Policy Scenarios for Decarbonising Azerbaijan's Transport System

Decarbonising Transport in Emerging Economies

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1. Background

This publication provides the results of three policy scenarios that were developed to assess the impact of policy measures on transport demand and related CO_2 emissions in Azerbaijan. It highlights measures and trends that will have significant impact on Azerbaijan's transport system in the decades to come. The work is part of the ITF's Decarbonising Transport in Emerging Economies (DTEE) project in Azerbaijan.

The policy scenarios were designed in close collaboration with Azerbaijan's Ministry of Digital Development and Transport and also the Baku Transport Agency, the State Agency for Highways of Azerbaijan, the Ministry of Environment and Natural Resources, Azerbaijan Railways CJSC, the State Maritime Agency and the Ministry of Energy to inform and support policy making in the coming years. These scenarios were informed by an in-person event and fact-collecting mission to the country in late 2019, a series of online meetings with relevant stakeholders and numerous data collection efforts between 2020-21.

The assessment of the scenarios was carried out using Excel-based transport models that project future transport demand and related emissions under various scenario settings. The ITF team developed these models specifically for Azerbaijan, following best practices in transport modelling and making use of methodologies applied and tested in ITF's in-house modelling work.

The ITF transport models used to assess the policy scenarios

The two transport models relevant for **passenger transport** in Azerbaijan are:

- A passenger transport model covering all passenger transport in Azerbaijan (excluding the Baku area), including aviation.

- A passenger transport model covering the Baku area

The build of these models was heavily informed by consultations with stakeholders in Azerbaijan, data collection efforts and, where relevant, the use of proxy data stemming from the ITF's in-house global transport models. The two models are available to national stakeholders for their further use and can be obtained from the ITF upon request. They define and test the impact of various policy measures on transport demand and related CO_2 emissions and come with relevant training/guidance documents.

The assessment of scenarios relevant for **freight transport** was carried out by using the ITF's in-house global freight model. The model was refined to best represent characteristics for Azerbaijan. Such work included updates to the national transport infrastructure network and data validation exercises. Outputs of the scenarios described in this publication are being made available to national stakeholders in a data explorer tool.

2. Policy scenarios for CO_2 reduction

The ITF and the Azerbaijan Ministry of Digital Development and Transport worked closely to identify and design **three distinct scenarios** to assess the CO_2 reduction potential of different policy pathways. The scenarios explore possible alternative futures, their impacts on the transport system and its externalities.

1

Baseline

No measures are implemented that will influence travel demand or CO_2 emissions during the 2020-2050 period. This scenario constitutes a "do nothing" reference against which the effectiveness of CO_2 reduction policies in the other two scenarios is tested.

2

Current policies

Azerbaijan's transport policy measures currently planned to influence travel demand or CO_2 emissions are carried out during the 2020-2050 period. If no further plans are established or measures taken to reduce transport CO_2 emissions, this scenario reflects the most likely future for Azerbaijan.

3

Climate ambition

Additional measures are introduced on top of the current policies scenario, to better align Azerbaijan's transport CO_2 emissions with reaching the Paris Climate Agreement.

NB: Detailed scenario definitions are in the Annex of this publication.

3. Azerbaijan's transport emissions

Passenger and freight transport activity will grow significantly in Azerbaijan to 2050

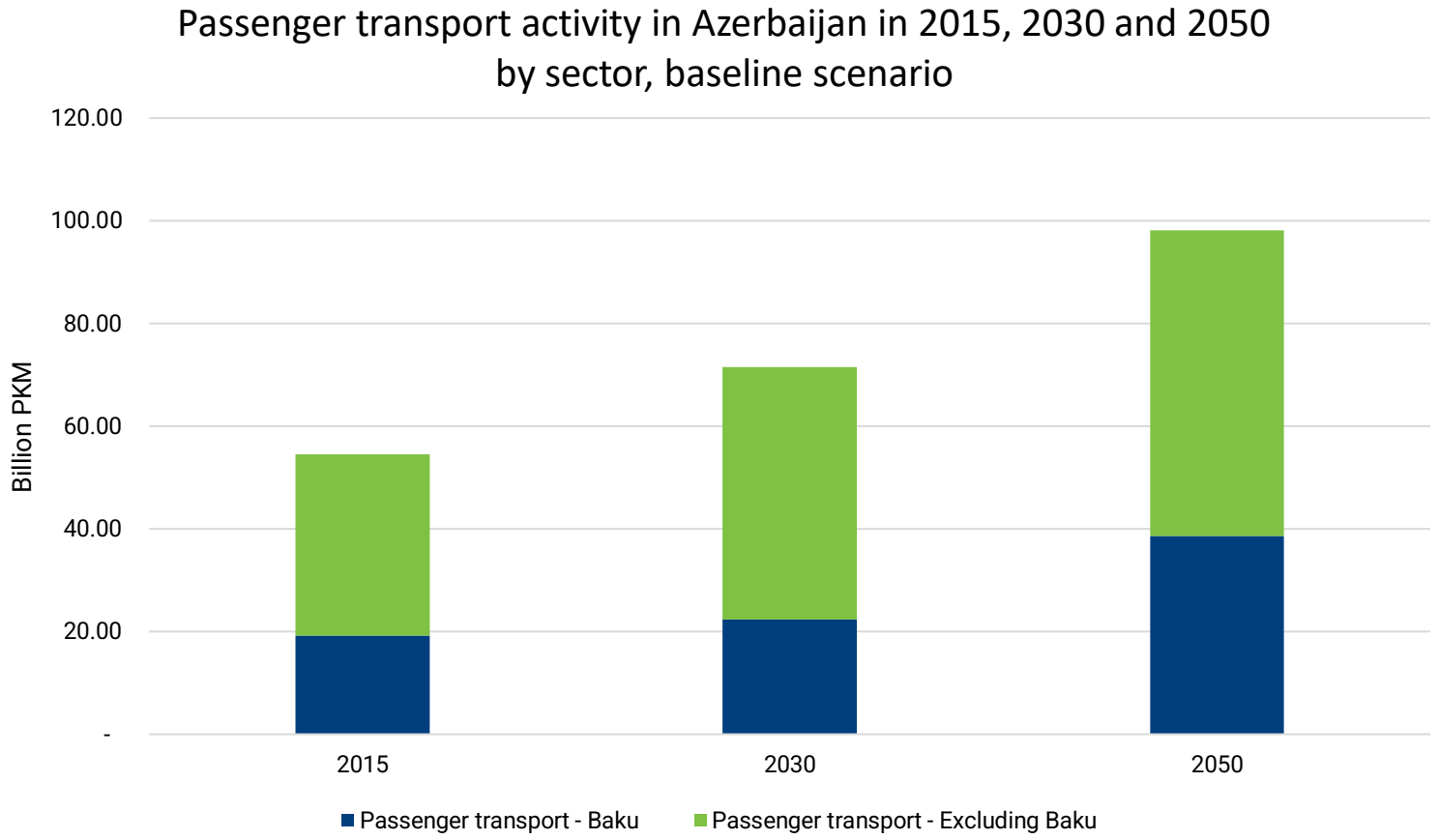
Current policy plans **limit the growth** of annual transport CO_2 emissions **to 25%** between 2015 and 2050

Measures proposed in the climate ambition scenario would cut annual transport CO_2 emissions to around 50% of the 2015 levels by 2050

Passenger transport activity will almost double by 2050

In the baseline scenario, passenger transport activity in Azerbaijan is set to increase by 80% by 2050.

In the current policies and climate ambition scenarios, passenger transport activity follows the same trend as in the baseline scenario. The policy measures put in place do not result in significant passenger demand reductions.

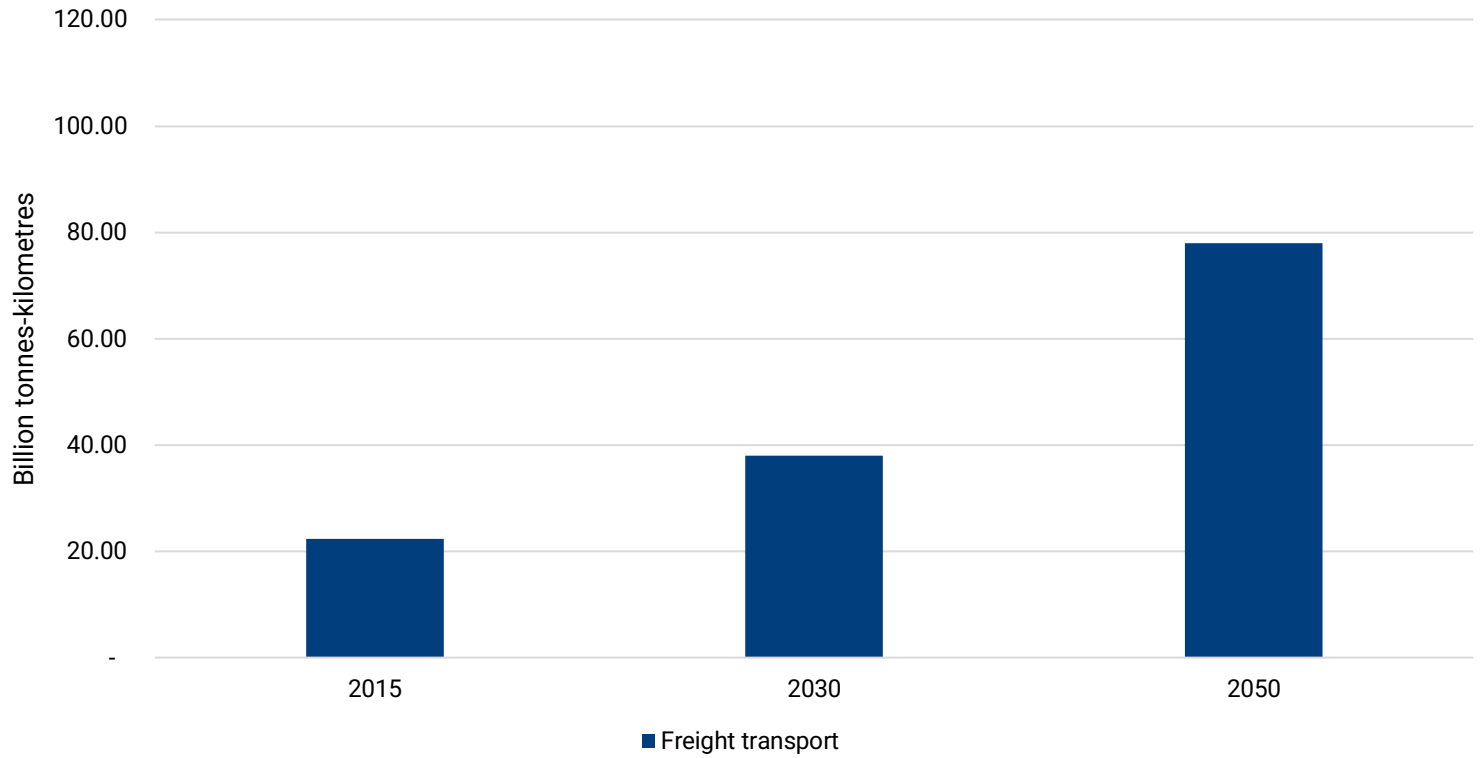


Freight transport activity will more than triple by 2050

In the baseline scenario, freight transport activity will grow by 250% by 2050.

This growth pattern also occurs for the current policies scenario. Only measures in the climate ambition scenario will limit freight growth, to 130%, by 2050.

Freight transport activity in Azerbaijan in 2015, 2030 and 2050 by sector, baseline scenario



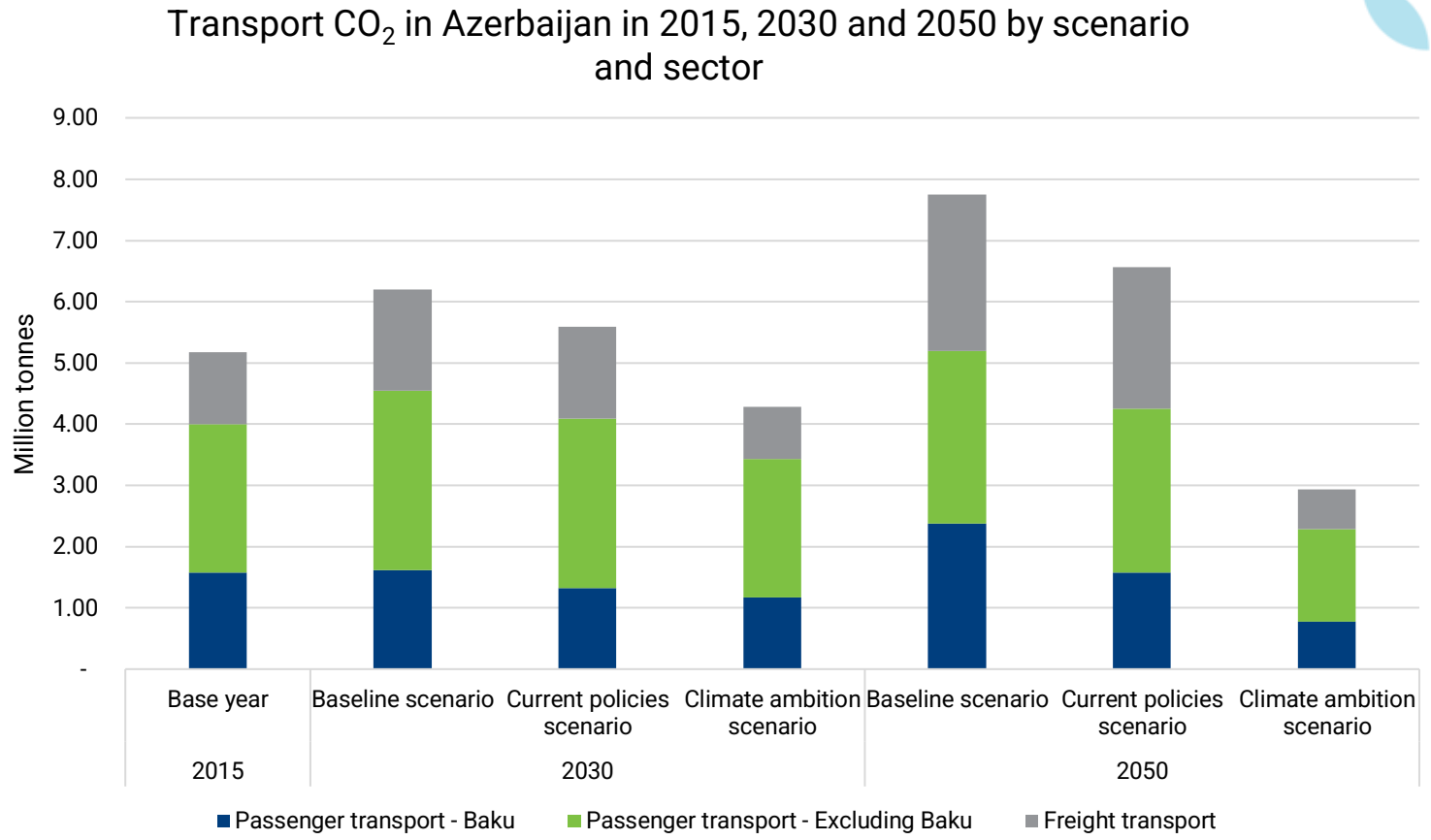
Ambitious policies can halve annual transport CO_2 emissions by 2050

Reductions in annual CO_2 emissions can only be achieved in the climate ambition scenario.

Current policies are insufficient to keep transport CO_2 emissions in check. They allow annual transport CO_2 emissions to grow by around 25% in the period from 2015-50 (see the current policies scenario).

This growth in emissions is driven by the transport demand growth in both passenger and freight transport sectors.

If no policy action were taken, Azerbaijan's annual CO_2 emissions would grow by 50% from 2015 to 2050 (see the baseline scenario).



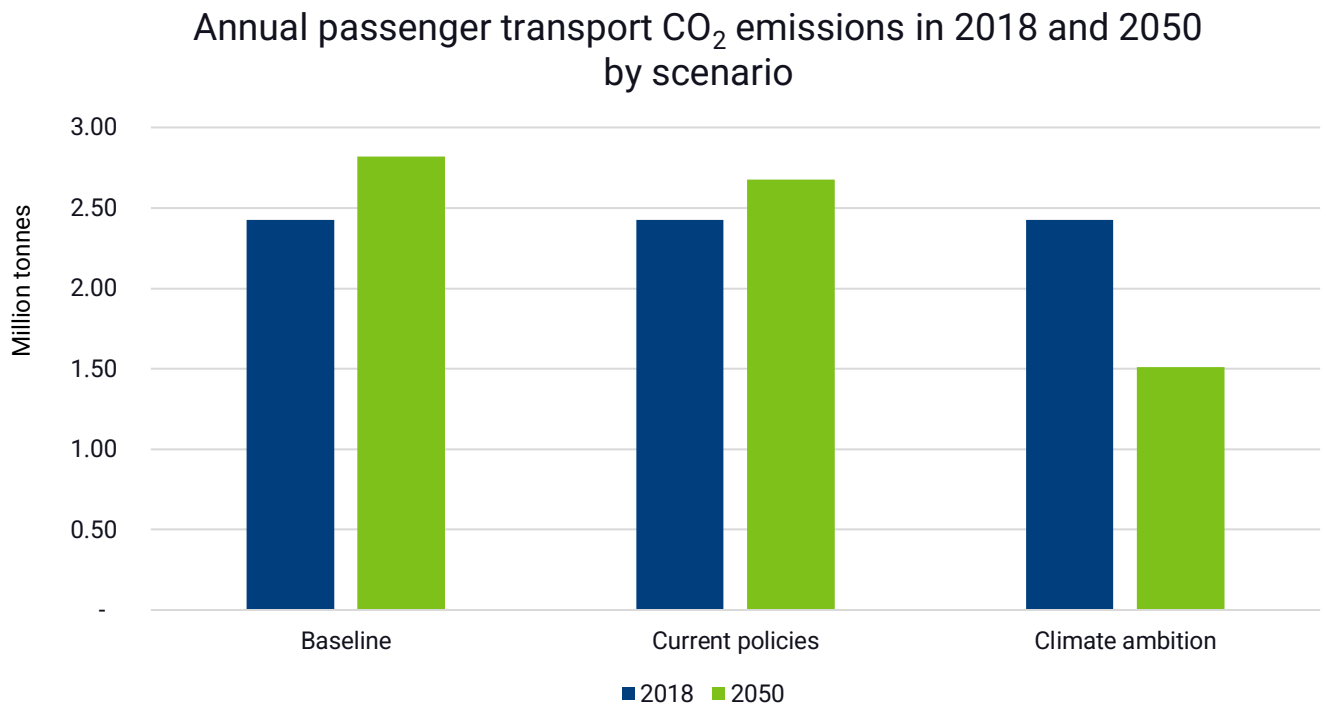
4. Insights by transport sub-sector

Passenger transport

Current policies are only a slight improvement to the "do-nothing" baseline scenario

Current policies will see annual transport CO_2 emissions further increase over time. To achieve reductions, more ambitious policies are required.

The policies of the climate ambition scenario can achieve a 40% reduction in CO_2 emissions by 2050 compared to 2018 levels and around 50% reduction when compared to the value that the baseline scenario will create by 2050.



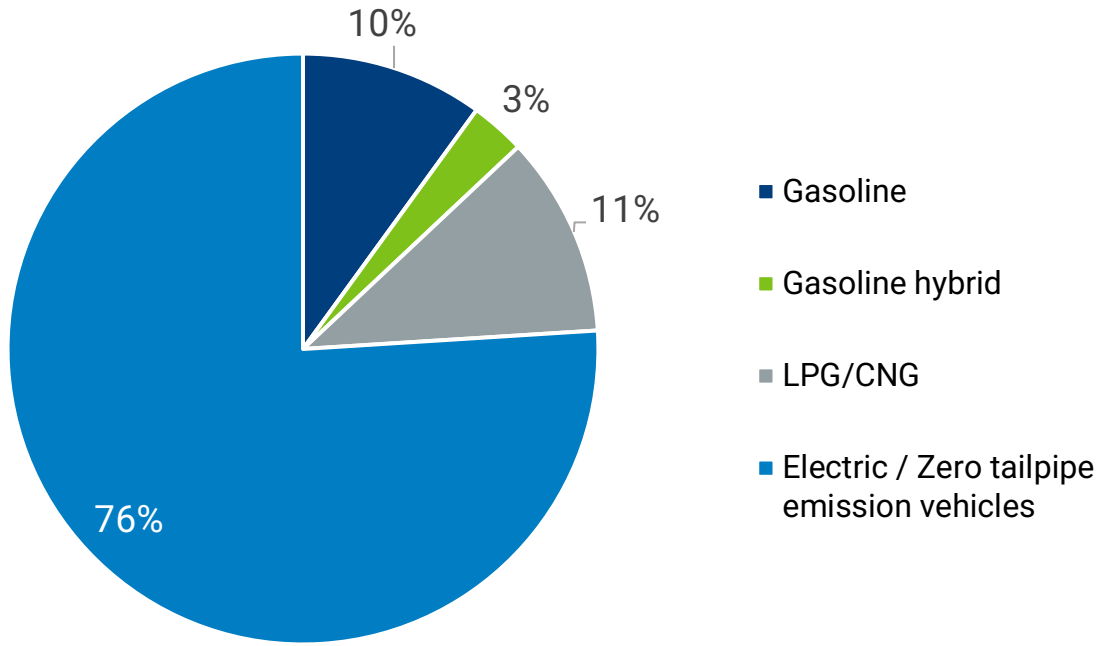
Cleaner vehicles are essential for achieving significant emission cuts

Achieving the emission cuts of the climate ambition scenario heavily relies on the uptake of cleaner vehicle technologies, especially in the inter-urban passenger transport segment.

To achieve the climate ambition scenario, the average CO_2 emissions per vehicle-kilometre must be halved for both the private and public vehicle fleets. Rail transport should be fully electrified.

Such average CO_2 emission reductions can only be achieved via the uptake of cleaner / zero-(tailpipe) emission vehicles. **Policy measures to ensure a transition to cleaner vehicles as quickly as possible are essential.**

Private vehicle sale shares needed by 2050 to achieve the climate ambition scenario in the passenger sector



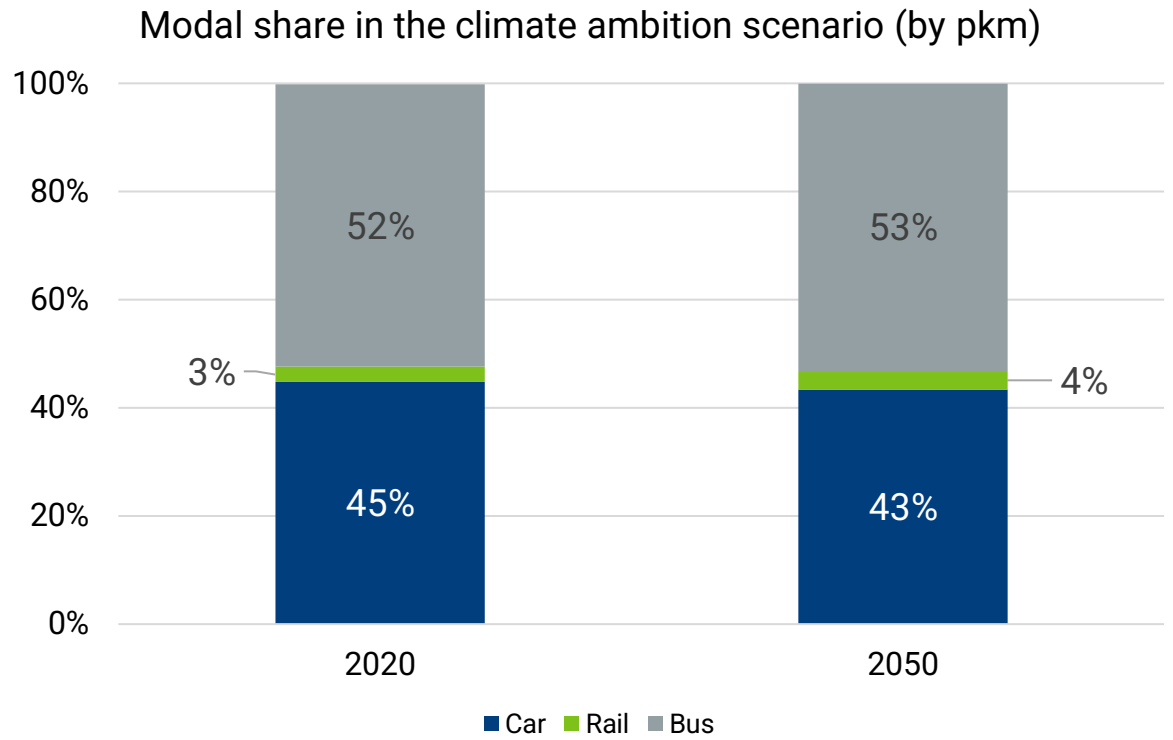
ITF work on cleaner vehicles:

https://www.itf-oecd.org/cleaner-vehicles

Enhancing the network of mass transit services will increase the sustainability of the transport system

Investment in rail infrastructure and services will increase the mode share of rail. This will enhance the resilience of the transport system, further reduce CO_2 emissions and also the reliance on private vehicles.

The measures proposed in the climate ambition scenario (including new rail infrastructure and enhancements to the frequency and speed of rail services) result in a mode share increase of 9 percentage points compared to the current policies scenario.

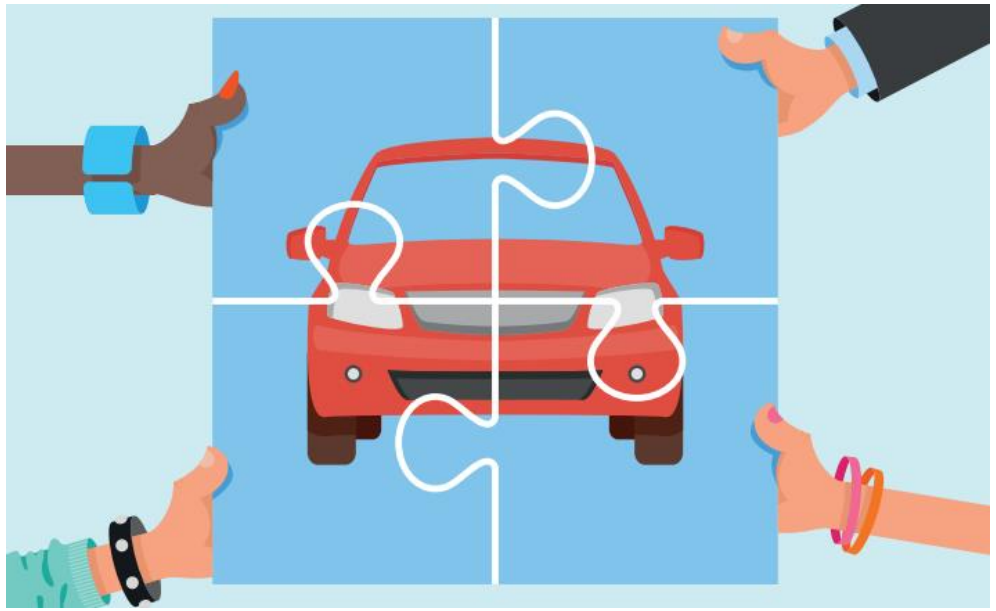


Increasing the load factors of vehicles will help meet growing transport demand

Ensuring better utilisation rates per vehicle (i.e. more passengers using the same vehicle at the same time) will help to meet growing transport demand, while keeping emissions in check.

In the climate ambition scenario, the load factors of private vehicles increase by 15% in the period to 2050. To achieve such increases, policy incentives, such as high occupancy lanes (giving preferential rights to vehicles with higher occupancy rates), especially in congested areas, could be considered.

Additionally, innovative shared mobility solutions, such as shared on-demand minibus services in urban or suburban areas, could be facilitated.



ITF work on shared mobility:
https://www.itf-oecd.org/itf-work-shared-mobility

4. Insights by transport sub-sector

ii Passenger transport in Baku

Current passenger transport policies allow Baku to keep CO_2 emissions in check

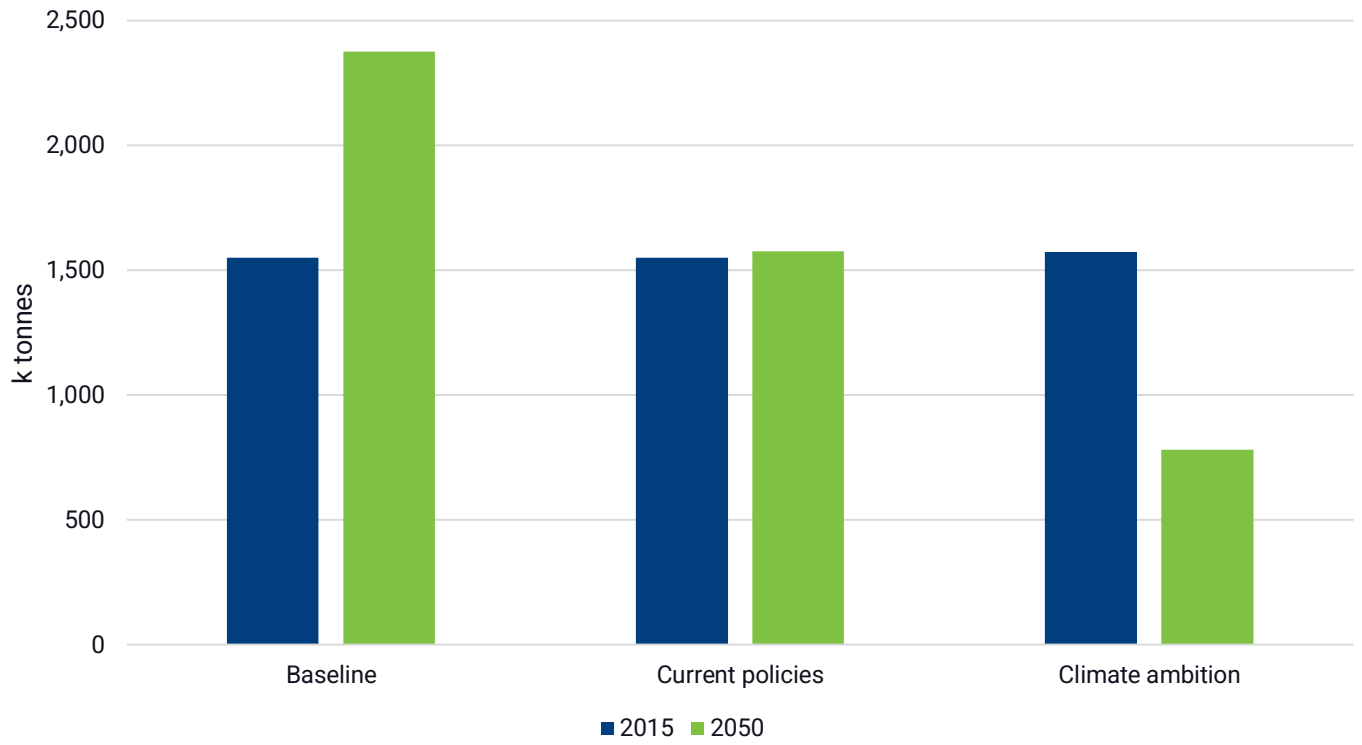
Emissions can be kept stable in the current policies scenario. This is mainly thanks to planned improvements to public transport services.

Policies of the climate ambition scenario, however, would allow Baku to cut CO_2 emissions by 50% compared to the current policies scenario.

Such emission cuts rely upon the uptake of cleaner vehicles.

Better land-use planning (i.e. ensuring the development of mixed-use developments in Baku), and a focus on active and shared mobility will reduce travel demand and private vehicle use. This would lower emissions even beyond the climate ambition scenario.

Annual passenger transport CO_2 emissions in Baku in 2015 and 2050 by scenario

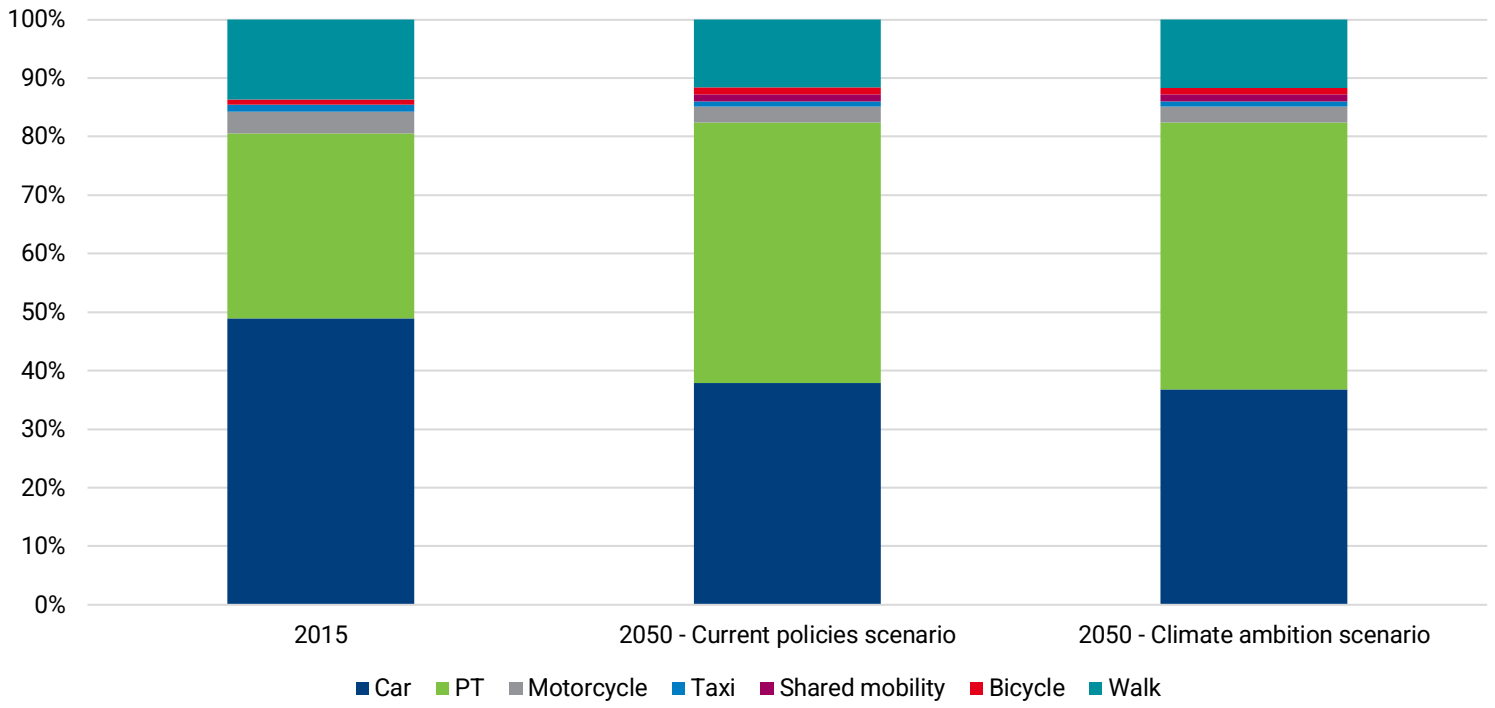


More support for active and shared mobility will reduce Baku's transport emissions further

In all scenarios, the share of cycling and shared mobility remains low (i.e. shared minibus services).

Policy measures that support these modes (e.g. the provision of better cycling infrastructure and services, and the support of shared vehicle services) can reduce emissions further.

Modal share in 2015 and 2050 for current policies and climate ambition scenarios by number of trips

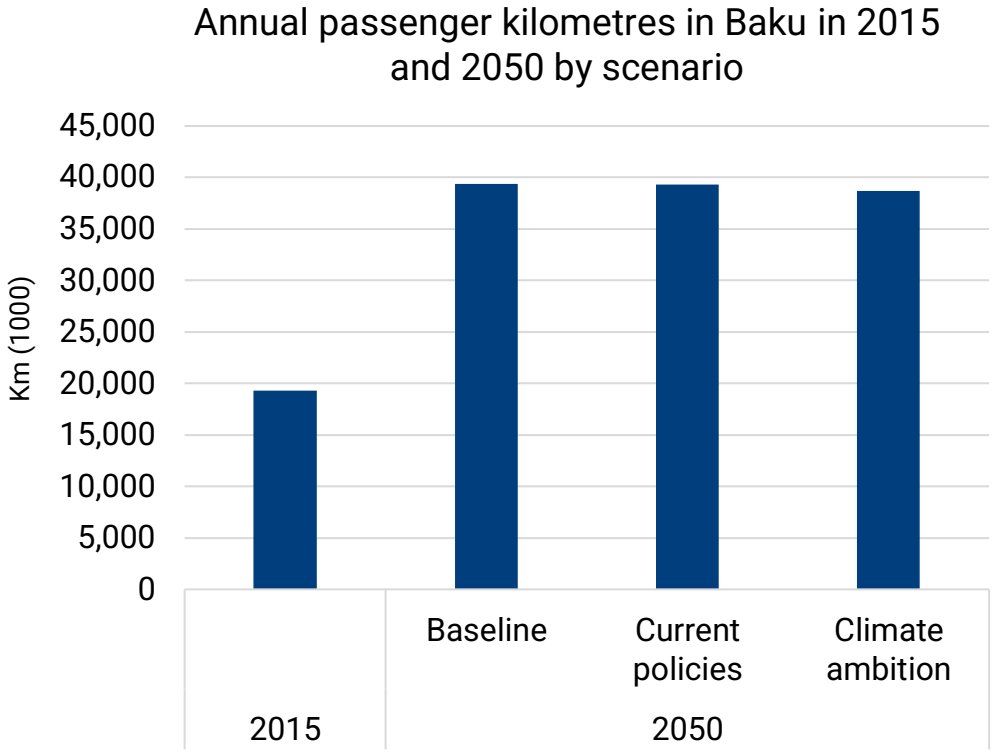


Changes to land-use planning can reduce passenger transport activity

Neither current policy plans, nor the climate ambition scenario will reduce passenger transport activity on their own.

Policy measures that focus on developing mixed-use zones can reduce transport activity and its related externalities. A reduction in commuting and other trip distances will reduce CO_2 emissions, noise, congestion and air pollution.

Such long-term measures will enhance the livability of Baku and incite the uptake of active mobility modes.



4. Insights by transport sub-sector

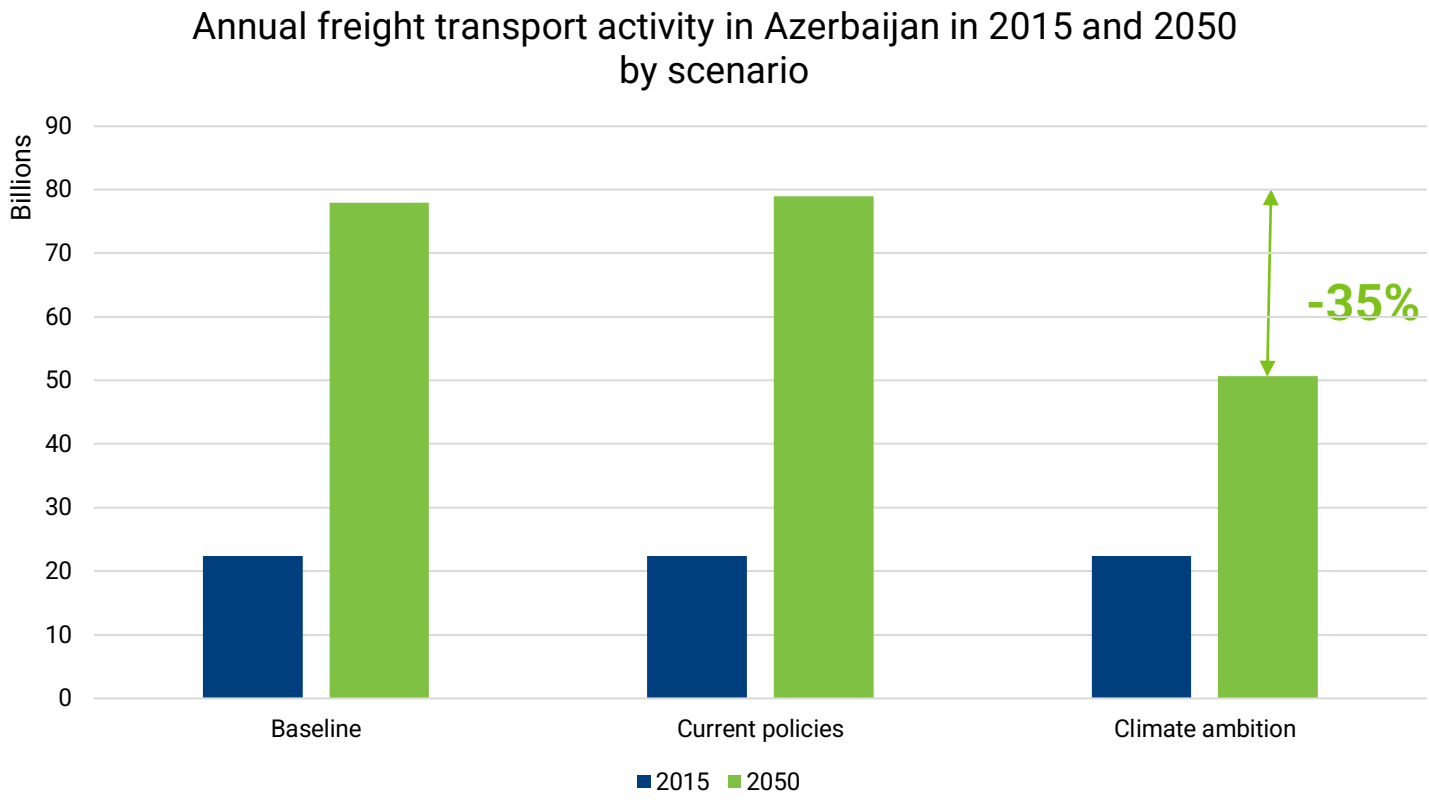
iii National freight transport

Freight transport activity may reduce significantly due to decarbonisation efforts

Decarbonisation of the energy sector, as per the climate ambition scenario, **could have a significant impact on the trade of coal, oil and related products**, therefore significantly reducing the freight transport demand.

New technologies, such as 3D printing, could also lower the international trade volume.

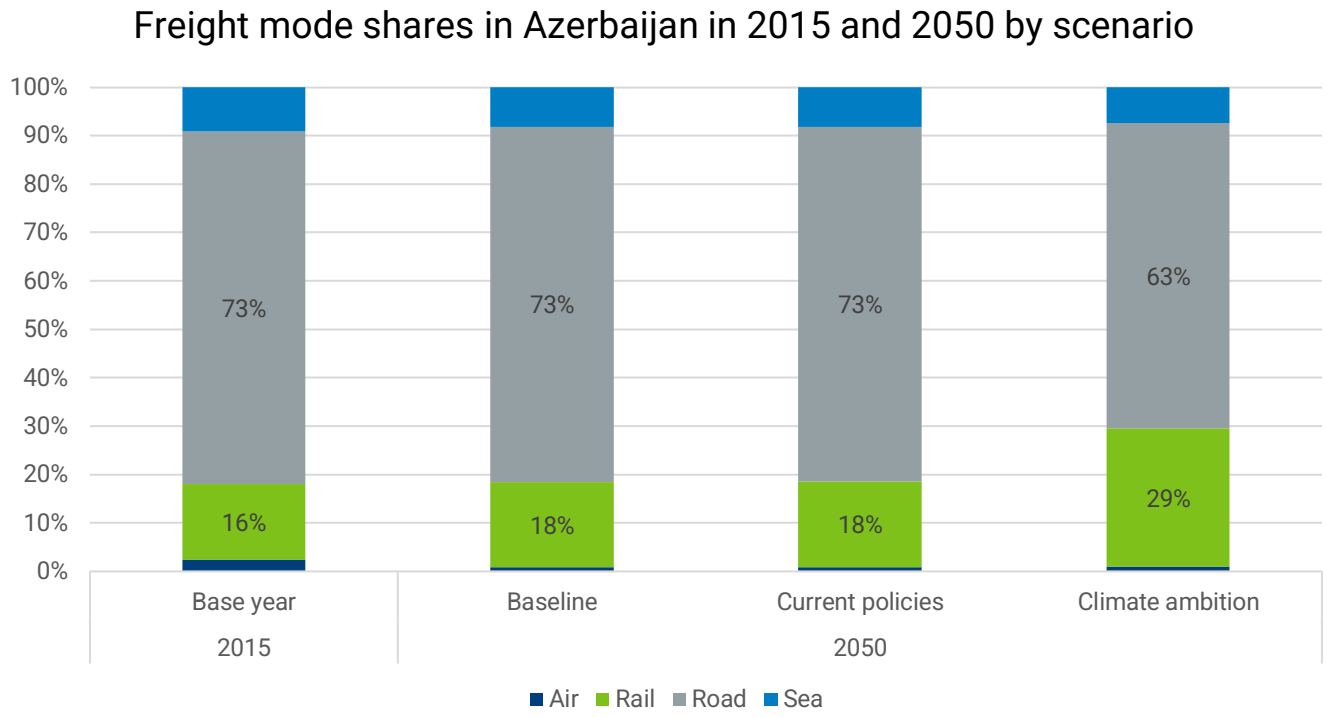
If this were to happen, the reduced freight transport activity will inevitably result in further CO_2 emissions reductions.



Mode shift policies are required to incentivise the use of cleaner modes

Pricing policies, such as distance-based charges and carbon pricing can internalise the environmental cost of high-emitting modes and reduce their demand.

Significant investments are necessary to improve railway infrastructure and the rail network's operational efficiency to improve its attractiveness for shippers.



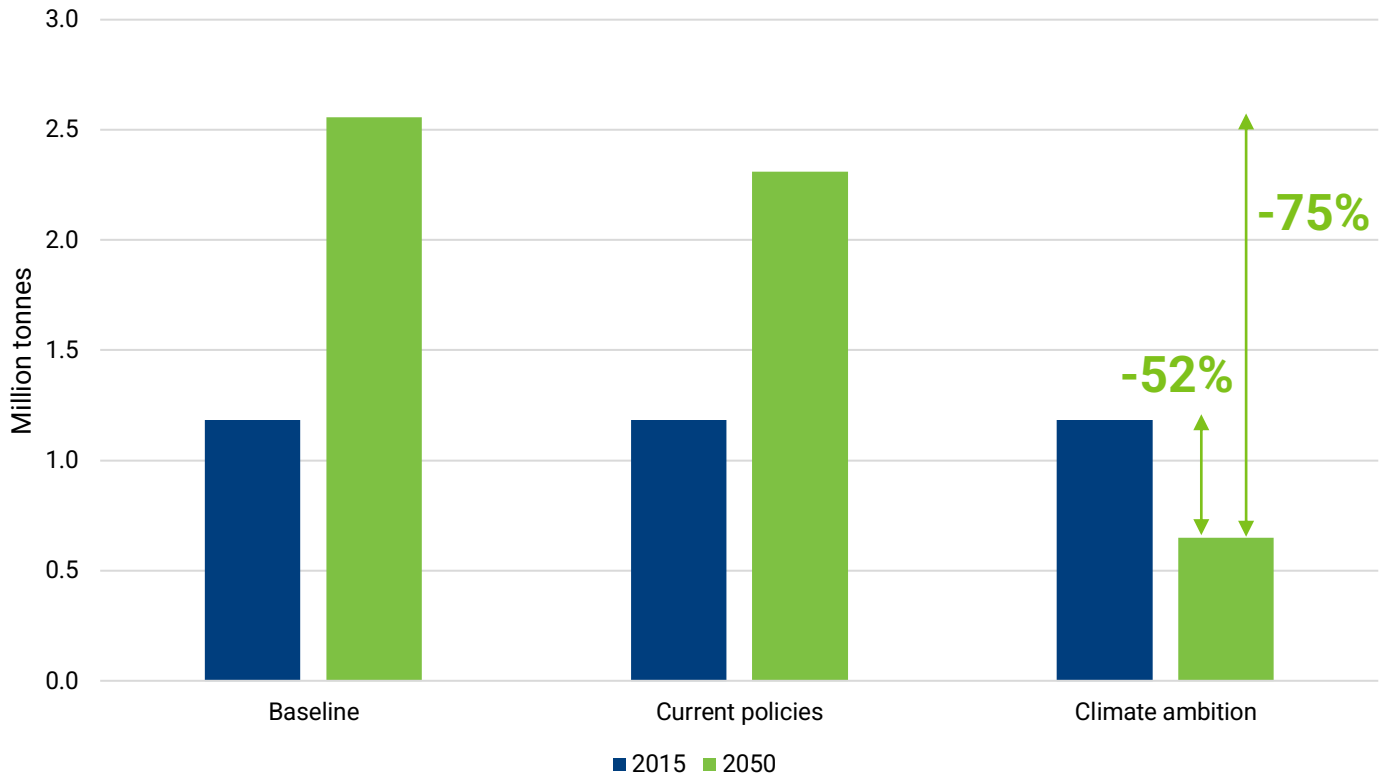
The adoption of cleaner vehicles is essential also for freight transport

As for the other transport sectors, the uptake of cleaner vehicles is essential to further reduce CO_2 emissions from freight transport.

Policy measures to support their uptake need to include, among others,

- investments in low carbon fuel/energy infrastructure supply and distribution networks
- pricing instruments that incentivise the uptake of clean vehicles, and
- legal provisions that limit used vehicle imports to those that meet increasingly stringent environmental standards.

Annual freight transport CO_2 emissions in Azerbaijan in 2015 and 2050 by scenario



5. Calls-to-action for policy makers

Support the uptake of a cleaner vehicle fleet across all transport sectors and increase stringent environmental/CO_2 standards for vehicle imports

Invest in rail and other mass-transport to densify the network and increase service quality to enhance the sustainability of the transport system overall

Support active and shared mobility, especially in urban areas; prioritising mixed-use developments will boost such modes of travel and reduce private and motorised vehicle demand

6. Annex: Scenario definitions and data outputs

Transport scenario definitions
Baku passenger transport

Current policies scenario

Measures	Assumptions
Prioritising public transport	15% of the bus network gets priority on the roads over other modes (e.g. with dedicated corridors)
Suburban rail improvement	An increase from 26 to 55 rail stations
Light-Rail Transit (LRT) development	Increase the length of LRT from 0 km to 67 km between 2020 and 2040
Bus-Rapid Transit (BRT) development	Increase the length of bus lanes from 8.5 km to 115 km between 2020 and 2040
Private car technology	Car sales composition to be 10% for electric vehicles and 30% for gasoline-hybrid vehicles by 2050
Bus technology	Bus fleet composition of 50% LPG/CNG and 50% electric vehicles by 2050
Bike and pedestrian infrastructure	Six times the current number of bike infrastructure by 2050

Climate ambition scenario

Measures *(in addition to current policies scenario)*	Assumptions
Carbon pricing	Set a carbon tax of USD 150 per tonne ofCO_2
Incentives for shared minibuses	Incentives supporting services with 4 minibuses per 1 000 inhabitant
Public transport service improvement	5% enhancement of PT service frequency for metro, 10% for buses.
Private car and bus technology	Follows the IEA Sustainable Development Scenario (SDS scenario)
Teleworking	Support teleworking practices and increase the number of regular teleworkers in the overall workforce by 6%
Transit-Oriented Development	Increases the average land-use as mixed-use developments by 5%

Scenario definitions
Passenger transport (excluding Baku)

Current policies scenario

Measures	Assumptions
Bus service improvements	Upgrades to urban and interurban lines; happening in 2025
Eco driving	Initiatives taken up in 2025, e.g. driver trainings
New rail line	Extension of the Baku-Ganza high-speed electric train from Ganja to the Georgian border
Update existing rail line	High-speed electric train services between Baku and Naftalan
New motorway developments	Resulting in travel time reductions… • by 5% for trips going through Ganja-Gazakh Economic region • by 15% between Baku and Russian border • by 5% within Khachmaz economic region • by 5% within Shamakhy economic region
Alternative fuel vehicles	Private vehicle sales, by 2050 to be: •10% fully electric vehicles •40% hybrid vehicles
	Bus vehicle stock, by 2050 to be: •13% fully electric •13% CNG/LPG

Scenario definitions
Passenger transport (excluding Baku)

Climate ambition scenario

Measures (in addition to current policies)	Assumptions
Car sharing / load factor increases	Urban trips: +15% from 2030; Intercity trips: +10% from 2030
Fuel price increases	+5% - +10% in each five-year interval from 2025 to 2050
Further new rail lines	New connection between Baku and Karabakh and Eastern Zengezur regions
Further rail improvements	Speed improvements for: •Baku<->Balaken and Baku <-> Sumgait from 2030 •Baku <-> Ganza from 2040
	Frequency improvements from 2030 for: •Baku <->Balaken •Baku<->Ganza •Baku<->Yalama •Baku<->Shirvan •Baku<->Sumgait
Alternative fuel vehicles	Private vehicle sales, by 2050 to be: •87% fully electric vehicles (battery electric or hydrogen) (in line with Sustainable development scenario SDS scenario of the International Energy Agency (IEA) – see slide 12)

Scenario definitions
Freight transport

Current policies scenario

Measures	Assumptions
Ship energy efficiency	Aligned with IMO targets based on MARPOL amendments to ensure a: •40% reduction of average CO_2 intensity by 2030 for all ship types •70% reduction of average CO_2 intensity by 2030 for all ship types
Railway infrastructure enhancement	Straight-line connections and average operational speed at 140 km/h are used as proxies
Highway infrastructure enhancement	Straight-line connections, four lanes, and an average operational speed of 80 km/h to be used as proxies
ITS Management System and traffic jam prevention	Increase the average speed for road freight transport from 45km/h to 56km/h due to the ITS management system and congestion reduction measures implemented
Stimulus package for clean vehicles	Penetration of electric Heavy, medium and light freight trucks (HFT, MFT, and LFT) are assumed to undertake: •1% for HFT, 1.5% for MFT and 2% for LFT of the freight vehicle activities, respectively by 2030 •4% for HFT, 5.5% for MFT and 11.5% for LFT of the freight vehicle activities, respectively by 2050
Eco-driving	Eco-driving to further reduce the average fuel consumption of the truck fleet by 8.5%.

Scenario definitions
Freight transport

Climate ambition scenario (I)

Measures	Assumptions
Distance charges	Charges introduced in 2030 growing to EUR 2.5 cents per tonne-kilometre by 2050
Port fees	Port fees to grow an additional 20% by 2050 decreasing the carbon intensity of shipping by 10%
Carbon pricing	Carbon pricing will vary across regions: USD 300 per tonne of CO_2 in 2050.
Rail and inland waterway improvements	The penalty for mode transfers at intermodal terminals is decreased and alternative specific constant of rail and inland waterways increases. The rate of change to grow from 0.8% in 2020 to 20% in 2050.
Energy transition for long-haul heavy-duty road freight vehicles	14% of heavy truck tkms are on these systems by 2050. Costs begin higher than conventional fuels but by 2050 become lower. Differences in uptakes and costs by region
Asset sharing and the Physical Internet	4% increase in average loads of road freight by 2020 growing to 10% by 2050
Slow steaming and speed reduction for maritime and trucks	Decrease in the speed of road and maritime transport by 1% in 2020, growing to a 20% decrease by 2050
Fuel economy standards for internal combustion engine (ICE) vehicles and fuel	Carbon intensity per tkm of ICE trucks to reduce by less than 1% in 2020 up to 10% by 2050
Low emission fuel incentives (including electric vehicles) and investment in distribution/supply infrastructure	Increase in low-emission fuel vehicle share to 1.3% by 2025, growing to 10% by 2050
Heavy capacity vehicles (HCV)	5% of non-urban road freight transport activity (tkm) to be done with high capacity vehicles by 2050

Scenario definitions
Freight transport

Climate ambition scenario (II)

Measures	Assumptions
Autonomous vehicles (AVs) and platooning	Up to 15% uptake on non-urban freight by 2050. Uptake on urban freight is lower, at 6%. Decrease of 14% on carbon intensity and 45% on costs.
Electric/alternative fuel vehicle penetration	Follows the IEA SDS Scenario.
Intelligent Transport Systems (ITS) and eco-driving	Reductions of 5% in carbon intensity in 2020, decreasing to 0.1% in 2050.
3D printing	International trade to reduce 10% by 2050. Values differ by commodities; electronic and manufactured goods have higher falls.
Decarbonisation of energy	Yearly decrease of 3.35% for coal and 2.1% for oil. By 2050 coal trade to reduce by 65% and oil close to 50%, compared to 2020 estimates.
E-commerce	Additional demand increase by 15% for urban freight and 6% for non-urban freight by 2050

Data outputs (I)

	Transport activity			
		[Billion pkm]	[Billion pkm]	[Billion tkm]
		Passenger transport - Baku	**Passenger transport - Excluding Baku**	**Freight transport**
2015	Base year	19.3	35.3	22.3
2030	Baseline scenario	22.4	49.2	38
2030	Current policies scenario	22.3	49	35.8
2030	Climate ambition scenario	22.2	49.3	25.3
2050	Baseline scenario	39.4	59.4	78
2050	Current policies scenario	39.3	59.2	79
2050	Climate ambition scenario	38.6	59.5	50.7

	CO_2 (Million tonnes)			
		Passenger transport - Baku	**Passenger transport - Excluding Baku**	**Freight transport**
2015	Base year	1.57	2.42	1.18
2030	Baseline scenario	1.61	2.94	1.65
2030	Current policies scenario	1.33	2.76	1.5
2030	Climate ambition scenario	1.18	2.25	0.86
2050	Baseline scenario	2.38	2.82	2.55
2050	Current policies scenario	1.58	2.68	2.31
2050	Climate ambition scenario	0.78	1.51	0.65

Data outputs (II)

Mode shares - Passenger transport Baku (by number of trips)							
	Walk	Bicycle	Motorcycle	Car	Taxi	Public transport	Shared mobility
2015	14%	1%	4%	49%	1%	32%	0%
2050 - Current policies scenario	12%	1%	3%	38%	1%	45%	1%
2050 - Climate ambition scenario	12%	1%	3%	37%	1%	46%	1%

Mode shares - Passenger transport (excluding Baku; by trips)					
		Car	Rail	Bus	Air
2018	Base year	50%	0%	50%	0%
2050	Current policies scenario	48%	0%	52%	0%
2050	Climate ambition scenario	48%	0%	52%	0%

Mode shares - Passenger transport (excluding Baku, by pkm)					
		Car	Rail	Bus	Air
2018	Base year	45%	3%	52%	0%
2050	Current policies scenario	43%	4%	53%	0%
2050	Climate ambition scenario	39%	12%	49%	0%

Mode shares - Freight transport (by tkm)					
		Air	Rail	Road	Sea
2015	Base year	2%	16%	73%	9%
2050	Baseline	1%	18%	73%	8%
2050	Current policies scenario	1%	18%	73%	8%
2050	Climate ambition scenario	1%	29%	63%	7%

7. Acknowledgements

The authors of this publication are Elisabeth Windisch, Mallory Trouvé and Guineng Chen (all ITF). They would like to thank Luis Martinez, Dimitrios Papaioannou (former ITF) and Olga Petrik (former ITF) who led data collection and modelling efforts that made this work possible. Turgut Mustafayev (local project consultant) has been instrumental in making this publication possible by co-ordinating all stakeholder engagement activities throughout the project.

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This project has received funding from the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU).

8. About the Decarbonising Transport in Emerging Economies 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.

More information about the project can be found on the ITF website: https://www.itf-oecd.org/dtee

About the project in Azerbaijan

DTEE in Azerbaijan: https://www.itf-oecd.org/dtee-azerbaijan

First project output:

Decarbonising Transport in Azerbaijan – Charting the Way Forward

The paper reviews opportunities and challenges for mitigating greenhouse gas emissions from Azerbaijan's transport sector. It provides an overview of Azerbaijan's transport system and reviews the country's existing policies and future plans for reducing CO_2 emissions from transport. The paper also provides an overview of the data on transport activity and emissions available for Azerbaijan, and the tools used by government agencies for assessing them. Finally, it proposes options for further action in the context of ITF's "Decarbonising Transport in Emerging Economies" (DTEE) project.

https://www.itf-oecd.org/decarbonising-azerbaijan-transport-system