three scenario categories. Figure 20 displays emission trajectories after quantification with the PROSPECTS Argentina scenario evaluation tool.

Table 14: Outcome overview of analysis on scaling up climate action in Argentina's electricity sector



Current Development Scenario (CDS)	Scenario based on *'MINEM Energy Scenarios'*	National scenarios	Best-in-class scenarios	1.5°C Paris Agreement Compatible scenario
28% by 2015	-	-	-	-
26% by 2030	**49%** by 2030	**45%–72%** by 2030	**48%–55%** by 2030	**70%–90%** by 2030
26% by 2040	*No target defined for 2040*	**47%–90%** by 2040	**62%–88%** by 2040	**89-95%** by 2040
26% by 2050	*No target defined for 2050*	**57%–92%** by 2050 *Under assumption that total emission levels in sector remain constant after 2040*	**75%–98%** by 2050	**100%** by 2050
Based on PROSPECTS Argentina tool developed by Climate Action Tracker (2019)	*Based on 'MINEM Energy Scenarios - Tendencial'. It includes targets until 2025 (Law 27.191) and an extension to 2030 (MINEM, 2017)*	*Based on 'Plataforma Escenarios Energéticos Argentina 2040' analysis* (Beljansky et al., 2018)	*Based on s-curve vRES update approach by De Villafranca Casas et al.* (2018) *and values identified in the literature (Fekete et al., 2015)*	*Based on 'Energy [r]evolution' by Greenpeace (2015) and Jacobson et. al. (2017)*

Required policy measures for sectoral transformation	Remaining challenges threatening implementation
⇨ Substantial grid infrastructure and transmission investments as well as grid management upgrade ⇨ Substantial and continuous support by government for promoting the large-scale uptake of renewables by 2030 and beyond ⇨ End fossil fuel subsidies and stop supporting the development of natural gas infrastructure ⇨ Targeted policy measures across supply and demand sectors to ensure sectoral linkages required for the energy transition	⇨ Government plans to accelerate the exploration of natural gas and promote the development of the natural gas industry ⇨ Limitations in grid infrastructure hamper large-scale deployment of renewable energy in the short and medium term ⇨ Economic uncertainty lowers investment attractiveness for domestic and international investors in the short and medium term

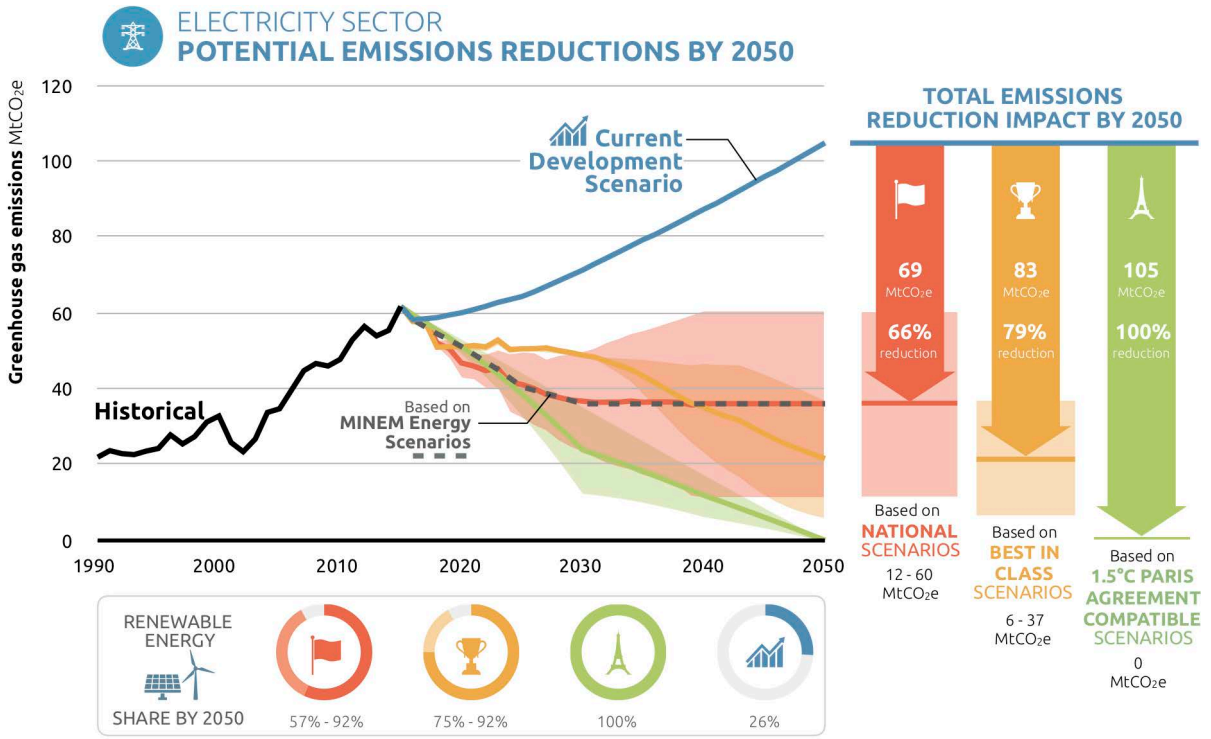


Figure 20: Overview of sectoral emission pathways under current policies and different levels of accelerated climate action in the Argentinian electricity supply sector. The forecasted electricity demand considers accelerated climate action in the Argentinian residential buildings sector and land-based passenger and freight transport. The CAT PROSPECTS Argentina scenario evaluation tool has estimated all historical emission calculations and sectoral projections towards 2050. For this reason, historical emission levels might differ from the latest inventory data.

4.1.1 Argentinian context for scaling up climate action in the electricity sector

A sector transformation towards renewables is financially feasible

Significant cost reductions in renewable technologies at national and international levels make the decarbonisation of the Argentinian electricity supply sector by mid-century financially feasible. The gradual price decrease for renewables contracted under different policy mechanisms such as RenovAr and MATER is evidence of the increasing competitiveness of renewable technologies. The average cost of renewable energy procured through RenovAr decreased from 61 USD/MWh in 2016 (Round 1) to 51 USD/MWh in 2018 (Round 2). The RenovAr auctions resulted in a cost decline of wind and solar technologies of more than 30% between 2016 and 2018, showing a strong business case for renewable energy developers (MINEM, 2018b).

Several studies suggest that the costs of renewable-based electricity generation will continue to decrease in the short and medium term at global scale (IRENA, 2016). The costs of other technologies enabling the transition to a low-carbon electricity system are also expected to

continue declining in the future. For example, the costs of storage technologies could drop between 50-65% in 2030 compared to 2016 levels (IRENA, 2017). These global trends will likely affect the electricity sector in Argentina and and drive down costs for renewables and their integration, making the sector transformation not only feasible but also attractive.

Argentina's plans to accelerate the exploration and development of natural gas put the transition towards a low-carbon energy sector at risk. These plans seek to make natural gas the main source of energy supply and to increase production to enable exports. A decision to centre the Argentinian economy around natural gas could lock-in the electricity sector into a pathway that is not compatible with the Paris Agreement, as well as jeopardise the transition of other sectors (e.g. by encouraging intensive use of natural gas in the transport and building sectors).

Shale gas exploitation is a bottleneck for Argentina to be compatible with the Paris Agreement in the long-term. The expected shale gas exports guide current national economic plans and have significant implications for Argentina's position on climate change. The cost-benefit analyses that support these plans should consider the risks associated with importing countries adopting Paris-compatible policies, which could shift global demand and export markets to renewable-based energy systems. Argentina's current exports plans, and hence economy, would face significant risks under such developments, including stranded gas infrastructure assets (Climate Action Tracker, 2017).

The abundance of low-carbon energy sources can be harnessed to boost the economy and redirect it towards Paris-compatible sector strategies and long-term development plans. The availability of renewable resources, particularly wind in the southern regions, can be used to decarbonise the power sector and even turn Argentina into a renewable energy exporter. The large-scale deployment of renewable technologies can encourage industrial development and create alternative export opportunities.

Long-term planning and investments in grid infrastructure indispensable

The transition towards a predominantly renewables-based electricity supply sector requires long-term planning of grid transmission, connection, and management infrastructure. Such forward-looking planning includes adjustments during the early stage, the medium stage to introduce market design concepts and enhanced system infrastructure flexibility, as well as the advanced stage in areas such as storage and sector coupling. Grid constraints remain a bottleneck for the large-scale deployment of variable renewables in the Argentinian electricity system. Grid-related limitations have caused delays in commissioning renewables projects in the first three RenovAr rounds and were the main reason to postpone the fourth auction of large-scale renewables from in mid-2018 towards later in 2019 (Bellato, 2018).

Argentina's macroeconomic context critically affects the expansion of the grid due to negative implications on investments. National studies suggest that around 10 GW of additional renewable capacity will be needed to achieve the 20% target by 2025, which translate into more than 1 GW of additional capacity instalments per year (MAyDS & MINEM, 2017). Such capacity additions cannot be managed by the current grid transmission infrastructure, limiting the renewable target to a maximum of roughly 10% of electricity generation (MAyDS & MINEM, 2017).

Coordinated long-term planning of generation and transmission allows for a better understanding of improvements needed in grid infrastructure, as well the resulting investment and technical assistance needs to guide the transition towards a decarbonised energy system. The Argentinian government already aims to expand the transmission grid by means of centrally organised tenders under a Public-Private Partnership (PPP) scheme to build a high voltage transmission line linking supply and demand centres. The transmission expansion plan consists of eight projects that started with the launch of the first tender in March 2019.

With an increasing share of (variable) renewable generation capacity and storage connected to the grid, investments in expanding and upgrading the Argentinian electricity grid are increasingly important to enable the transition towards a decarbonised electricity sector.

Employment benefits and local economic development

The power sector's transition towards a high share of renewable-based electricity supply fosters significant employment generation in low-carbon economies and contributes to local economic development as well as distribution of job opportunities across the country. National analysis on the employment impact of renewable supporting policies in place (i.e. RenovAr and MATER) suggests that such initiatives provide a favourable framework for employment generation and related specialisation due to training, capacity building and job security. Renewables support programmes stimulate the development of the sector and build a '*know how*' base for future renewable deployment in Argentina (Rijter, 2018). Analysis of the RenovAr programme estimates that it had created around 5,000 new direct jobs in the renewable sector by August 2018. This represented around 10% of the total new jobs registered in the private sector in 2017. The same study estimates that the completion of all the renewable projects awarded support contracts under three rounds of RenovAr will create a total of about 15,000 new direct jobs in the sector (Rijter, 2018).

The geographically distributed character of renewable deployment fosters employment opportunities across the entire country, favouring industrial and economic development in rural areas. The job assessment of the RenovAr programme reveals that the deployment of renewable capacity can represent a substantial source of job creation in zones that have been historically relegated in terms of economic growth and labour market opportunities (Rijter, 2018). Regions such as the North-West and Patagonia are developing their labour market around the exploitation of their rich renewable resources. More than 50% of the total direct jobs stimulated by the RenovAr programme support are based in these regions.

Employment generation and local industrial development in sectors that are more likely to form the core of renewable-based electricity supply in the future, both in Argentina and globally, directly enable Argentina to promote sustainable economic growth and employment as provisioned in SDG 8 and SDG 9. A recent global macroeconomic analysis estimates that Argentina will create more than 120,000 net full-time jobs (i.e. accounting for job losses in the fossil-fuel and nuclear energy industries) if it transitions to a 100% wind, water and solar power system by 2050 that is consistent with a 1.5 °C Paris Agreement compatible pathway, (Jacobson et al., 2017).

4.1.2 Scenario analysis for scaling up climate action in the electricity sector

4.1.2.1 Identification of indicator levels

Table 15 provides a complete overview of indicator levels identified for the three scenario categories. The indicator levels were directly input into the PROSPECTS Argentina scenario evaluation tool alongside the current development scenario to conduct the emission pathway analysis for the Argentinian electricity supply sector.

Table 15: Identification of indicator levels for analysis of scaling up climate action in the electricity supply sector

	Current Development Scenario (CDS)	Scenario based on *'MINEM Energy Scenarios'*	National scenarios	Best-in-class scenarios	1.5°C Paris Agreement Compatible scenario
Share of renewables in total electricity generation	28% by 2015	-	-	-	-
	26% by 2030	49% by 2030	45%–72% by 2030	48%–55% by 2030	70%–90% by 2030
	26% by 2040	*No target defined for 2040*	47%–90% by 2040	62%–88% by 2040	89-95% by 2040
	26% by 2050	*No target defined for 2050*	57%–92% by 2050 *Under assumption that total emission levels in sector remain constant after 2040*	75%–98% by 2050	100% by 2050
References	*Based on PROSPECTS Argentina tool developed by Climate Action Tracker (2019)*	*Based on 'MINEM Energy Scenarios - Tendencial'. It includes targets until 2025 (Law 27.191) and an extension to 2030 (MINEM, 2017)*	*Based on 'Plataforma Escenarios Energéticos Argentina 2040' analysis* (Beljansky et al., 2018)	*Based on s-curve vRES update approach by De Villafranca Casas et al. (De Villafranca Casas, Kuramochi, Hagemann, Hans, et al., 2018) and values identified in the literature (Fekete et al., 2015)*	*Based on 'Energy [r]evolution' by Greenpeace (2015) and Jacobson et. al. (2017)*

1.5°C Paris Agreement compatible benchmarks

The 1.5°C Paris Agreement compatible benchmarks represent sectoral indicator values for the renewable energy share (RES) in total electricity generation, which are in line with a 1.5°C Paris Agreement compatible emission trajectory for the Argentinian electricity supply sector. The review of relevant literature in the field identifies a RES indicator range of **70%–90% by 2030**, **89%-95%% by 2040**, and **100% by 2050**. The benchmark values are derived from the following literature:

- **Upper bound of the RES indicator range**: The upper bound indicator values are based on the 'Advanced Energy Scenario' by Greenpeace for the Latin America (LATAM) region (Greenpeace, 2015). The 'Advanced Energy Scenario' analysis models yield a RES of **90% by 2030**, **95% by 2040**, and **100% by 2050**. Caveats for this scenario are that it was originally developed for the Latin American region, not for Argentina, and that it is very ambitious until 2030 and less ambitious afterwards.

- **Lower bound of the RES indicator range**: The lower bound indicator values for Argentina are based on 1.5°C compatible electricity shares for 2050 informed by the *100% Clean and Renewable Scenario* by Jacobson et. al. (Jacobson et al., 2017). We assume a linear emission pathway between current shares in 2016 and zero emissions from electricity supply in 2050. The technology mix between 2016-2050 that determines a linear decarbonisation pathway towards 2050 assumes a gradual reduction of fossil-fuel technologies in total generation considering their respective emission intensities. The resulting renewable shares for 2030 are in line with the benchmarks presented in the IPCC Special Report on 1.5 °C, presented in Table 16 below (IPCC, 2018). The analysis yields a RES of **70% by 2030**, **89% by 2040**, and **100% by 2050**.

Table 16: Identification of indicator levels for renewables share in global electricity generation (in %) in Figure 3B of the IPCC Special Report on the impacts of global warming of 1.5 °C (IPCC, 2018). *P4 scenarios have been excluded in this table as these scenarios assume a high overshoot.*

Renewables share in electricity generation (in %)	P1 - No or low overshoot	P2 - No or low overshoot	P3 - No or low overshoot	Interquartile range - No or low overshoot
by 2030	60%	58%	48%	(47%,65%)
by 2050	70%	81%	63%	(69%,87%)

Applying best-in-class levels

Applying best-in-class levels of international renewable energy frontrunners serves as a model for how the Argentinian electricity sector could transform under similar developments. The application results in RES indicator ranges of **48–55% by 2030**, **62–88% by 2040**, and **75–98% by 2050**. The range of RES indicator values are derived as follows:

Upper bound of the RES indicator range: The upper bound indicator values are obtained by applying an s-curve shaped good practice trajectory for the uptake of variable renewable-based electricity generation (i.e. solar and wind) to Argentina's recent sector developments as of 2015. The s-curve is fitted to Costa Rica's growth in the share of variable renewables generation between 2008 and 2015 (2.1% to 10.0%) and an upper ceiling defined as 75% of renewable electricity generation by 2050. The analysis is based on *Variable renewable energy policy impact forecast tool* developed by NewClimate Institute (De Villafranca Casas, Kuramochi, Hagemann, Hans, et al., 2018). The results for Argentina, starting with a share of variable renewable-based electricity generation of below 1% in 2015, are 23% by 2030, 62% by 2040, and 74% by 2050. This share only includes variable renewable energy sources. The s-curve based approach to apply best-in-class levels narrowly focuses on variable renewables while not modelling the uptake of other low-carbon electricity generation technologies. The RES including non-variable forms of electricity generation are **55% by 2030**, **88% by 2040**, and **98% by 2050**. Assumptions for the development of non-variable forms of electricity generation have been taken from the most ambitious end of national scenarios.

- **Lower bound of the RES indicator range**: The lower bound values represent a linear increase of 1.35 %-points per year in Argentina's share of renewable-based electricity generation. The annual increase in %-points is informed by the average growth of renewable energy in the United Kingdom and in Germany after the implementation of ambitious renewables support policies (Fekete et al., 2015). The results for Argentina starting with a share of renewable-based electricity generation of 28% in 2015 (incl. hydro) are **48% by 2030**, **62% by 2040**, and **75% by 2050**. This linear approach faces the limitation that no dynamic uptake in the renewable energy can be incorporated, especially when reaching the natural threshold of 100% in total generation. Furthermore, the breakdown of renewable energy technologies as well as the share of non-renewable energy sources need to be derived based on external scenario projections until 2050.

National scenarios

Recently published modelling results by Argentinian research institutions as part of the 'Plataforma Escenarios Energéticos Argentina 2040' analysis inform the selection of RES ranges for national electricity sector scenarios (Beljansky et al., 2018). The RES indicator ranges are **45–72% by 2030, 47–90% by 2040** and **57%–92% by 2050**. Table 17 presents the range of indicator values informed by the scenario results.

Table 17: Overview of renewable electricity supply shares provided by the 'Plataforma Escenarios Energéticos Argentina 2040' analysis (Beljansky et al., 2018)

Institution	2020	2030	2040	2050
Argentinian Electricity Generators association (AGEERA)	**41%**	**59%**	**68%**	*All national scenario projections cover the period up to 2040. Total emission levels are assumed constant until 2050.*
Argentinian Association of Large Electricity Consumers (AGUEERA)	**36%**	**45%**	**49%**	
Argentinian Committee of the World Energy Council (CACME)	**45%**	**49%**	**60%**	
Argentinian Chamber of Renewable Energy (CADER)	**46%**	**68%**	**79%**	
Advisory Council on Energy Policy of the Province of Cordoba (CAPEC)	**39%**	**55%**	**51%**	
Environment and Natural Resources Foundation (FARN)	**53%**	**85%**	**90%**	
Political Ecology Forum (FEP)	**44%**	**74%**	**91%**	
Wild Life Foundation (FVS)	**38%**	**67%**	**81%**	
NOA group	**48%**	**57%**	**64%**	

- **Upper bound of RES indicator range**: We obtain the upper bound indicator values from the scenario modelling by the Political Ecology Forum (FEP). Among all the scenarios in 'Plataforma Escenarios Energéticos Argentina 2040', the **FEP scenario** yields the most ambitious share of renewables by 2040. The scenario assumes alignment of the energy supply sector with the Paris Agreement considering the Argentinian country context. All scenarios presented in the 'Plataforma Escenarios Energéticos Argentina 2040' cover the time period until 2040. We assume constant emission levels from 2040 onwards. The technology mix between 2016-2050 that determines constant emission levels towards 2050 assumes a gradual reduction of current fossil-fuel technologies in total generation considering their respective emission intensities. The resulting generation mix between 2040-2050 differs from 2040 due to an increasing electricity demand during the period. The resulting RES are **72% by 2030**, **90% by 2040**, and **92% by 2050**.

- **Lower bound of RES indicator range**: We obtain the lower bound indicator values from the scenario modelling by Argentinan Association of Large Electricity Consumers (AGUEERA). Among all the scenarios in 'Plataforma Escenarios Energéticos Argentina 2040', the **AGUEERA scenario** can be considered the least ambitious scenario. The scenario assumes full development of Vaca Muerta's shale gas reserves and excludes of CO_2 prices in the modelling exercise. All scenarios presented in the 'Plataforma Escenarios Energéticos Argentina 2040' cover the time period until 2040. We assume constant emission levels from 2040 onwards. The technology mix between 2016-2050 that determines constant emission levels towards 2050 assumes a gradual reduction of current fossil-fuel technologies in total generation considering their respective emission intensities. The resulting generation mix between 2040-2050 differs from 2040 due to an increasing electricity demand during the period. The resulting RES are **45% by 2030**, **47% by 2040**, and **57% by 2050**.

4.1.2.2 Quantification of emission levels with PROSPECTS Argentina

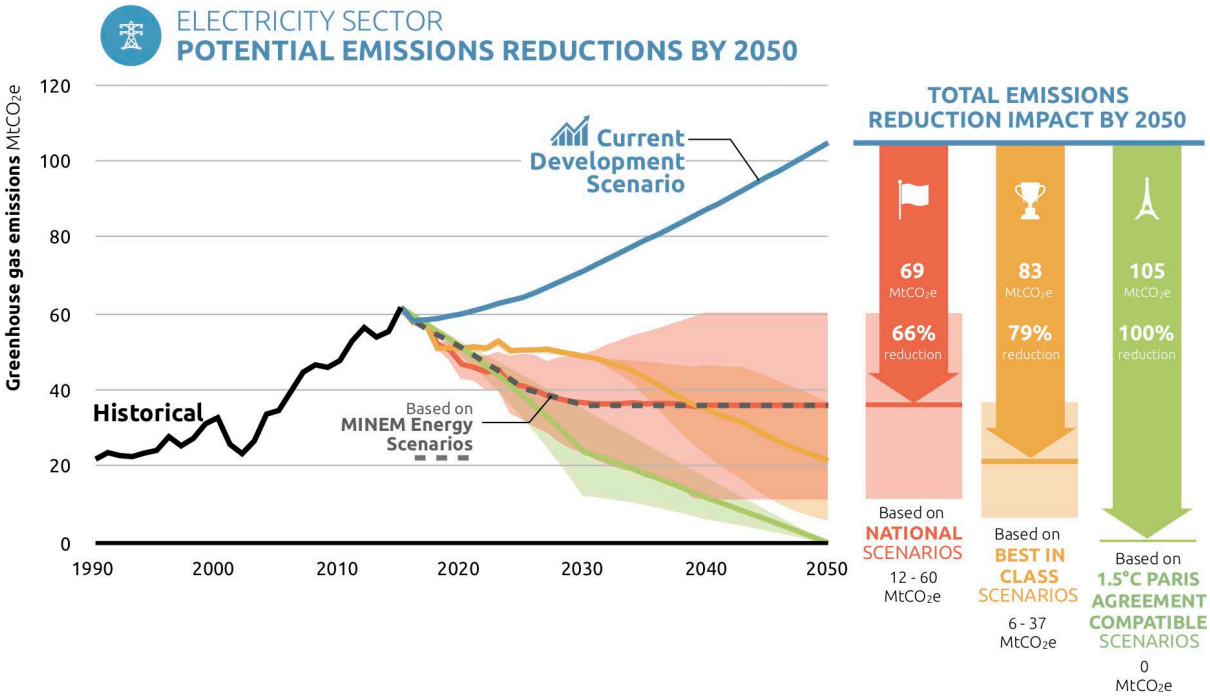


Figure 21: Overview of sectoral emission pathways under current policies and different levels of accelerated climate action in the Argentinian electricity supply. The forecasted electricity demand considers accelerated climate action in the Argentinian residential buildings sector and land-based passenger and freight transport. The CAT PROSPECTS Argentina scenario evaluation tool has estimated all historical emission calculations and sectoral projections towards 2050. For this reason, historical emission levels might differ from the latest inventory data.

Figure 21 illustrates the emission ranges for emissions from electricity generation up to 2050 under the different scenarios. Under the Current Development Scenario (CDS), emissions continue to increase steadily up to 2050. The emission levels in 2050 are around 43 $MtCO_2e$ above 2015 levels of 62 $MtCO_2e$. The scenario based on '*MINEM Energy Scenarios*' reflects the full implementation of the renewable electricity generation targets up to 2025 (Law 27.191) and extended to 2030 (MINEM, 2017). This scenario, which represents a variation of the Current Development Scenario, assumes a 20% share of non-conventional renewables by 2025 and 25% by 2030. Emission levels in 2030 are around 26 $MtCO_2e$ below 2015 levels. After 2030, we assume constant total emission levels until 2050.

All pathways under accelerated climate action in the Argentinian electricity sector lead to substantially lower emissions than the current development scenario by 2050. The pathways vary in the level of emissions by 2050 and the distinct pathway trajectories:

- The **'1.5°C Paris Agreement compatible' pathway** starts decreasing emissions immediately, driven by a quick ramp-up of non-conventional renewable electricity generation and decreasing gas-based generation. The rates of reduction are close to constant over time. The sector fully decarbonises by mid-century implying an electricity supply sector based on renewables and other zero-carbon technologies.

- The **'Applying best-in-class levels' pathway** keeps emissions at around 45-50 $MtCO_2e$ until 2030. From 2030 onwards, emission levels start decreasing at a higher rate under the lower end of the range and nearly decarbonise the Argentinian electricity supply sector by 2050 with only 3 $MtCO_2e$/yr emitted in that year. Emission reductions under the upper range are moderate until 2050.

- The '**National scenarios' pathway** covers a wide range of ambition levels in nationally determined scenarios. The lower end of the range starts decreasing emissions immediately, driven by a quick ramp-up of non-conventional renewable electricity generation and decreasing gas-based generation. Emission levels under the lower end of

the range reach 12 $MtCO_2e/yr$ by 2040, which is 50 $MtCO_2e/yr$ below 2015 levels. The upper end of the range also decreases annual emission levels immediately, but only until 2030. From 2030 onwards, emissions increase until 2040 to reach 2015 levels again. The emission range remains constant after 2040 as all national scenarios only cover the period up to 2040.

Table 18: Key indicators describing the GHG emission scenarios for GHG emissions for the electricity supply sector in Argentina for the period between 2015–2050.

Scenario	Year of peaking	Remaining emissions in 2050 [$MtCO_2e/yr$]
Current Development Scenario (CDS)	2050	105
Scenario based on 'MINEM Energy Scenarios'	Immediate	36
1.5°C Paris Agreement compatible	Immediate	0
Applying best-in-class levels	Immediate	3-37
National scenarios	Immediate to 2040 *(given wide range of ambition levels in scenarios)*	12-60

The total electricity generation varies between different scenario categories due to changes in climate action in other sectors, e.g. increased electrification of transport on land and electricity savings in households (see Figure 22). The forecasted electricity generation continues to increase substantially until 2050 under all scenarios.

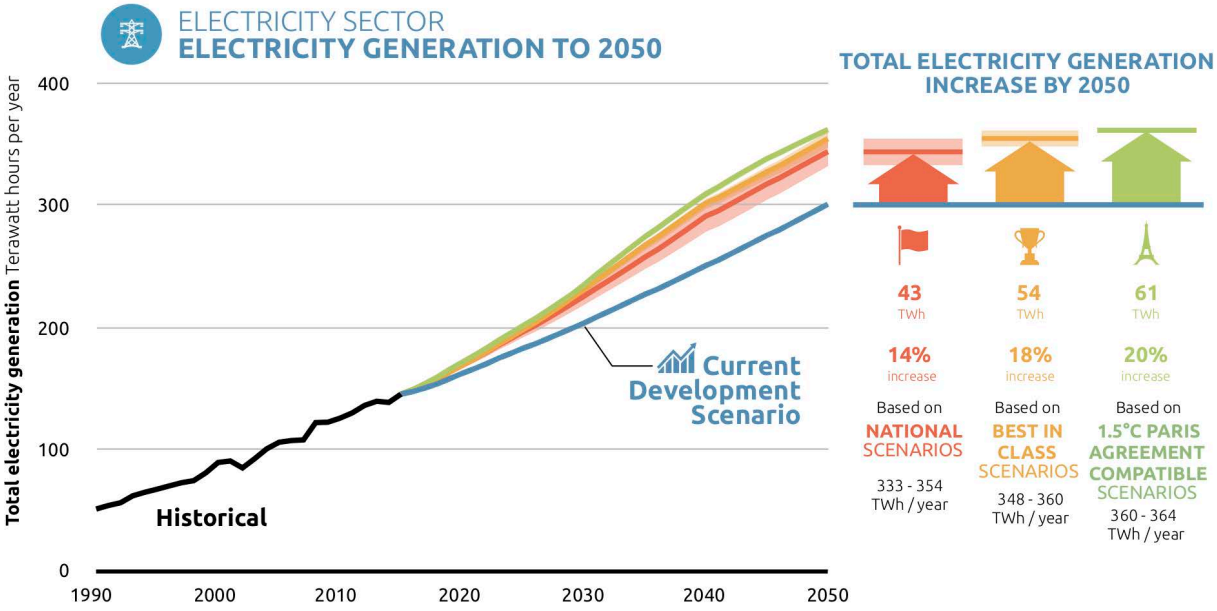


Figure 22: Total annual electricity generation (in TWh/yr) in Argentina under different scenario categories, considering the demand side effects from accelerated climate action in land-based passenger and freight transport and the residential buildings sector in the respective scenario categories. Historical electricity generation and projections towards 2050 are estimated in the CAT PROSPECTS Argentina scenario evaluation tool. For this reason, historical emission levels might differ from the latest inventory data.

4.1.2.3 Quantification of employment impacts for different scenarios

Employment is lowest in the Current Development Scenario (CDS)

The quantification of employment impacts for different electricity supply sector scenarios between 2016 and 2030 reveals that the Current Development Scenario (CDS) — in which most capacity additions are fuelled by gas and oil — supports the fewest jobs. Under the CDS, approximately 37 thousand people on average per year are directly employed in the development of new capacity and the operation and the maintenance of both existing and new capacity over the period between 2016 and 2030. We estimate that the investments would stimulate a further 103 thousand indirect and induced jobs on average per year.

The alternative scenarios, which rely more heavily on renewable capacity additions, all have higher employment impacts. They range between approximately 40–66 thousand direct jobs per year and a further 98–135 thousand jobs when considering the wider indirect and induced impacts of the investments. This range includes the scenario based on 'MINEM Energy Scenarios' that generates an additional 12 thousand direct jobs per year compared to the Current Development Scenario and two Paris Agreement compatible scenarios which generate 29 and 5 thousand additional direct jobs per year, respectively, compared to the Current Development Scenario. Direct employment estimates are relatively broad in scope reflecting investments linked to planning, construction, manufacturing of component parts, operation (including fuel supply, where relevant) and maintenance of power plants. Total employment further considers the indirect impact of electricity supply investments through the supply chain — for example the production of cement for concrete foundation of wind turbines — as well as induced economic impacts driven by the spending of wages throughout the economy.

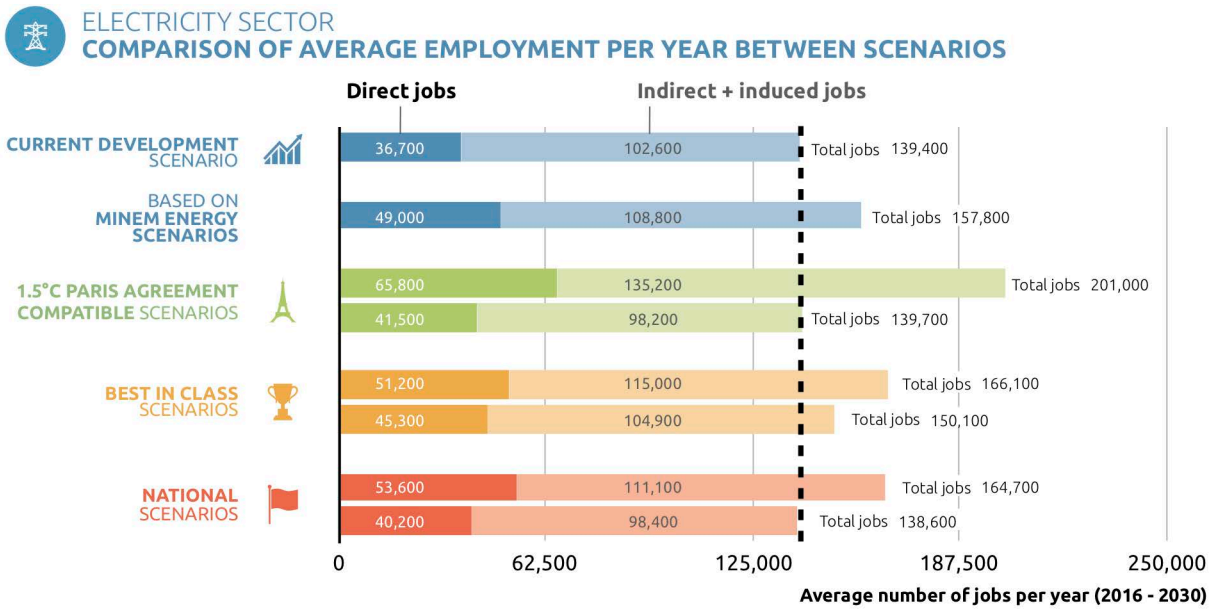


Figure 23: Average direct employment per year between 2016–2030 and average total employment per year between 2016–2030 in Argentina for different electricity generation scenarios. Employment impacts are estimated with the Economic Impact Model for Electricity Supply (EIM-ES).

Transitioning to a low-carbon pathway can support the development of skills needed in the long-term

Hydropower and natural gas generation are the main incumbent technologies in Argentina's electricity supply sector today. In the CDS, a large share of jobs are supported by gas-fired generation technologies, both combined and open cycle plants (see Figure 24, left hand side). This includes both jobs related to the planning and construction of new plants as well as the operation of both new and existing gas plants. Jobs in the extraction sector —to supply natural gas, and to a lesser extent oil, for electricity generation—account for approximately 45% of total

jobs during the 2020s (see top left chart). These additional jobs in fossil fuel-based production and electricity generation are at risk if Argentina commits to decarbonise its electricity sector in line with the Paris Agreement temperature target. Even in the case of the scenario based on the 'MINEM Energy Scenario', a trajectory that is not aligned with the goals of the Paris Agreement, we estimate that only approximately 25% of total jobs will be in the extraction sector during the 2020s. Further investment in the natural gas sector could lead to structural unemployment and a domestic labour force that is ill-prepared to support the expansion of renewables required to deliver on the commitments of the Paris Agreement.

In the lower bound 1.5°C Paris Agreement compatible scenario, the mining and extraction sector accounts for less than 20% of jobs over the same period (see Figure 24, right hand side), or less than half as many as in the CDS. Instead employment is focused in the construction and manufacturing sectors and increasingly in the development and operation of renewable energy sources, notably hydropower, solar PV and onshore wind. Jobs supported by these technologies grow over time and will continue to be needed well after 2030 as the electricity generation sector moves towards full decarbonisation, both in Argentina and globally.

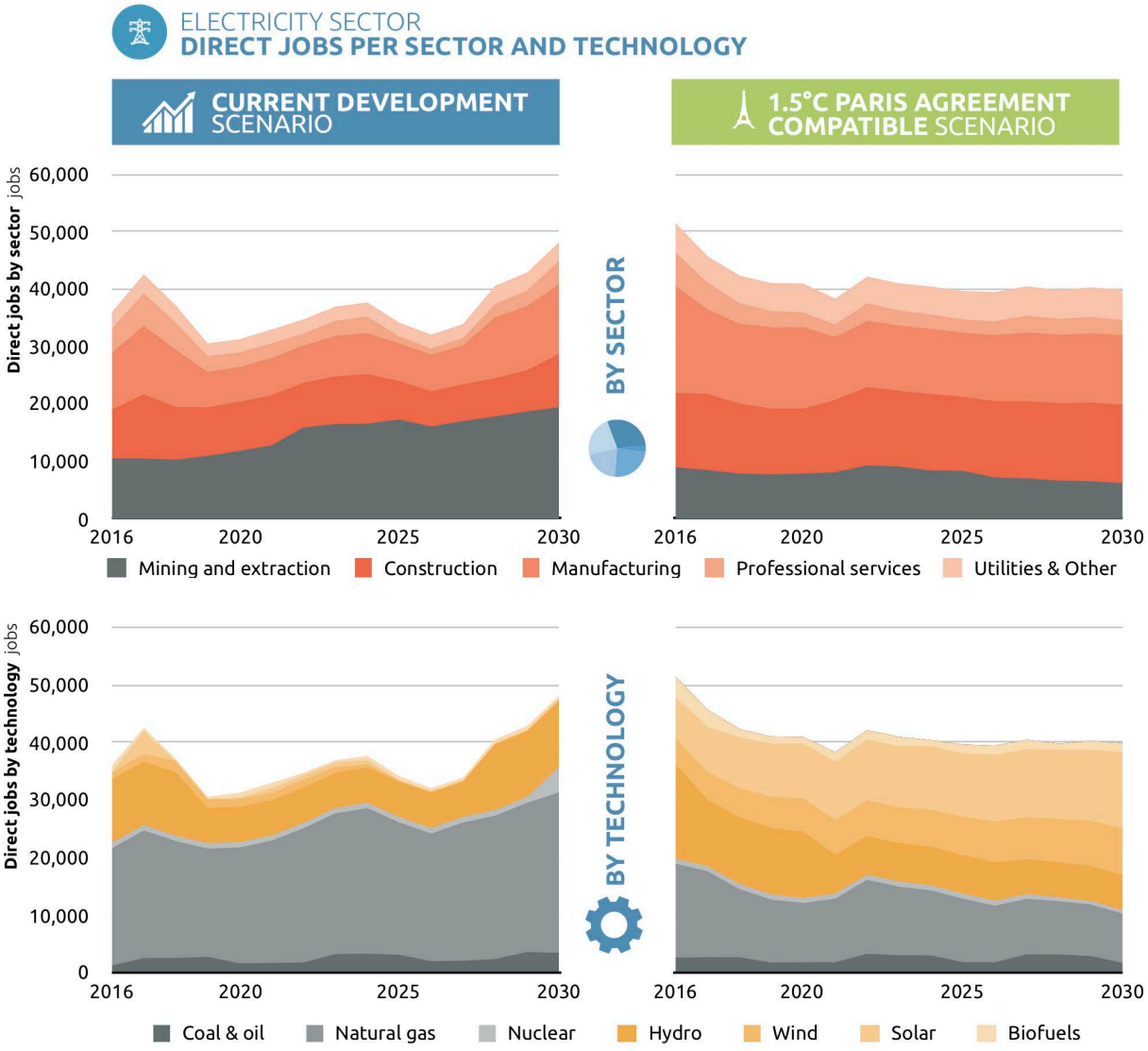


Figure 24: Direct jobs per employment sector' and 'Direct jobs per generation technology' between 2016-2030 for the Current Development Scenario (CDS) (graphs on left) and the lower bound 1.5°C Paris Agreement compatible scenario for the Argentinian electricity supply sector (graphs on right). Direct employment estimates reflect energy supply sector investments linked to planning, construction, manufacturing of component parts, operation (including fuel supply such as oil and gas production, where relevant) and maintenance of power plants. Note employment impacts for mining and extraction only relate to the fuels used in the Argentinian electricity supply sector and do not include jobs supported to supply other sectors or the export market. Employment impacts are estimated with the Economic Impact Model for Electricity Supply (EIM-ES).

These findings emphasise the higher overall employment potential of accelerated climate action in the electricity generation sector. At the same time, they highlight the need to avoid investing in skills and jobs in the gas industry, which are incompatible with delivering the Paris Agreement and could lead to structural issues in the Argentinian labour market; typically accompanied by social problems and a costly retraining of workers. A well-managed transition should start now by reducing the incentives to join the natural gas sector and could be delivered via the usual workforce turnover of the workforce in combination with increasing opportunities to develop skills in future-proof technologies.

Assessing the relationship between employment impacts, domestic investment and electricity generation across scenarios

The upper bound of the Paris Agreement compatible range stimulates the largest investment in Argentina amongst all the scenarios and also supports the most jobs per unit of investment. In this scenario hydropower is expanded in addition to solar PV and onshore wind capacity. The share of the total investment that is kept within Argentina is higher for hydropower than for other renewable technologies and gas-fired generation because more of the components are produced domestically. The higher absolute employment impacts in this scenario are also driven, in part, by higher overall investment requirements.

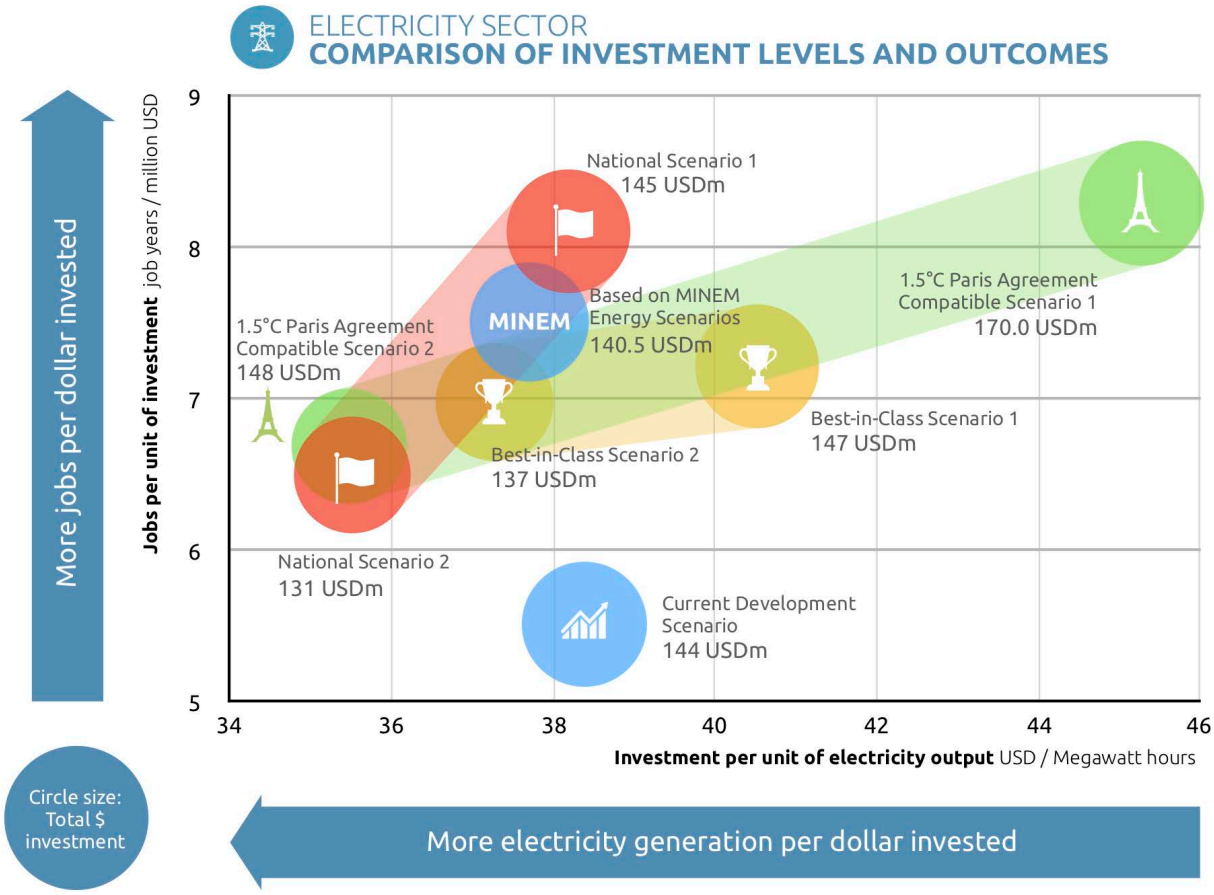


Figure 25: Average job generation per unit of investment (in job years per USDm) and average investment per unit of electricity generation (in USD per MWh) in the Argentinian electricity supply sector for different electricity generation scenarios between 2016–2030. Note the figures reported here relate exclusively to investments in Argentina and do not reflect the overall cost of scenarios, which also include investments on imported products and services. Employment impacts are estimated with the Economic Impact Model for Electricity Supply (EIM-ES).

The number of jobs supported per unit of investment in Argentina is lowest in the current development scenario despite similar levels of domestic investment per unit of electricity output and overall scenario costs compared to alternative scenarios. This is because the number of jobs created in Argentina per unit of investment in new capacity are lower for gas (and oil) fuelled generation technologies than any of the renewable technologies.

4.2 Land-based passenger and freight transport

The Paris Agreement-compatible sectoral trajectories almost fully decarbonise Argentina's passenger and freight transport sector on land by 2050. This requires a substantial modal shift for passenger and freight transport, introducing zero-emission vehicles, buses, and trucks, and a tightening of CO_2 fuel economy standards for new personal vehicles. It would fully decarbonise Argentina's passenger and freight transport sector by mid-century - and would also require the electricity supply sector to be fully decarbonised by 2050 in line with the Paris Agreement temperature goal. The electrification of transport and a modal shift away from fossil-based vehicles reduces adverse effects of air and noise pollution and their harmful effects on health. This directly promotes provision of healthy lives and well-being for all ages (SDG 3).

Table 19 provides an overview of scenario analysis in Argentina's passenger and freight transport sector on land and presents the value ranges for selected indicators considered relevant. Figure 26 displays the resulting emissions trajectories for all scenarios after quantification with PROSPECTS Argentina scenario evaluation tool.

Table 19: Outcome overview of analysis on scaling up climate action in passenger and freight transport sector

Indicator	Indicator values for scenario categories			
	Current Development Scenario (CDS)	**National scenarios**	**Applying best-in-class level(s)**	**1.5°C compatible scenarios**
Land-based road transport				
Emissions intensity improvement rate for non-electrified personal vehicle transport	• **1.5%-2.7%** by 2030 • **0.7%-0.9%** by 2040 • **0.6%-0.8%** by 2050 *Based on PROSPECTS Argentina tool developed by Climate Action Tracker (2019). Main reference is IEA Mobility Model.*	*Same indicator levels as in CDS as no national target or benchmark exists*[1] *[-]*	**1.5%-1.8%** per year for 2016-2050 *Based on European Parliament (2009)*	*Same as in 'Applying best-in-class-level(s)' scenario as no PA compatible benchmark exists* *[-]*
Share of public transport (bus, train) in total road and rail passenger transport activity	• **11%** by 2030 • **10%** by 2040 • **10%** by 2050 *Based on PROSPECTS Argentina tool developed by Climate Action Tracker (2019). Main reference is IEA Mobility Model.*	**20%-35%** by 2030 and constant thereafter[1] *Based on Mitigation Potential Study: Recovering the Argentinian rail system* (Universidad Nacional de San Martin, 2015)	• **22%-29%** by 2030 • **33%-47%** by 2040 • **45%-64%** by 2050 *Based on Replogle & Fulton (2014) for Other Latin America and IEA* (2017c) *for South Korea*	*Same as in 'Applying best-in-class-level(s)' scenario as no PA compatible benchmark exists* *[-]*
Share of electric vehicle in total passenger vehicle fleet: Personal Vehicles	• **1%** by 2030 • **4%** by 2040 • **13%** by 2050	• **3%-7%** by 2030 • **20%-60%** by 2040 • **70%-97%** by 2050	• **16%-18%** by 2030 • **36%-67%** by 2040 • **56%-89%** by 2050	• **42%** by 2030 • **87%** by 2040 • **100%** by 2050
Share of electric vehicle in total passenger vehicle fleet: Buses	• **0%** by 2030 • **1%** by 2040 • **3%** by 2050 *Based on PROSPECTS Argentina tool developed by Climate Action Tracker (2019). Main reference is IEA Mobility Model.*	• **60%** by 2030 • **100%** by 2040 • **100%** by 2050 *Based on 'Plataforma Escenarios Energéticos Argentina 2040' analysis (Beljansky et al., 2018)*[1]	• **69%-100%** by 2030 • **100%** by 2040 • **100%** by 2050 *Based on IEA* (2018)	• **49%** by 2030 • **93%** by 2040 • **100%** by 2050 *Based on 'Plataforma Escenarios Energéticos Argentina 2040' analysis (Beljansky et al., 2018)*

[1] *The Transport Action Plan includes efficiency labelling measures, measures to foster public transportation, plans to increase light duty EV, and measures to increase electric buses. However, the plan does not provide specific values for these indicators. For this reason, it could not be considered in the present analysis.*

Land-based freight transport				
Share of train transport in total freight transport	• **2%** by 2030 • **2%** by 2040 • **1%** by 2050	**10.6%-14.6%** by 2030 and constant thereafter	• **11%** by 2030 • **21%** by 2040 • **30%** by 2050	*Same as in 'Applying best-in-class-level(s)' scenario as no PA compatible benchmarks exists*
	Based on PROSPECTS Argentina tool developed by Climate Action Tracker (2019). Main reference is IEA Mobility Model.	*Based on Universidad Nacional de San Martin (2015) and MAyDS & MINTRAN (2017)*	*Based on analysis by the Climate Action Tracker* (2018f)	*[-]*
Share of zero-emission trucks in total truck fleet	• **0%** by 2030 • **1%** by 2040 • **2%** by 2050	*Same indicator levels as in CDS as no national target or benchmark exists*	• **16%** by 2030 • **37%** by 2040 • **58%** by 2050	• **33%-42%** by 2030 • **75%-91%** by 2040 • **99%-100%** by 2050
	Based on PROSPECTS Argentina tool developed by Climate Action Tracker (2019). Main reference is IEA Mobility Model.	*[-]*	*Based on analysis by the Climate Action Tracker* (2018f)	*Based on analysis by the Climate Action Tracker* (2018f)

Required policy measures for sectoral transformation	Remaining challenges threatening implementation
⇨ Initiation of an ambitious modal shift towards public transport in urban areas ⇨ Discourage use of private vehicles while simultaneously promoting private electric vehicle purchase and investing in charging infrastructure ⇨ Support for research and implementation of pilot projects for low-emission freight transport	⇨ Lack of funding in the short- and medium term for required investments ⇨ High private and public investment costs for low-emission vehicles and charging infrastructure, especially in the context of long-distance freight transport ⇨ Lack of willingness by political leadership to initiate ambitious sectoral transformation

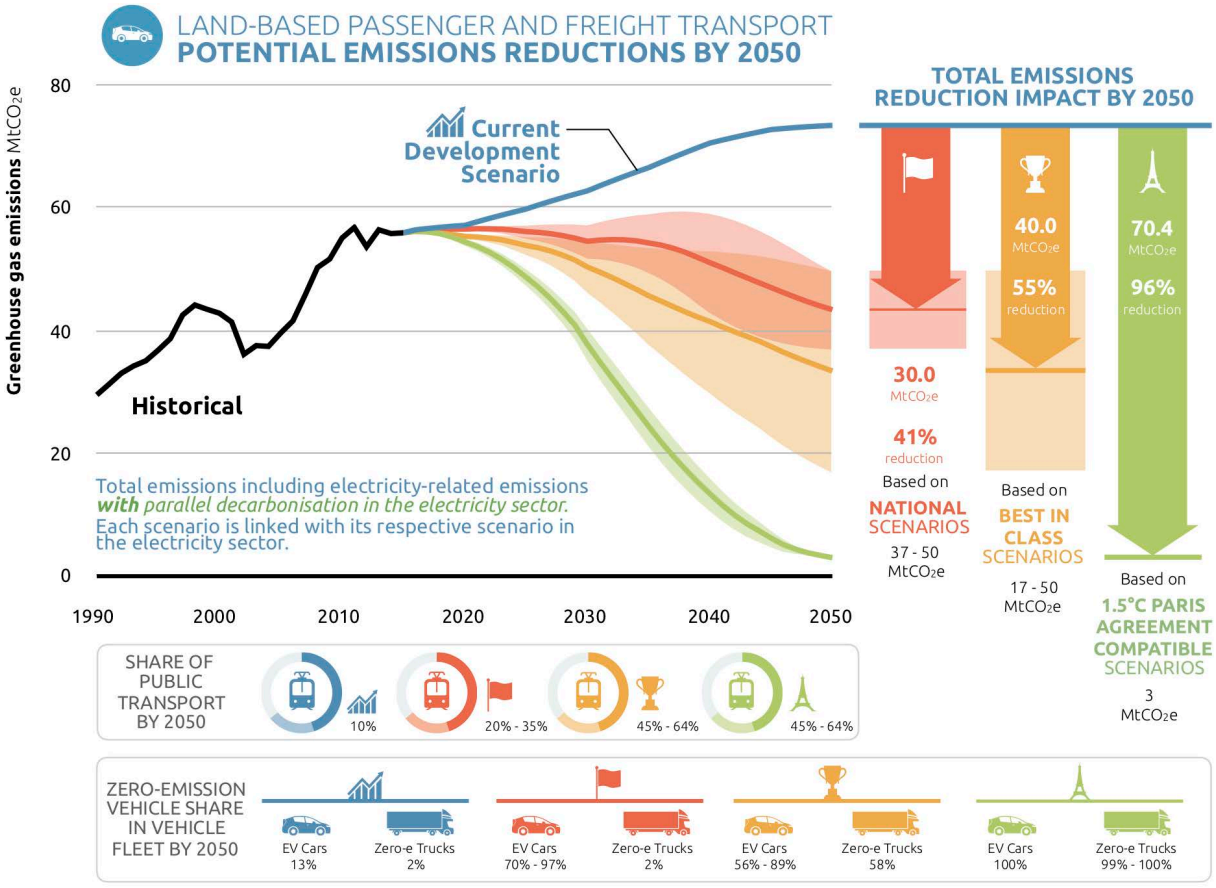


Figure 26: GHG emissions in the land-based passenger and freight transport sector in Argentina, including electricity-related emissions and parallel decarbonisation actions according to the respective scenario categories in the electricity supply sector. All emission pathways in the land-based transport sector assume the forecasted electricity supply mix as specified for the respective scenario categories. The CAT PROSPECTS Argentina scenario evaluation tool has estimated all historical emission calculations and sectoral projections towards 2050. For this reason, historical emission levels might differ from the latest inventory data.

4.2.1 Context for scaling up climate action in the road transport sector

Important role of electrified transport for urban passenger transport

The number of electric vehicles sold in Argentina remains negligible but developments to promote electric urban mobility have recently taken place. The lack of incentives for low-emission vehicles by Argentinian government keeps and will continue to keep the market share of electric vehicles low for a long time (Infobae, 2018b). As of June 2018, Argentina had started the manufacturing of a first 100% electric vehicle in the country (Infobae, 2018a). The electric city-cars will be affordable as part of a new mobility concept in urban areas based on clean energy transport. International development in this context will likely further drive the uptake of electric vehicles and industrial developments in Argentina. Buenos Aires is a member of the C40 Cities Climate Leadership Group initiative, under which several case studies related to urban transport have been conducted (C40 Initiative, 2018).

After Mexico and Brazil, Argentina has the third largest automotive industry in Latin America. The manufacturing of combustion vehicles in Argentina provided about 29 thousand direct jobs in 2017 and contributed to more than 2% of the GDP in the same year (ADEFA, 2017; INDEC, 2018). Nearly half a million combustion-engine vehicles (gasoline and diesel) were produced in Argentina in 2017 (ADEFA, 2017). The employment impacts of a transformation away from fuel-combustion vehicles towards electromobility crucially depends on the ability of car manufacturers in Argentina, mostly multinationals, to build up production capacities for EVs in Argentina.

A major challenge for electric mobility in Argentina lies in the energy infrastructure, particularly power grid stability and charging infrastructure. Further improvements in grid stability and transmission infrastructure are necessary for a large-scale deployment of electric vehicles. The higher costs of electric vehicles compared to vehicles with internal combustion engines are also an obstacle for increased uptake. The costs of hybrid and full-electric vehicles are up to 30% and 80% more expensive respectively compared to a conventional vehicle (Turturro & Ubogui, 2016). The transport sector's decarbonisation by means of high electrification rates is conditioned by ongoing decarbonisation efforts in the electricity supply sector.

The electrification of transport and a modal shift away from fossil-based vehicles reduce adverse effects of air and noise pollution, particularly in urban centres. The transport sector is responsible for a constant source of air pollution in cities, including pollutants such as NOx, NMVOC and PM (Abrutzky, Dawidowski, Murgida, & Natenzon, 2014). Similarly, both passenger and freight road transport constitute an important source of noise pollution.

Freight transport

Argentina's main actions to reduce emissions of freight transport include biofuel blending mandates and energy efficiency measures. The National Transport and Climate Change Action Plan also identifies a modal shift to rail-based freight transport as one of the most impactful mitigation measure (MAyDS & MINTRAN, 2017). However, more ambitious measures are required to achieve significant emissions reductions for heavy-duty vehicles in Argentina and globally (Climate Action Tracker, 2018d).

While most freight transport in Argentina is currently carbon-intensive, there is potential to explore technological alternatives and reduce emissions. Measures to achieve zero-emissions freight transportation include a modal shift to less carbon-intensive modes of transport, renewable-based electrification of trucks and trollies, energy efficiency measures, and fuel substitution among others (Climate Action Tracker, 2018d).

Argentina's extensive size and the geographical distribution of its main production centres pose challenges associated with the abovementioned measures in freight transport. This is particularly important regarding Argentina's exploitation activities of natural resources:

agriculture, mining, livestock and forestry. These geographical characteristics, together with an inadequate rail infrastructure, explain the preponderance of roads in freight transport.

A lack of investment and the high costs associated with upgrading the rail services represent a challenge for a substantial modal shift in freight transport. Alternatives to the status quo such as a large-scale electrification of trucks using renewable-based electricity or for substitution for cleaner alternatives (e.g. renewable-based hydrogen) would require substantial initial investments (Climate Action Tracker, 2018d). The low market maturity makes these technologies commercially uncompetitive under current policies. Moreover, charging infrastructure (electricity or hydrogen charging points) needs to be developed in parallel, which entails additional costs. Policies in Argentina and globally need to quickly address these challenges to ensure zero-emission technologies are introduced fast enough to reduce emissions from heavy road transport.

4.2.2 Scenario analysis for scaling up climate action in the road transport sector

4.2.2.1 Identification of indicator levels

Table 20: Identification of indicator levels for scaling up climate action in urban passenger transport sector

Indicator		National scenarios	Applying best-in-class level(s)	1.5°C compatible scenarios
Land-based road transport				
CO_2 standards/ fuel economy standards for new personal vehicles		*No quantifiable target defined by national institutions for Argentina apart from general intention to phase in Ultra Low Emission Vehicles (ULEV) by 2030* *Based on analysis by MAyDS & MINTRAN (2017)[1]*	EU targets for fuel economy standards for new vehicles: • 95 gCO_2/vkm by 2020/2021 • 15% reduction relative to 2020 by 2025 and 31%-37.5% by 2030 corresponding to 81 gCO_2/vkm by 2025 and 59-68 gCO_2/vkm by 2030 *Based on European Parliament (2009) and European Commission (2019)*	*No specifically defined benchmark for Paris Agreement compatibility for fuel economy standards. Accordingly, emission standards defined in 'Applying best-in-class level(s)' scenarios are used.* *[-]*
Share of public transport (bus and train) in passenger transport on land		20%-35% share of public transport in interurban passenger transport by 2030 *Based on Mitigation Potential Study: Recovering the Argentinian rail system (Universidad Nacional de San Martin, 2015)[1]*	International frontrunners' share of public transport in total passenger transportation on land: • Other Latin America: 64% share of public transport by 2050 • South Korea: 45% share of public transport in 2016 *Based on Replogle & Fulton (2014) for Other Latin America and IEA (2017c) for South Korea*	*No specifically defined benchmark for Paris Agreement compatibility for share in public transport. Accordingly, modal shifts defined in the most ambitious end of 'Applying best-in-class level(s)' scenarios are used.* *[-]*
Electric vehicle shares in total stock	**Personal Vehicles**	Penetration rate of electric vehicles of 20-60% in total car stock by 2040 *Based on 'Plataforma Escenarios Energéticos Argentina 2040' analysis (Beljansky et al., 2018)[1]*	International frontrunners in share of electric cars: 30% share of new cars in Norway in 2016 *Based on IEA (2018)*	Zero-emissions vehicles constitute 100% of newly-sold vehicles worldwide by 2035, leading to a 100% zero emissions car stock by 2050 *Based on benchmarks identified in Kuramochi et al. (2017)*
	Buses	100% replacement of total bus fleet with electric buses by 2040 *Based on 'Plataforma Escenarios Energéticos Argentina 2040' analysis (Beljansky et al., 2018)*	International frontrunners' share of electrified bus transportation: • Shenzhen: 100% electric bus fleet between 2012-2017 • California: full transition to 100% electric bus fleet by 2040 with last non-electric bus purchased latest by 2029 *Based on WRI (2018) for Shenzhen and YaleEnviornment360 (2018) for California*	

[1] *The Transport Action Plan includes efficiency labelling measures, measures to foster public transportation, plans to increase light duty EV, and measures to increase electric buses. However, the plan does not provide specific values for these indicators. For this reason, it could not be considered in the present analysis.*

Land-based freight transport				
Share of train transport in total freight transport	10.6%-14.6% share of train transport in total freight transport by 2030 *Based on Mitigation Potential Study: Recovering the Argentinian rail system (Universidad Nacional de San Martin, 2015) and National Transport and Climate Change Action Plan (MAyDS & MINTRAN, 2017)*	30% share of train transport in total freight transport by 2050 inspired by EU Member States of Slovakia, Austria and Switzerland *Based on analysis by the Climate Action Tracker* (2018f)	*No specifically defined benchmark for Paris Agreement compatibility for share in total freight transport.* *[-]*
Share of zero-emission trucks in total truck fleet	*No quantifiable target defined by national institutions for Argentina.* *[-]*	30% electric trucks in new truck sales by 2030 in entire EU *Based on analysis by the Climate Action Tracker* (2018f)	Zero-emissions trucks constitute 100% of newly sold trucks worldwide by around 2035-2040, leading to an almost 100% zero-emissions truck stock by 2050 *Based on analysis by the Climate Action Tracker* (2018f)

Indicator levels for scenario analysis in the PROSPECTS Argentina scenario evaluation tool

Indicator		National scenarios	Applying best-in-class level(s)	1.5°C compatible scenarios
Land-based road transport				
Emissions intensity improvement rate for non-electrified personal vehicle transport	High ambition	*Same indicator levels as in 'Current Development Scenario' as no national target/benchmark exists*	**1.5%** per year average emissions intensity improvement rate of non-electrified personal vehicle transport activity for **2016-2050**	*Same as in 'High ambition' indicator levels of Applying best-in-class-level(s) scenario as no PA compatible benchmarks exist*
	Low ambition		**1.8%** per year average emissions intensity improvement rate of non-electrified personal vehicle transport activity for **2016-2050**	
Share of public transport (bus, train) in total road and rail passenger transport activity	High ambition	**35% as of 2030 and constant thereafter**	• **29% by 2030** • **47% by 2040** • **64% by 2050**	*Same indicator levels as in 'High ambition' scenario of Applying best-in-class-level(s) category as no PA compatible benchmarks exist*
	Low ambition	**20% as of 2030 and constant thereafter**	• **22% by 2030** • **33% by 2040** • **45% by 2050**	
Share of electric vehicle in total passenger vehicle fleet: Personal Vehicle	High ambition	• **0% by 2020** • **7% by 2030** • **60% by 2040** • **97% by 2050**	• **1% by 2020** • **18% by 2030** • **67% by 2040** • **89% by 2050**	• **5% by 2020** • **42% by 2030** • **87% by 2040** • **100% by 2050**
	Low ambition	• **0% by 2020** • **3% by 2030** • **20% by 2040** • **70% by 2050**	• **2% by 2020** • **16% by 2030** • **36% by 2040** • **56% by 2050**	
Share of electric vehicle in total passenger vehicle fleet: Buses	High ambition	• **20% by 2020** • **60% by 2030** • **100% by 2040** • **100% by 2050**	• **33% by 2020** • **100% by 2030** • **100% by 2040** • **100% by 2050**	• **7% by 2020** • **49% by 2030** • **93% by 2040** • **100% by 2050**
	Low ambition		• **9% by 2020** • **69% by 2030** • **100% by 2040** • **100% by 2050**	

Land-based freight transport				
Share of train transport in total freight transport	**High ambition**	**14.6% as of 2030 and constant thereafter**	• **11% by 2030** • **21% by 2040** • **30% by 2050**	*Same as in 'High ambition' indicator levels of Applying best-in-class-level(s) scenario as no PA compatible benchmarks exist*
	Low ambition	**10.6% as of 2030 and constant thereafter**		
Share of zero-emission trucks in total truck fleet	**High ambition**	*Same indicator levels as in 'Current Development Scenario' as no national target/benchmark exists*	• **3% by 2020** • **16% by 2030** • **37% by 2040** • **58% by 2050**	• **6% by 2020** • **42% by 2030** • **91% by 2040** • **100% by 2050**
	Low ambition			• **5% by 2020** • **33% by 2030** • **75% by 2040** • **99% by 2050**

1.5°C Paris Agreement compatible scenarios

To be in line with a 1.5°C compatible pathway, passenger transport-related emissions must decrease to almost zero around mid-century (Kuramochi et al., 2017). Accordingly, all personal vehicles on the road must be electric by that time, requiring the last fossil fuel car to be sold by 2035 (Kuramochi et al., 2017). Recent research also highlights the importance of modal shifts in transport to achieve the GHG emissions reductions required to meet the Paris Agreement temperature target (Gota, Huizenga, Peet, Medimorec, & Bakker, 2018). Modal shift and electrification of transport ought to be complementary measures and not alternatives, as high shares of public transport facilitate the electrification of the entire sector. Combined, these measures lead to cleaner and less energy intensive urban transport.

- **Passenger transport on land - 1.5°C Paris Agreement compatible benchmarks:**
  - **Emissions intensity of new cars**: *As no 1.5°C Paris Agreement compatible benchmark exists for the emissions intensity improvement rate of non-electrified personal vehicle transport, this scenario uses the more ambitious end of the benchmark defined in 'Applying best-in-class level(s)' scenario.*
  - **Modal shift**: *As no 1.5°C Paris Agreement compatible benchmark exists for the modal shift achieved by mid-century, this scenario uses the more ambitious end of the benchmark defined in 'Applying best-in-class level(s)' scenario.*
  - **Electrification of personal vehicles**: For personal vehicles, the share of EVs in new sales is modelled with an s-curve that reaches 100% in 2036. With a lifetime for personal vehicles assumed to be 15 years, this leads to an indicator level of 42% EVs in total stock by 2030 and 100% by 2050 using a simplified stock turnover model.
  - **Electrification of buses**: The share of electric buses in new sales is modelled with an s-curve that reaches 100% in 2036. With a lifetime for buses assumed to be 12 years, this leads to an indicator level of 48% electric buses in total stock by 2030 and 100% by 2050 using a simplified stock turnover model.
- **Freight transport on land - 1.5°C Paris Agreement compatible benchmarks:**
  - **Modal shift**: *As no 1.5°C Paris Agreement compatible benchmark exists for the modal shift achieved by mid-century, this scenario uses the more ambitious end of the benchmark defined in 'Applying best-in-class level(s)' scenario.*

- **Share of zero-emission trucks**: To be compatible with the Paris Agreement's long-term goal, freight trucks need to be almost fully decarbonised by around 2050 (Climate Action Tracker, 2018d). Considering an average lifetime of 15 years, the last truck running on fossil fuel would need to be sold between 2035 (most ambitious end) and 2040 (least ambitious end).

Applying best-in-class level(s) scenarios

The objective of "applying best-in-class level(s)" scenarios is to assess the impact of sectoral transformations that have either already occurred or are expected to occur in other comparable countries or regions. This would indicate that reaching similar levels of change is technically feasible in Argentina, however without taking into account different political or socio-economic circumstances. For the four indicators assessed in this study, there are illustrative examples of countries or regions that have achieved or have a demonstrated potential to achieve an important level of transformation.

When it comes to public transport, South Korea (a recently developed economy) has achieved one of the highest shares of rail and bus in the modal split for passenger transport globally. In 2015, passenger train and bus trips represented almost 45% of the passenger-kilometers travelled on land (IEA, 2017c). The Institute for Transportation and Development Policy (ITDP) has developed a technically feasible scenario (High Shift Scenario) for the development of public transport in the 'Other America' region, reaching a share of 64% public transport in 2050 (Replogle & Fulton, 2014).

Norway's support for electric cars serves as the best-in-class example for electric mobility development. The global market share of electric vehicles (EVs) was only 0.8% in 2016 (IEA, 2017b). In Norway, EVs (incl. plug-in hybrids) however accounted for nearly 30% of new cars in 2016 (IEA, 2018). When it comes to the emissions intensity of new vehicles, the EU sets one of the most stringent fuel economy standards in the world.

- **Passenger transport on land - Applying best-in-class level(s): High ambition**

  - **Emissions intensity of new cars**: For emission standards of new cars, our analysis applies the EU targets of 95 gCO_2/vkm for 2020/2021. According to Regulation (EU) 2019/631 adopted by the European Parliament and the Council in April 2019 (European Commission, 2019), new EU fleet-wide CO_2 emission targets are set for the years 2025 and 2030 defined as a percentage reduction from the 2021 starting points:
    - Cars: 15% reduction from 2025 and 37.5% reduction from 2030 onwards
    - Vans: 15% reduction from 2025 and 31% reduction from 2030 onwards

    Accordingly, we assume targets of 81 gCO_2/vkm for 2025 and 59 gCO_2/vkm for 2030 for new LDVs in line with the more ambitious end for cars. We assume no further improvements after 2030. The inputs on annual activities in vehicle-kilometres travelled, total and new vehicle stock as well as the share of EVs are taken from the Current Development Scenario. By assuming an average life expectancy of 15 years and adding new cars with the efficiency standards specified above using a stock turnover model, we calculated the average emissions intensity improvement rate of non-electrified personal vehicle transport activity as required for input to the PROSPECTS Argentina scenario evaluation tool.

  - **Modal shift**: Public transport (bus and train) share of 64% in total road passenger transport used as a 2050 target based on the "High Shift Scenario" for the "Other America" region. The increase is interpolated linearly.

  - **Electrification of personal vehicles**: The share of EVs in new vehicle sales is based on the historical growth rate observed for Norway between 2007 and 2017. The share of EVs in new sales is modelled with an s-curve based on the best practice case applied for Argentina (De Villafranca Casas, Kuramochi, Hagemann, Fekete, et al.,

2018). With a 15-year lifetime for personal vehicles, this leads to an indicator level of 17% EVs in total stock by 2030 and 88% by 2050 using a simplified stock turnover model.

- **Electrification of buses**: The most ambitious target is informed by Shenzen's best-in-class example to reach a 100% share of electric buses in total bus fleet within 5 years between 2012-2017 (WRI, 2018). An additional 10 years is added to achieve a fully electrified bus fleet to account for challenges in the uptake of electrified rural bus transport.

- **Passenger transport on land - Applying best-in-class level(s): Low ambition**

  - **Emissions intensity of new cars**: For emission standards of new cars, our analysis applies the EU targets of 95 gCO_2/vkm for 2020/2021. According to Regulation (EU) 2019/631 adopted by the European Parliament and the Council in April 2019 (European Commission, 2019), new EU fleet-wide CO_2 emission targets are set for the years 2025 and 2030 defined as a percentage reduction from the 2021 starting points:
    - Cars: 15% reduction from 2025 and 37.5% reduction from 2030 onwards
    - Vans: 15% reduction from 2025 and 31% reduction from 2030 onwards

    Accordingly, we assume targets of 81 gCO_2/vkm for 2025 and 68 gCO_2/vkm for 2030 for new LDVs in line with the less ambitious end for vans. We assume no further improvements after 2030. Calculations follow the approach outlined under the high ambition scenario above.

  - **Modal shift**: Public transport (bus and train) share of 45% in total road passenger transport used as a 2050 target based on the share achieved by South-Korea. The increase is interpolated linearly.

  - **Electrification of personal vehicles**: The 30% current share of EVs in new vehicle sales in Norway is applied as the 2030 target for middle- and high-income countries according to the 'good practice' policy scenario developed by Kriegler et al. (2018). We further extrapolate this target and assume a linear increase to a 70% share of electric cars in new sales by 2050. With a 15-year assumed lifetime for personal vehicles, new sales of EVs translate into the EV share of the total fleet over time via a stock turnover model.

  - **Electrification of buses**: Least ambitious target informed by California's legislation to reach a 100% share of electric buses in new bus sales by 2030 to reach a fully electrified bus fleet by 2040 (YaleEnvironment360, 2018).

- **Freight transport on land - Applying best-in-class level(s)**

  - **Modal shift**: The 30% share of train transport in total freight transport by 2050 is based on Slovakia, Austria and Switzerland that have implemented regulatory measures to incentivise rail transport over road traffic (Climate Action Tracker, 2018d).

  - **Share of zero-emission trucks**: The benchmark is based on the 30% electric trucks share in new truck sales by 2030 being discussed in the entire EU28 that could be achieved through a combination of different policies supporting a fast uptake of zero-emission trucks (Climate Action Tracker, 2018d).

National scenarios

Indicator values for the 'National scenarios' in the Argentinian passenger transport sector have been informed by the recently published scenario analysis of the 'Plataforma Escenarios Energéticos Argentina 2040' analysis (Beljansky et al., 2018). The *Mitigation Potential Study: Recovering the Argentinian rail system* by the Universidad Nacional de San Martin provides further input on the potential for modal shift towards freight rail transport (Universidad Nacional de San Martin, 2015).

- **Passenger transport on land - National scenarios: High ambition**
    - **Emissions intensity of new cars**: *No nationally determined benchmark available for the emissions intensity reduction by mid-century, this scenario uses indicator values defined in 'Current Development Scenario'.*
    - **Modal shift**: *No nationally determined benchmark available for the modal shift by mid-century, this scenario uses indicator values defined in 'Current Development Scenario'.*
    - **Electrification of personal vehicles**: The most ambitious benchmark of a 60% share of EVs in the total car fleet by 2040 from the 'Plataforma Escenarios Energéticos Argentina 2040' analysis (Beljansky et al., 2018) is applied using an s-curve shaped increase from the 2015 level and continuation beyond 2040 towards 2050.
    - **Electrification of buses**: Benchmark of a 100% share of electric buses in total bus fleet by 2040 from the 'Plataforma Escenarios Energéticos Argentina 2040' analysis (Beljansky et al., 2018) applied using an s-curve shaped increase from the 2015 level.
- **Passenger transport on land - National scenarios: Low ambition**
    - **Emissions intensity of new cars**: *No nationally determined benchmark available for the emissions intensity reduction by mid-century, this scenario uses indicator values defined in 'Current Development Scenario'.*
    - **Modal shift**: *No nationally determined benchmark available for the modal shift by mid-century, this scenario uses indicator values defined in 'Current Development Scenario'.*
    - **Electrification of personal vehicles**: The least ambitious benchmark of a 20% share of EVs in the total car fleet by 2040 from the 'Plataforma Escenarios Energéticos Argentina 2040' analysis (Beljansky et al., 2018) is applied using an s-curve shaped increase from the 2015 level and continuation beyond 2040 towards 2050.
    - **Electrification of buses**: Benchmark of a 100% share of electric buses in total bus fleet by 2040 from the 'Plataforma Escenarios Energéticos Argentina 2040' analysis (Beljansky et al., 2018) is applied using an s-curve shaped increase from the 2015 level.
- **Freight transport on land – National scenarios**
    - **Modal shift**: The *Mitigation Potential Study: Recovering the Argentinian rail system* informs a range of 10.6%-14.6% for the share of train transport in total freight transport by 2030 (Universidad Nacional de San Martin, 2015). The National Transport and Climate Change Action Plan indicates an aim to increase the share of train in freight transport from the current 4% to about 12% by 2030 (MAyDS & MINTRAN, 2017)
    - **Share of zero-emission trucks**: *No nationally determined benchmark available for the modal shift by mid-century, this scenario uses indicator values defined in 'Current Development Scenario'.*

4.2.2.2 Quantification of emission levels with PROSPECTS Argentina

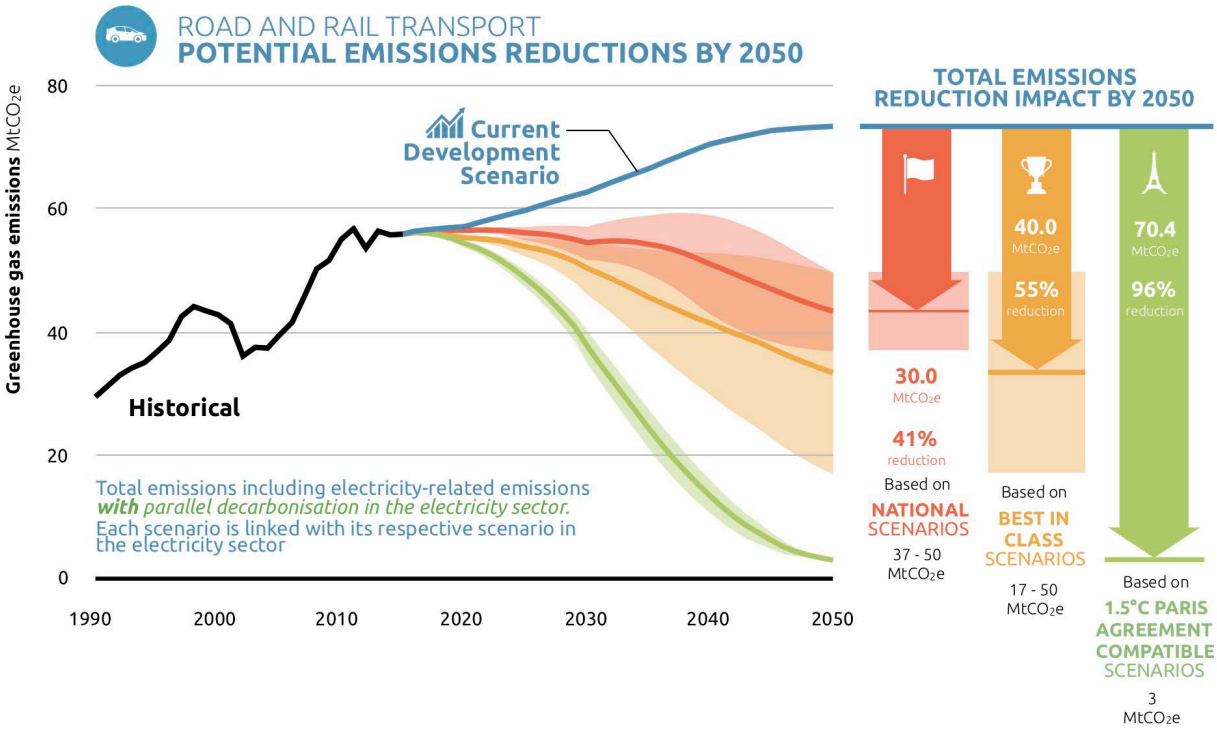


Figure 27: GHG emissions in the land-based passenger and freight transport sector in Argentina, including electricity-related emissions and parallel decarbonisation actions according to the respective scenario categories in the Argentinian electricity supply sector. All emission pathways in the residential buildings sector assume the forecasted electricity supply mix as specified for the respective scenario categories. The CAT PROSPECTS Argentina scenario evaluation tool has estimated all historical emission calculations and sectoral projections towards 2050. For this reason, historical emission levels might differ from the latest inventory data.

Figure 27 illustrates the ranges of GHG emissions including electricity-related emissions for land-based passenger and freight transport in Argentina up to 2050 under the different scenarios. Emissions continue to increase up to 2050 under a Current Development Scenario (CDS) to around 73 $MtCO_2e$/yr, including electricity-related emissions. Accelerated acclimate action can significantly reduce GHG emissions levels by 2050 through (1) initiating a substantial modal shift in favour of passenger and freight transport, (2) introducing zero-emission vehicles, buses, and trucks, and (3) tightening CO_2 fuel economy standards for new personal vehicles. The mitigation impact of electrifying passenger and freight transport critically depends on the decarbonisation of electricity generation.

- The **'1.5°C Paris Agreement compatible' pathway** substantially reduces emissions (incl. electricity-related emissions) after 2020 and leads to the near complete decarbonisation of the land-based passenger and freight transport by mid-century. This is mainly driven by the strong electrification of the passenger vehicle and bus fleet as well as the ambitious uptake of zero-emission trucks. Further influencing factors include a modal shift towards a higher share of public and train transport as well as emissions intensity improvements of non-electric personal vehicles.

- The upper bound of the **'Applying best-in-class levels' pathway** stabilises emissions (incl. electricity-related emissions) from land-based passenger and freight transport around 2030 and leads to slightly lower emission levels of around 50 $MtCO_2e$/yr by mid-century compared to the 2015 level of 56 $MtCO_2e$/yr. Under the lower bound trajectory, emission levels constantly decrease after 2020 until mid-century. The lower bound emission levels remain above the '1.5°C Paris Agreement compatible' pathway range by

around 14 $MtCO_2e$/yr. This is due a less ambitious modal shift towards lower-emitting modes of transport, lower transport electrification, as well as less ambitious decarbonisation of the Argentinian electricity supply in this scenario category.

- The upper bound of the **'National scenarios' pathway** stabilises emissions from land-based passenger and freight transport at 2015 emissions level until 2030, followed by an increase in emissions between 2030 and 2040. Thereafter, emissions decrease to reach around 50 $MtCO_2e$/yr by 2050 and overlapping with the upper bound of the 'Applying best-in-class levels' pathway range. Under the lower bound trajectory, emissions would decrease after 2020 to reach 37 $MtCO_2e$/yr by 2050, which would be well within the 'Applying best-in-class levels' pathway range.

Accelerated climate action in land-based passenger and freight transport changes the electricity demand of the sector, given the increased share of zero-emission vehicles, buses and trucks under the different scenarios considered. Figure 28 illustrates the same scenario pathways as in Figure 27 including electricity-related emissions but no parallel decarbonisation actions beyond the Current Development Scenario (CDS). Emission levels across all scenarios decrease significantly slower in

Figure 28, driven by shifting from direct fuel use to electricity.

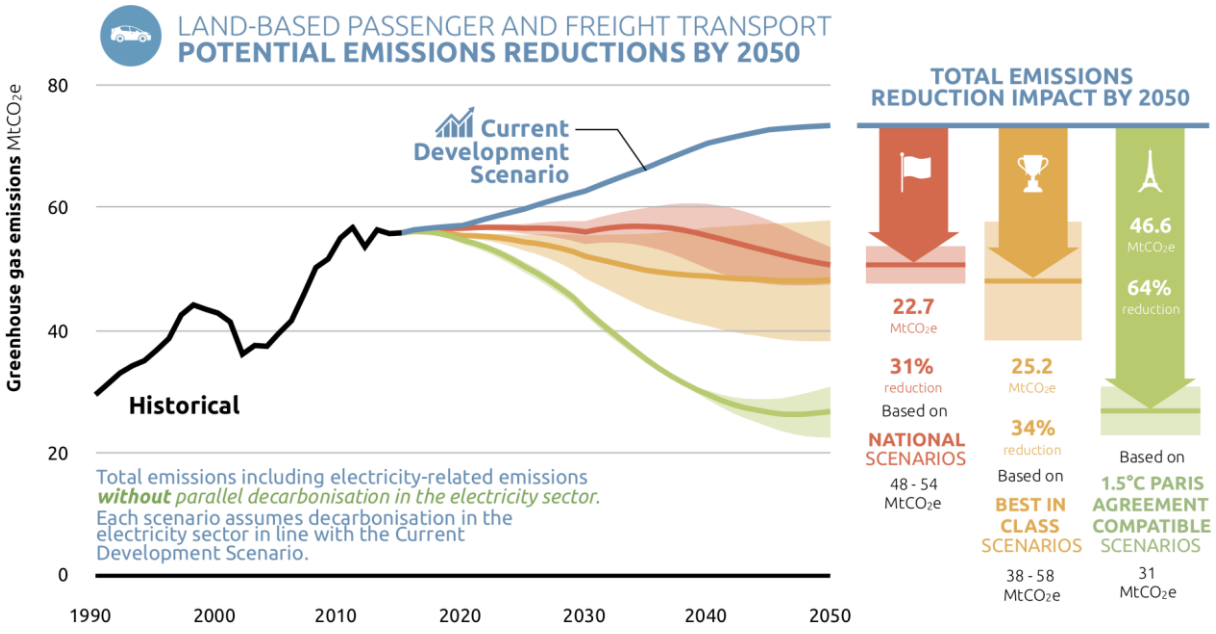


Figure 28: GHG emissions in the land-based passenger and freight transport sector in Argentina, including electricity-related emissions but no parallel decarbonisation actions beyond those included in the Current Development Scenario (CDS). All historical emission calculations and sectoral projections towards 2050 have been done in the CAT PROSPECTS Argentina scenario evaluation tool. For this reason, historical emission levels might differ from latest inventory data.

This means that the difference in emissions between both graphs stems from decarbonisation efforts in the Argentinian electricity generation sector. This comparison emphasises the critical importance of comprehensive action across sectors. Electrifying passenger and freight transport without increasing the share of zero-carbon technologies in electricity generation will limit potential positive mitigation impacts of accelerated climate action in the land-based passenger and freight transport.

Figure 29 breaks down the 2050 GHG emissions trajectories of the transport sector by land-based passenger transport (upper graph) and land-based freight transport (lower graph).

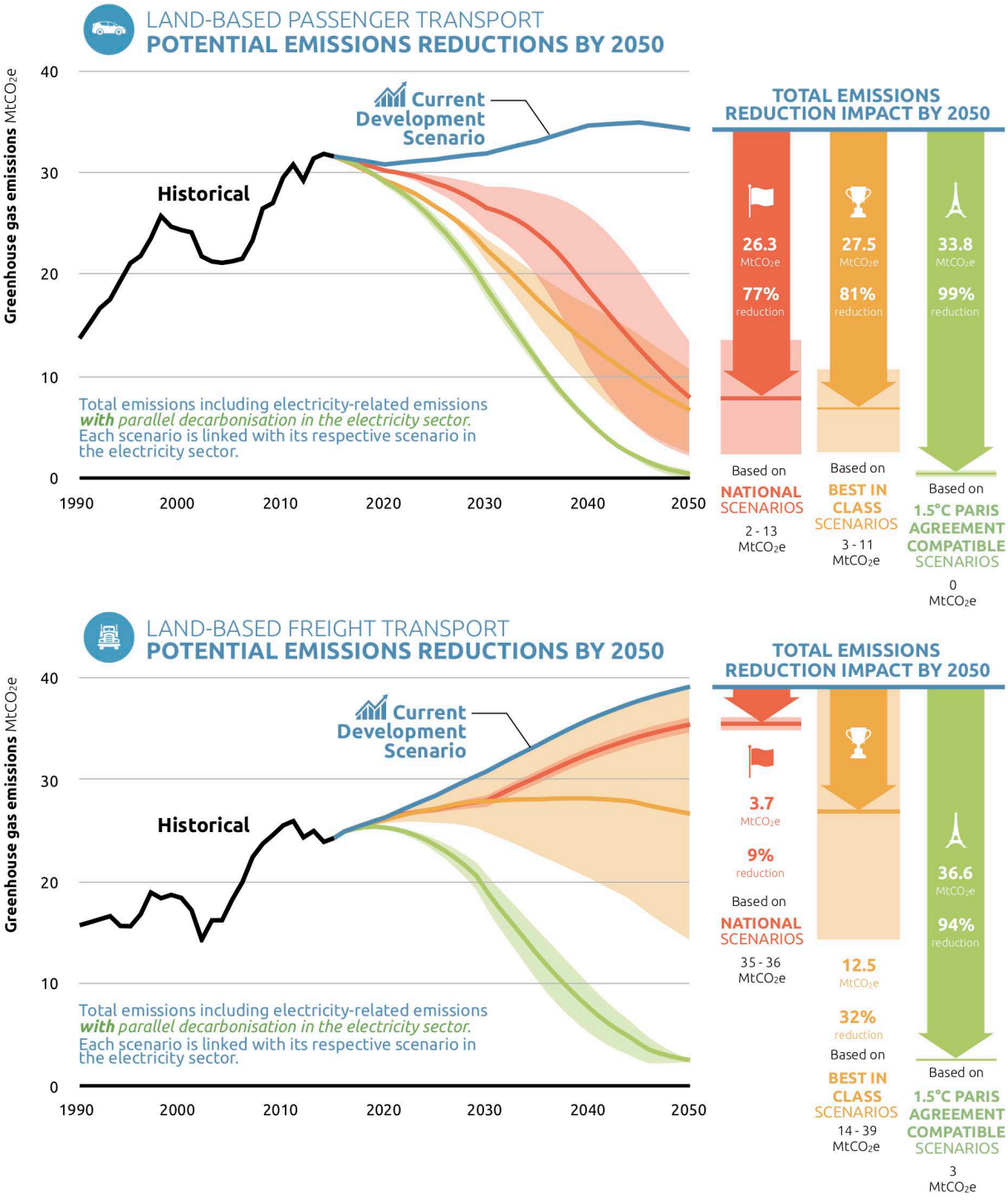


Figure 29: GHG emissions in the land-based passenger transport sector (upper graph) and land-based freight transport sector (lower graph) in Argentina, including electricity-related emissions and parallel decarbonisation actions according to the respective scenario categories in the Argentinian electricity supply sector. All emission pathways in the residential buildings sector assume the forecasted electricity supply mix as specified for the respective scenario categories. The CAT PROSPECTS Argentina scenario evaluation tool has estimated all historical emission calculations and sectoral projections towards 2050. For this reason, historical emission levels might differ from the latest inventory data.

4.3 Residential buildings sector

Energy efficiency gains through tightened building codes, increased rates of thermal retrofits, electrification of water/space heating, and more efficient appliances can almost fully decarbonise the Argentinian residential buildings sector by mid-century. These efforts again critically depend on the electricity supply sector decarbonising in line with the Paris Agreement temperature goal. This residential building sector transition entails key opportunities to advance socially just housing, while generating local employment and attenuating the adverse health effects of inappropriate housing. Even without any further climate action in the electricity supply sector beyond current levels, the abovementioned policies in Argentina's residential buildings sector could still reduce emissions by up to 31% below today's levels by 2050.

Table 21 provides an overview of the analysis results for scaling up climate action in the residential buildings sector. The table's upper rows present the value ranges for three indicators considered relevant for the scenario modelling in the Argentinian residential buildings sector. Figure 30 displays the resulting emission trajectories for each of the three scenarios.

Table 21: Outcome overview of the scaling up climate action analysis in the residential buildings sector

Indicator	Indicator values for scenario categories		
	National scenarios	**Applying best-in-class level(s)**	**1.5°C compatible benchmarks**
Renovation rate	• **0.5%-2%** renovation rate from **2020** • Rate under current policies before 2020	• **2%** renovation rate from **2030** • Rate under current policies before 2030	• **3%** renovation rate from **2020** • Rate under current policies before 2020
	Based on 'Plataforma Escenarios Energéticos Argentina 2040' analysis (Beljansky et al., 2018)	*Based on best-in-class practice identified in Kriegler et al. (2018)*	*Based on benchmark for non-OECD regions specified in Kuramochi et al.* (2017)
Relative improvement of energy efficiency in renovated/new buildings	**50%** improvement compared to 2015	**45%-81%** improvement compared to 2015	**75%-100%** improvement compared to 2015
	Based on 'Plataforma Escenarios Energéticos Argentina 2040' analysis (Beljansky et al., 2018)	*Based on best-in-class benchmarks for new buildings identified in Kriegler et al.* (2018)	*Based on benchmarks for new buildings identified in Kuramochi et al.* (2017)
Energy intensity improvement of cooking/ lighting/ appliances (electricity + direct energy)	*No quantifiable energy intensity improvements in action plan but intention to upscale efficiency standards of cooking/lighting appliances by 2030*	Average efficiency improvement of **1.5%-1.8%** per year applied in 2016–2050	Average efficiency improvement of **2%** per year applied in 2016–2050
	Based on National Action Plan on Energy and Climate Change (MAyDS & MINEM, 2017)	*Based on best-in-class practice identified in Fekete et al.* (2015)	*Based on benchmarks identified in Kriegler et al. (2018)*
Electrification rate in water heating/space heating	**40%-60%** electrification rate in water/space heating **by 2040** with continuation of trends up to 2050	*No specified benchmark, accordingly electrification rate under high ambitious end of national scenarios applied*	**100%** electrification rate in water/space heating **by 2050**
	Based on National Action Plan on Energy and Climate Change (MAyDS & MINEM, 2017) and 'Plataforma Escenarios Energéticos Argentina 2040' analysis (Beljansky et al., 2018)	*[-]*	*Based on plans by European Union MS to entirely replace natural gas-based heat boilers with zero emissions electric/hybrid heat pumps, or other renewable energy technologies*

Required policy measures for sectoral transformation	Remaining challenges threatening implementation
⇨ Support low-carbon heating alternatives to initiate switch away from gas-based heating	⇨ Lack of willingness by political leadership to initiate ambitious sectoral transformation, particularly given government support to gas-based technologies and support for the development of the domestic gas sector
⇨ Introduce measures reducing the upfront investment costs of thermal retrofits (e.g. lower interest rates, repaying the costs of efficiency measures with savings on the heating costs)	⇨ Tight national fiscal budget situation coupled with a lack of international funding for social housing
⇨ Increase awareness about the (non-)economic benefits of increasing energy efficiency in the housing sector	⇨ High upfront costs for deep building retrofits in times of economic crisis hinder increased renovation rates

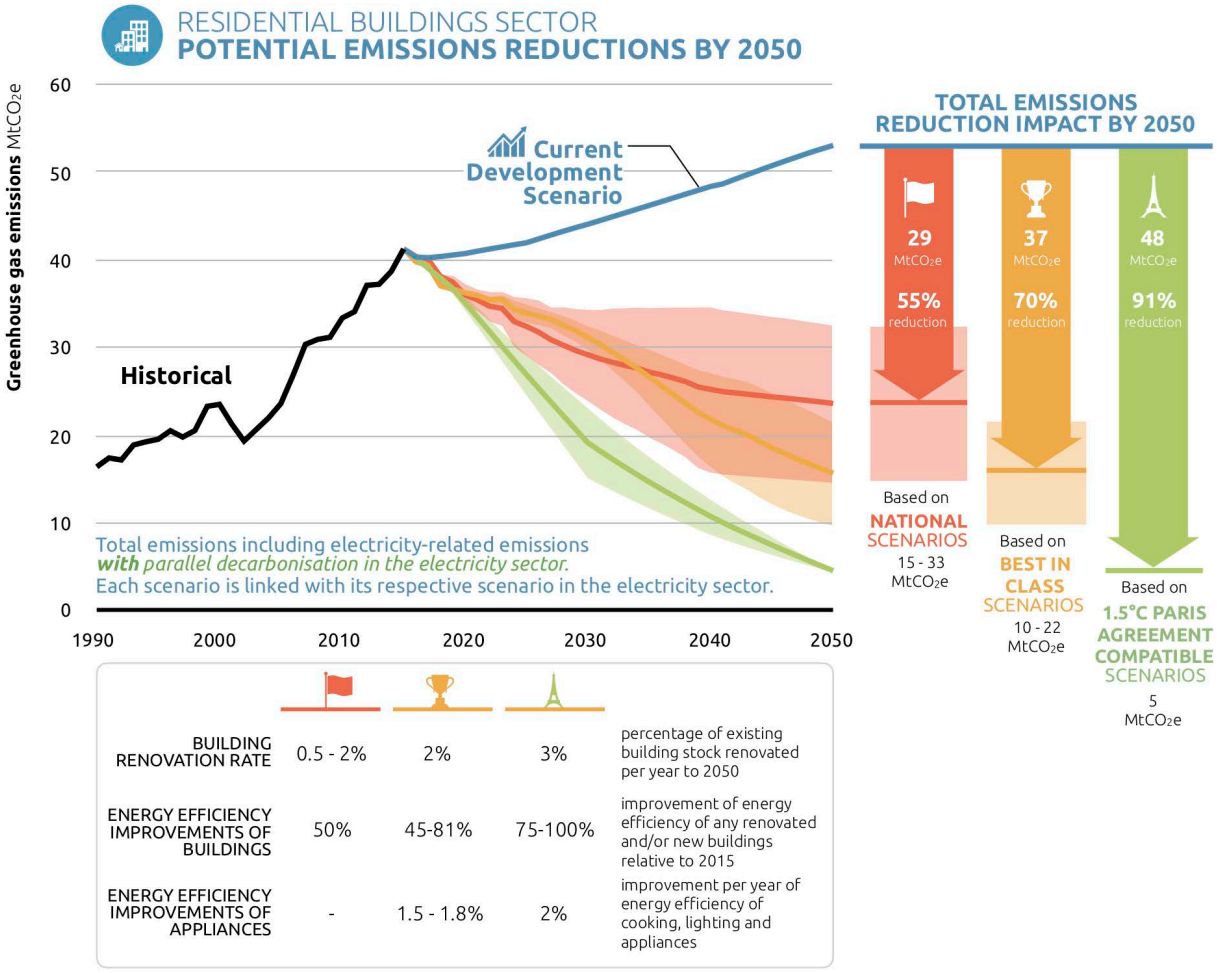


Figure 30: GHG emissions in the Argentinian residential buildings sector under different scenarios, including the sector's electricity-related emissions and additional climate action in the electricity supply sector beyond current policies. All emission pathways in the residential buildings sector assume the forecasted electricity supply mix as specified for the respective scenario categories. The CAT PROSPECTS Argentina scenario evaluation tool has estimated all historical emission calculations and sectoral projections towards 2050. For this reason, historical emission levels might differ from the latest inventory data.

4.3.1 Argentinian context for scaling up climate action in the buildings sector

Significant potential for emissions reduction in residential housing

The implementation of energy efficiency measures and a substitution of natural gas with cleaner energy sources such as thermal solar heaters or renewable-based electrification have the potential to substantially reduce emissions in the sector (MAyDS & MINEM, 2017). Recent analysis by the Argentinian government shows that the construction of low-emission residential housing in combination with other mitigation measures leads to a mitigation potential representing more than 40% of the NDC reduction target in the Argentinian energy sector by 2030 (MIOPV et al., 2019) The residential sector in Argentina is responsible for about 25% of total energy consumption (MINEM, 2016) and 15% of total emissions in 2014, including indirect emissions from electricity consumption (Ministry of Environment and Sustainable Development, 2017a). For this reason, the residential buildings sector is an important area of accelerated climate action.

While energy efficiency measures and self-consumption of renewable electricity would contribute to reducing emissions in the sector, most potential to accelerate mitigation lies in substituting natural gas with zero-carbon alternatives as the sector's main source of energy. Natural gas and liquefied petroleum gas (LPG) represent 64% and 9% respectively of the final energy consumption in the residential sector in 2016 (MAyDS & MINEM, 2017). Heating

currently remains the largest energy end-use in residential buildings and is predominantly generated with gas-based heaters. Gas-based heating is the main driver of emissions in the residential building sector.

The electrification of energy end-uses in the residential sector presents an opportunity for the sector's decarbonisation. This electrification can largely be implemented with electric heating using heat pumps, assuming a simultaneous decarbonisation of the electricity supply sector (IEA, 2019). The low end-consumer costs for natural gas remains a major challenge for this switch in heating technologies. The low costs decrease the economic attractiveness of cleaner alternatives and, combined with the government's intention to increase domestic natural gas exploitation, could lock the residential sector into fossil fuel-based heating in the long-term.

From an energy efficiency perspective, wide-ranging building retrofit programmes to achieve higher standards of thermal insulation are important to reduce emissions of the existing building stock. High upfront costs for deep retrofits and the lack of resources to ensure compliance of the thermal insulation standards in buildings currently prevent the increasing renovation rates in Argentina planned in the National Energy Action Plan and Climate Change (MAyDS & MINEM, 2017).

Low-emission housing provides multiple benefits beyond climate mitigation

Low-emission (social) housing has the potential to improve health, education and social integration while driving the transformation towards a low-carbon residential buildings sector. The social, economic and health-related benefits of social housing could enable Argentina to promote its sustainable development agenda, particularly on inclusive, resilient and sustainable human settlements and cities (SDG 11) as well as on increasing well-being and general health (SDG 3).

Energy efficiency improvements through low-emission housing present significant opportunities for local economic development and job creation (Day et al., 2018). Argentina's initiative to build energy efficient buildings is guided by social housing projects and a manual that provides guidelines to support the construction of sustainable social housing. These projects can demonstrate financial self-sufficiency and other benefits such as job creation, poverty alleviation, skills development, capacity building, and emission reductions, as has been demonstrated in other countries pursuing low-emissions social housing. Efforts in this field offer high potential for further gains in employment for all skill and qualification levels within the labour force, as well as gains in innovation and technology development in the sector.

Energy efficiency and electricity self-consumption from renewable sources lead to lower energy consumption and therefore lower energy costs for end users, while reducing overall emissions. After a high upfront investment, the running costs of heating and cooling would decrease significantly while improving the quality of life for residents. Further incentivising Argentinians to generate their own electricity from distributed renewable resources (e.g. with rooftop PV panels) would lead to progress towards key national sustainable developments goals (SDG), such as ensuring access to affordable, reliable, sustainable and modern energy for all (SDG 7). Law 27.424 intends to encourage small-scale electricity users to produce their own energy with renewable resources (Government of Argentina, 2017a), including residential and commercial consumers. Self-consumption of electricity is encouraged through a net-metring structure, in which consumers can sell their electricity generated with renewable sources — and not consumed — to the grid. These incentives are implemented by means of the Distributed Renewable Generation Fund (FODIS), which facilitates loans, subsidies to credit rates, and encourages R&D.

A relevant share of the in-house air pollution stems from the combustion of fossil fuels in households. A transformation towards a cleaner residential sector would also reduce adverse health impacts from air pollution.

4.3.2 Scenario analysis for scaling up climate action in the buildings sector

4.3.2.1 Identification of indicator levels

Table 22 provides a complete overview of indicator levels identified for the three different scenario categories. The upper part presents the respective benchmarks specified in relevant literature. The lower part explains how these benchmark levels were translated into indicator levels for input in the PROSPECTS Argentina scenario evaluation tool.

Table 22: Identification of indicator levels for scaling up climate action in the residential buildings sector

		National scenarios	Applying best-in-class level(s)	1.5°C compatible benchmarks
Renovation rate		**0.5-2%** annual renovation rate with **50%** energy efficiency improvement per retrofit *Based on 'Plataforma Escenarios Energéticos Argentina 2040' analysis (Beljansky et al., 2018)*	**2%** renovation rate from **2030** onward with **45%** energy efficiency improvement per retrofit *Based on best-in-class practice identified in Kriegler et al. (2018)*	**3%** renovation rate from **2020** onward with **75%–80%** energy efficiency improvement per retrofit *Based on benchmark for non-OECD regions specified in Kuramochi et al. (2017)*
New buildings stock		*No quantifiable target defined by national institutions for Argentina* *[-]*	**20-22 kWh/m²/year** for new buildings stock from **2030** onward *Based on best-in-class benchmarks for new buildings identified in Kriegler et al. (2018)*	**0 kWh/m²/year** for new buildings stock from **2025** onward *Based on benchmarks for new buildings identified in Kuramochi et al. (2017)*
Appliances		*No quantifiable target defined by national institutions for Argentina but intention to upscale efficiency standards and LED lighting by 2030* *Based on National Action Plan on Energy and Climate Change (MAyDS & MINEM, 2017)*	Average efficiency improvement of **1.5-1.8%** per year (all appliances) *Based on best-in-class practice identified in Fekete et al. (2015)*	Average efficiency improvement of **2%** per year (all appliances) *Based on benchmarks identified in Kriegler et al. (2018)*
Water/space heating		• Electrification of water/space heating: **40-60%** of buildings shift from natural gas to heat pumps by 2040 • Full deployment of thermal solar for water heating by 2040, reducing the consumption of natural gas from **1,5** m³/user-day to **0,5** m³/user-day *Based on 'Plataforma Escenarios Energéticos Argentina 2040' analysis (Beljansky et al., 2018)*	*No specifically defined benchmark for best-in-class level(s) scenarios* *[-]*	**100%** electrification of water/space heating **by 2050** *Based on plans by European Union MS to entirely replace natural gas-based heat boilers with zero emissions electric/hybrid heat pumps, or other renewable energy technologies*
Indicator levels for scenario analysis in the PROSPECTS Argentina scenario evaluation tool				
Renovation rate	High ambition	• **2%** renovation rate from **2020** • Rate under current policies before 2020	• **2%** renovation rate from **2030** • Rate under current policies before 2030	• **3%** renovation rate from **2020** • Rate under current policies before 2020
	Low ambition	• **0.5%** renovation rate from **2020** • Rate under current policies before 2020		

Relative improvement of energy efficiency in renovated/ new buildings	High ambition	**50%** as identified by 'Plataforma Escenarios Energéticos Argentina 2040' analysis	**81%** calculated compared to average historical energy intensity per m^2 in 2015 from benchmark for new buildings stock	**100%** as derived from benchmark for new buildings stock of **0 kWh/m^2/year**
	Low ambition		**45%** as derived from benchmark for renovated buildings stock	**75%** as derived from lower range of benchmark for renovated buildings stock
Energy intensity improvement of cooking/ lighting/ appliances (electricity + direct energy)	High ambition	*Same indicator levels as in 'Current Development Scenario' as no national target/benchmark exists*	Average efficiency improvement of **1.8%** per year (all appliances)	Average efficiency improvement of **2%** per year (all appliances)
	Low ambition		Average efficiency improvement of **1.5%** per year (all appliances)	
Electrification rate in water heating/space heating	High ambition	**60%** electrification rate in water/space heating **by 2040** with continuation of trends up to 2050	*No specified benchmark, accordingly the electrification rate under the high ambition end of national scenarios is applied*	**100%** electrification rate in water/space heating **by 2050**
	Low ambition	**40%** electrification rate in water/space heating **by 2040** with continuation of trends up to 2050		

1.5°C Paris Agreement compatible benchmarks

The 1.5°C Paris Agreement compatible benchmarks represent sectoral indicator values, which are in line with a 1.5°C Paris Agreement compatible sectoral emission trajectory for the Argentinian residential buildings sector. A review of relevant literature and studies in the field identifies the following:

- All new buildings shall be fossil fuel free and near net-zero energy by 2025. This is an average value proposed for OECD regions based on 1.5°C compatible benchmarks, as identified in Kuramochi et al. (2017).

- For the retrofit of the existing residential buildings stock, the renovation rate needs to increase to 3% by 2020 (constituting the average benchmark for non-OECD regions) with an achieved average reduction of 75–80% in final energy use per retrofit (Boermans, Bettgenhäuser, Offermann, & Schimschar, 2012; Kuramochi et al., 2017).

- For the energy efficiency performance of lighting and residential appliances, an average efficiency improvement of 2% per year is assumed, as implied by the "net zero" policy package proposed by Kriegler et al. (2018), which adds policies pushing for zero-emission technologies particularly in energy end-use sectors in line with the Paris Agreement's goal to reach net-zero CO_2 emissions in the second half of the century.

- For the decarbonisation of water/space heating, a 100% electrification rate is assumed in residential buildings by 2050. Replacing fossil fuel-based heating with renewable energy such as solar thermal heating would achieve equivalent results. This has been mainly inspired by the assessment conducted in the Climate Action Tracker (Climate Action Tracker, 2016) concluding that the buildings sector needs to decarbonise by mid-century to be in line with a 1.5°C pathway.

Based on the Paris Agreement compatible benchmarks as specified above, the following indicator levels have been identified for the quantification of emissions trajectories with the PROSPECTS Argentina scenario evaluation tool:

- **Renovation rate**: 3% renovation rate from 2020 onwards with current renovation rates used before 2020.

- **Relative improvement of energy efficiency in renovated/new buildings**: Range of 75% (deep retrofit of existing buildings) to 100% (near-zero emission new buildings).

- **Relative improvement of total energy intensity of cooking/lighting/appliances (electricity + direct energy)**: Average efficiency improvement of 2% per year for all appliances.

- **Electrification rate in water heating/space heating**: 100% electrification of space heating/water by 2050. We assume a linear interpolation between a level of 3% in 2015 and the target value.

Applying best-in-class levels

Applying best-in-class levels of international frontrunners in increasing the energy efficiency of new and existing buildings indicates a path for how the Argentinian residential buildings sector could transform under similar developments. A review of relevant literature and international good practices identifies the following benchmarks:

- The European Union's Energy Performance of Buildings Directive (EPBD) requires all new buildings in EU Member States to be nearly net-zero energy by the end of 2020 (Climate Action Tracker, 2016). In general, the EPBD's requirements can be considered international best practice, although EU Member States interpret the directive's objective of 'near zero energy' differently in terms of final energy consumption allowed (BPIE, 2015). A common interpretation of "nearly net-zero energy" is an energy consumption of 22 kWh/m^2/year. Denmark has the most ambitious definition of nearly Zero-Energy Buildings (nZEB) with a proposed (primary) energy consumption level of 20 kWh/m^2/year. The range of 20-22 kWh/m^2/year constitutes an improvement of 79%-81% compared to the average energy efficiency of the existing building stock in Argentina in 2015 (Kriegler et al., 2018).

- For existing residential buildings, a renovation rate of 2% with efficiency improvements of 45% from 2030 onwards can be considered as a best-in-class approach (Kriegler et al., 2018), based on the following indicator components identified in the literature and other policies:

    - **Renovation rate (% per year)**: 2% renovation rate as stipulated by the '2 Degree Scenario' in IEA's Energy Technology Perspective 2016 report (IEA, 2016). The European Union's EPBD obliges a 3% deep renovation rate for centrally-owned government buildings (Climate Action Tracker, 2016) but this renovation rate has not yet been extended to residential buildings.

    - **Relative improvement of energy efficiency in renovated/new buildings (in %)**: Subsidies and loans offered by the government-owned banking group *Kreditanstalt fuer Wiederaufbau* (KfW) in Germany provide economic incentives for new buildings and for renovations of existing buildings that meet requirements of the quality label "Effizienzhaus" (efficient building). The maximum subsidy (corresponding to the highest standard) are granted to the buildings which are at least 45% more efficient than the reference house in the respective category, i.e. require only 55% of the energy needed by a reference house in the corresponding category.

    - **Target year**: The target year of the renovation rate specified above is 2020 for developed countries as informed by the European Union's EPBD and 2030 for developing countries.

- As for energy efficiency improvements of appliances and lighting, an average range of 1.5%-1.8% per year across all appliances is considered international best practice. Analysis conducted by Kriegler et al. (2018) informs the lower ambition end of 1.5% per year, while analysis by Fekete et al. (2015) informs the higher ambition end of 1.8% per year. This higher ambition end builds on the average improvement of appliances'

efficiencies between 2001 and 2012 for EU member states with successful efficiency policies implemented before 2005: UK, Sweden, Netherlands, France, Slovakia, Finland, Czech Republic and Latvia according to the MURE database.

These identified best-in-class benchmarks translate into indicator levels for the PROSPECTS-based emission trajectory in Argentina as follows:

- **Renovation rate**: 2% renovation rate from 2020 onwards (identified by IEA ETP 2016) with a renovation rate applied under the Current Development Scenario (CDS) before 2020.

- **Relative improvement of energy efficiency in renovated/new buildings**: Range of 45% adopted from best-in-class efficiency improvement for renovations (deep retrofit of existing buildings) to 81% efficiency improvement by applying best-in-class levels of European Union's Energy Performance of Buildings Directive (EPBD), as implemented in Denmark, to Argentina's average historical energy intensity per m^2 in 2015.

- **Relative improvement of total energy intensity of cooking/lighting/appliances (electricity + direct energy)**: Average efficiency improvement of 1.5%-1.8% per year for all appliances.

National scenarios

Indicator values for the 'National scenarios' in the Argentinian residential buildings sector have been informed by the recently published scenario analysis of the 'Plataforma Escenarios Energéticos Argentina 2040' (Beljansky et al., 2018).

- *For new buildings stock under construction, no quantifiable target could be identified from the analyses of national institutions in Argentina.*

- For the renovation of the existing residential buildings stock, the scenarios specify a range of 0.5-2% renovation rate per year with a 50% energy efficiency improvement per retrofit.

- *As for energy efficiency improvements of appliances and lighting, no quantifiable target could be identified from the analyses of national institutions for Argentina apart from the intention to upscale efficiency standards and LED lighting by 2030.*

- As for the electrification of water and space heating, the scenarios specify a range of 40-60% of residential buildings shifting from natural gas to heat pumps by 2040 and the full deployment of thermal solar for water heating by 2040 reduces the consumption of natural gas from 1,5 m^3/user-day to 0,5 m^3/user-day. The National Action Plan on Energy and Climate Change assumes a 90% share of heat pumps in new heating systems installed between 2026-2030 (Ministry of Energy of Argentina, 2017). Based on the provided assumptions, a simplified stock turn-over model estimates an overall penetration of heat-pumps ranging between 30-50% by 2030 in the total heating systems stock. We consider the penetration rates of 40-60% by 2040 assumed by Plataforma Scenarios 2040 are aligned with the National Action Plan (Beljansky et al., 2018).

Based on the national scenarios described above, the following indicator levels have been identified for the quantification of emissions trajectories with the PROSPECTS Argentina scenario evaluation tool:

- **Renovation rate**: Range of 0.5% to 2% annual renovation rate from 2020 onwards based on 'Plataforma Escenarios Energéticos Argentina 2040' analysis (Beljansky et al., 2018) with renovation rates of the Current Development Scenario (CDS) used before 2020.

- **Relative improvement of energy efficiency in renovated/new buildings**: 50% based on 'Plataforma Escenarios Energéticos Argentina 2040' analysis (Beljansky et al., 2018) for upper and lower bound scenarios.

- **Relative improvement of total energy intensity of cooking/lighting/appliances (electricity + direct energy)**: *No nationally determined benchmark available for the energy intensity improvement by mid-century; this scenario uses indicator values defined in 'Current Development Scenario'.*

- **Electrification rate in water/space heating**: The range of 40% to 60% electrification rate in water/space heating by 2040 is based on 'Plataforma Escenarios Energéticos Argentina 2040' analysis (Beljansky et al., 2018) reflecting a shift from natural gas to heat pumps by 2040.

4.3.2.2 Quantification of emission levels with PROSPECTS Argentina

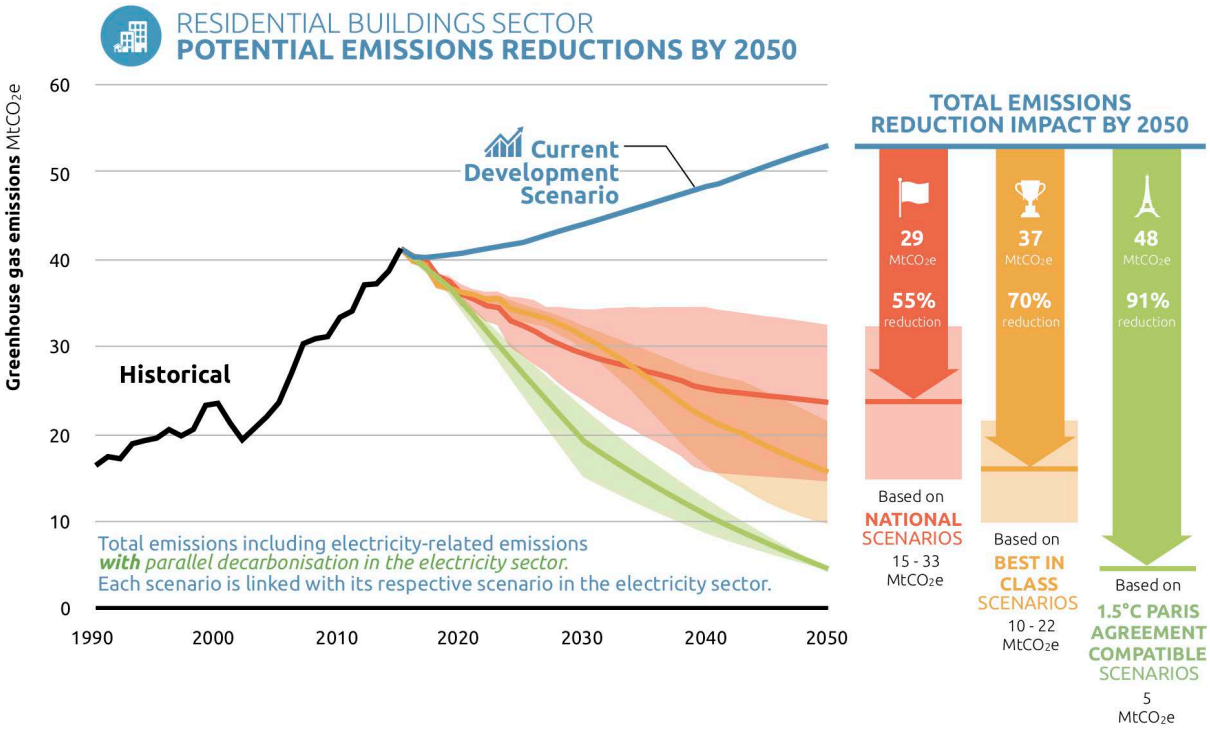


Figure 31: GHG emissions in the Argentinian residential buildings sector under different scenarios, including electricity-related emissions and parallel decarbonisation actions according to the respective scenario categories in the Argentinian electricity supply sector. All emission pathways in the residential buildings sector assume the forecasted electricity supply mix as specified for the respective scenario categories. The CAT PROSPECTS Argentina scenario evaluation tool has estimated all historical emission calculations and sectoral projections towards 2050. For this reason, historical emission levels might differ from the latest inventory data.

Figure 31 illustrates the emission trajectories in the residential buildings sector up to 2050 under the different scenarios. The graph includes electricity-related emissions, which contribute about 57% of the sector's total emissions and increase over time. Under the Current Development Scenario (CDS), emissions from residential buildings continue to increase until 2050 up to about 53 $MtCO_2e$/yr.

Pathways under accelerated climate action comprising (1) retrofitting of the existing building stock, (2) building codes for new buildings, (3) improvements in the energy performance of appliances, and (4) electrification of water and space heating lead to strong GHG emissions reductions compared to the current development scenario:

- The '**1.5°C Paris Agreement compatible' pathway** immediately reduces emissions levels from around 41 $MtCO_2e$/yr in 2015 to around 5 $MtCO_2e$/yr in 2050. This is mainly driven

by deep renovations, strong efficiency improvements in renovated and new buildings, energy intensity improvement in building appliances, as well as the electrification of heating in residential buildings.

- The '**Applying best-in-class levels' pathway range** reduces the emission levels continuously to 48% and 78% below 2015 levels by 2050 under the low and high ambition case respectively. These emission reductions are triggered by deep renovations, efficiency improvements in renovated and new buildings, and energy intensity improvement of building appliances.

- The '**National scenarios' pathway range** reduces emission to 21% and 64% below 2015 levels in 2050 under the low and high ambition level scenario respectively. This is mainly driven by deep renovations and strong efficiency improvements in renovated buildings as well as the electrification of heating.

Emission pathways under the different scenarios fundamentally change when not accounting for accelerated climate action in the electricity supply sector beyond current policies as displayed in Figure 32 below. These results emphasise the critical importance of comprehensive and coordinated climate action across demand and supply sectors. The residential buildings sector depends on decarbonised electricity generation to transition towards zero emissions by mid-century or shortly thereafter. Without increasing the share of zero-carbon technologies in Argentinian electricity supply, the mitigation impact of accelerated climate action will be limited in the residential buildings sector.

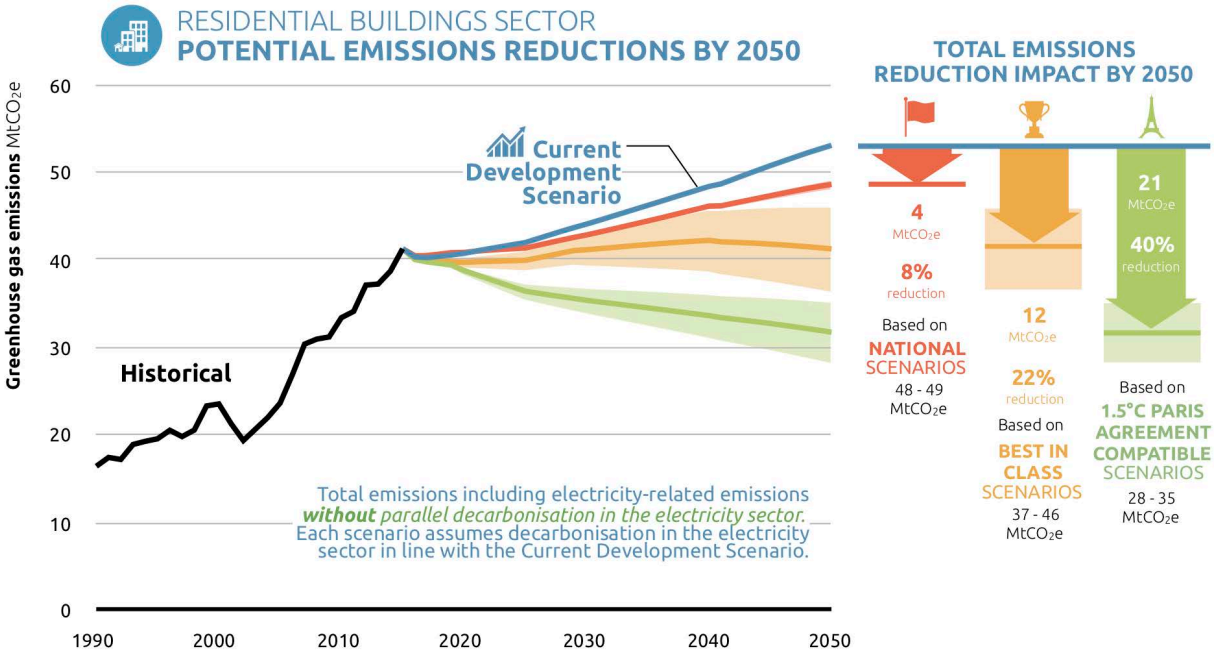


Figure 32: GHG emissions in the Argentinian residential buildings sector under different scenarios, including the sector's electricity-related emissions but without any additional climate action in the electricity supply sector beyond current policies. All emission pathways in the residential buildings sector assume the forecasted electricity supply mix as specified under the Current Development Scenario (CDS). The CAT PROSPECTS Argentina scenario evaluation tool has estimated all historical emission calculations and sectoral projections towards 2050. For this reason, historical emission levels might differ from the latest inventory data.

4.4 Combined cross-sectoral analysis

Accelerated climate action in line with the Paris compatible scenarios in the three sectors would allow Argentina to overachieve its unconditional and conditional target of limiting emissions to 322 $MtCO_2e$ by 2030.

The Climate Action Tracker's country assessment rates Argentina's current mitigation target "Highly Insufficient". If Argentina were to increase its ambition by making its conditional target unconditional, the Climate Action Tracker would upgrade its rating to "Insufficient" instead of the current "highly insufficient" rating. To be compatible with the Paris Agreement, the target would need to decrease emissions further - to below 205 $MtCO_2e$.

An important conclusion from these findings is that it is beneficial for Argentina to considerably ratchet up its 2030 target to be consistent with the Paris Agreement. Increased climate action will achieve a wide range of benefits, while they can build on already ongoing activities. Argentina will have to scale up action considerably in the electricity sector as well as in both the buildings and transport sectors.

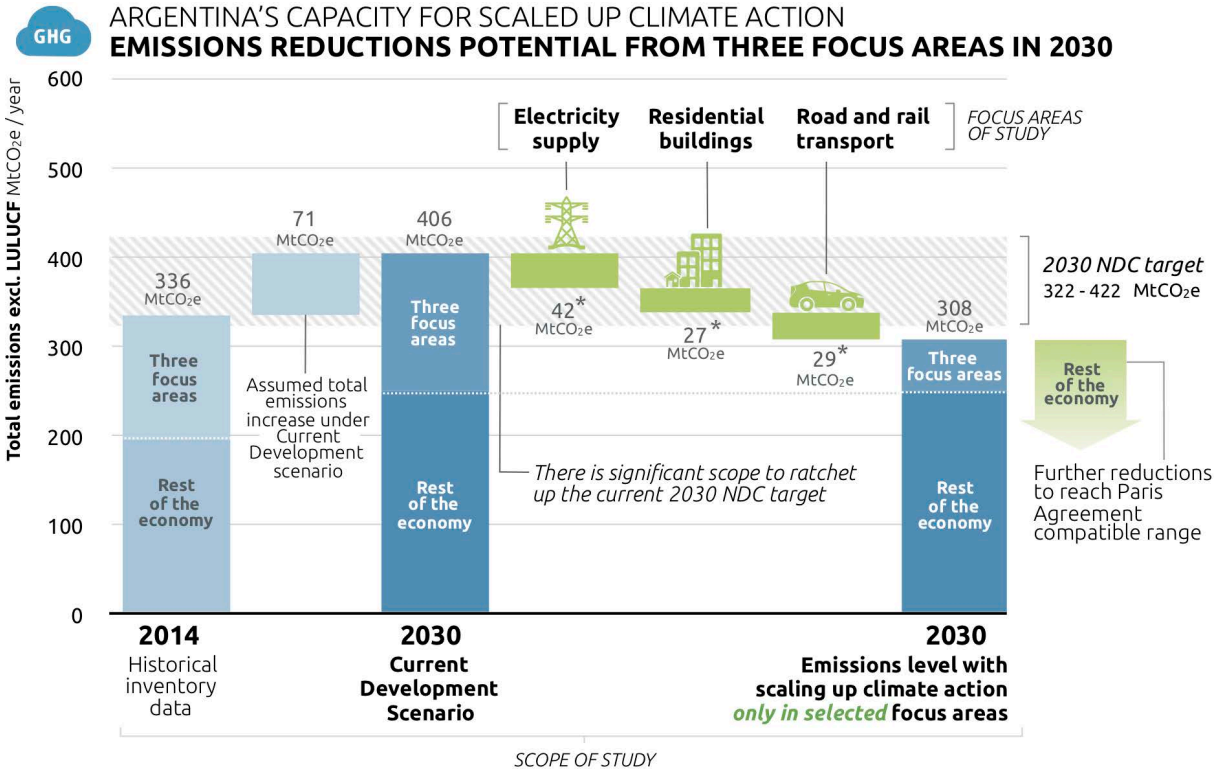


Figure 33: Overview of total emission levels (excl. LULUCF) under historical inventory data in 2014 (left bar), under a Current Development Scenario in 2030 (middle bar), and most ambitious levels of accelerated climate action by 2030 in the electricity supply, the residential buildings sector, and land-based passenger and freight transport (right bar). All electricity-related emission reductions from the residential buildings and transport sectors are allocated as emissions reductions under these two end-use sectors.

Scaling up climate action in Argentina's electricity supply, residential buildings sector, and land-based passenger and freight transport alone can reduce Argentina's total greenhouse gas emissions by up to 7% below 2014 levels (excluding LULUCF) by 2050. Our analysis also shows that these three sectors can be fully decarbonised by 2050.

When determining its long-term strategy by mid-century, Argentina can consider these identified mitigation potentials for the three focus sectors in line with the Paris Agreement's

temperature target. It will need to implement more ambitious and stringent policies to initiate and steer these sectoral transformations.

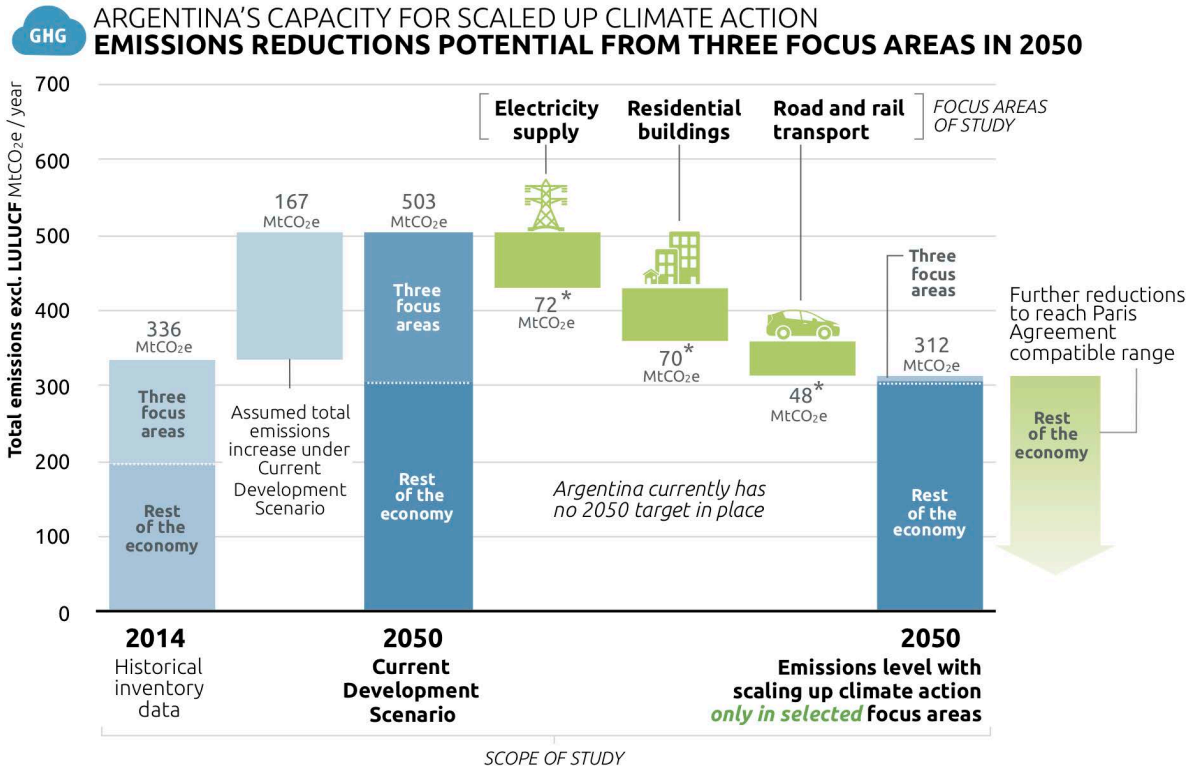


Figure 34: Overview of total emission levels (excl. LULUCF) under historical inventory data in 2014 (left bar), under a Current Development Scenario in 2050 (middle bar), and most ambitious levels of accelerated climate action by 2050 in the electricity supply, the residential buildings sector, and land-based passenger and freight transport (right bar). All electricity-related emission reductions from the residential buildings and transport sectors are allocated as emissions reductions under these two end-use sectors.

If it does so, Argentina can become a regional and international frontrunner in successfully transitioning its energy supply and demand sectors, while benefiting from a wide range of socio-economic benefits such as sustainable employment generation, reduced levels of dangerous air pollution, and socially just housing.

Our findings emphasise that Argentina will still need to undertake additional mitigation actions in all other remaining sectors to align its economy-wide emissions pathway with the Paris Agreement's temperature limit, particularly in the agriculture and forestry sectors.

5 Conclusion

The analysis shows that upscaled mitigation action in electricity generation, residential buildings, and passenger and freight transport on land alone can exceed Argentina's current emissions reduction target for 2030 and decarbonise these three sectors by mid-century, in line with a global Paris Agreement-compatible pathway. Further actions in all other sectors will be required to ensure economy-wide Paris Agreement-compatible developments.

The upscaled mitigation actions come with important co-benefits, such as improved air quality. While job losses resulting from the phase out of gas extraction constitute an important challenge in some regions, our analysis indicates that replacing natural gas with renewable energy could not only enable a mostly decarbonised electricity sector by 2030 and beyond but would also result in net job creation.

Ambitious policy making is required for a Paris Agreement-compatible and "just" development scenario in the focus areas considered in this report. For the electricity sector, a clear commitment to renewables-based electricity generation is needed in parallel with a phaseout of subsidies and other forms of support to the natural gas industry. The 2025 target to generate 20% of electricity from renewables is an important step in the right direction but requires rigorous implementation in the next years. This target should be furthered strengthened beyond 2025 to avoid natural gas infrastructure becoming stranded assets under a Paris Agreement-compatible pathway.

Comprehensive policy packages in passenger and freight transport on land can reduce transport demand and initiate a shift towards zero-carbon solutions, notably by increasing the penetration of electric passenger vehicles, buses and trucks. In the residential buildings sector, a transition to new zero-energy buildings and increased renovation rates for existing buildings are fundamental to ensure compatibility with the Paris Agreement. A decarbonisation of the buildings and transport sectors is only possible if the electricity sector also decarbonises by mid-century of shortly thereafter.

KEY FINDINGS

- Scaling up climate action in Argentina's electricity supply, its residential buildings sector, and land-based passenger and freight transport can reduce greenhouse gas emissions by up to 94% below 2014 levels in these areas by 2050. Together, these sectors account for around 40% of Argentina's 2014 emissions.
- Actions in these areas alone would reduce economy-wide emissions by 7% below 2014 levels by 2050, equivalent to 38% below a Current Development Scenario by 2050. However, while the three focus areas will almost fully decarbonise under a Paris Agreement- compatible scenario, Argentina will still need to take additional action in other sectors such as agriculture and land-use sectors in order to decrease economy-wide emissions by mid-century in line with the Paris Agreement's temperature limit.
- Research from Argentinian researchers and other stakeholders indicates that large-scale expansion of renewable energy could reduce GHG emissions from electricity generation by up to 80% below 2014 emissions levels by 2040. Some of these scenarios explicitly consider Paris Agreement aligned sector developments in the Argentinian context.
- A fully decarbonised electricity sector is critical for enabling low-carbon electrification trends in land-based passenger and freight transport as well as residential housing to get in line with the Paris Agreement temperature limit. Given its rich natural endowment of renewable resources and ambitious 2025 renewable expansion targets, if it strengthens policy efforts to ensure it achieves these targets, Argentina could become a global frontrunner in achieving a successful energy transition.
- There is huge potential to accelerate climate action by decarbonising key energy demand sectors such as land-based passenger and freight transport and residential housing, for example by shifting modes of transport and increasing electric and zero-emission mobility. Under our Paris Agreement- compatible scenario, those sectors' emissions decrease by 94%

below 2014 and by 88% below 2014, respectively, by mid-century. This would foster benefits for sustainable development goals by reducing pollution and promoting modern housing.

- ⇨ Transitioning towards a low-carbon, renewables-based electricity supply by 2030 is likely to support more domestic employment opportunities in Argentina compared to the Current Development Scenario, where the majority of capacity additions are fuelled by natural gas. This energy transition provides jobs in technologies and sectors that are more likely to form the core of future electricity supply, both in Argentina and globally.
- ⇨ If Argentina, building on already ongoing activities, considerably ratcheted up its 2030 target and scaled up action to be consistent with the Paris Agreement, it will achieve a wide range of benefits, such as low-carbon-oriented employment generation and support of sustainable development goals by adverse health impacts pollution effects and promotion of modern housing facilities.
- ⇨ The CAT sees significant risks in Argentina's planned development of large-scale gas extraction and export infrastructure. Those investments could cause a lock-in in high-emissive energy supply. Heavy reliance and infrastructure investments in natural gas may also hamper decarbonisation efforts in demand sectors such as transport and buildings.

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The Climate Action Tracker (CAT) is an independent scientific analysis produced by three research organisations tracking climate action since 2009. We track progress towards the globally agreed aim of holding warming well below 2°C, and pursuing efforts to limit warming to 1.5°C.

The Consortium

NewClimate Institute is a non-profit institute established in 2014. NewClimate Institute supports research and implementation of action against climate change around the globe, covering the topics international climate negotiations, tracking climate action, climate and development, climate finance and carbon market mechanisms. NewClimate Institute aims at connecting up-to-date research with the real world decision making processes.

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Climate Analytics is a non-profit climate science and policy institute based in Berlin, Germany with offices in New York, USA, Lomé, Togo and Perth, Australia, which brings together interdisciplinary expertise in the scientific and policy aspects of climate change. Climate Analytics aims to synthesise and advance scientific knowledge in the area of climate, and by linking scientific and policy analysis provide state-of-the-art solutions to global and national climate change policy challenges.

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