Policy Scenarios for Decarbonising Argentina's Transport System

Decarbonising Transport in Emerging Economies

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1. Decarbonising Argentina's transport system: At a glance

This publication provides the results of seven scenarios that were developed to assess the impact of policy measures on freight transport demand and related costs, emissions and shipping times in Argentina. It highlights measures and trends that will have significant impact on Argentina's transport system and its connections with other world regions in the decades to come.

The scenarios were designed in close collaboration with Argentina's Ministry of Transport and local experts with the objective to inform and support policy making in the coming years. The assessment of these scenarios was carried out using ITF's global freight model. The model was updated and calibrated with country-level data to reflect the specific characteristics of Argentina and its transport system in the best possible way.

The scenario building and assessment work was informed by extensive stakeholder consultation activities, as well as a fact-finding mission and a virtual conference "Decarbonising Transport in an Unprecedented Global Crisis". A first project report summarised initial findings. For more information about the work carried out in the context of this project please see: https://www.itf-oecd.org/dtee-argentina.

This work is part of the ITF's Decarbonising Transport in Emerging Economies project.

Argentina's transport system

Passenger and freight transport activities in Argentina are responsible for 15% of the country's CO_2 emissions. More than 90% of these emissions stem from road transport; half of all road transport emissions stem from trucks transporting goods. Goods transported by rail only account for around 0.3% of all transport emissions in the country.

Argentina's large size and low population density are crucial challenges for transport activity in the country. Its 2 780 400 km^2 make it the world's eighth-largest country. However, its 40.1 million inhabitants, result in a population density of only 14.4 inhabitants per km^2. The Metropolitan Area of Buenos Aires (AMBA) is the home of 37% of the national population.

Argentina has an extensive main road network. Freight movements at border crossings are facilitated by 16 bridges, 16 rafts, 1 tunnel and 30 mountain passes. The country has one of Latin America's longest railway networks. Yet, only about 60% of the concessioned network is in operation. The country also holds an immense waterway network that stretches 4 600 km and has 102 public and private ports.

In 2018, 536 million tonnes of freight were transported within Argentina, and another 141 million tonnes were traded with other countries. Most internal freight transport was done by road (i.e. almost 90% of total tonnes-km). The share of rail amounted to 4% and the share of water transport attained 8%. More than 90% of Argentinian exports, and 75% of imports, were carried by water-borne means of transport [1].

For more information see the publication *Decarbonising Argentina's Transport System – Charting the Way Forward*
https://www.itf-oecd.org/decarbonising-argentina-transport-system

Main challenges for Argentina's freight transport system

1. An old, high-emitting vehicle fleet for transporting goods

2. Limited availability of alternatives to transporting goods by road

3. Ensuring a competitive economy while reducing CO_2 emissions from transport

What we found

1

Vehicle technology and vehicle operations play a critical role in decarbonising the transport of goods

In all scenarios, most surface freight transport is done by road vehicles. The characteristics of the vehicle fleet (e.g. its efficiency and the fuel used) and of vehicle operations (e.g. the share of empty runs in total vehicle-kilometres) play a critical role in the ability to decarbonise the sector.

2

Improvements to infrastructure and inter-modal transport options will have a strategic impact in the region

Improving transport infrastructure, fostering inter-modality and facilitating cross-border procedures, namely by opening up new regional corridors, can increase transport and trade in the region. It leads to increased exchanges in the region and to a relative decrease of trade with more distant markets.

3

Global trends can significantly alter transport patterns and emissions

Without decarbonisation measures, global trends, such as E-commerce and trade regionalisation, can increase emissions in Argentina. Decarbonisation efforts across the globe and across all sectors are also likely to cause major changes to trade patterns and the commodity mix being traded.

2. Policy scenario design

The ITF worked closely with the Argentinian Ministry of Transport to identify and design seven distinct scenarios that help assess the CO_2 reduction potential of different policy pathways. The scenarios provide insights into possible alternative futures, their impacts on the transport system and its externalities.

The impacts of these scenarios were assessed using the ITF global freight model [2]. Outputs were obtained for the years 2015, 2030, and 2050.

Extensive data collection efforts, workshops to define scenarios and their parameters and result validation exercises fed this work.

Policy scenarios for freight transport

1

Baseline: Reference point

The baseline is the least ambitious scenario for achieving CO_2 emission reductions. It includes existing commitments for decarbonisation but no additional policies or more stringent targets. It represents the current policy trajectory.

It is a point of comparison for the other policy scenarios. It assesses the impact of alternative policy scenarios and potential cost of not taking further steps to decarbonise Argentina's freight transport.

2

Intermodal and infrastructure improvements

This scenario assumes improvements to the transport network (rail, road, and inland waterways), ports and border crossings and an increased attractiveness of intermodal solutions.

3

Fleet renewal with transition to gas

This scenario assumes a full renewal of the heavy and medium freight truck fleet for non-urban transport by 2030, as well as its transition to gas-powered vehicles.

4

Urban freight fleet electrification

This scenarios assumes a full transition of all vehicles used in "last-mile" urban logistics to electric vehicles by 2030.

5

E-commerce

This scenario assumes an increase in transport demand due to a continued increase in E-commerce.

6

Global trends

Carbon taxes, trade regionalisation, 3D printing, slow steaming and higher port costs are put in place; the economy decarbonises.

7

Combined

All measures from scenarios 2, 3, 4, 5, and 6 are incorporated simultaneously.

3. ITF global freight model updates

The ITF's international global freight model [2], previously only used to obtain results at global or regional level, was refined to provide results specifically for Argentina. This allowed to analyse with more detail the potential decarbonisation pathways as defined in the policy scenarios.

The model refinement work included:

- Updates to the national transport infrastructure networks (including road, rail, and inland waterways) and the accounting for proposed and planned future improvements to the networks;
- Data validation exercises, such as comparing aggregated transport volumes, modal shares, flows at borders, ports and on transport network links as obtained from the model with outputs obtained from Argentina's national freight transport model);
- Verification and updates to trade flows, such as updates to border crossing routes, port and airport throughputs, and a review of traded commodities; and
- Updates to vehicle emission factors.

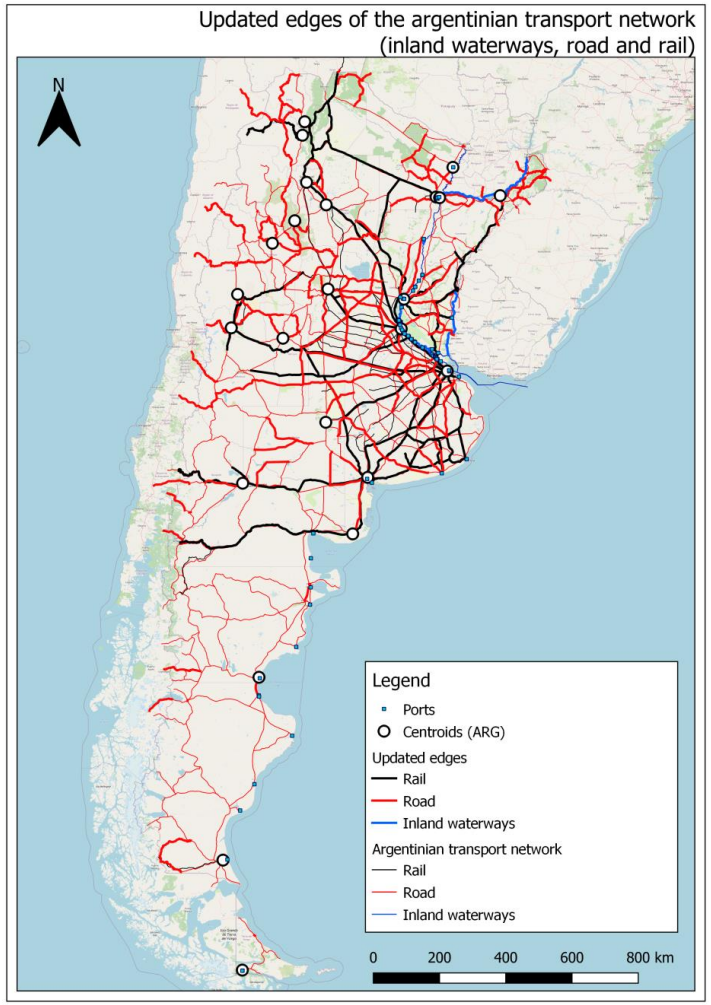
Updates to the network

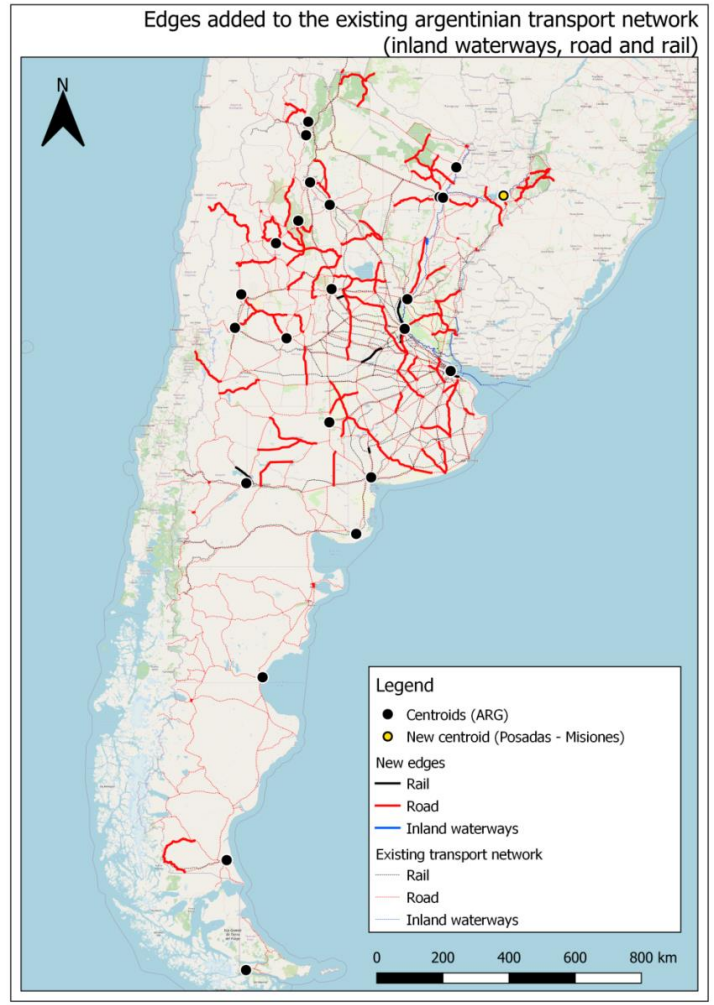
Network updates and validation encompassed three main tasks.

First, the number of centroids that define potential origins and destinations for international trade in Argentina was increased. One centroid was defined for each province in order to better reflect Argentina's transport network.

Second, the level of detail of transport links in the model was enhanced, resulting in the inclusion of a further 58 642 km of roads, 23 128 km of rail and 2 241 km of inland waterways (see the Figures to the right). This update was mostly based on the National Directorate for Cargo and Logistics Planning's model [3].

Third, entry and exit points to/from Argentina for international movements of goods were defined. Ports and border crossings were validated including their capacity and efficiency and respective time delays at such points in the network were defined or updated.

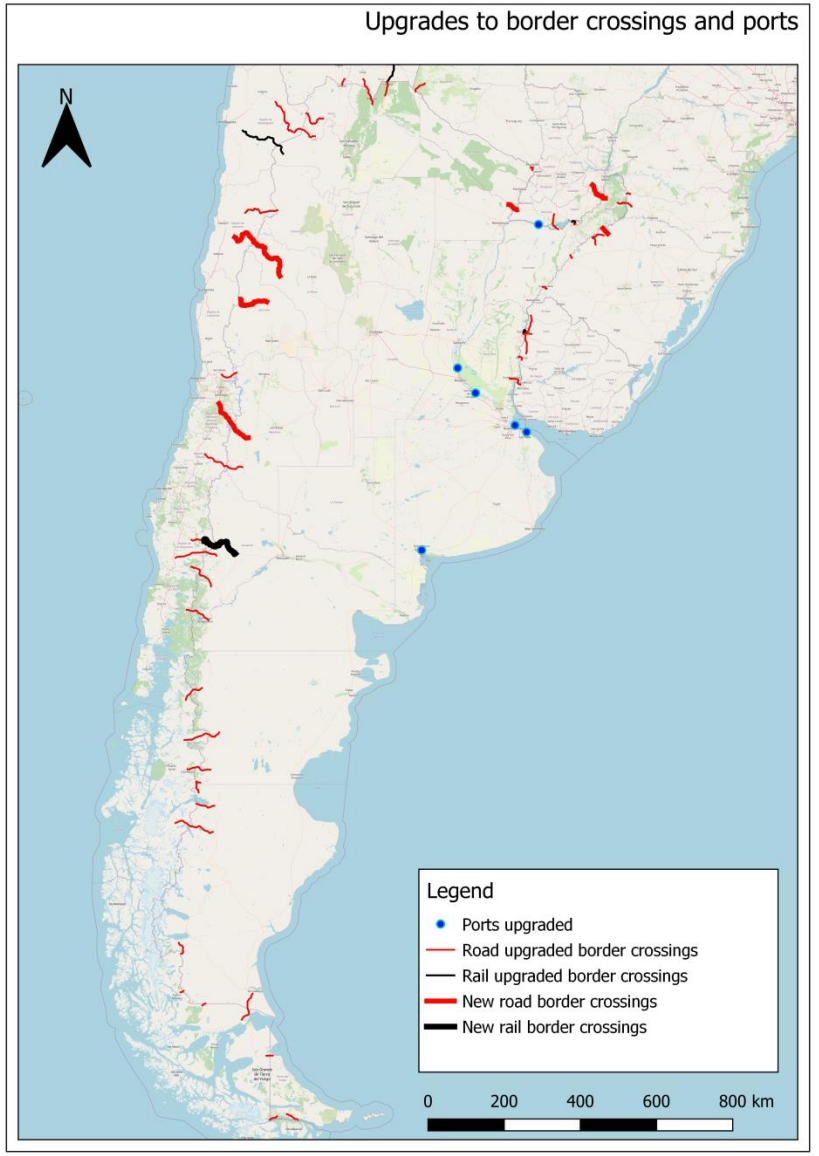




Upgrades to border crossings and gateways in the intermodal and combined scenarios

In addition to existing infrastructure, existing national and regional plans were reviewed to define potential future improvements to the infrastructure that could be integrated in the intermodal and combined scenarios. This included new rail and road border crossings, improvements and upgrades at the existing border crossings, and upgrades to port gateways. Improvements in border-crossings and ports encompass "soft measures" like simplified administrative processes and digitalisation.

Future infrastructure links were assumed to be operational according to current planning. This allows measuring the direct impact of these improvements in the intermodal and combined scenarios.

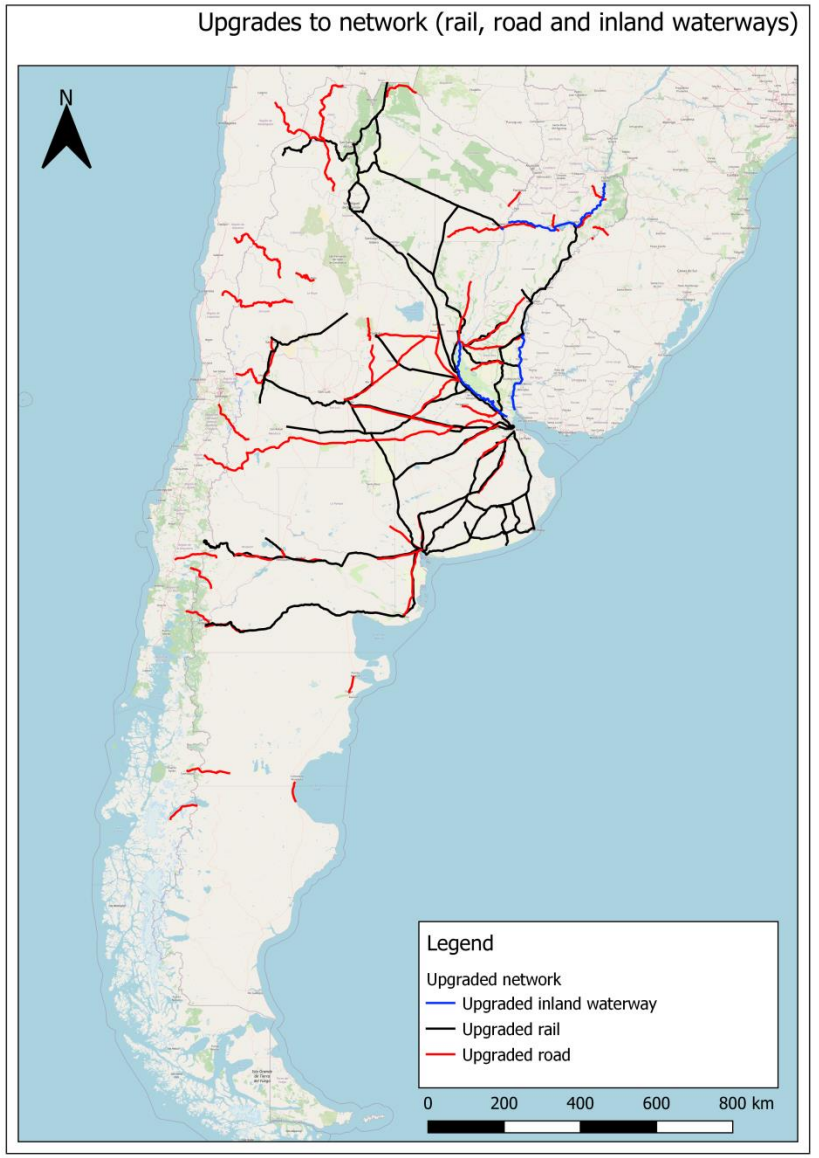


Upgrades to the network in the intermodal and combined scenarios

An extensive inventory of future upgrades to the network was made based on expert consultations and reviews of existing plans and proposals.

In the intermodal and combined scenarios these projects are assumed to be implemented and include 363 upgraded transport links (i.e. improved capacity and speeds for roads, railways and/or waterways).

Each link of the transport network is defined by its geometry, capacity, speed and usage costs.



Note: The intermodal and combined scenarios assume functioning rail links between Argentina and its neighbours (currently this is not the case).

Updates to emission factors for goods vehicles

The emission factors for goods vehicles in the ITF global freight model stem from the IEA's Mobility Model (MoMo) [4]. MoMo provides emission factors by world region, mode, vehicle type, type of operation, power train and energy source.

These emission values were validated and updated to more accurately reflect the emissions of Argentina's vehicle fleet. This work was based on expert consultations and a review of the existing literature and data sources specific to Argentina.

Examples of emission factors for 2015

Mode (vehicle)	gCO_2 per tkm		
	Argentina	Germany	United States
Heavy trucks (non-urban, diesel)	86.91	53.37	55.01
Light commercial vehicles (urban, diesel)	308.54	385.77	496.38
Rail (diesel)	21.84	21.27	13.84
Inland waterways	8.43	28.09	28.09

Note: This is an excerpt and not the full list of emission factors used in the model. Both in urban and non-urban road operations, also other types of vehicles are used, such as gas-fuelled light commercial vehicles in urban settings. The total emissions calculated by the model result from these emission factors, the vehicle type mix and transport activity for each vehicle type. Values from Germany and the United States are shown for comparison.

Updates to foreign trade

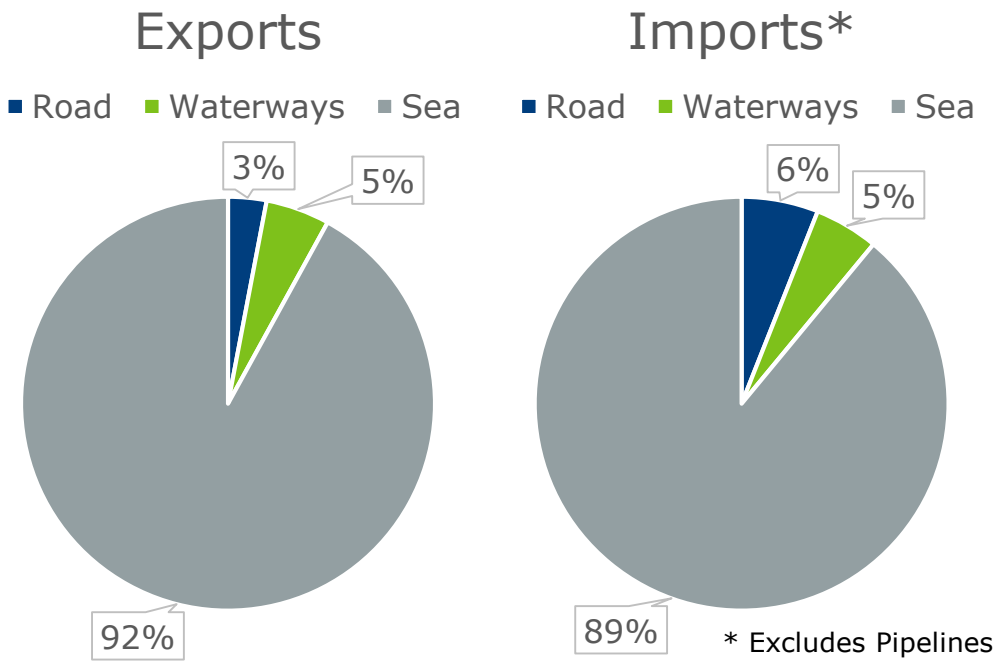
Argentina's foreign trade is expected to grow significantly over the next two decades. At the global level, trade estimates rely on existing and expected GDP and population developments. However, looking at Argentina specifically requires a more careful analysis of trade patterns.

Argentinian trade values, including the total ratio between imports and exports, the modal split of goods movements, and the commodity types being traded, were validated. Available governmental data sources were reviewed and used to calibrate the existing model. Local experts were also consulted to verify resulting trade assumptions.

Argentinian global trade validation: Imports and exports (in thousand tonnes)

Global Trade	ITF Freight model		Argentina DNPTCyL Model		% Diff
	total	ratio	total	ratio	
Export	102 664 469	70%	104 464 612	72%	-2%
Import	43 072 276	30%	39 986 188	28%	8%
TOTAL	145 736 744	-	144 450 799		1%

Note: Argentina Data from Dirección Nacional de Planificación de Cargas y Logística (DNPTCyL) based on Instituto Nacional de Estadística y Censos- INDEC (2017).



Baseline: Trade by world regions

World regions/markets were defined to disaggregate Argentina's total foreign trade. Mercosur countries were grouped separately from the rest of South America. Additionally, China was defined as a single region, rather than as part of the greater Asian market.

For imports, the largest trade partners include Mercosur countries, China, the United States, Canada, and other South American countries. Exports are dominated by flows to Europe and Africa, despite much lower import values from these regions. China, North America (United States and Canada), and South American countries remain significant export destinations.

Argentinian global trade by trade region, baseline scenario (thousand tonnes)

Trade Regions	Imports		Exports	
Africa	1 157 272	3%	11 343 111	11%
China	8 034 239	19%	16 862 185	16%
Europe and Transition	3 525 505	8%	13 205 480	13%
Mercosur	11 562 531	27%	17 492 580	17%
Oceania	387 996	1%	1 566 492	2%
Other Asia	1 921 171	4%	7 042 412	7%
Other Latin America and Caribbean	3 641 018	8%	6 411 955	6%
Other South America	5 000 199	12%	12 013 238	12%
South-East Asia	547 858	1%	3 980 379	4%
United States + Canada	7 294 487	17%	12 746 636	12%
Grand total	**43 072 276**		**102 664 469**	

Baseline: Port throughput

Port throughput was validated to ensure that the model reflected the reality of the most used entry and exit points to/from the country.

In the model, five ports account for more than 80% of port throughput: Buenos Aires, San Martín/San Lorenzo, Rosario, Timbues and Bahía Blanca.

Argentinian global trade: Port throughput in baseline scenario (ordered by total throughput)

ITF Freight model (2015)		**Argentina data (2017)**	
Ports	**Cumulative %**	**Argentinian region**	**Cumulative %**
Buenos Aires	33%	Distrito Federal de Buenos Aires	27%
San Martín/San Lorenzo	50%	Santa Fé/Rosario	77%
Rosario	63%		
Timbues	74%		
Bahía Blanca	81%	Bahía Blanca	86%
Rest	100%	Rest	100%

Baseline: Demand and emissions validation

Model results were also calibrated with available estimates for transport activity and emissions from Argentinian sources. Particularly valuable were the values supplied by the Argentinian national freight model for non-urban freight activity.

Surface freight activity and emissions in Argentina for 2015

	Tkm (millions)			**Mode share** (non-urban)		**CO_2 emissions** (thousand tonnes)		
Modes	**ITF**	**Argentina**	**% difference**	**ITF**	**Argentina**	**ITF**	**Argentina**	**% difference**
Road	180 341	182 212	-1%	86%	86%	15 610	15 238	2%
Inland waterways	20 608	22 254	-7%	10%	10%	168	164	2%
Rail	8 625	8 528	1%	4%	4%	185	165	12%
Total non-urban	209 574	212 994	-2%	-	-	15 963	16 463	-3%
Urban	44 652	NA	NA	-	-	4 506	4 912	-8%

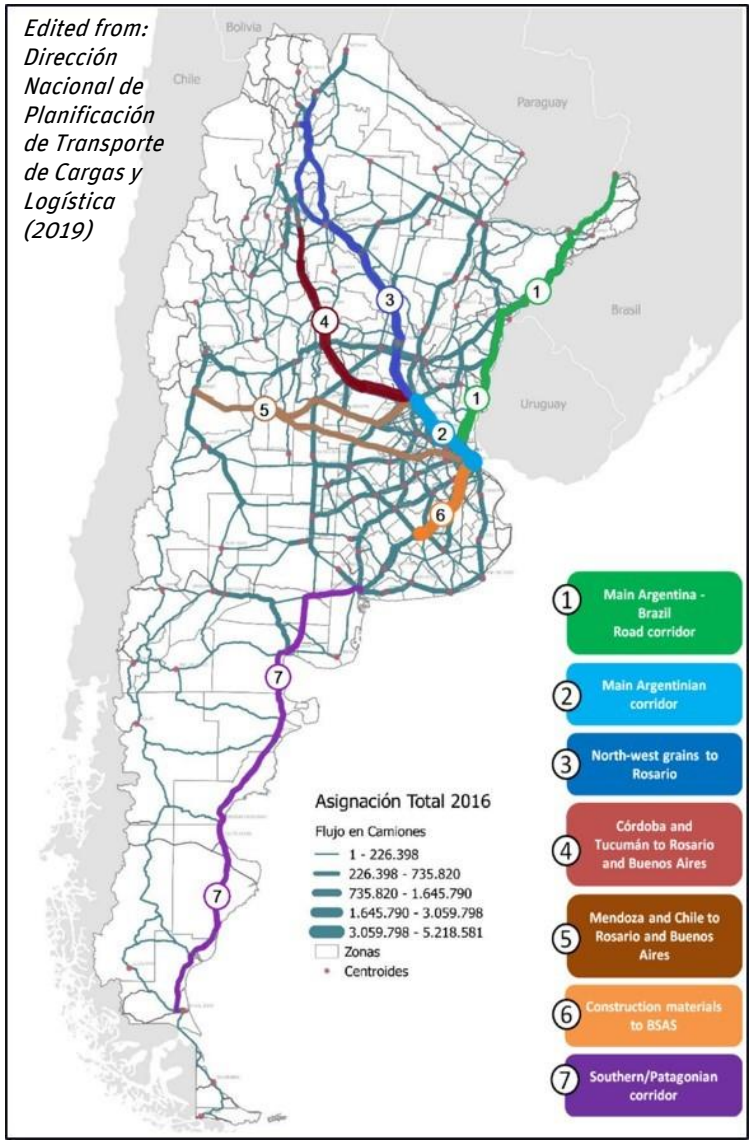
Note: Non-urban freight activity (in tkm) was obtained from the Argentinian national freight model for the year of 2016. Estimates for total urban activity are not available. The ITF model estimates that it corresponds to 20% of total surface activity. This estimate is in line with values for this world region and a country of Argentina's size.
Emission values for rail were obtained from the National Action Plan for Transport and Climate Change [5]. Urban and non-urban road freight fuel consumption figures for 2016 were obtained from the Argentinian National Fleet report [6]. Using these values in combination with information on the carbon content of fuels in Argentina allows estimating emissions from road transport. Emissions from inland waterways were derived from fuel consumption values of the Hidrovía Paraguay-Paraná report for 2019 [7] (tug boats and self-propelled barges).

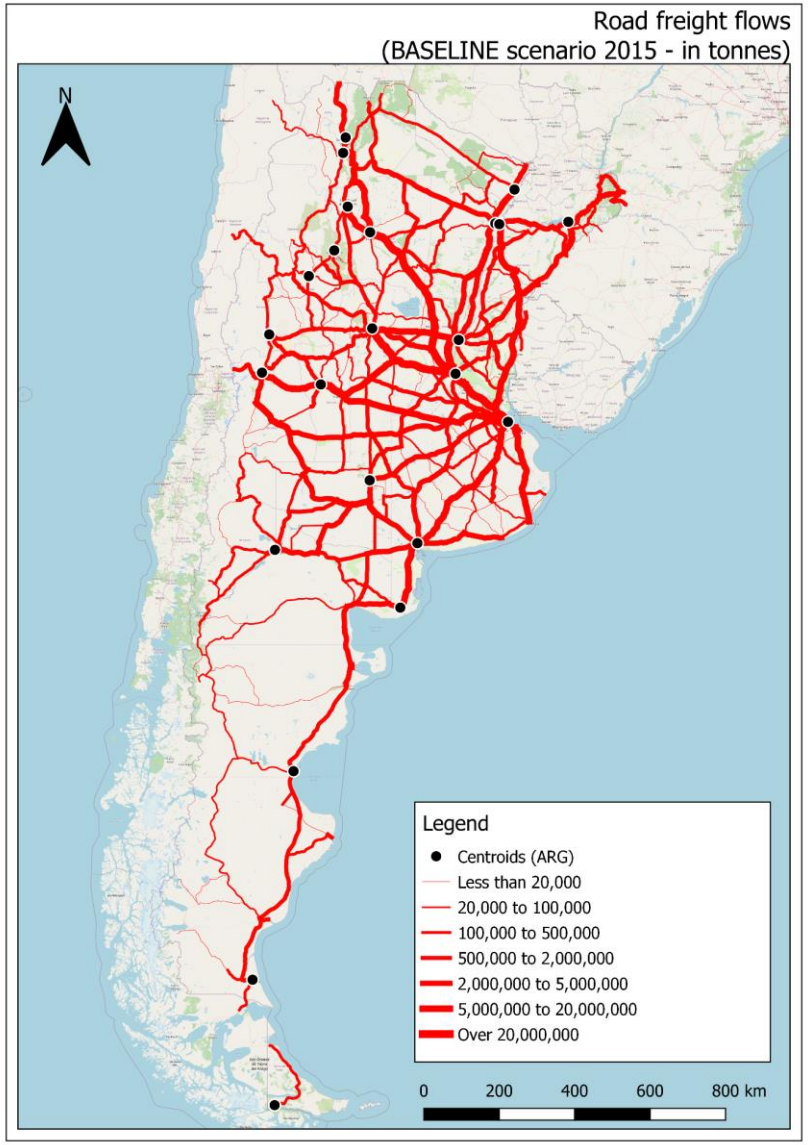
Baseline: Validating transport flow assignments

Transport flows in the baseline scenario were assigned to the road network and compared to the outputs of the national freight model of the Argentinian Ministry of Transport.

The national model identified seven main road transport corridors, all of them leading to Buenos Aires. In the ITF model, there are 24 centroids for international flows (one for each province) and 149 for domestic traffic.

The allocation of transport flows to the road network is similar, though not identical, in both models.





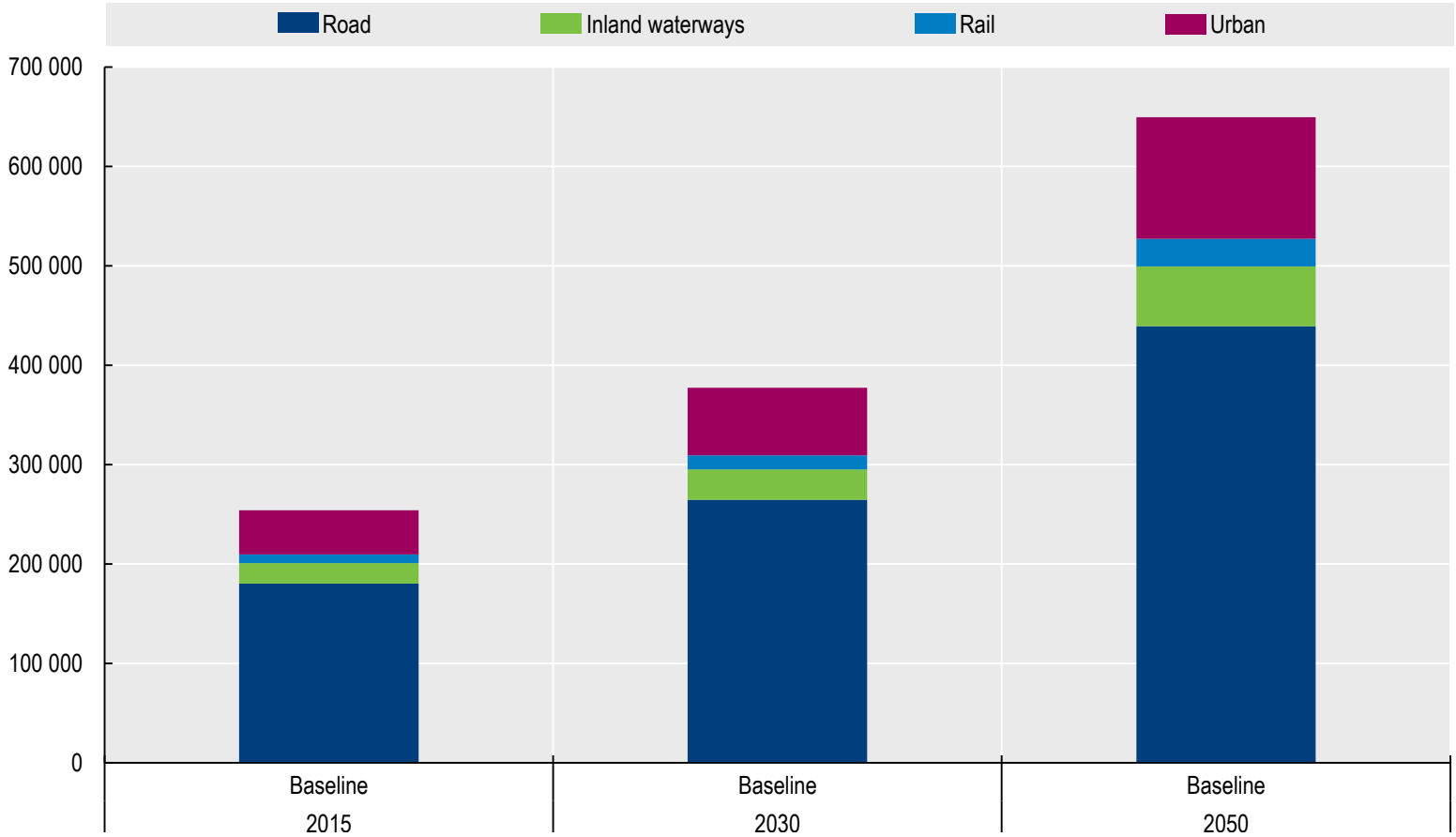
4. Overall results

This section provides results for the Baseline and all alternative scenarios. They focus on the impact of the different scenarios on freight transport demand, mode shares and resulting CO_2 emissions. It also addresses international transport from Argentina to and from different regions.

Freight surface transport

In the Baseline, surface freight activity will grow by 48% in the period from 2015 to 2030 and by 155% in the period from 2015 to 2050. This increase is roughly in line with global estimates. It is higher than for Europe, United States +Canada or Oceania, but lower than the increase expected for Asia and Africa.

Surface freight activity in Argentina by mode
(million tonnes-kilometres)



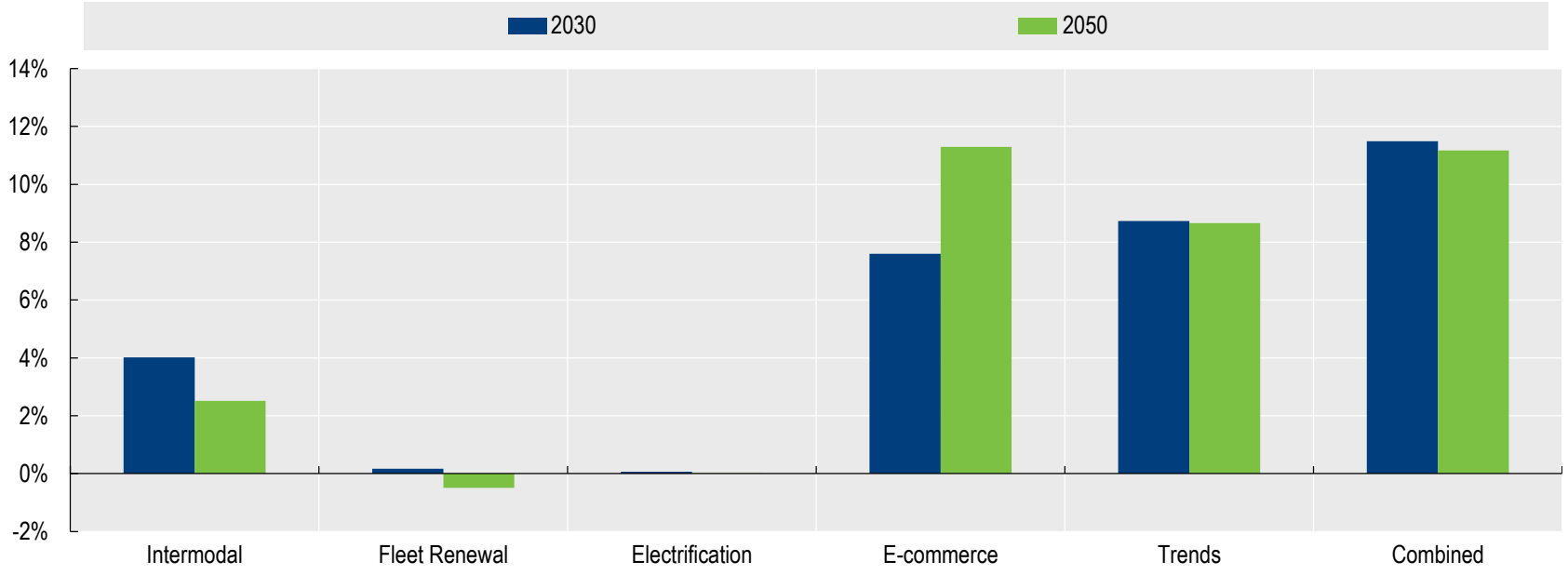
Note: Surface modes include road (urban and non-urban), rail and inland waterways. All activity done inside Argentina domestically or internationally is accounted for.

Freight surface transport

In the intermodal and infrastructure scenarios, activity will grow at a slightly higher rate, reflecting the increased demand induced by better infrastructure and improvements at border-crossings. E-commerce is expected to incite the greatest transport activity growth by 2050.

The global trends and combined scenarios also lead to a growth in transport activity. These scenarios include E-commerce growth, but also trade regionalisation, 3D printing and assume a decarbonisation of the global economy. The latter leads to a global drop in activity. However, this drop does not impact surface transport in Argentina.

Variation of demand compared to the baseline scenario (% based on tonne-kilometres)

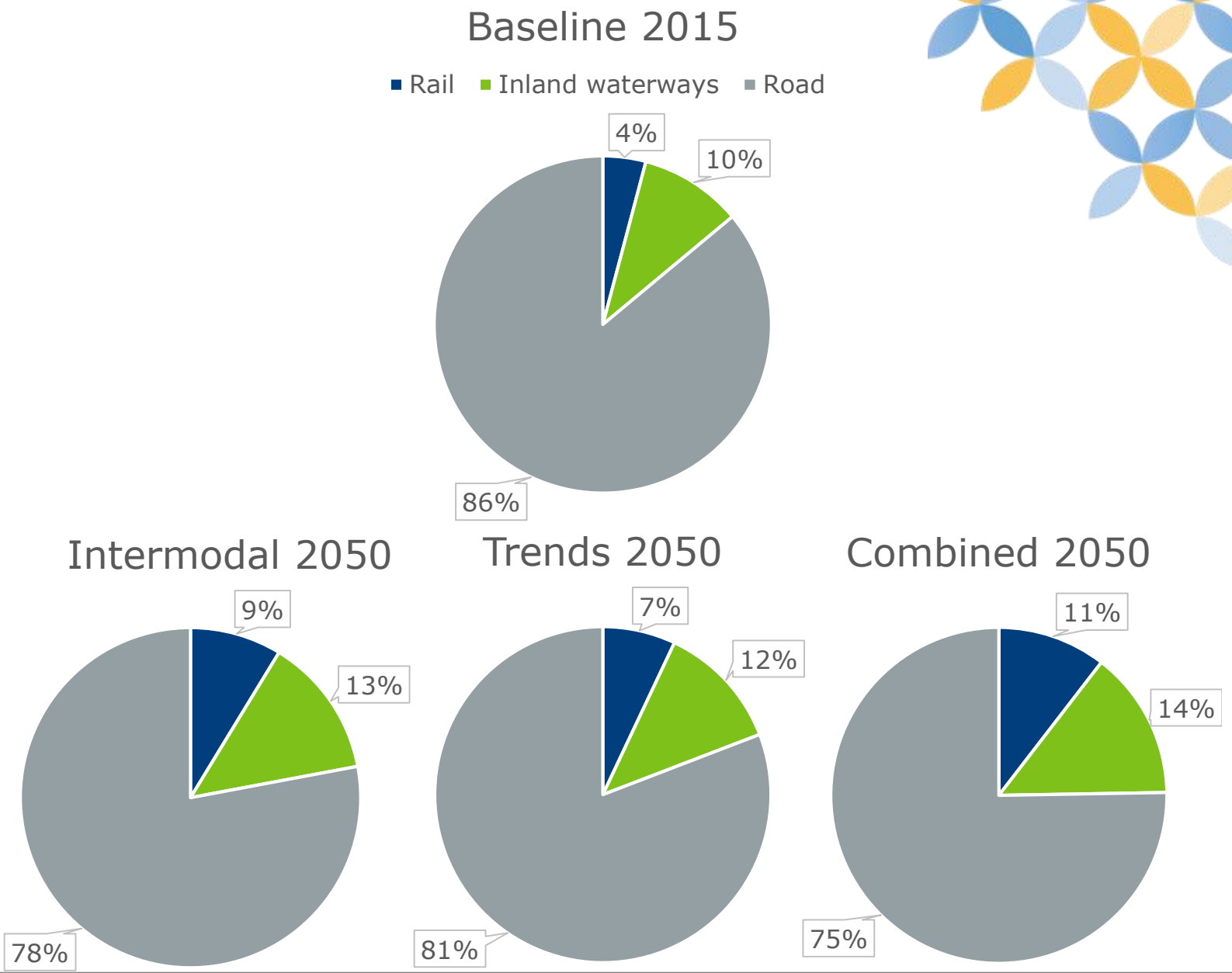


Modal shift

The share of rail will more than double by 2050 in the intermodal scenario, while inland waterways will also increase their share.

Increases are expected to be even higher for the combined scenario. Modal shifts can also be observed in the Global trends scenario. These results highlight that beyond investments in infrastructure and improvements to operations other factors are also important to foster intermodality: pricing, road speed limits or changes in trade patterns.

Nonetheless, in any scenario the share of road freight transport remains dominant and will account for at least 75% of transport activity in 2050.

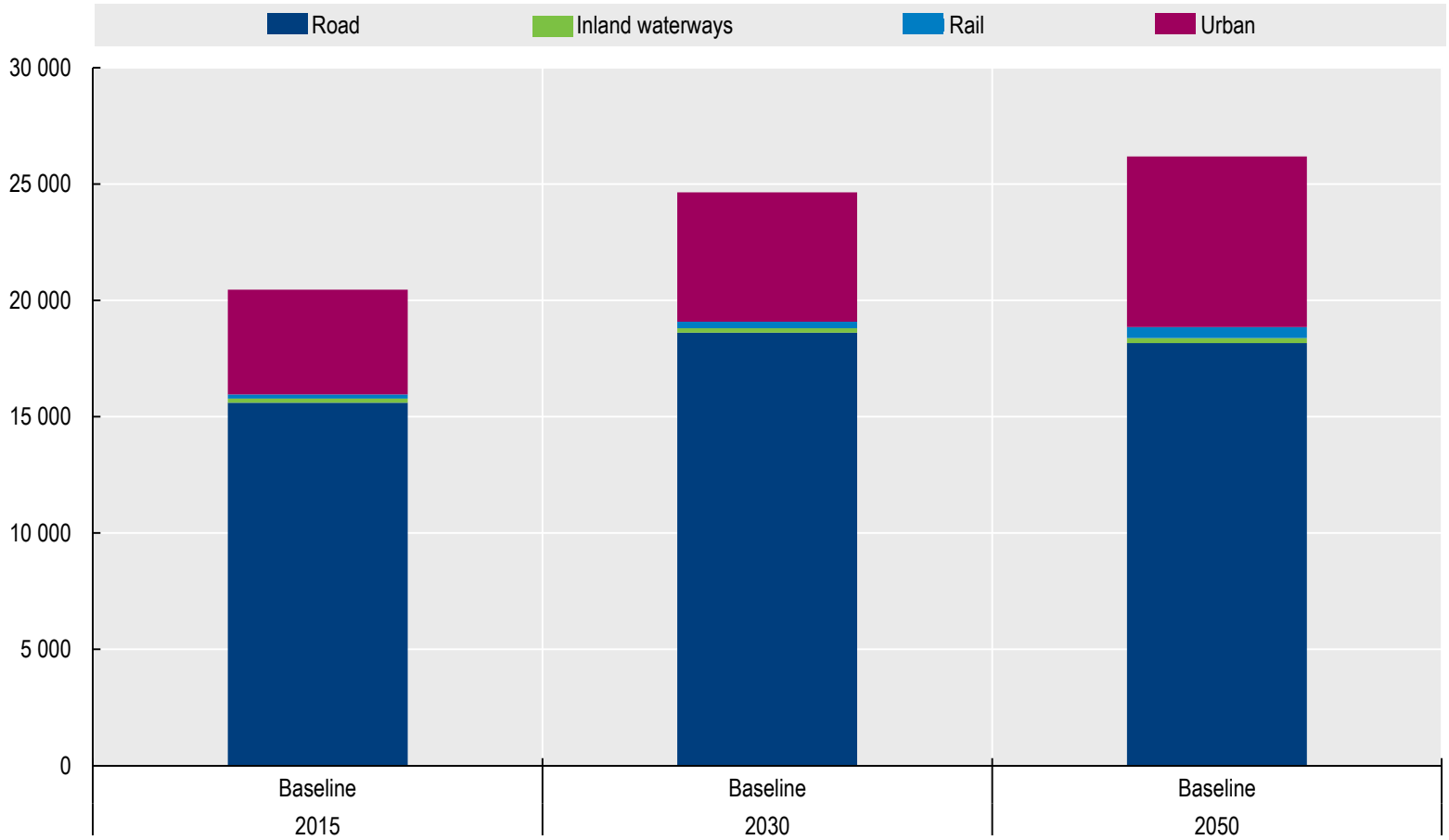


Emissions from surface freight transport

Emissions from surface freight transport increase in the Baseline by 20% in the period from 2015 to 2030 and by 28% in the period to 2050.

Some decarbonisation efforts are expected in the Baseline, including improvements in vehicle efficiency, the uptake of alternative fuels and increased intermodality. However, these developments take place at a gradual pace only. As a result, total CO_2 emissions grow given the expected substantial increases in transport demand.

Surface freight emissions in Argentina by mode (thousand tonnes of CO_2)



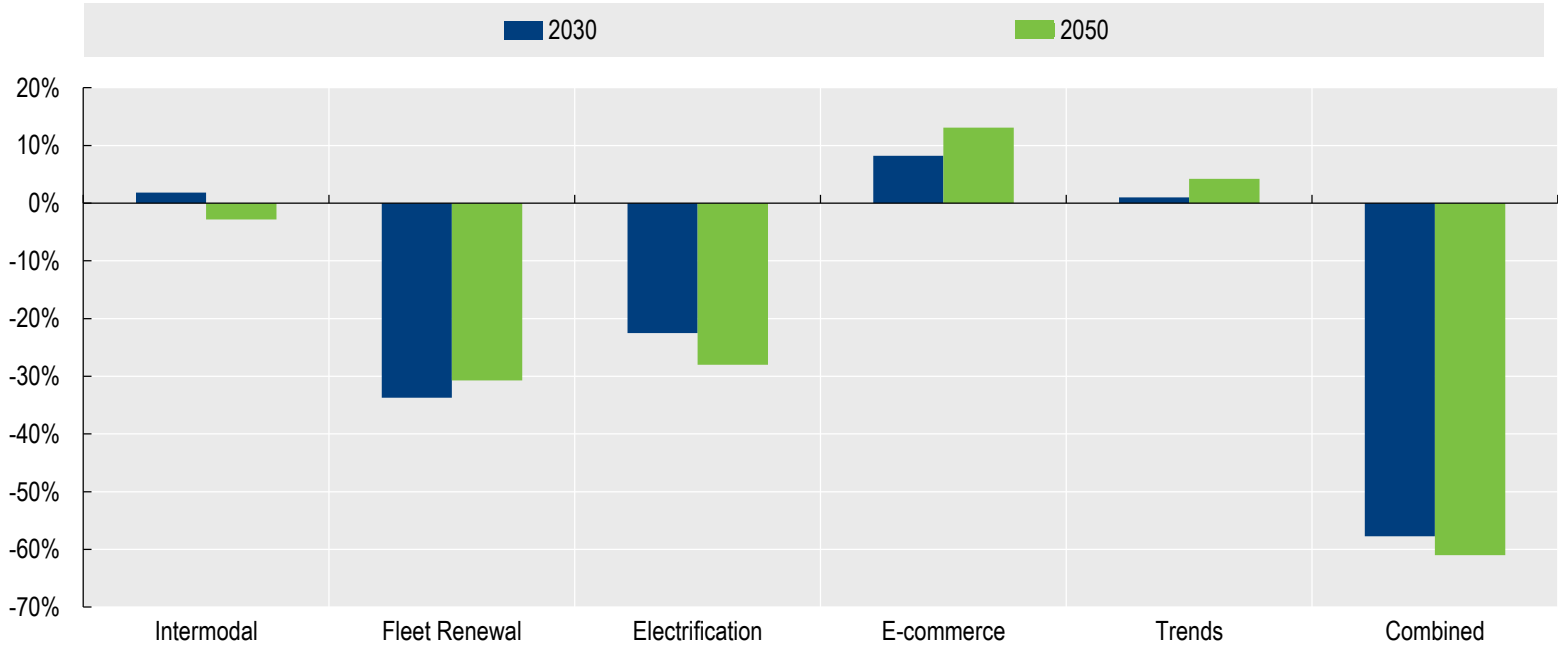
Emissions from surface freight transport

The fleet renewal with a transition to gas and the electrification of urban freight scenarios can achieve a substantial decrease in emissions compared to the Baseline and even to 2015 values.

The combined scenario presents the highest savings in CO_2 emissions. This is because the effects of fleet renewal (urban and non-urban) and modal shift are combined.

Increases in emissions in the E-commerce and global trends scenarios reinforce the finding that emissions from the sector will increase unless decisive policy action directed at decarbonising transport is taken.

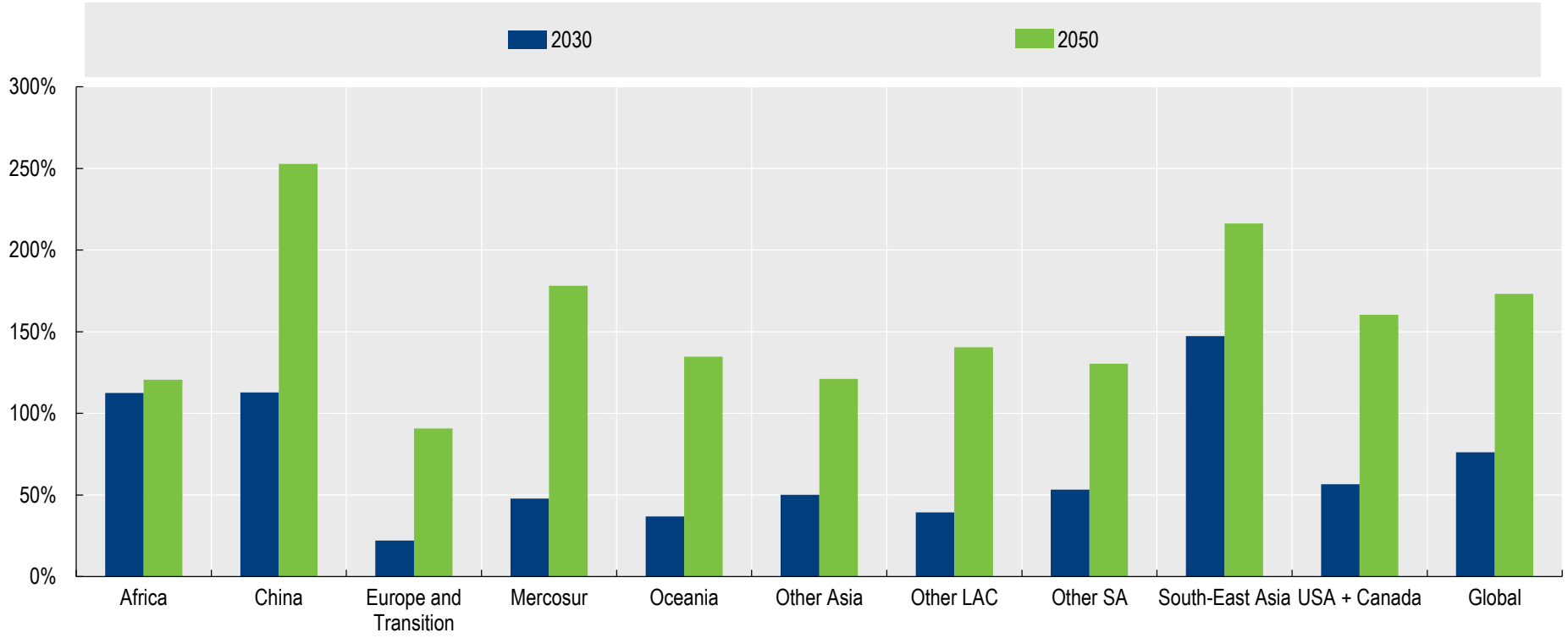
Variation of emissions compared to the baseline scenario (%)



International freight transport activity

Freight transport between Argentina and other regions will grow more than domestic movements. The two main regions driving this growth are China and South-East Asia, though transport activity grows to all world regions.

Growth of import/export transport in the baseline scenario compared to 2015, by world region and global
(% based on tonne-kilometres)

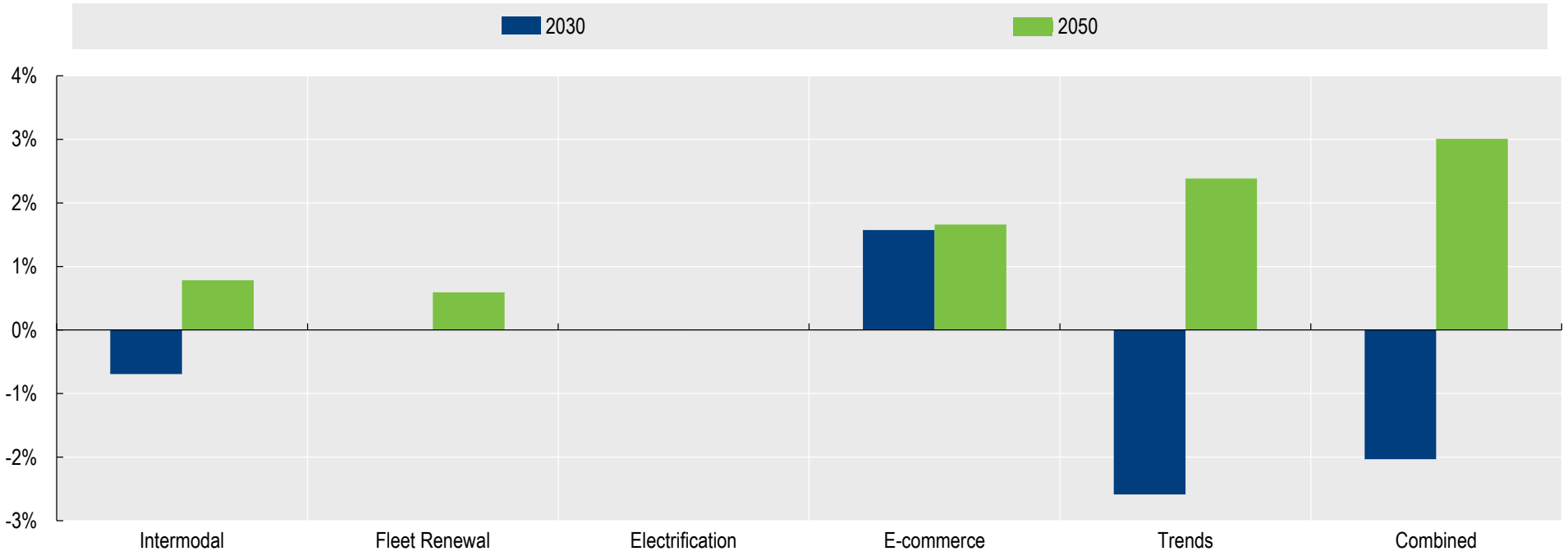


Note: These values include total transport activity from origin to destination, including trip segments outside Argentina.

International freight transport activity

E-commerce is expected to cause the largest increase in international transport activity in the period to 2030. In the trends and combined scenarios, a decrease in transport activity is expected in the period to 2030, then followed by an increase in 2050. All observed changes remain at or below 3% compared to 2015.

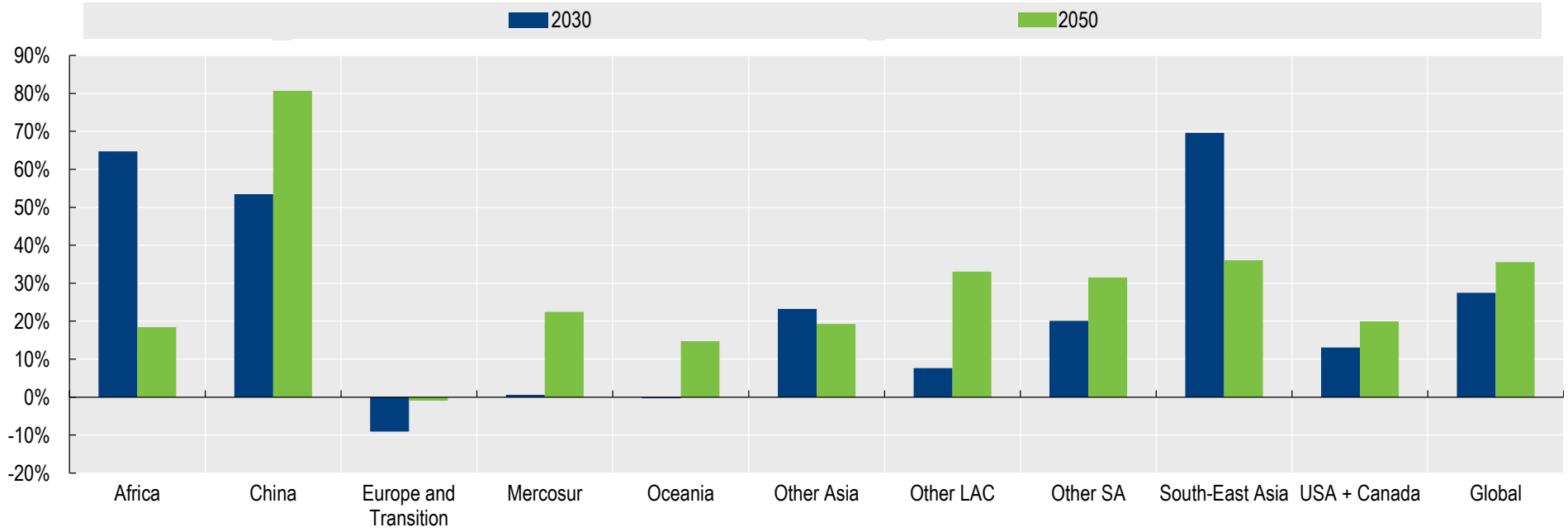
Variation of import/export transport compared to the baseline scenario (% based on tonne-kilometres)



Emissions associated with Argentina's foreign trade

Emissions from transport related to import/export activities will increase, except for transport between Argentina and Europe and Transition countries. Especially Europe is expected to follow through on their decarbonisation agenda, which also results in emissions reductions for transport activity to/from Argentina.

Import/export transport CO_2 emissions for 2030 and 2050 compared to 2015 for the baseline scenario, by world region and these combined globally (%)



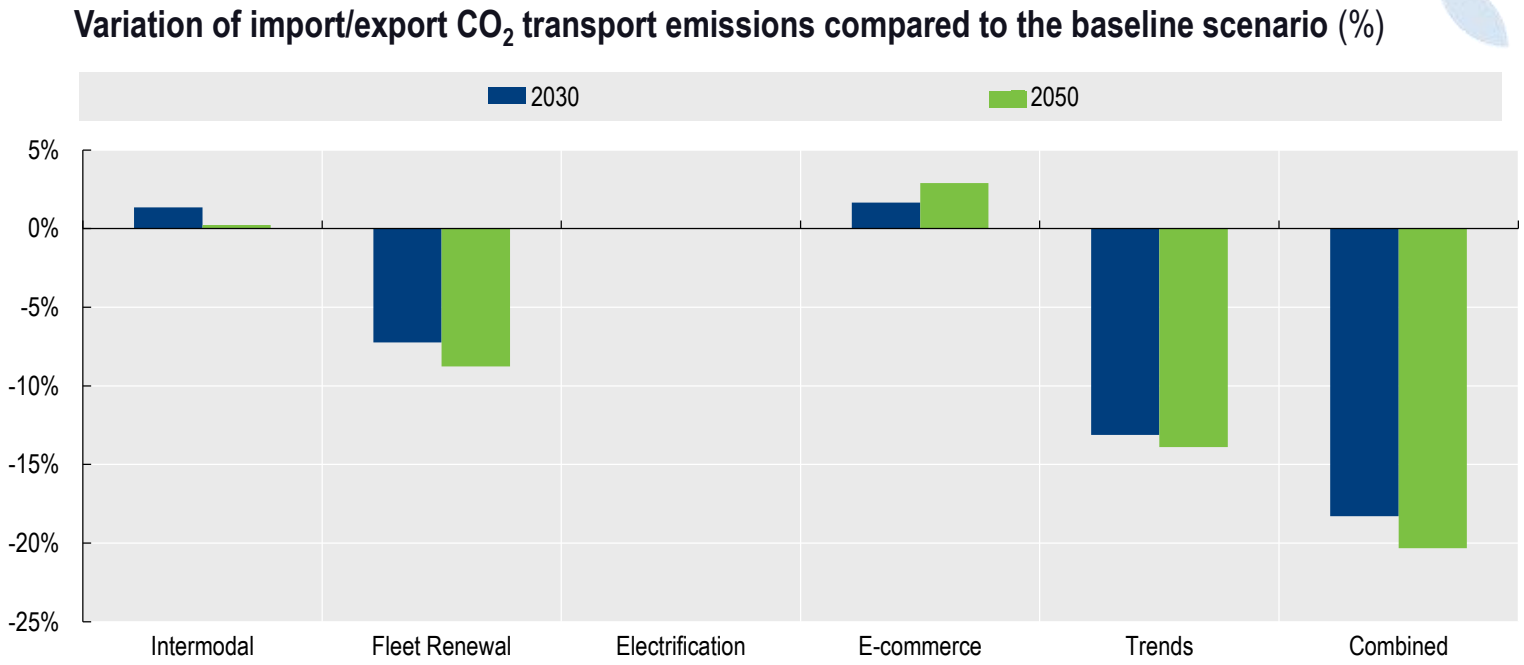
Note: See the Annex for a definition of the world regions.

Emissions associated with Argentina's foreign trade

The combined scenario leads to the largest drop in emissions.

The global trends scenario is also affected by policy measures in other world regions that have impact on international transport flows (such as port fees or distance charges). Indeed, global transport requires global measures to achieve emissions reductions.

There is also a relevant decrease in the CO_2 emissions associated with import/export movements in the fleet renewal scenario. This is because international movements heavily rely on road transport, e.g. for bringing goods to/from ports or when shipping them across borders. Reducing emissions from road transport will therefore have significant impact on the emissions stemming from international movements.

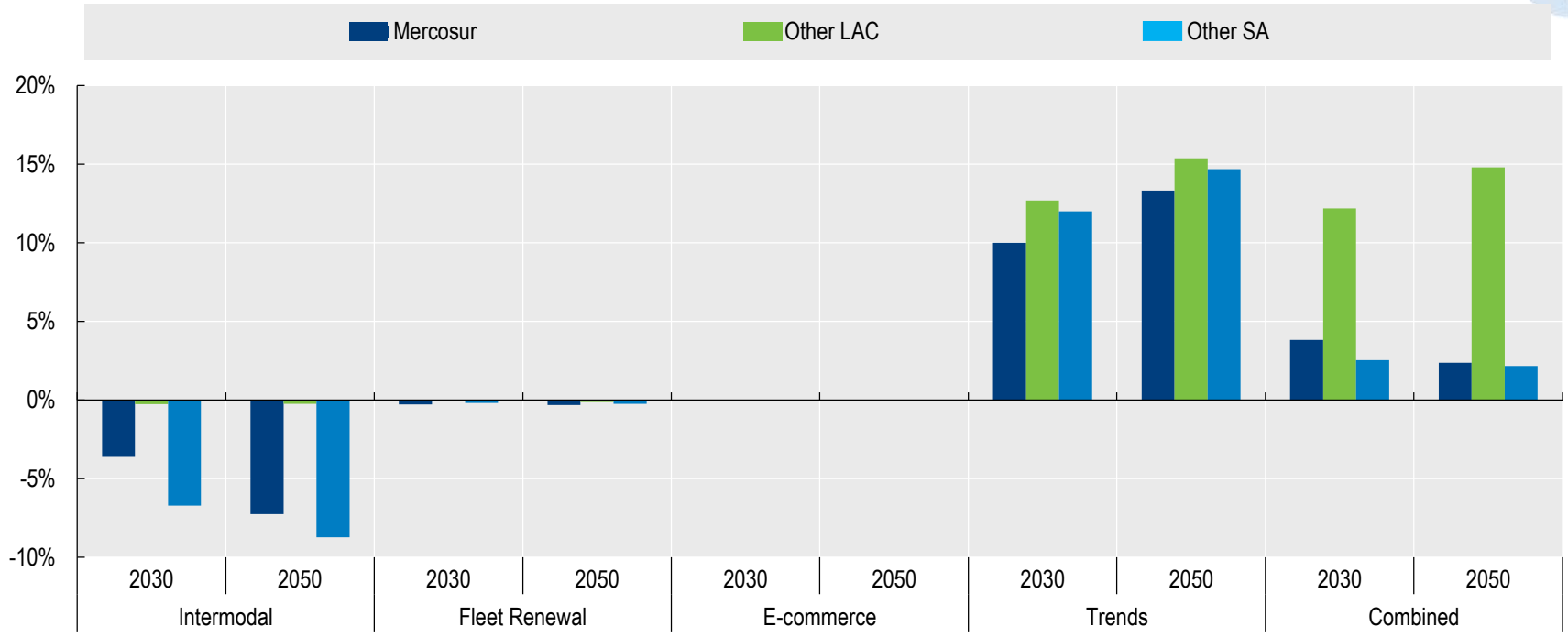


Transport costs of Argentina's foreign trade

In the intermodal scenario, costs for surface transport decrease thanks to investments in transport infrastructure and resulting shorter routes, improvements to border crossings and the availability of rail services across the region.

Distance charges and carbon pricing increase the costs of transport in the region for the global trends scenario. The same applies for the combined scenario. However, here, the increase in costs is mitigated by better infrastructure, enhanced border crossings and a mode shift to rail and inland waterways.

Variation of surface transport costs compared to the baseline scenario (%)

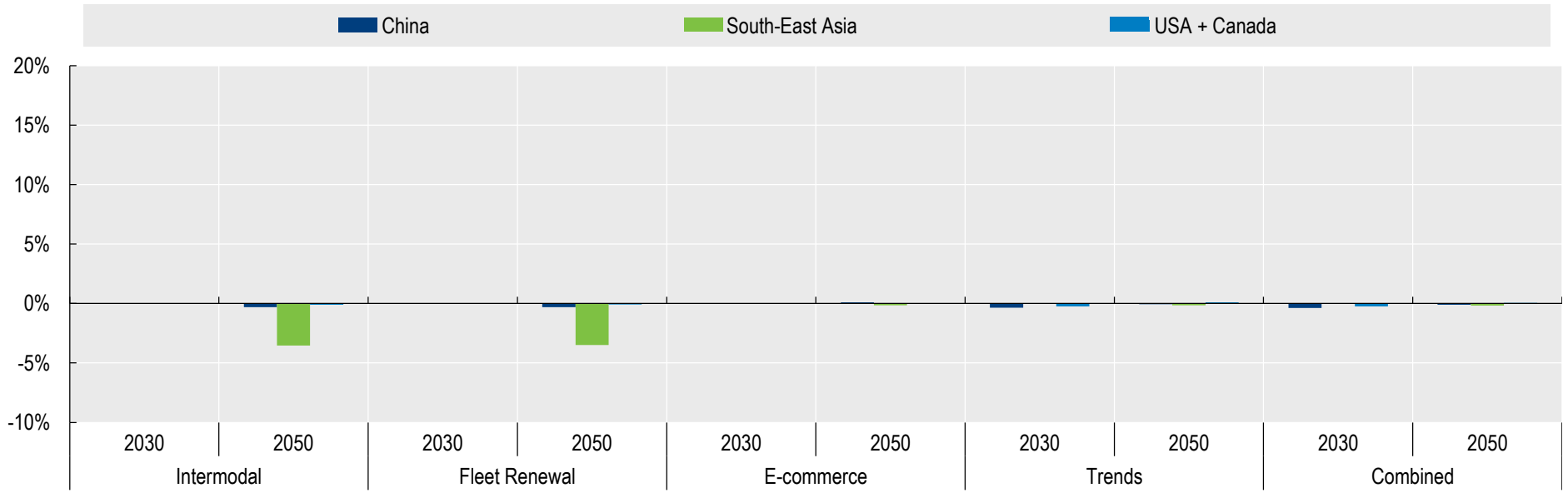


Note: Surface transport includes trips where road, rail or inland waterways are the main mode. Other SA includes Chile.
Costs are operational costs, they do not include initial infrastructure costs. They are an average by mode and between all centroids in Argentina and all centroids in each region, averaged by the activity for each mode in each region.

Transport costs of Argentina's foreign trade

Sea transport is mostly international and takes place far beyond Argentina's boundaries. As a result, national policies that result in changes to transport costs do not show relevant impacts on the costs of sea transport in any scenario.

Variation of sea transport costs compared to the baseline scenario (%)



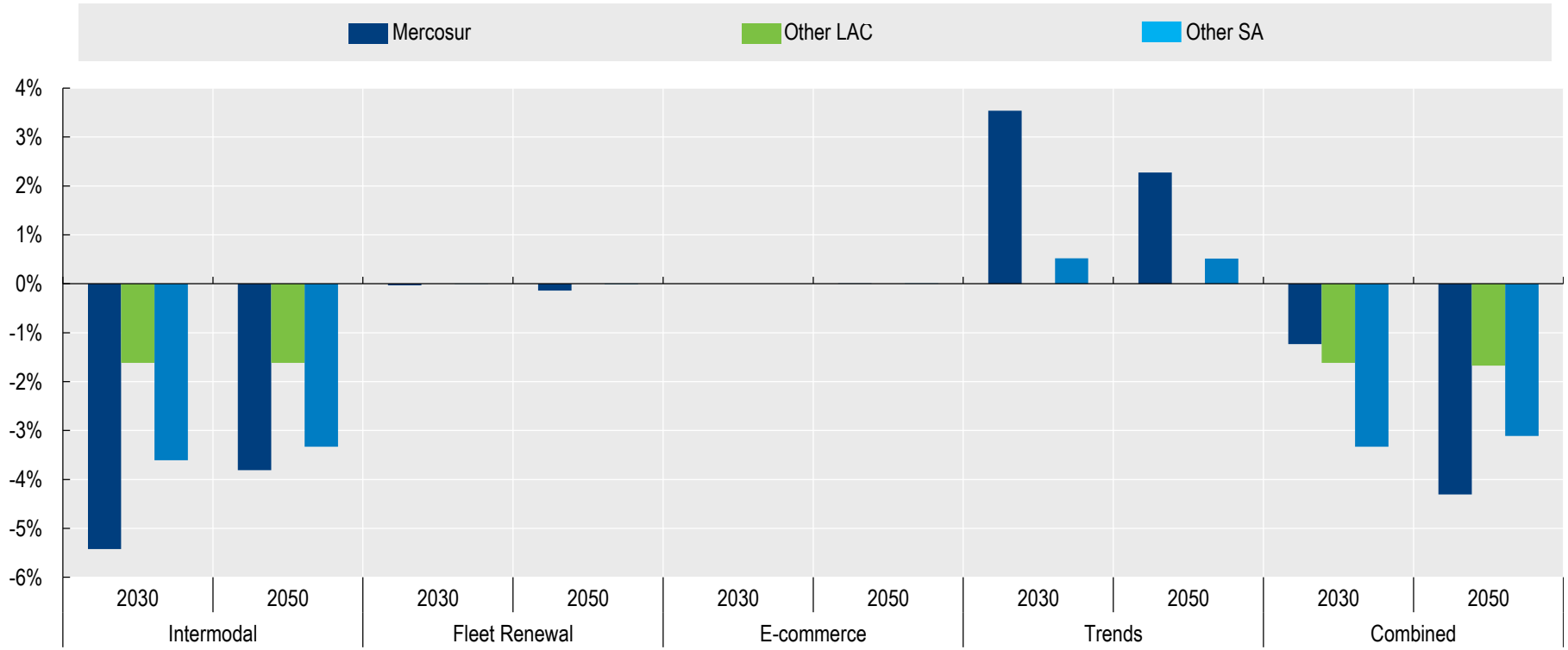
Note: Sea transport includes the entire transport chain, including access by rail, road or inland waterways at origin and destination.

Travel times of Argentina's foreign trade

In the intermodal scenario, travel times for surface transport within South America are reduced thanks to investments in infrastructure and new and improved border crossings.

These improvements can also be observed in the combined scenario, but are mitigated by speed reductions for road freight. Speed reductions are also the reason for travel time increases in the trends scenario.

Variation of surface travel times compared to the baseline scenario (%)

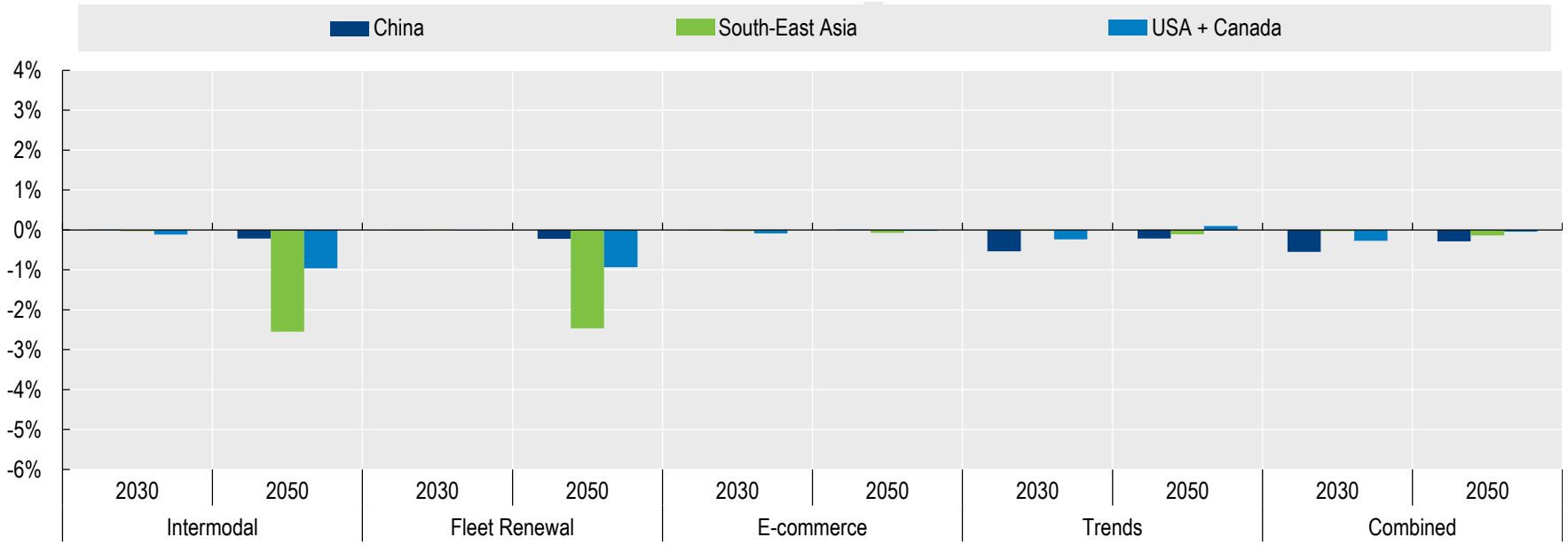


Note: Travel times are an average by mode and between all centroids in Argentina and all centroids in each region, further averaged by the activity volume on each mode by region.

Travel times of Argentina's foreign trade

Developments in sea transport are mostly affected by global policies. As a result, changes to sea travel times thanks to national policies in Argentina are not significant.

Variation of sea travel times compared to the baseline scenario (%)

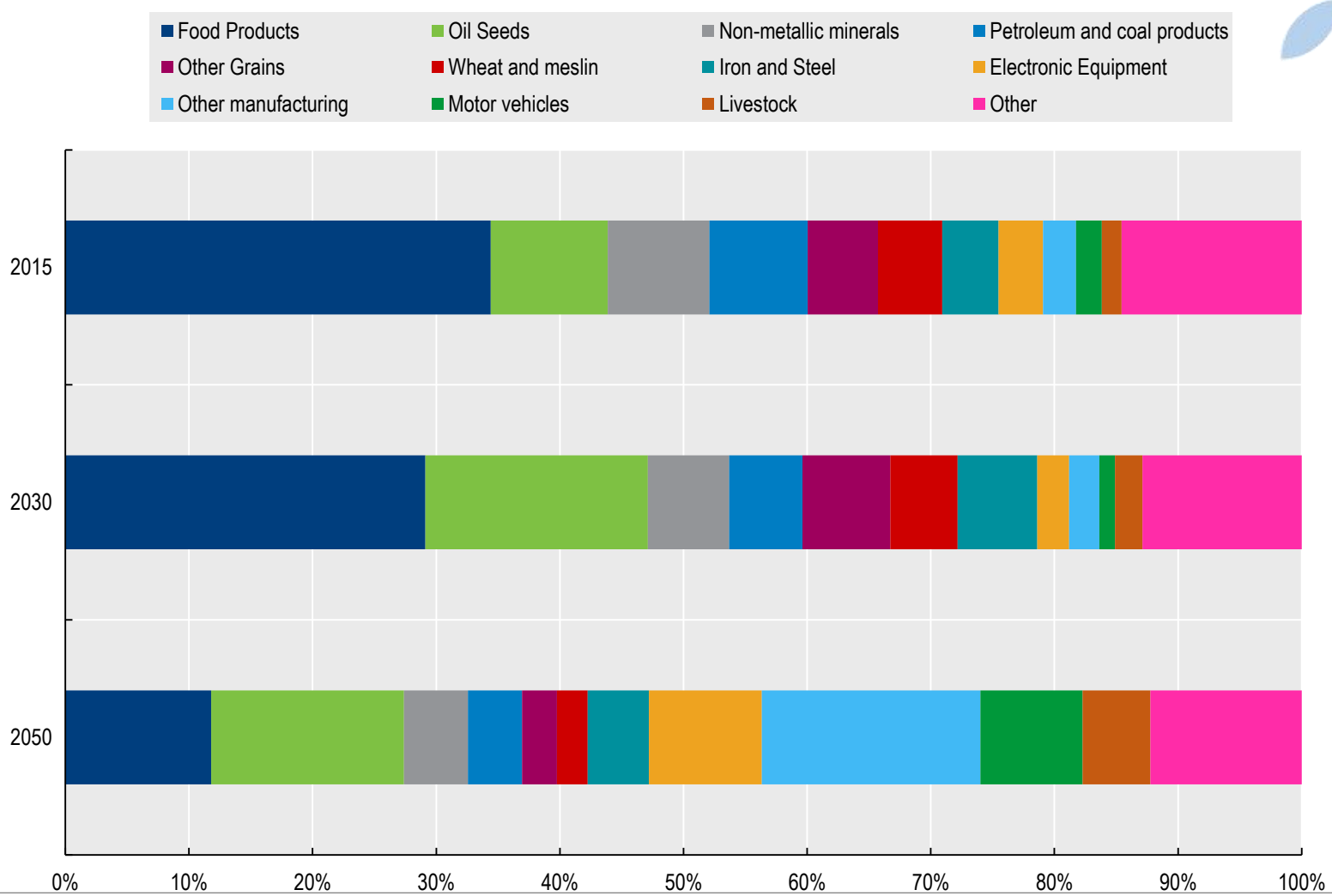


Expected developments to the traded commodity mix

The model distinguishes 28 different commodity types. In 2015, Argentina's most traded commodities were food products, oil seeds (e.g. soja, sunflower), petroleum and coal products, and minerals.

It is expected that the share of oil seeds in total trade flows will continue to grow, while the share of food products will decrease significantly. By 2050, there is also significant growth potential for the trade of electronic equipment, and other manufacturing.

Commodity mix of Argentina, external trade in baseline scenario (% based on tonnes)



5. Highlights per scenario

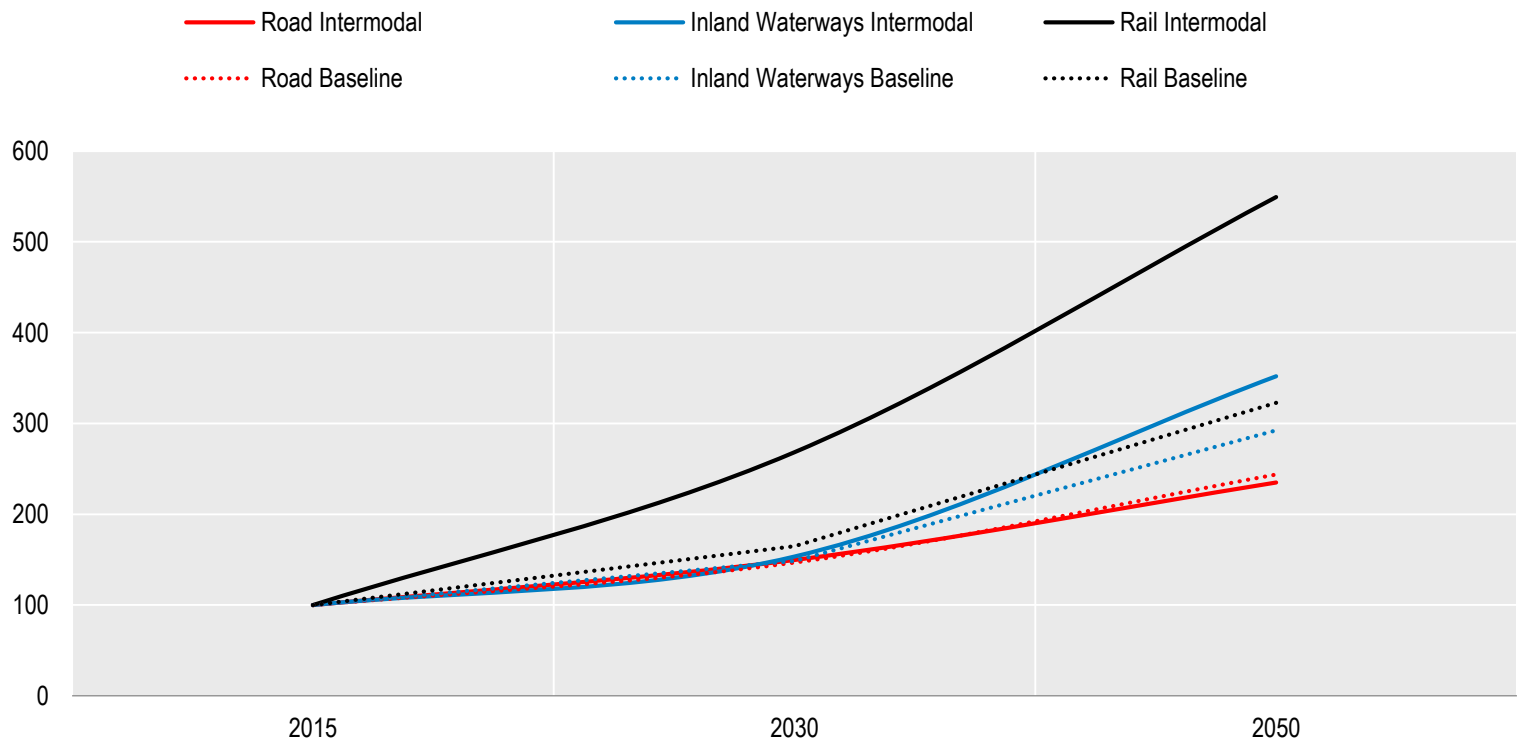
This section presents specific results for each of the scenarios and highlights their most striking features.

Intermodal and infrastructure improvements

This scenario leads to an increase in freight activity and a decrease in transport costs. Further, as more routing options become available, the resilience of freight transport improves. Only in this and the combined scenarios is rail an option for transport with neighboring countries.

Decreases in emissions rely on shifting the movement of goods from road transport to rail transport and inland waterways. However, the gains resulting from increased energy efficiency can be offset by increases in demand.

Trends in demand of non-urban surface modes in Argentina (tonnes-kilometres, 2015=100)

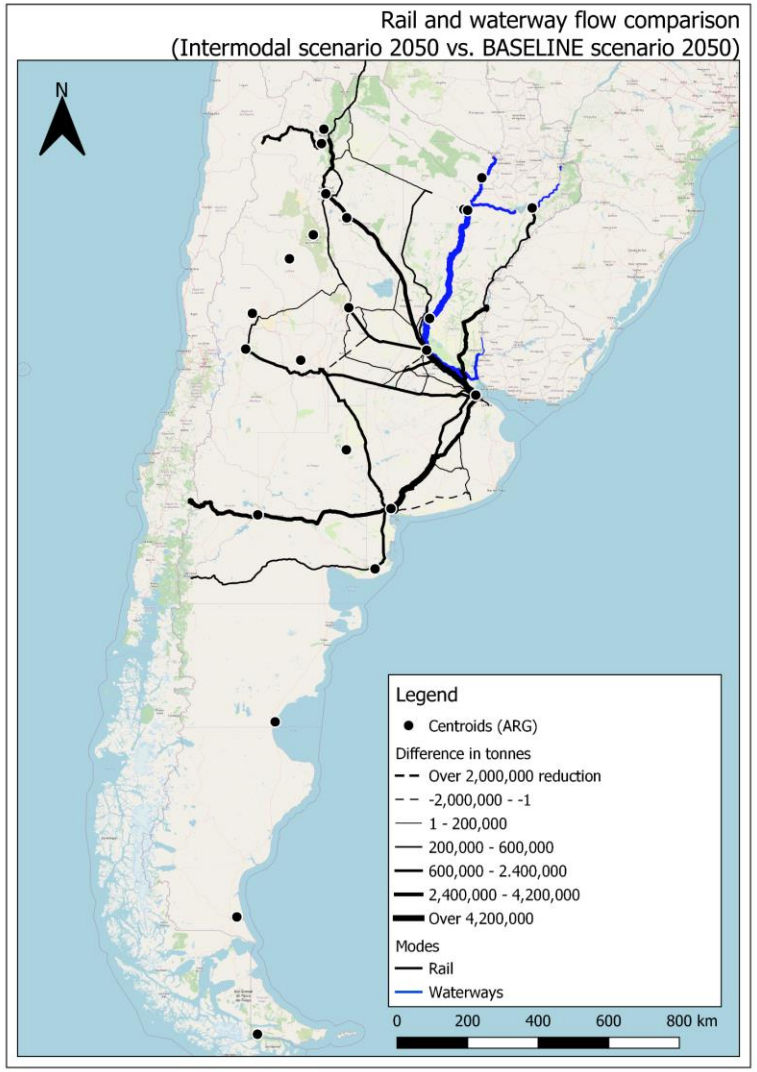


Note: This scenario does not include a transition to electrified railways with zero tank-to-wheel emissions from rail transport. It does include significant improvements to efficiency and use of cleaner fuels both for railways and inland waterways. See table on page 64 for the evolution of carbon intensity of surface modes in this scenario.

Intermodal and infrastructure improvements

In this scenario, the Argentinian rail and waterways network would absorb new transport flows over long distances for international and domestic freight. Rail would connect Chile and Bolivia with the Atlantic Ocean using existing lines in the North of the country (Socompa and Salvador Mazza). A second line to Chile could be used in 2050 as part of the new "Trasandino del Sur" line (an extension of the North-Patagonian corridor). International flows by rail to Brazil would also increase using the international connection of Paso de los Libres and Salto Grande (over the Uruguayan rail network).

The domestic flows would use the inland waterway network more intensively between the capital, Buenos Aires, and the main metropolitan areas of the North-East of the country (Corrientes and Resistencia). The North-West of the country, as well as the North of the patagonian region, would benefit from a more intense use of the rail network using Rosario and Bahía Blanca as the main ports, respectively. Mendoza, in the west of the country, would have a stronger rail connection to Buenos Aires and Bahía Blanca.

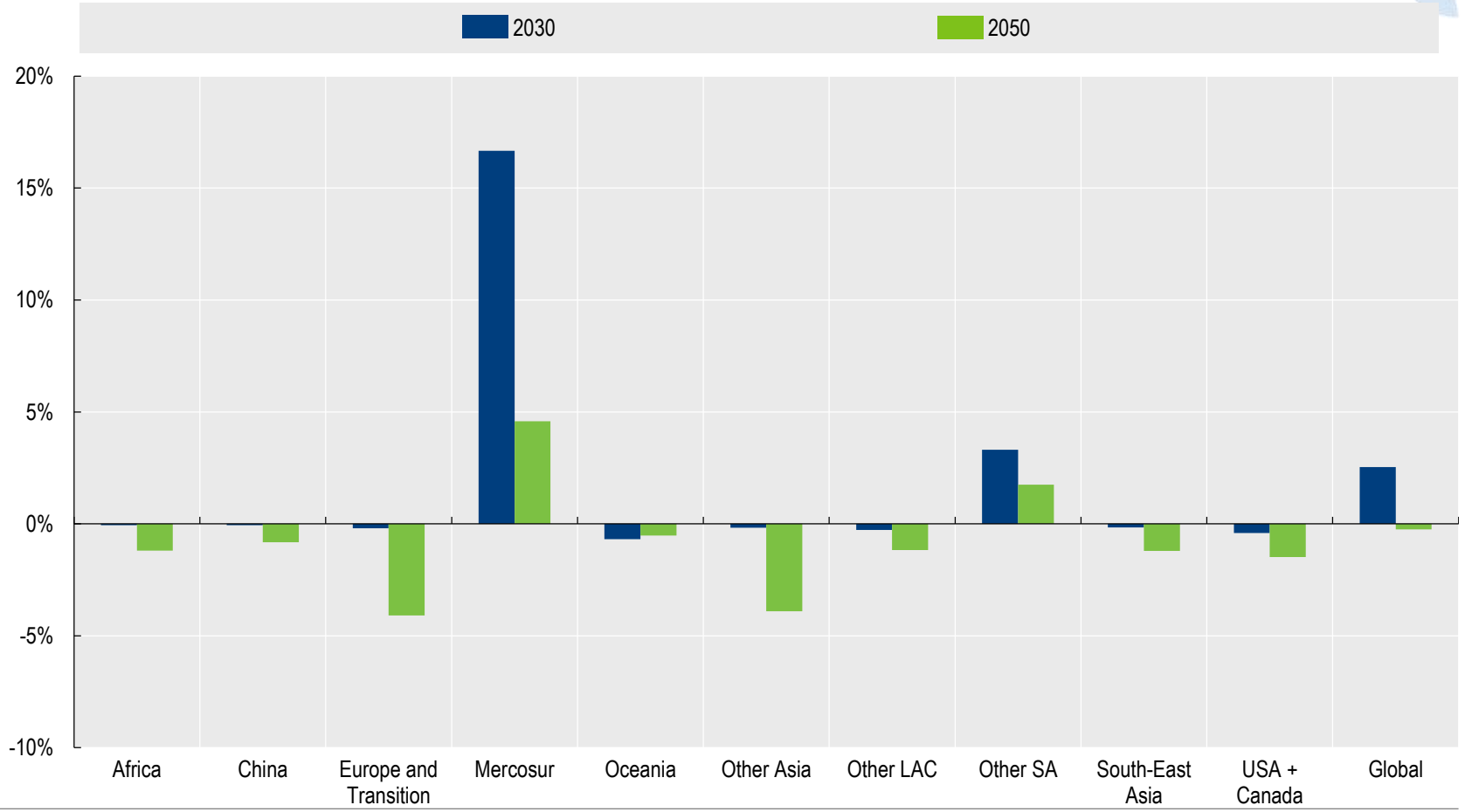


Note: Chile only has one centroid in the model. International flows also include transport movements to/from ports.

Intermodal and infrastructure improvements

Lower transport costs foster trade with neighbours, while maintaining or slightly reducing exchanges with other regions.

Tonnes traded from/to Argentina for the intermodal scenario compared to the baseline scenario, by world region (%)

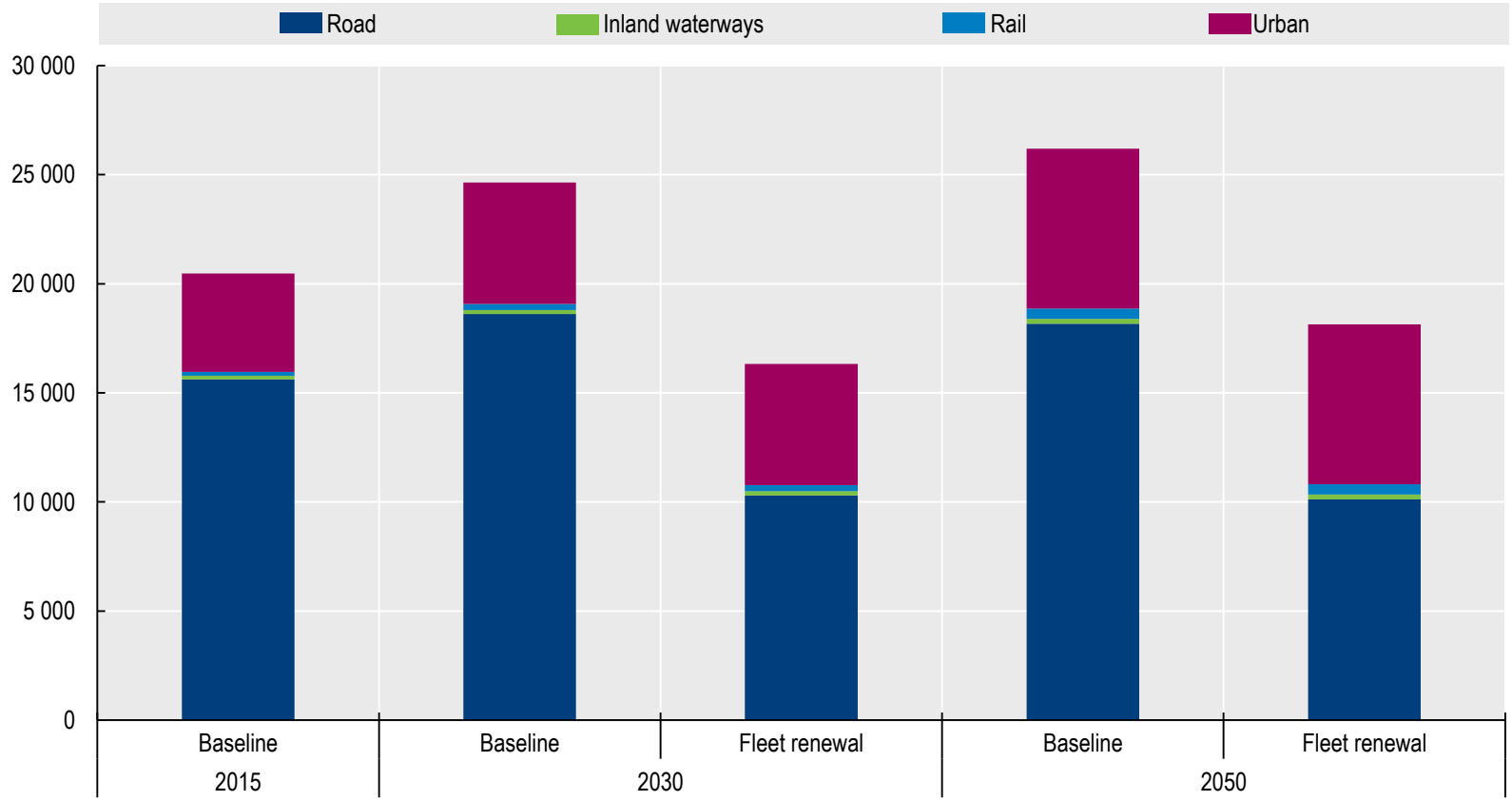


Fleet renewal with transition to gas

This scenario shows the second largest reduction in emissions compared to the Baseline. Compared to 2015, emissions drop by 20% by 2030 and by 11% by 2050.

After the full renewal of the non-urban freight vehicle fleet fully renewed by 2030, further savings in emissions are offset by increased demand and lack of other decarbonisation initiatives.

Surface freight emissions in Argentina by mode in the fleet renewal scenario (thousand tonnes of CO_2)



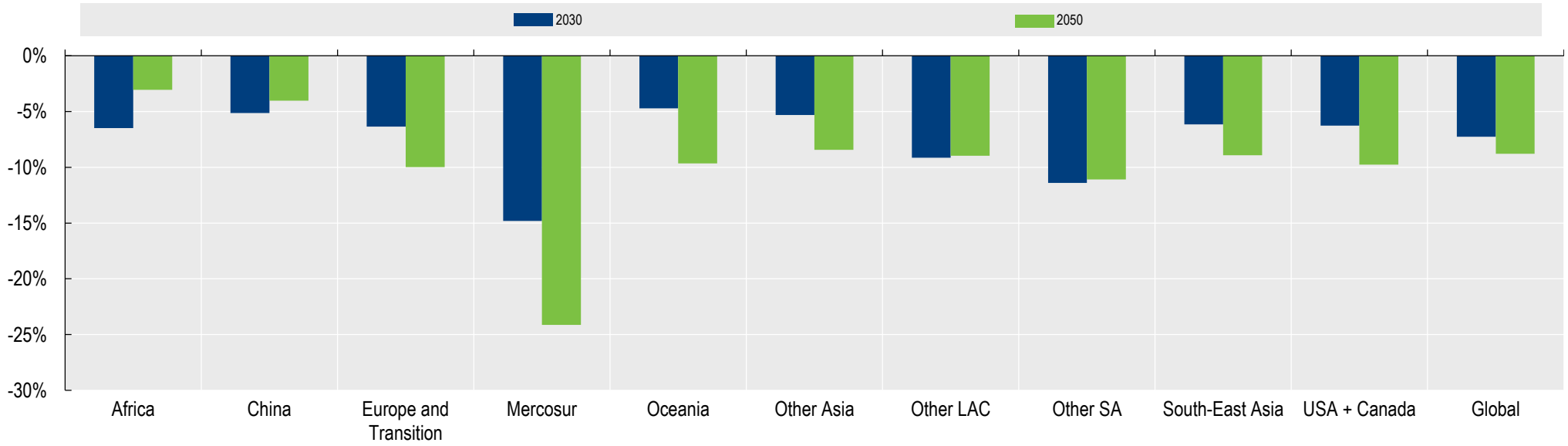
Note: The fleet renewal scenario also includes the full transition of non-urban medium freight trucks to new gas vehicles.

Fleet renewal with transition to gas

This scenario reduces emissions from freight transport within Argentina but also affects the carbon footprint of movements from/to Argentina.

Transport emissions reduce especially for those trade movements that rely more heavily on road freight transport, such as freight transport to/from Mercosur. However, as road plays an important role also in all other international shipments, e.g. for bringing goods to/from ports, the fleet renewal scenario also results in emissions reductions for all other trade.

CO_2 emissions of fleet renewal scenario for 2030 and 2050 compared with the baseline scenario, by world region and these combined globally (%)

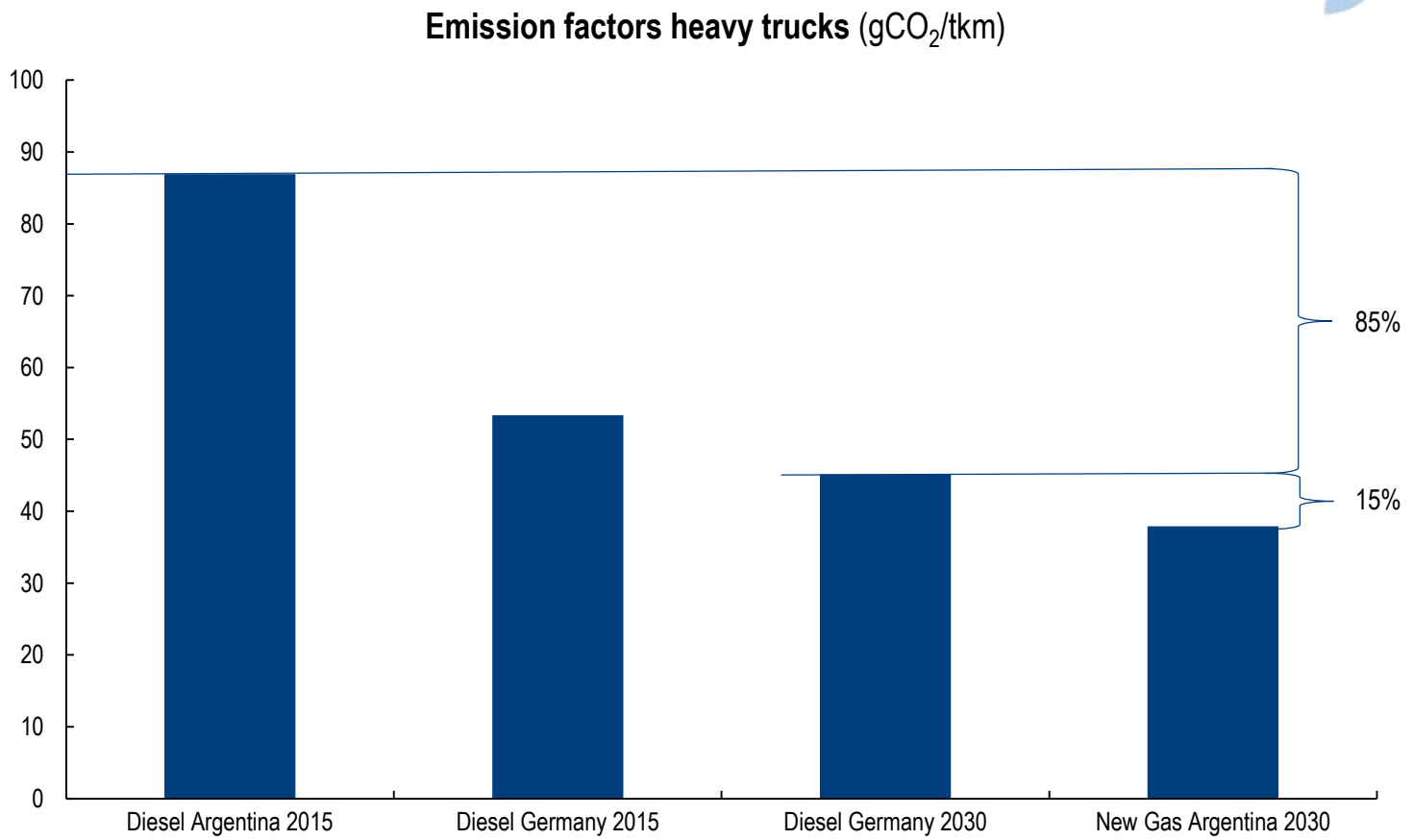


Fleet renewal with transition to gas

Most of the emissions reduction in this scenario can be achieved with a fleet renewal and increased operational efficiency.

The transition to gas *per se* is responsible for 15% of the total reduction of carbon emissions of heavy long haul trucks by 2030. Increased vehicle efficiency and improvements to operations enable the remaining 85%. In the timeframe to 2050, the transition to gas accounts for only 11% of the total emissions reductions achieved in this scenario.

For comparison, empty running in Europe and the US is estimated to be around 20% of vkm, whereas in Argentina it is around 50%.



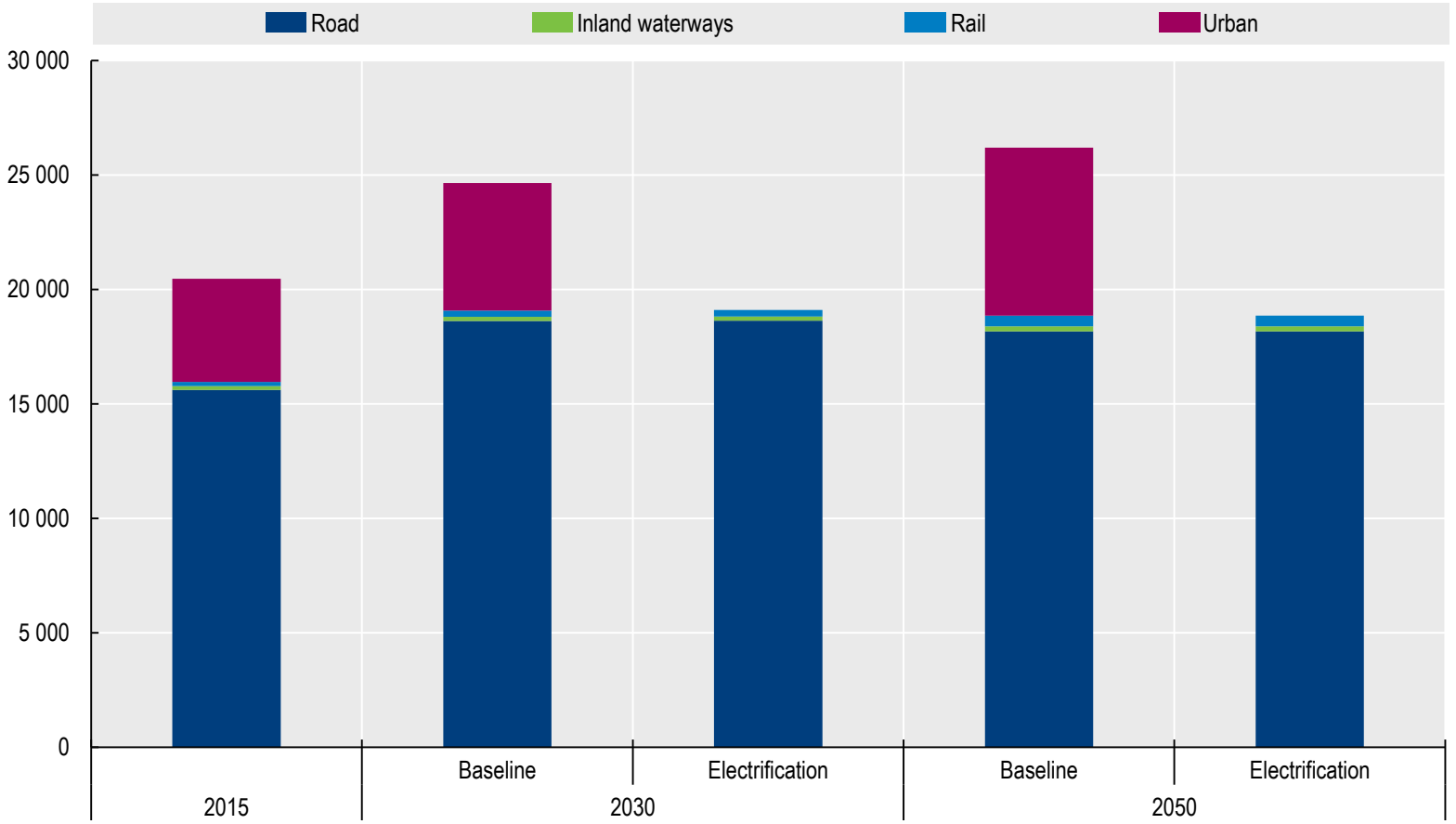
Note: All emissions considered in this analysis are tank-to-wheel; upstream methane leaks are not accounted for. The latter can decrease emissions reductions from a transition to gas when accounting for well-to-wheel emissions.

Urban freight fleet electrification

Urban freight currently accounts for around 22% of all freight transport emissions in Argentina, second only to non-urban road. Decarbonising this sector is critical to decrease freight and overall transport emissions.

In this scenario, the electrification of the urban delivery fleet achieves an 8% reduction in freight transport emissions in the period from 2015 to 2050. This signifies an improvement to the Baseline scenario of 20% in 2030 and 30% in 2050.

Surface freight emissions in Argentina by mode in the urban freight electrification scenario
(thousand tonnes of CO_2)

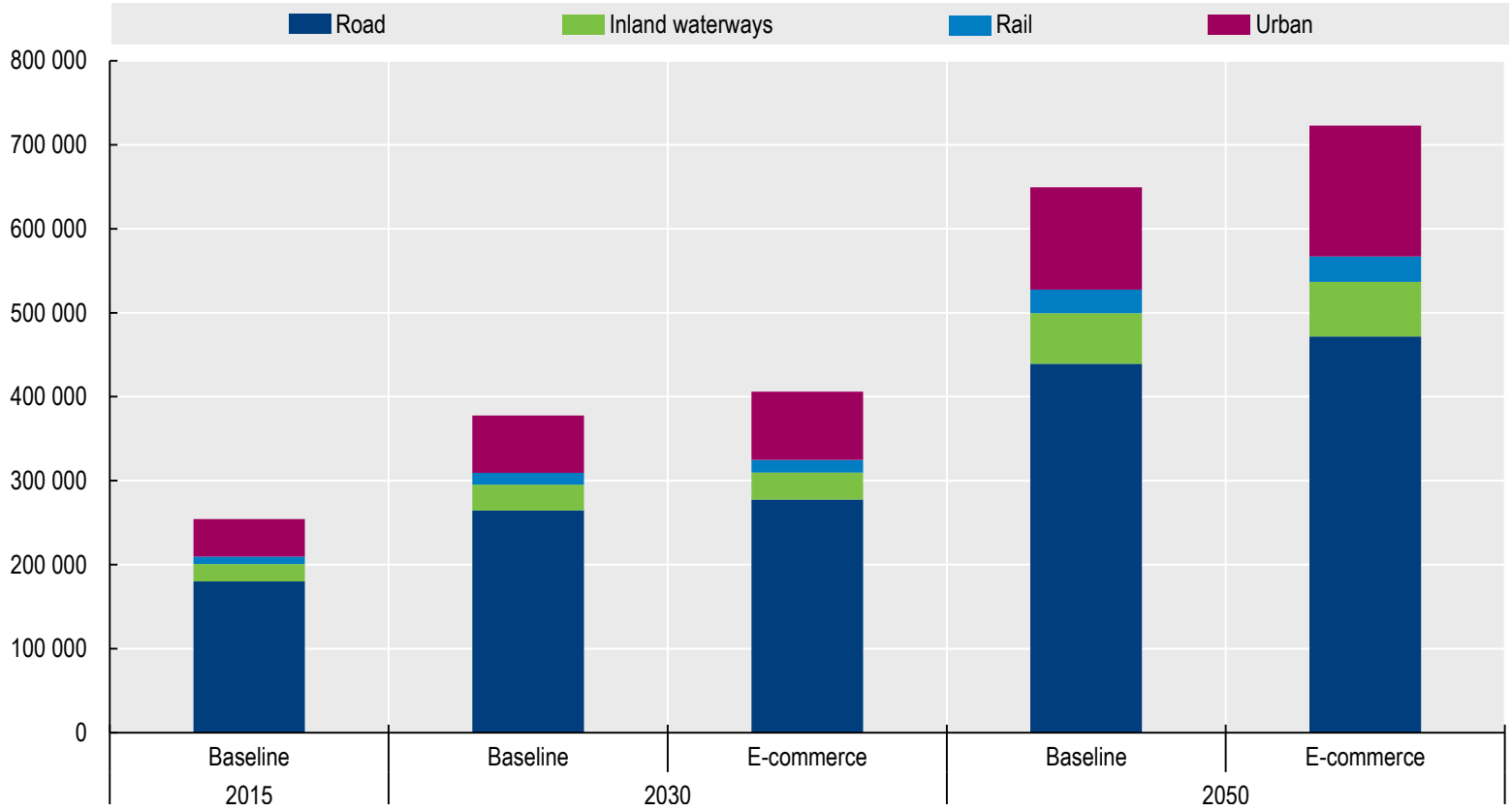


E-commerce

Continued E-commerce growth is expected to result in an increase in emissions due to increased transport demand. In particular, urban freight transport can be expected to grow as a result of an increase in last-mile deliveries.

The E-commerce scenario results in an increase of 82% in urban freight transport (in tkm) by 2030 (compared to 2015). This increase signifies a 20% increase to 2030 baseline values. By 2050, total urban freight activity (in tkm) would be 249% higher than in the base year (2015), and 28% higher than 2050 Baseline values.

Surface freight tkm in Argentina by mode in the E-commerce scenario (million tkm)

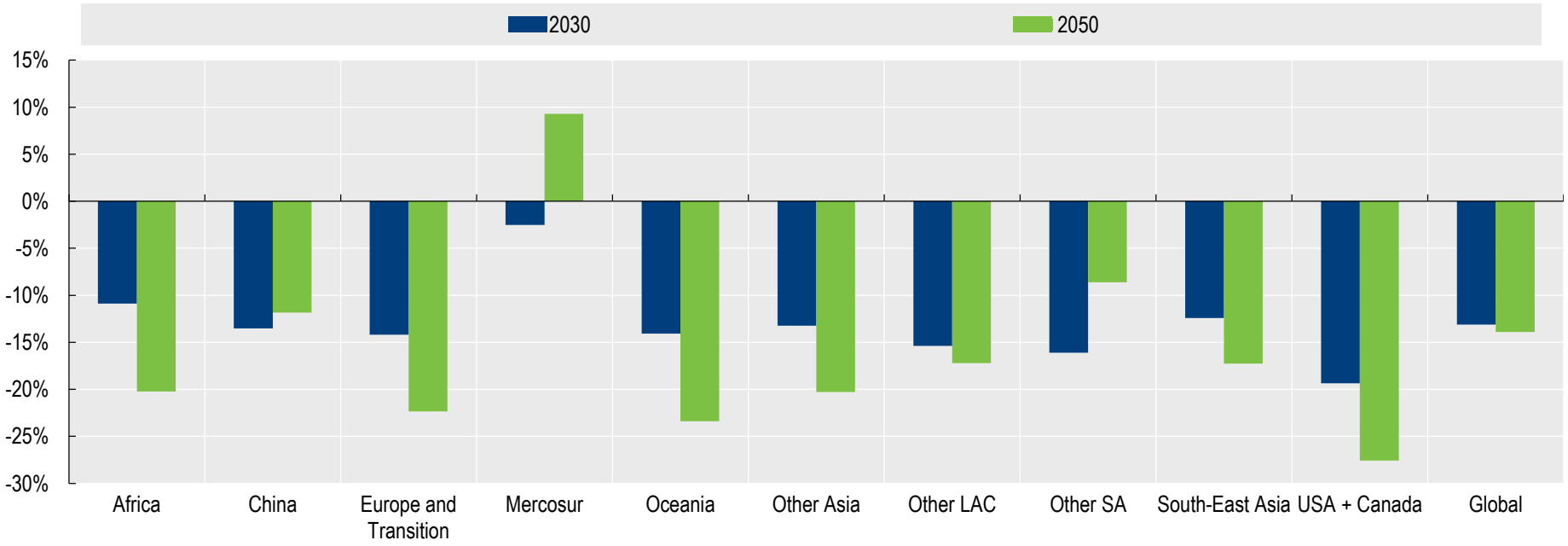


Global trends

In this scenario, freight surface transport emissions, activity and import/export related transport increase compared to the Baseline. However, emissions from international long-distance transport decrease due to global decarbonisation efforts. These include measures such as carbon taxes, distance charges and differentiated port fees that lead to emissions reductions in international shipping.

Trade patterns change substantially with nearby countries gaining importance compared to more distant regions of the world.

CO_2 emissions of import/export transport for the global trends scenario compared to baseline scenario, by world region (%)

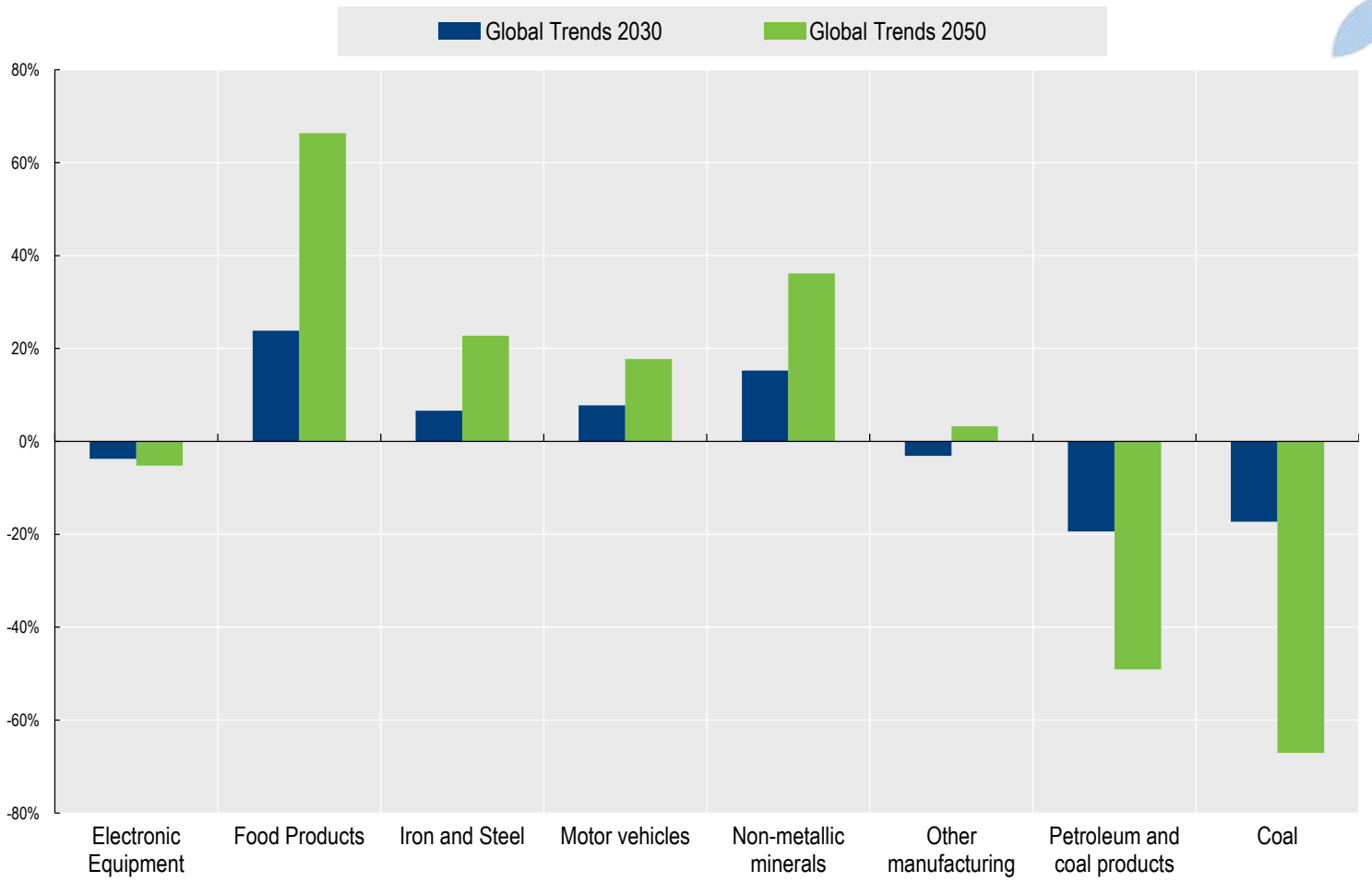


Global trends

Decarbonisation policies are likely to influence the amount of each commodity type being traded. In the global trends scenario, there are significant changes in the traded commodities when compared to the Baseline.

In particular, there is a strong reduction in the export of fossil fuels. In 2030, exports of petroleum and coal products are 19% below the Baseline value; in 2050, they are 50% below the Baseline. Coal exports would decrease by close to 70% in 2050 compared to the Baseline.

Total tonnes of export in the global trends scenario compared to baseline scenario for 2030 and 2050 (%)



Note: This is an excerpt and not the complete list of commodities included in the model. The figure only includes commodities that make up at least 5% of the total trade, and commodities with particular relevance to decarbonisation efforts.

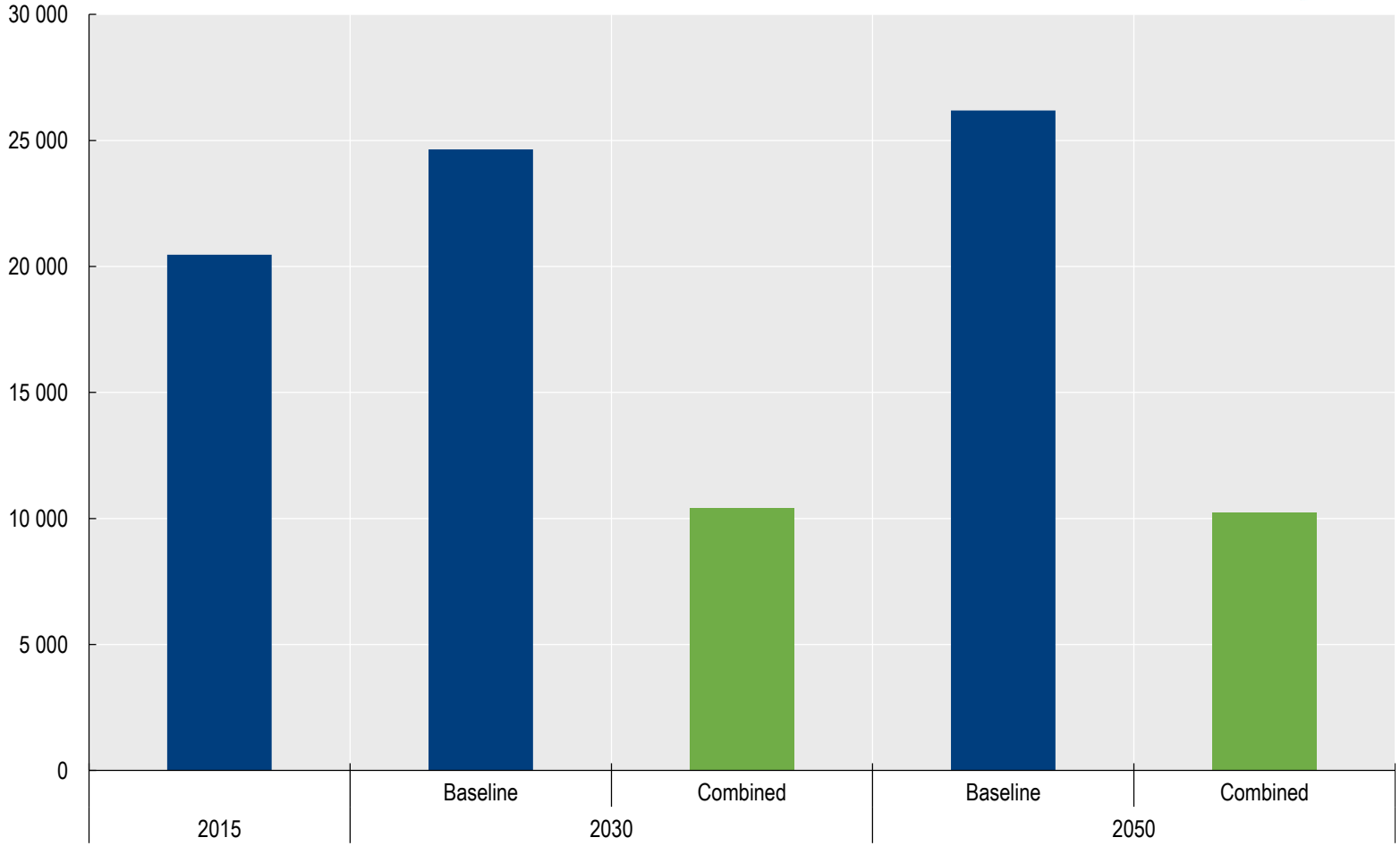
Combined

This scenario prompts the largest decrease in emissions, cutting emissions by half in 2050 compared to 2015 (or by around 60% compared to the Baseline in 2050).

Some policies lead to an increase in freight surface transport costs, but also contribute to modal shift from road to other surface modes, resulting in overall emissions reductions.

A decarbonised world with increased trade regionalisation results in significant changes to trade patterns and the commodity mix being traded.

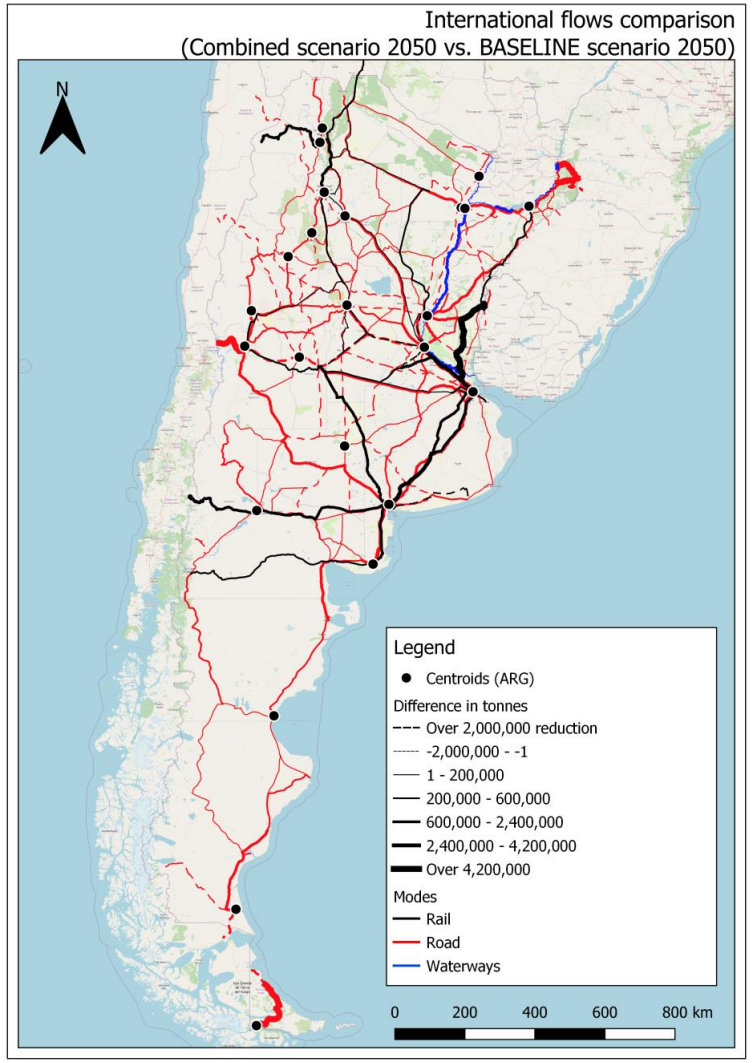
Emissions of baseline and combined scenarios (thousand tonnes of CO_2)

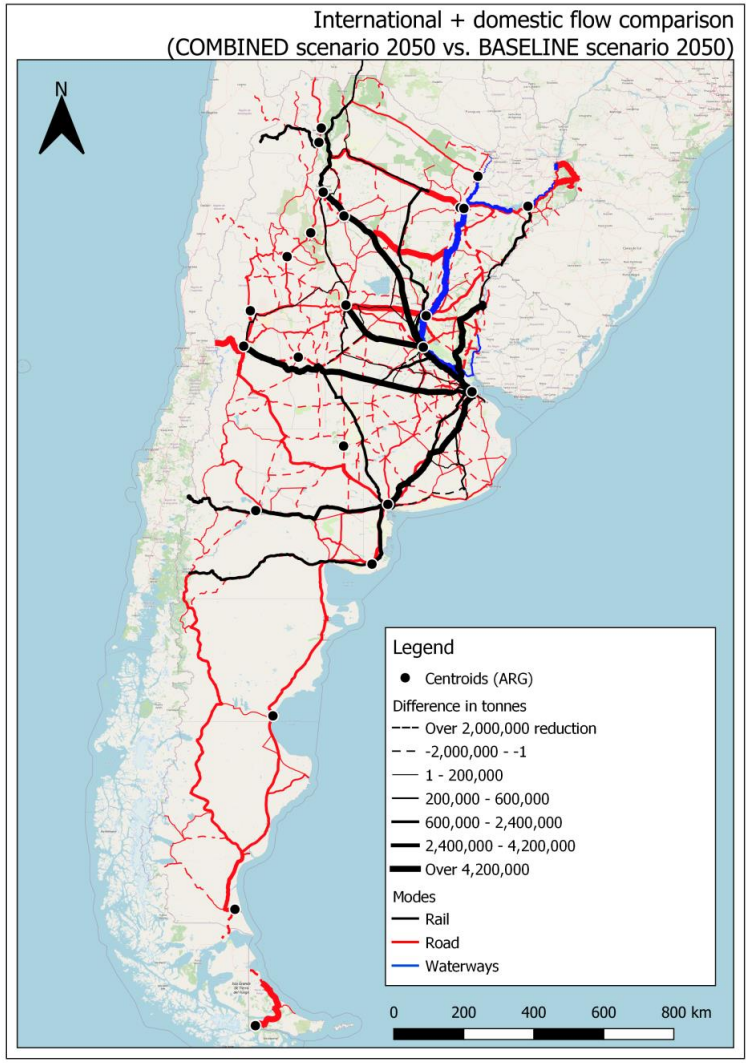


Combined

The combined scenario results in an increase in goods moved by rail to Brazil via Uruguay. Rail flows between Chile and Bahía Blanca, crossing the North of the Patagonia, will also grow.

Domestic long distance freight flows carried out by rail increase in this scenario (with corridors from Buenos Aires to Tucumán, Mendoza, Viedma, Bahía Blanca and Córdoba). The North and center of Argentina will benefit from a more robust rail network that is complemented by a waterway axis.





6. Main insights

This section provides the key takeaways of the analysis and the conclusions that can be drawn from it, phrased in the form of calls for action for policy makers.

Main steps to decarbonise freight transport in Argentina

1. Renew fleets and improve road freight operations (in urban and non-urban areas)

2. Foster intermodality where modal shifts can be achieved and activity increases can be avoided

3. Combine measures that complement one another (infrastructure, operations, policy and pricing)

Calls to action for policy makers in Argentina

1. Pursue bold actions to decrease emissions from freight transport

2. Enhance the monitoring and reporting of emissions by transport sub-sector

3. Install appropriate institutional frameworks that allow to implement pathways to reduce emissions, while promoting transport resilience and efficiency

Summary and outlook

Reducing emissions from freight transport in Argentina requires bold policy action. Current developments are able to decrease the carbon intensity of transport, but these gains are offset by estimated increases in demand. If trends like E-commerce continue to develop, the increase in emissions can be even higher than in a Baseline scenario.

Decreasing freight transport emissions in Argentina is possible. Combined action including the complete road freight fleet renewal, urban and non-urban, with the adoption of low or zero emission fuels, next to improvements fostering intermodality can cut emissions by half in 2050 compared to 2015 values.

Supporting Argentina's efforts to identify and revise effective measures and well-defined pathways to achieve CO_2 reductions in the transport sector is the main goal of this publication and the overall work of the DTEE Argentina project.

The results stem from a "what-if" simulation analysis where the impacts of measures and trends on emissions, demand, operational costs, travel times and other indicators were estimated by the ITF's freight transport model. They do not constitute a cost-benefit analysis of specific transport projects.

Additional insights into the policy implications and implementation feasibility of the scenarios discussed will be provided in future publications.

7. About this project

The Decarbonising Transport in Emerging Economies (DTEE) project aims to support authorities from four countries in turning their transport decarbonisation ambitions into clear actions. Between 2019 and 2023 teams from the International Transport Forum (ITF) and the Wuppertal Institute (WI) have been collaborating alongside authorities from Argentina, Azerbaijan, India and Morocco to decarbonise their passenger and freight transport activities, according to country-specific priorities. DTEE is funded by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). DTEE is part of the ITF's Decarbonising Transport initiative (DTi).

DTEE uses qualitative and quantitative analysis to identify the most effective transport decarbonisation measures. A scoping report for each country highlights main challenges and opportunities for decarbonising transport. DTEE also includes the development of country-specific modelling tools to measure the CO_2 mitigation potential of selected policies, and, when possible, economic and social externalities. Authorities will be trained in the use of these tools for future planning decisions.

DTEE fosters dialogue for transport decarbonisation between all relevant stakeholders. Various national events bring together public and private actors to combine efforts required for decarbonising transport. DTEE further organises regional events for promoting policy exchange between emerging countries: for Argentina, these foster exchanges in experiences with other Latin American countries.

Our team

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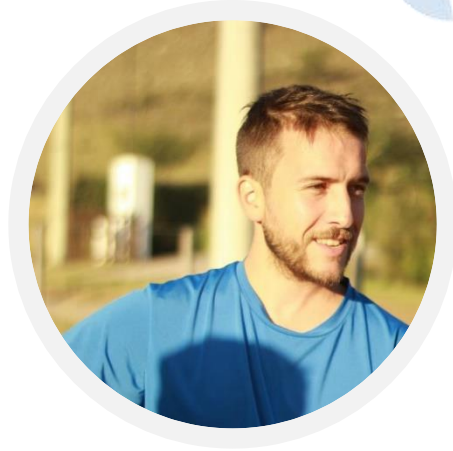


Pablo Vazano

External consultant

Fact-finding mission in Argentina

Decarbonising freight transport in Argentina: A scoping report

This report highlights important findings from the kick-off meetings for the Decarbonising Transport in Emerging Economies project (DTEE) in Argentina. It gives a brief overview of freight transport activity in the country, covering the road, railways, ports and inland waterways, and the urban logistics sectors. It highlights some of the main challenges and opportunities for decarbonising freight transport.

Freight transport decarbonisation measures need to be aligned with sustainable development goals, regional cohesion and increased efficiency of the transport system, while adhering to significant budgetary constraints.

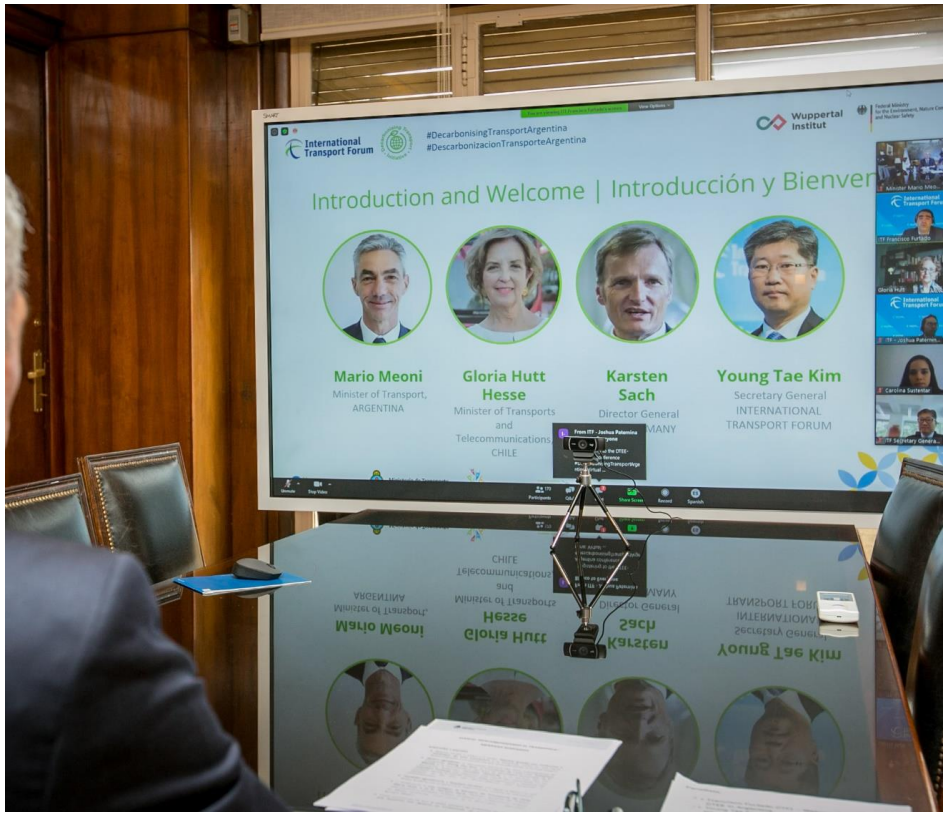
The scoping report is available here: https://www.itf-oecd.org/decarbonising-argentina-transport-system

The report is a summary of a longer document, shared with Argentinian authorities and other stakeholders. The longer version can be obtained upon request to the ITF (https://www.itf-oecd.org/dtee-argentina).

Decarbonising transport in an unprecedented global crisis: A virtual conference

The Covid-19 pandemic increased the challenges for decarbonising transport in emerging regions. A virtual conference was organised in the framework of the DTEE project to highlight the extent of these challenges, as well as their potential opportunities, arising from such an unprecedented crisis. The series of online events spanned throughout July 2020 and was organised jointly with the Argentinian Transport Ministry and the "Sustentar" Association. The main outputs of the conference are available online (https://www.itf-oecd.org/dtee-output).

The conference brought together more than 600 participants from more than 50 countries. More than two-thirds of the participants were from Latin America. High-level speakers included the late Transport Minister of Argentina, Mr. Mario Meoni, and Mrs Gloria Hutt Hesse, Minister of Transport and Telecommunications of Chile.



8. Annex

The ITF global freight transport model

The ITF Global Freight Model [1] is designed to estimate the global freight transport activities for **28 key commodities.**

It estimates the weight of the commodities traded between countries or regions, the modal choice, and the route choice used to transport these commodities. It considers transport network characteristics and relevant socio-economic variables.

This gravity-based model measures the number of opportunities (defined in terms of the share of global GDP) that can be reached from each centroid or region. It includes four explanatory variables: distance, transport cost, travel time and border crossing time.

For the current analysis, the model is applied to estimate the potential impact of decarbonisation policy measures in Argentina.

The model has four key components/sub-models:

The **spatial discretisation model** defines the international and domestic centroids that are used for the analysis.

The **international freight model** consolidates road, rail, maritime, and inland waterway networks into a single model. It includes three sub-components: a network model, a weight-value model, and a mode share model.

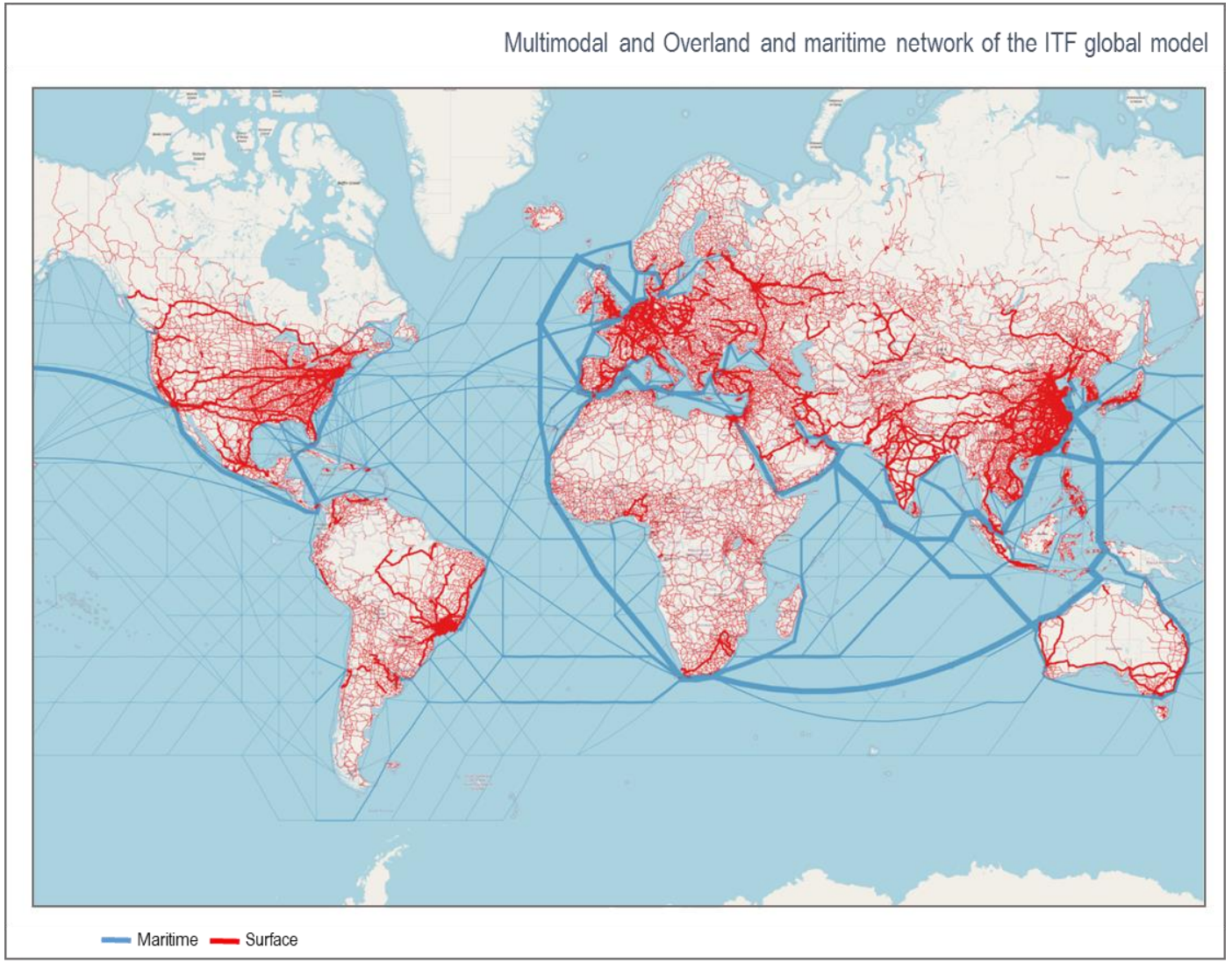
The **domestic freight model** departs from the total freight activity estimation using a gravitational approach that aims to understand how the total trade splits into the complete Origin-Destination matrix.

The **equilibrium assignment** model uses an iterative equilibrium assignment procedure with travel time and cost updates for every iteration (i.e. 5 years) to assign transport flows to the available network and its links.

The ITF global freight transport model

One of the greatest assets and added value propositions of the ITF global model is that it estimates international trade simultaneously for all countries and regions in the world.

Additionally, the multimodal network is entirely integrated. It includes maritime, road, railroad, aviation and inland waterway links. Commodities can move across any and all possible links, regardless of the mode combinations used.



ITF global freight model by region

The extensive validation of all of the Argentinian components of the global model, including the country's entry and exit points, allows for the analysis of Argentinian global trade with the most up to date information.

However, the model remains global, and is estimated simulataneously for all regions of the world. Therefore, it is not designed to analyse specific projects or links (e.g. a particular border crossing or port), or to conduct path analysis to determine the routing of particular shipments. It models the aggregate trade flows between the different regions of the world, and more specifically, between the defined centroids for each of these regions.

The level of detail between the regions can vary signficantly as a result of the available data. See the table for an overview of the number of centroids used in the model.

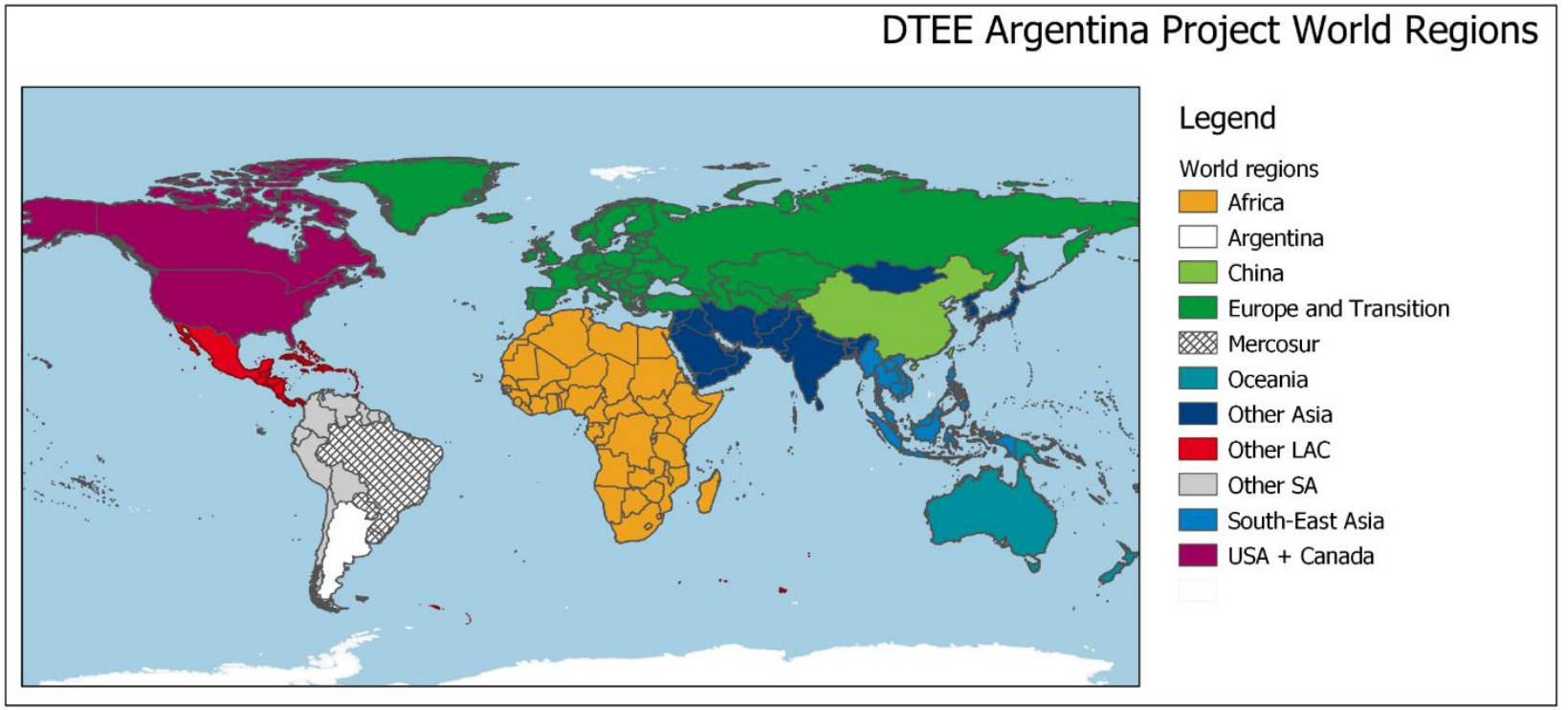
Number of international centroids in the global ITF freight model (per region)

Country/Region	Centroids
Argentina	**24**
Mercosur	**17**
Brazil	15
Paraguay	1
Uruguay	1
Other South America	**15**
Bolivia	1
Chile	1
Colombia	4
Ecuador	2
Guyana	1
Peru	3
Venezuela	3
Other Latin America & Caribbean	**21**
China	**28**
Europe and Transition	**773**
Oceania	**15**
Other Asia	**111**
Africa	**78**
South East Asia	**22**
United States and Canada	**60**
Total	**1 164**

DTEE Argentina project: World regions

Argentina's global trade was analysed by grouping countries in 10 world regions. This grouping was aligned with project aims and the strategic importance of specific world regions regarding trade with Argentina.

The 10 world regions were defined as (1) MERCOSUR countries, (2) other South American countries, (3) other countries in Latin America and the Caribbean, (4) the US and Canada, (5) Europe and transition countries (6) China, (7) South East Asia, (8) other Asian countries, (9) Africa, and (10) Oceania.



Scenario specifications

Measure	Description	Scenarios						
		Baseline	Intermodal	Fleet renewal with transition to gas	Electrification	E-commerce	Global trends	Combined
Distance charges	Distance based charges for road freight.	Charges introduced in 2030 growing to 1 cent per tonne-kilometre by 2050.					Charges introduced in 2030 growing to 2.5 cents per tonne-kilometre by 2050.	
Port fees	Differentiated port fees depending on environmental performance of vessels, i.e. ships with no clean technologies have higher port fees.	Port fees grow an additional 1% by 2050 decreasing the carbon intensity of shipping by 0.5%.					Port fees grow an additional 20% by 2050 decreasing the carbon intensity of shipping by 10%.	
Carbon pricing	Pricing of carbon-based fuels based on the emissions they produce.	Carbon pricing varies across regions: 150 - 250 USD per tonne of CO_2 in 2050, e.g. in Argentina 150, in Scandinavia 250.					Carbon pricing varies across regions: 300- 500 USD per tonne of CO_2 in 2050, e.g. in Argentina 300, in Scandinavia 500.	
Rail and inland waterways improvements	Increase in attractiveness of intermodal solutions, namely trips with a rail or inland waterway component. The penalty for mode transfers at intermodal terminals is decreased and alternative specific constant of rail and inland waterways increases.	The rate of change varies by world region: 1-2% in 2020 to 5-20% in 2050 (Argentina 20% in 2050).	The rate of change varies by world region: 2-4% in 2020 to 10-40% in 2050 (Argentina 40% in 2050).	The rate of change varies by world region: 1-2% in 2020 to 5-20% in 2050 (Argentina 20% in 2050).				The rate of change varies by world region: 2-4% in 2020 to 10-40% in 2050 (Argentina 40% in 2050).
Transport network improvement plans	Construction and upgrade of new infrastructure, e.g. new roads, railways or port expansion.	No changes in Argentina. The network is updated with planed infrastructure in other regions of the world (e.g. developments in Central Asia, TEN-T European projects).	In Argentina new rail and road border-crossings and improvements to existing ones. Rail becomes available for international connections. Upgrades to capacity, speed and lower costs across the network, including some Ports. The network is updated with planed infrastructure in other regions of the world (e.g. developments in Central Asia, TEN-T European projects).	No changes in Argentina. The network is updated with planed infrastructure in other regions of the world (e.g. developments in Central Asia, TEN-T European projects).				In Argentina new rail and road border-crossings, improvements to existing ones. Rail becomes available for international connections. Upgrades to capacity, speed and lower costs across the network, including some Ports. The network is updated with planed infrastructure in other regions of the world (e.g. developments in Central Asia, TEN-T European projects).
Fleet renewal with transition to gas	Renewal of all the fleet of vehicles employed for non-urban freight operations in Argentina with transition to gas powered engines	Follows the IEA STEPS Scenario.		By 2030 non-urban fleet is fully renewed and running on gas in Argentina.	Follows the IEA STEPS Scenario.			By 2030 fleet is fully renewed and running on gas in Argentina.

Note: The specifications were based on the scenarios of the ITF Transport Outlook 2021 [8], with adjustments to better fit the Argentinian case study and adapted to match the seven policy scenarios developed for this project. The measures are deployed across all regions of the world. Differences and specificities for some regions are mentioned.

Scenario specifications

Measure	Description	Scenarios						
		Baseline	Intermodal	Fleet renewal with transition to gas	Electrification	E-commerce	Global trends	Combined
Slow steaming and speed reduction for maritime and trucks	Reduction of the average speed of ships or trucks to reduce emissions.	Decrease in the speed of road and maritime transport is less than 1% in 2020, growing to a 10% decrease by 2050.					Decrease in the speed of road and maritime transport is less than 1% in 2020, growing to a 20% decrease by 2050.	
3D Printing	Enables manufacturing closer to the point of consumption, leading to drop in long distance trade for several commodities compared to estimated values, namely manufactured goods.	Negligible impact on trade.					International trade shrinks 10% by 2050. Values differ by commodities, electronic and manufactured goods have higher falls.	
Decarbonisation of energy	Decreases in trade and consumption of oil and coal as societies decarbonise, directly impacting freight transport demand for fossil fuels.	Oil and Coal grow less than other commodities (following ENV-Linkages model (ENV-OECD), (Chateau et al., 2014)					Yearly decrease of 3.35% for coal and 2.1% for oil. By 2050 coal trade has reduced 65% and oil close to 50%, compared to 2020 estimates.	
Trade regionalisation	Simulates increased trade exchanges within regions or trade blocks, while decreasing longer distance trade between regions.	No specific fees for inter-regional trade.					10% increase in penalty fees for inter-regional trade.	
E-commerce	Simulates the impact of growth in e-commerce and home deliveries. Increases the estimated demand of goods over time in addition to the projected values.	Urban freight with an additional 5% demand increase by 2050, smaller impacts on non-urban freight.				Urban freight with an additional 25% demand increase by 2050, and 6% for non-urban freight.		
Electrification of urban logistics	Renewal of all the fleet of vehicles employed for urban freight operations in Argentina with transition to battery electric engines	Follows the IEA STEPS Scenario.			By 2030 urban fleet is fully renewed and battery electric in Argentina.	Follows the IEA STEPS Scenario.		By 2030 urban fleet is fully renewed and battery electric in Argentina.
Electric/alternative fuel vehicle penetration and increases in efficiency for all transport modes	Electric/alternative fuel vehicle penetration and increases in efficiency for all transport modes (including average loads and vehicle capacity).	Follows the IEA STEPS Scenario.		In Argentina full transition to gas of the non-urban freight fleet by 2030.	In Argentina full transition to electric of the urban freight fleet.	Follows the IEA STEPS Scenario.		In Argentina full transition to gas of the non-urban freight fleet and electricity of the urban fleet by 2030.

Note: The measures above listed have different deployment levels for different scenarios. In addition, there are a few other measures that are applied equally across all of the scenarios and that match the Recover scenario of the ITF Transport Outlook 2021 [8]. In that report the underlying trade and GDP inputs that drive transport demand are also discussed.

Additional results

Surface freight activity in Argentina by scenario (million tonne-kilometres)

	Scenarios						
Years	**Baseline**	**Intermodal**	**Fleet renewal**	**Electrification**	**E-commerce**	**Trends**	**Combined**
2015	254 227	254 227	254 227	254 227	254 227	254 227	254 227
2030	377 467	392 638	378 081	377 716	406 155	410 409	420 810
2050	649 443	665 736	646 264	649 453	722 783	705 651	721 954

Modal share of non-urban surface modes in Argentina (% based on tonne-kilometres)

	2015	2030				2050			
Modes	**Baseline**	**Baseline**	**Intermodal**	**Trends**	**Combined**	**Baseline**	**Intermodal**	**Trends**	**Combined**
Road	86%	86%	83%	83%	80%	83%	78%	80%	75%
Inland waterways	10%	10%	10%	11%	11%	11%	13%	12%	14%
Rail	4%	5%	7%	6%	9%	5%	9%	7%	11%

Surface freight emissions in Argentina by scenario (thousand tonnes of CO_2)

	Thousand tonnes of CO_2						
Years	**Baseline**	**Intermodal**	**Fleet renewal**	**Electrification**	**E-commerce**	**Trends**	**Combined**
2015	20 469	20 469	20 469	20 469	20 469	20 469	20 469
2030	24 645	25 093	16 333	19 098	26 675	24 895	10 415
2050	26 194	25 453	18 144	18 861	29 624	27 297	10 219

Additional results

Growth in demand of non-urban surface modes in Argentina compared to 2015 (% based on tonne-kilometres)

	2030				2050			
Modes	**Baseline**	**Intermodal**	**Trends**	**Combined**	**Baseline**	**Intermodal**	**Trends**	**Combined**
Road	47%	50%	50%	50%	144%	135%	148%	138%
Inland waterways	49%	53%	73%	85%	192%	252%	227%	295%
Rail	65%	168%	149%	240%	223%	449%	351%	591%
Total non-urban	48%	55%	61%	61%	152%	159%	178%	172%

Carbon intensity of surface transport

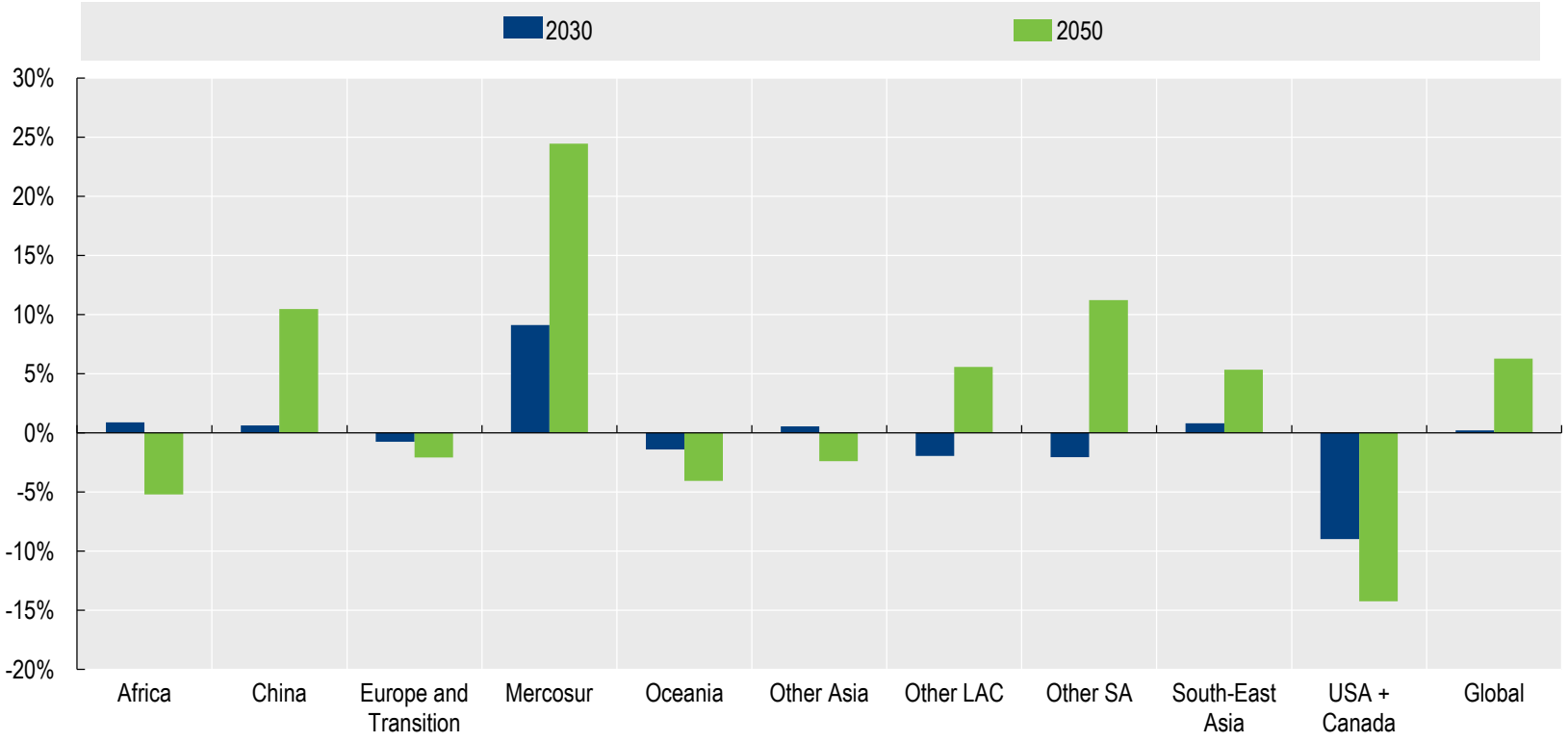
	2015	2030		2050	
Modes	**Baseline**	**Baseline**	**Intermodal**	**Baseline**	**Intermodal**
Road	86.6	70.3	70.3	41.4	41.3
Inland waterways	8.1	6.0	5.2	3.6	1.2
Rail	21.5	19.7	17.1	17.0	10.8
Surface	80.5	65.3	63.9	40.3	38.2

Variation of surface freight emissions in the fleet renewal scenario compared to 2015 (%)

	Road	Inland waterways	Rail	Urban	Total
2030	-34%	9%	51%	23%	-20%
2050	-35%	30%	154%	63%	-11%

Additional results

Tonnes traded from/to Argentina in the global trends scenario compared to the baseline scenario for 2030 and 2050, by world region (%)



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Policy Scenarios for Decarbonising Argentina's Transport System

One of the biggest challenges for climate change mitigation is to enable emerging economies to continue lifting people out of poverty while at the same time reducing greenhouse gas emissions. The DTEE project helps governments of emerging nations to identify ways to reduce their transport CO_2 emissions and meet their climate goals.

Freight transport activities are essential in Argentina. The import and export of bulk commodities are at the heart of the country's economy. Road transport is responsible for most freight transport in the country, and trucks, which have a particularly high carbon intensity, have the highest share of emissions in the transport sector. Renewing the truck fleet and increasing efficiency offers a great opportunity for decarbonisation. Argentina can also leverage its extensive railway and inland waterway networks to decrease the carbon intensity of transport and foster trade with its neighbor countries. Combining measures will bring the widest benefits. These policies and scenarios where explored using the ITF freight model that was for the first time used for a country-level analysis.

For more details check: https://www.itf-oecd.org/dtee-argentina