

# DECARBONISING PATHWAYS FOR ULAANBAATAR'S URBAN MOBILITY

## Findings & Recommendations

September 2023



On behalf of:

# DECARBONISING PATHWAYS FOR ULAANBAATAR'S URBAN MOBILITY

This publication presents the results of the SIPA road map study for Ulaanbaatar under the Sustainable Infrastructure Programme in Asia (SIPA).

It features the impacts of three policy scenarios on passenger transport demand and emissions in the capital city of Mongolia between 2015 and 2050. In light of these results, the ITF developed a list of policy recommendations to promote and facilitate the implementation of more ambitious decarbonising policies in Ulaanbaatar's urban passenger transport sector.

For more details, see:

<https://www.itf-oecd.org/decarbonising-pathways-urban-mobility-mongolia>



# OUTLINE

- SIPA-TRANSPORT FOR MONGOLIA
- POLICY RECOMMENDATIONS
- SCENARIO DESIGN
- SCENARIO RESULTS
- POLICY IMPACTS
- MODELLING TOOL
- PROJECT RESOURCES



# SIPA-Transport for Mongolia

# SIPA Overview

## What is the Sustainable Infrastructure Programme in Asia (SIPA)?

- A four-year program supporting the development of **cleaner infrastructure** in Central and Southeast Asia
- Led by the **OECD** and funded by the International Climate Initiative (IKI) of **Germany's Ministry for the Environment**
- The ITF leads transport-related studies. It aims to provide **transport policy guidance** with a focus on **decarbonising** and enhanced **connectivity** by:
  - Producing an **assessment of transport infrastructure** at both the **regional** level and **national** level
  - Providing policymakers with **simulation tools** to assess the impact of policy options and identify effective decarbonising measures



## Sustainable Infrastructure Programme in Asia – Transport (SIPA-T)

### Central Asia

Central Asia regional study

Mongolia national study

Uzbekistan national study

### Southeast Asia

Southeast Asia regional study

Philippines national study

# Mongolia National Study

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## What is the national roadmap study for Mongolia?

The national roadmap study for Mongolia developed **decarbonising pathways** for **urban passenger transport** in the capital city, Ulaanbaatar. It focused on the role of public transport and its development. It comprises three parts:

- A** **Understanding the urban transport context in Ulaanbaatar:** data collection, analysis of policy priorities
- B** **Quantitatively assessing decarbonising pathways for Ulaanbaatar:** tailor the ITF modelling tool to forecast carbon emissions under 3 different scenarios (Baseline, Current Policies, Climate Ambition)
- C** **Disseminating best practices for low-carbon transport systems**

## Organisation of the national study



# Policy Recommendations

# Develop the public transport service



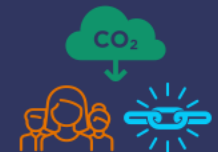
## Why is this a priority?

Ulaanbaatar is facing a **surge in private car use** led by an increase in private motorisation (+40% registered private cars between 2015 and 2020): it experiences the challenges of strong development without the alternative of relying much on private motorcycles because of **unfavourable climate conditions**.

As a result, **congestion levels are unbearable**, especially during the winter season. **An efficient mass public transport system is necessary** to address the increasing flow of passengers.

Hopefully, the city benefits from a built-up environment based on **wide streets that eases the implementation of several high-capacity solutions**.

- 1 **Create a mass public transport network** with a high level of service as a backbone of the mobility system
- 2 **Reallocate road space and give the right of way** to public transport
- 3 **Provide and promote services compatible with the climate conditions** in Ulaanbaatar







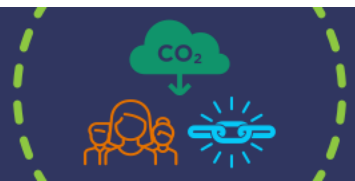
- 1** Establish a **Metropolitan Transport Agency (MTA)** in charge of the whole urban mobility system and overseeing all modes
- 2** Develop and implement a **sustainable urban mobility plan** to coordinate the efficient growth of the mobility supply
- 3** Integrate **land-use and transport development** for providing accessibility and clean mode alternatives to new settlements

## Why is this a priority?

**Ulaanbaatar is expanding fast:** several new settlements are expected in the near future. To ensure that these are not isolated from the rest of the city or connected to the city centre only by car, **it is crucial to plan the place of new areas in the mobility system.**

It is necessary to **make the different stakeholders share perspectives** on the combined challenges of land use and transport growth to adopt a systemic approach.

While Ulaanbaatar already benefits from local expertise, **it is necessary to break the institutional and thematic silos to adopt a holistic approach to decision-making.**



# Build on new technologies and active mobility



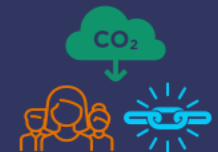
## Why is this a priority?

No shared mobility is available in Ulaanbaatar, and the average age and emissions of private vehicles are high. The almost even shares of right and left stirring wheels also make roads particularly dangerous to all its users, especially pedestrians and cyclists.

Promoting healthy active mobility and developing shared mobility systems complementary to the public transport system can boost its frequentation and reduce private mobility and its externalities. Shared mobility is also a solution for making public transport solutions accessible from ger areas.

As Ulaanbaatar is expanding, there is a lot of potential for promoting active and shared mobility at the city design level.

- 1 **Leverage micromobility, shared mobility and digitalisation** for convenient multimodal integration
- 2 **Promote cleaner vehicles & regulate private vehicle use** to reduce the carbon intensity and improve traffic safety
- 3 **Incentivise pedestrian and bicycle use** via efficient infrastructure planning. These contribute to a more liveable city



# Scenario Design

# Policy Scenarios for CO<sub>2</sub> Reduction

The ITF designed **three distinct scenarios** to assess the **CO<sub>2</sub> reduction potential** of different policy pathways. The scenarios explore alternative futures, their impacts on the transport system and their externalities. They rely on **a set of measures** – targeting policy and technology development – levels.

- 1 Baseline scenario:** no measures are implemented for sustainable mobility
- 2 Current Policies scenario:** expected and planned measures are implemented
- 3 Climate Ambition scenario:** planned measures are enhanced, and new measures are proposed

**Data collection** in cooperation with stakeholders in Mongolia



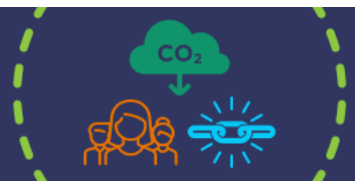
**Development** of a tailored strategic urban mobility model for Ulaanbaatar based on city-specific data and state-of-the-art methods from the ITF



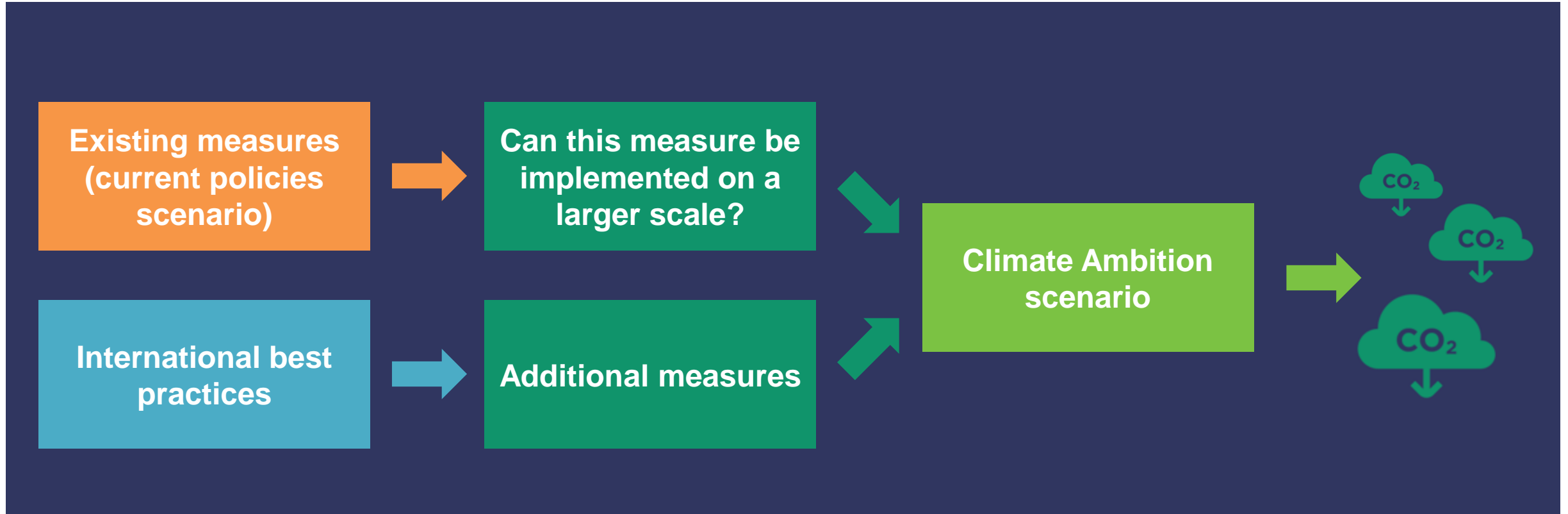
**Scenario definition** with partners in Mongolia: analysis of existing, planned and potential measures



**Model handover** to the Ministry of Transport and Road Development and the City of Ulaanbaatar for supporting local policy building

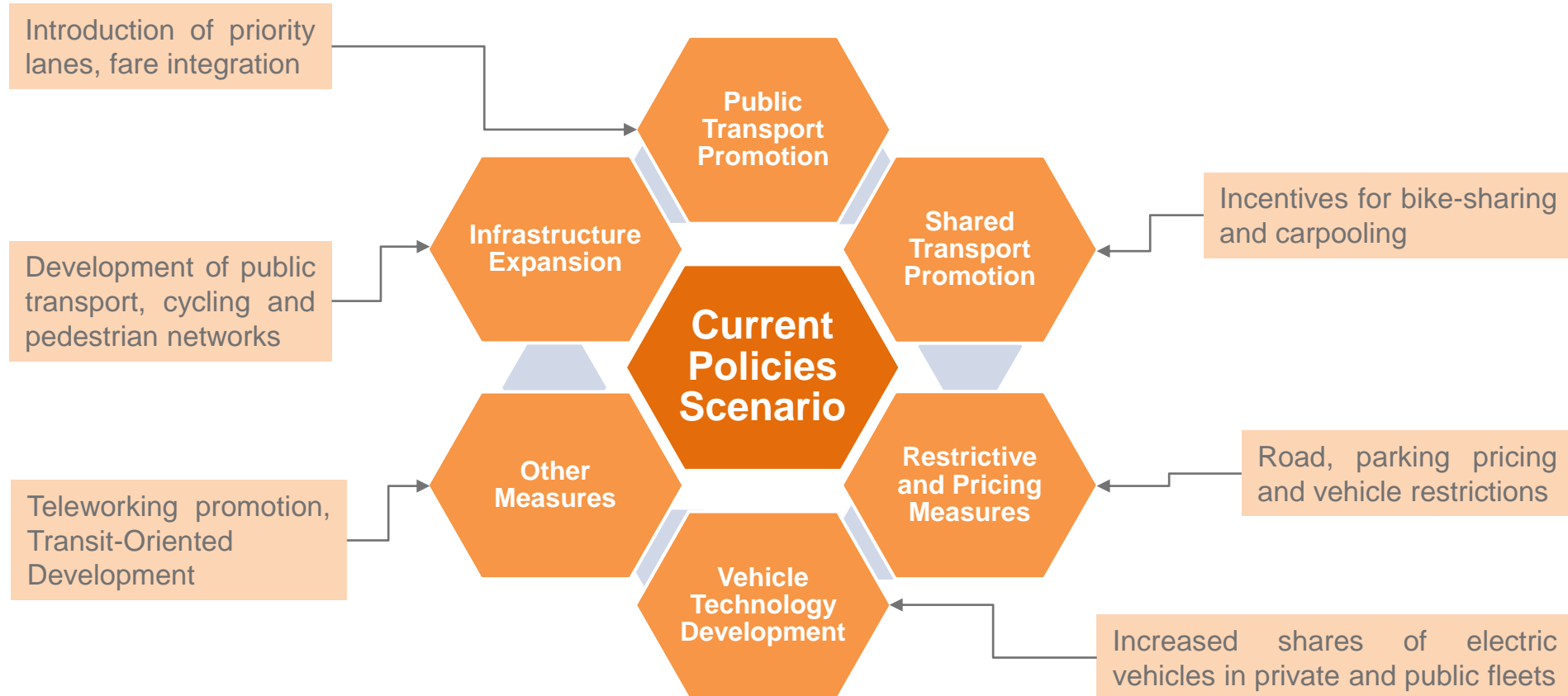


# How did we build the Climate Ambition scenario?



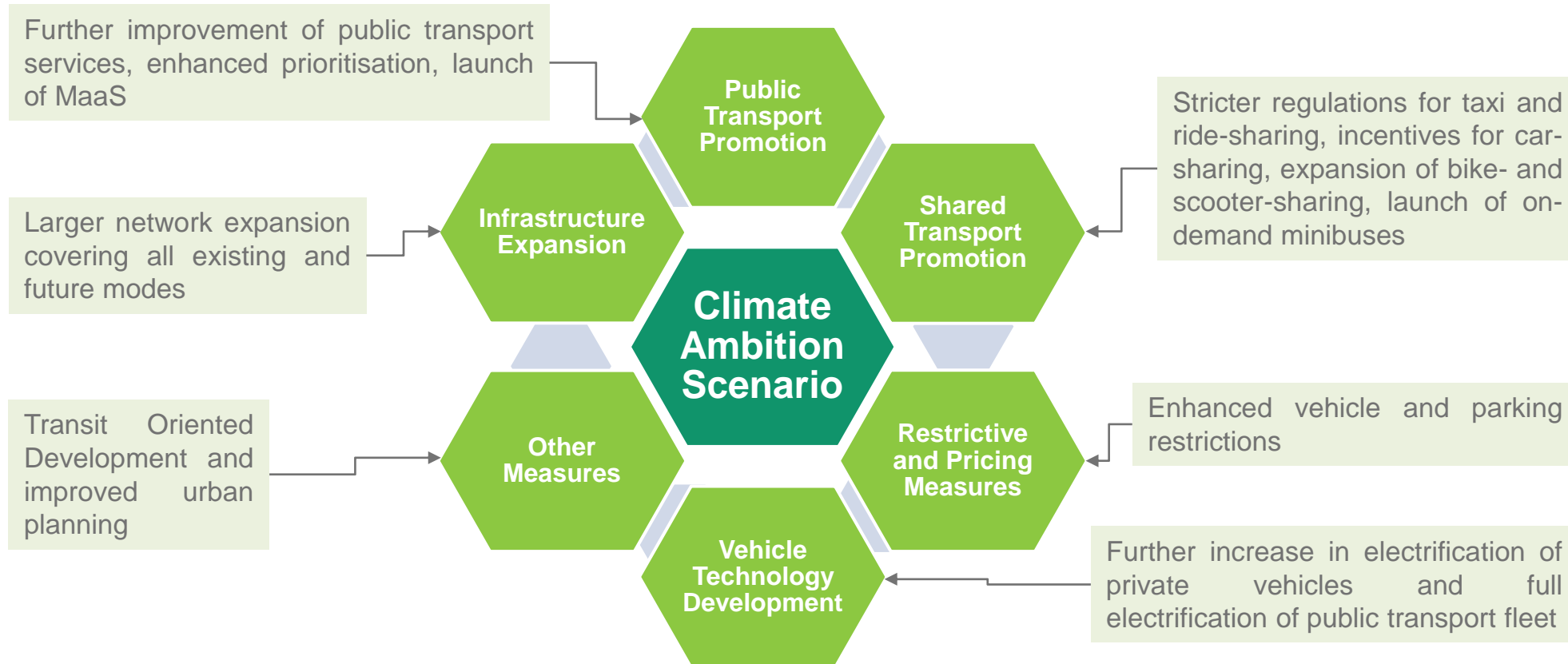
# Current Policies scenario

The **Current Policies scenario** refers to the existing and committed strategies, regulations, and initiatives in the city to transition its mobility system towards low-carbon and environmentally sustainable.



# Climate Ambition scenario

The **Climate Ambition** scenario builds upon the planned policies of the Current Policy scenario but with further enhancements aimed at achieving significant reductions in CO<sub>2</sub> emissions to reach the climate goals.



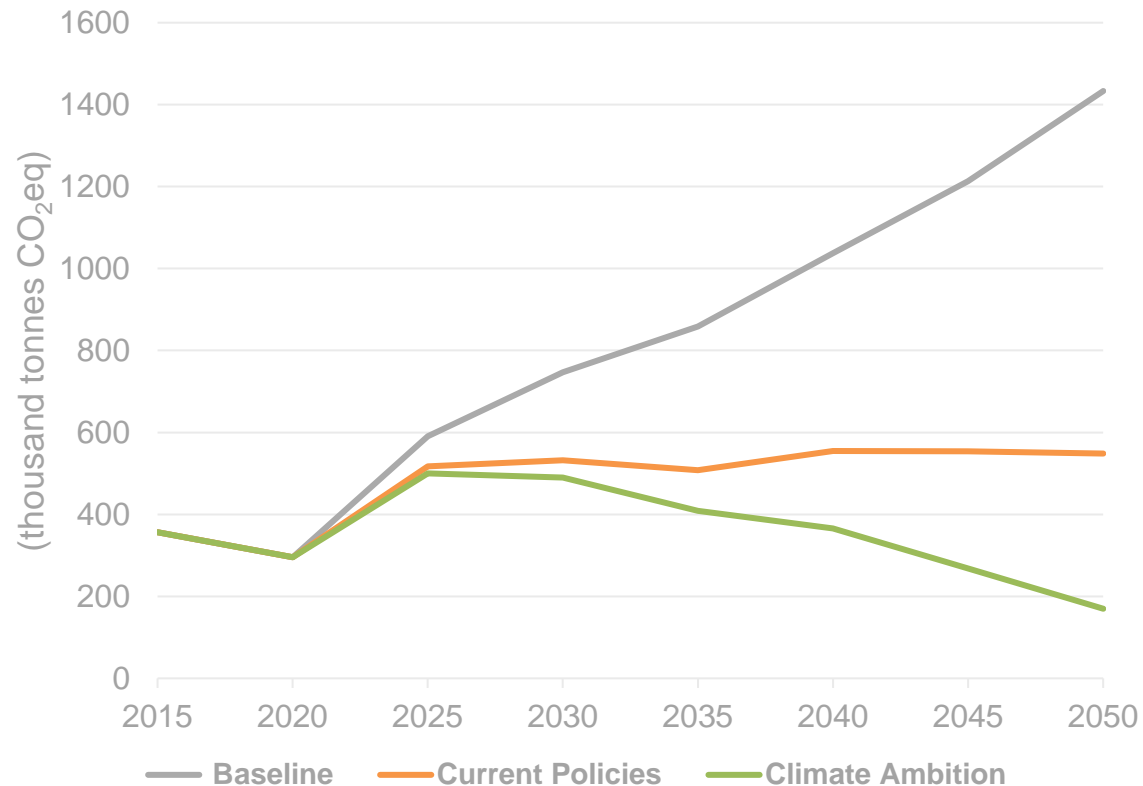
# Scenario Results

Impact per scenario



# Urban passenger total CO<sub>2</sub> emissions in Ulaanbaatar

## Trajectories of CO<sub>2</sub> emissions until 2050



## Main findings

- **Baseline:** strong population and income growth and shift towards private vehicles result in a sharp increase in CO<sub>2</sub> emissions
- **Current Policies:** planned policy actions only enable stabilising the emission trajectory. They are not sufficient to achieve Ulaanbaatar's climate goals
- **Climate Ambition:** effective policy measures allow for cutting CO<sub>2</sub> emissions and achieving decarbonising goals

## Evolution of CO<sub>2</sub> emissions from 2015 to 2050

**Baseline**  
Business as usual

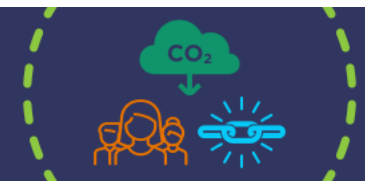
x4

**Current Policies**  
Where we are heading

+54%

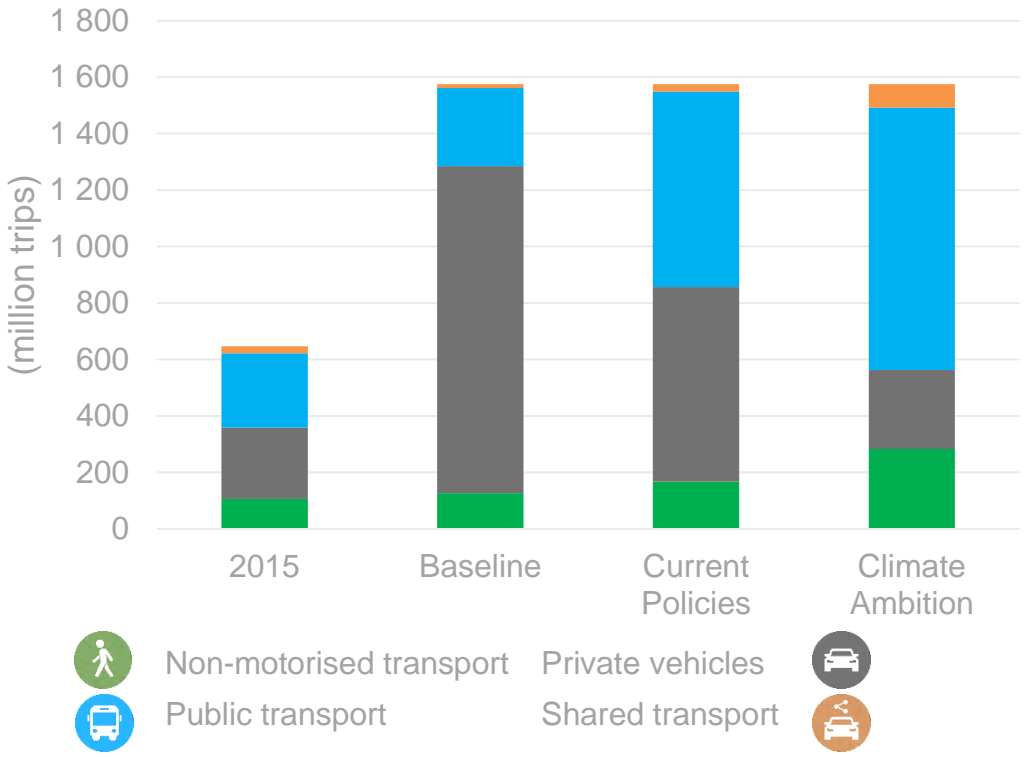
**Climate Ambition**  
How far we must go

-52%



# Trip & Passenger demand

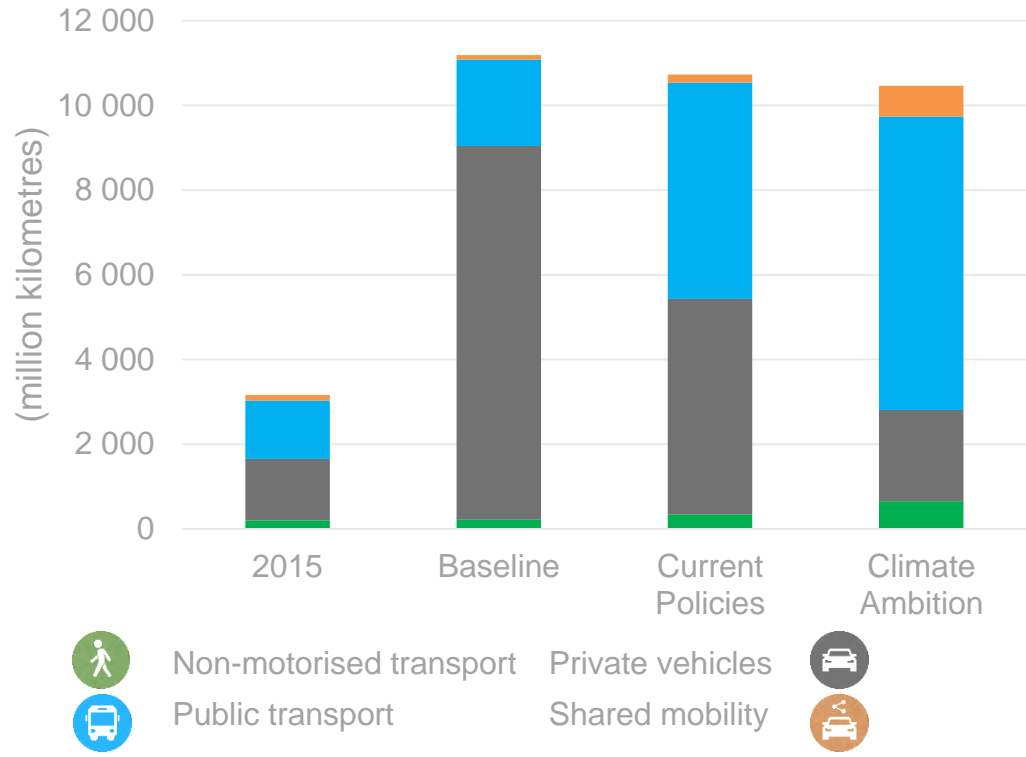
### Number of trips in 2050



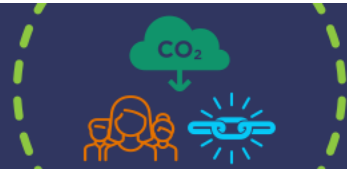
Without policy action, the tripling demand will mostly be fulfilled with private vehicles

Current policies enable maintaining the same ratio of public transport vs private vehicles trips

### Passenger-Kilometers (PKM) in 2050

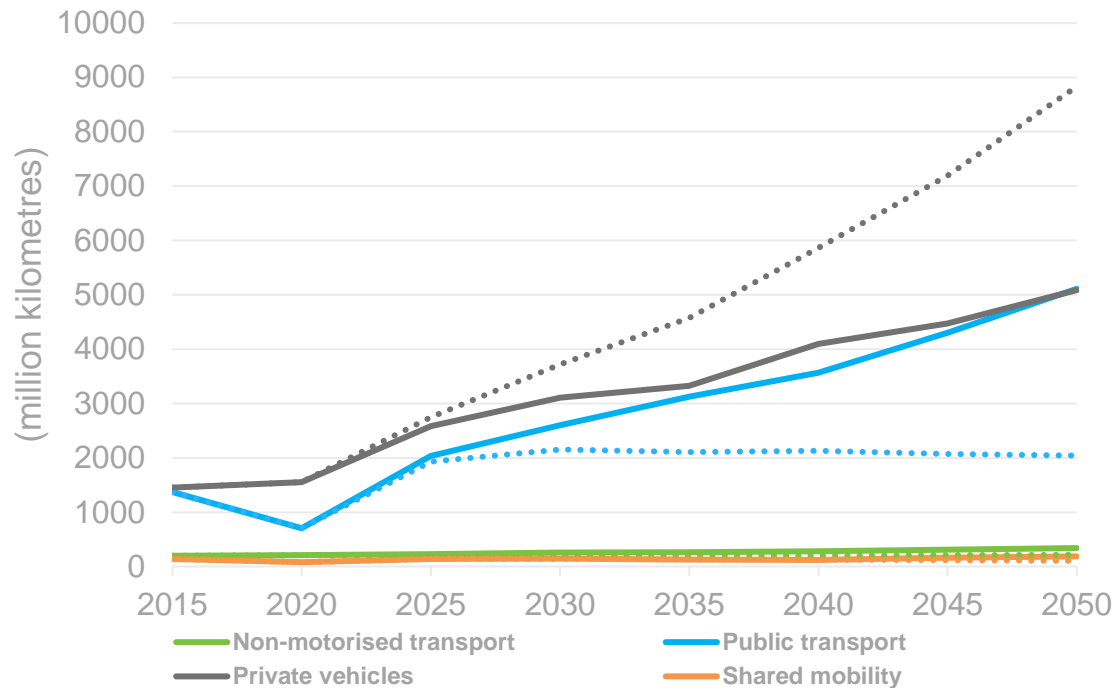


The Climate ambition is achieved by a significant uptake of all the modes competing with private vehicles

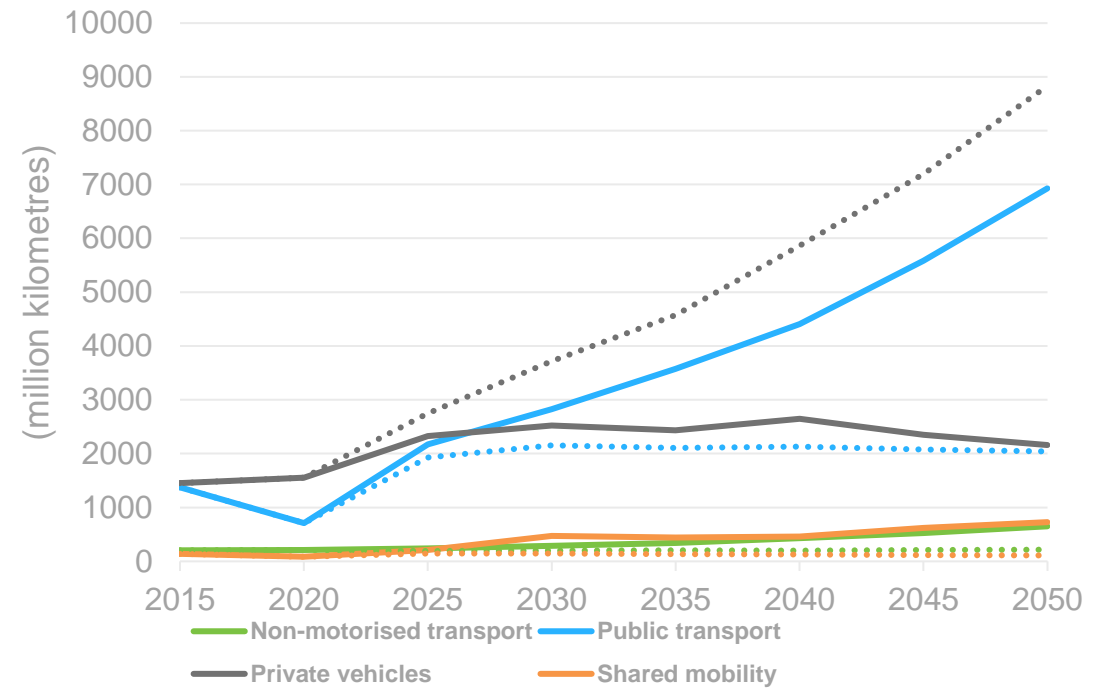


# Passenger demand trajectories

**PKM by mode from 2020 to 2050**  
**Current Policies**



**PKM by mode from 2020 to 2050**  
**Climate Ambition**

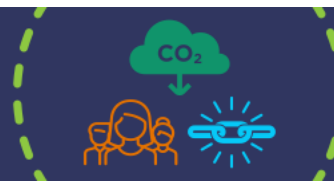


Note: the dotted lines represent the Baseline scenario

**Current Policies do not lead to a major evolution of the rank of each mode**

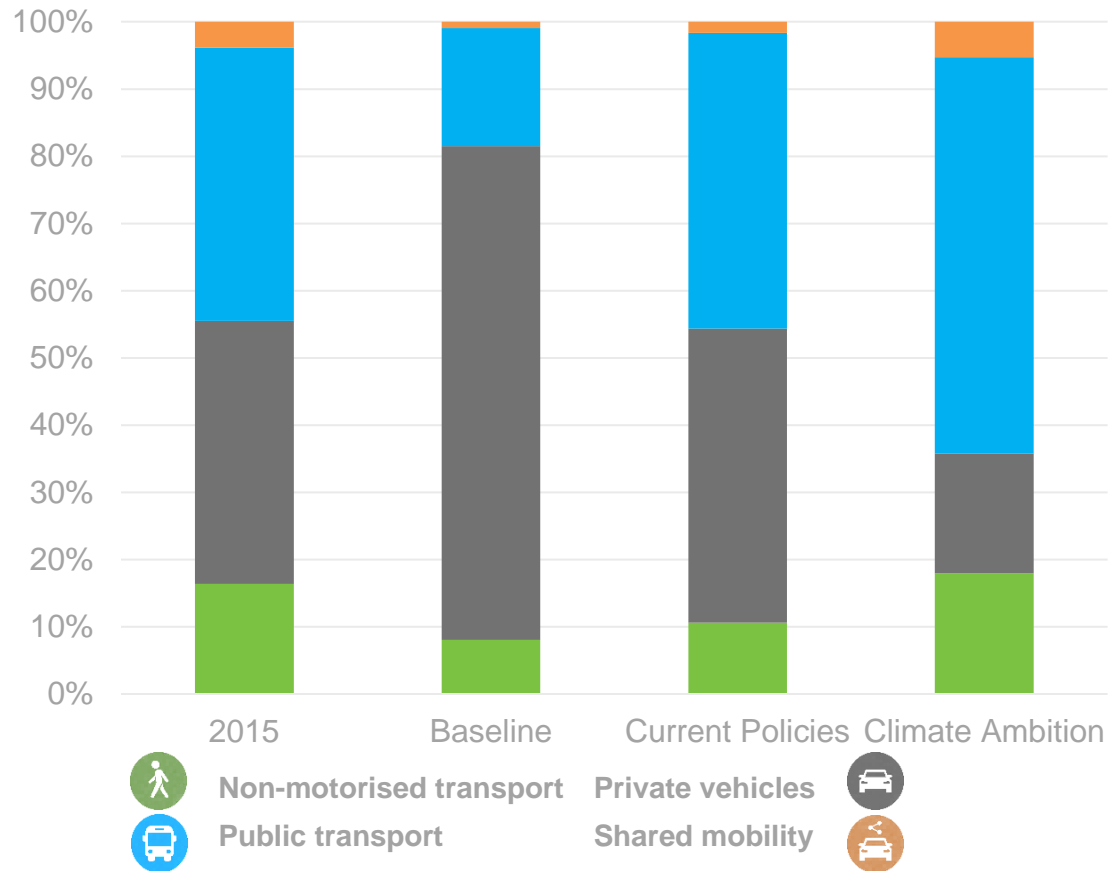
**Non-motorised and shared mobility only significantly rise under the Climate Ambition scenario**

**Climate Ambition switches the rank of Baseline public transport and private vehicles levels for the better**



# Evolution of the mode mix

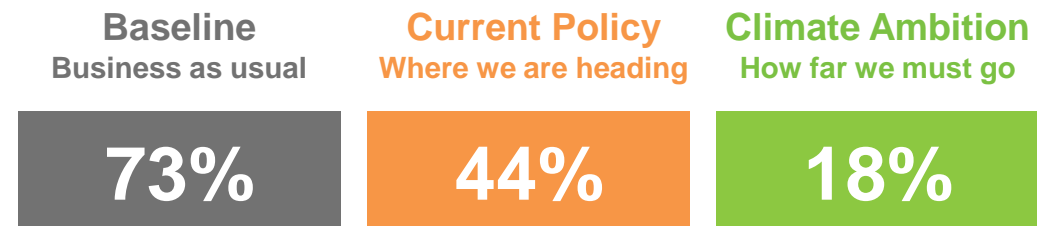
## Mode shares in 2050



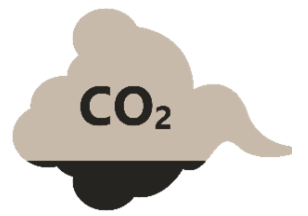
## Main findings

- **Baseline:** income growth leads to a surge of private vehicles
- **Current Policies:** investments in public transport infrastructure favour a shift to public transport usage keeping up with the 2015 mode share levels
- **Climate Ambition:** additional measures boost clean modes while limiting private vehicles allowing for a sharp decrease in usage of carbon-intensive modes

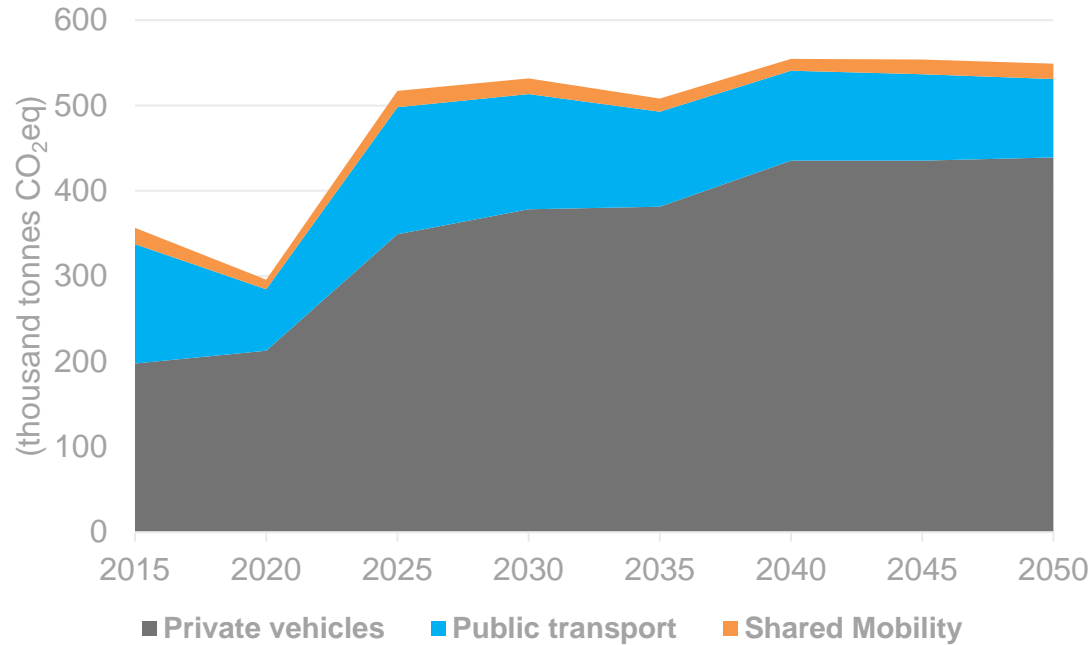
## Share of private vehicles by 2050



# Total CO<sub>2</sub> emissions

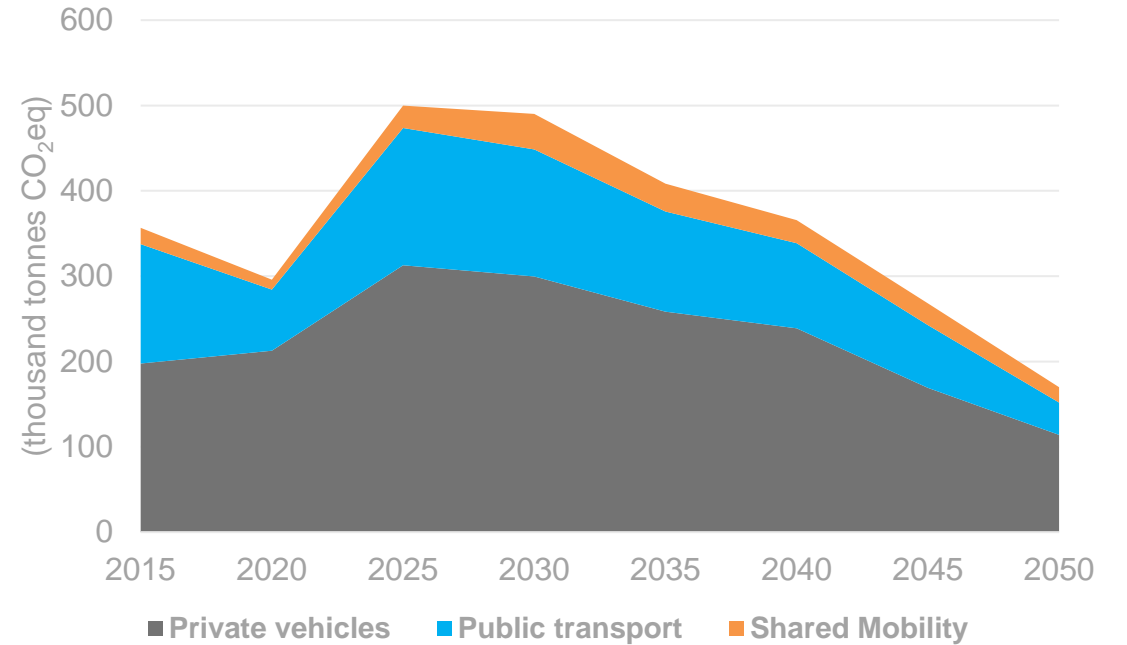


## Current Policies

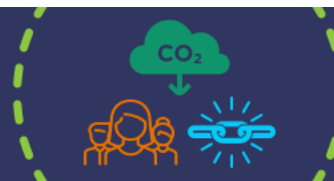


Current policies stop the increase in private vehicle emissions, but emissions will rise again without further action and policy planning after 2035

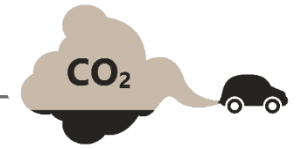
## Climate Ambition



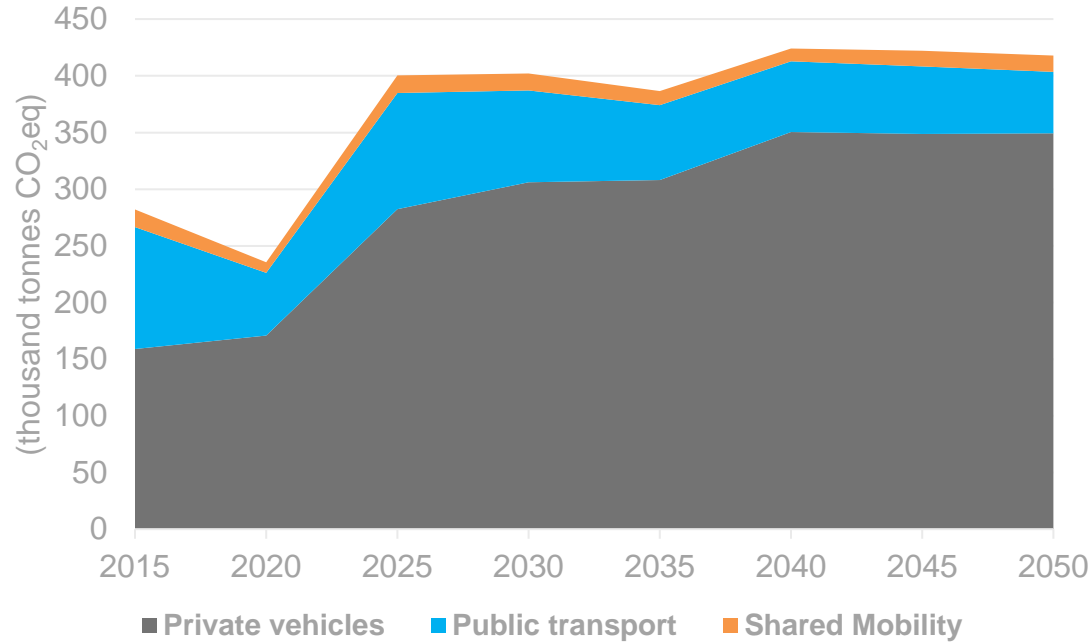
The efficiency of Climate Ambition relies on a steady decrease in private vehicle emissions supported by an additional decrease in public transport emissions



# Direct CO<sub>2</sub> emissions (Tank to wheel)

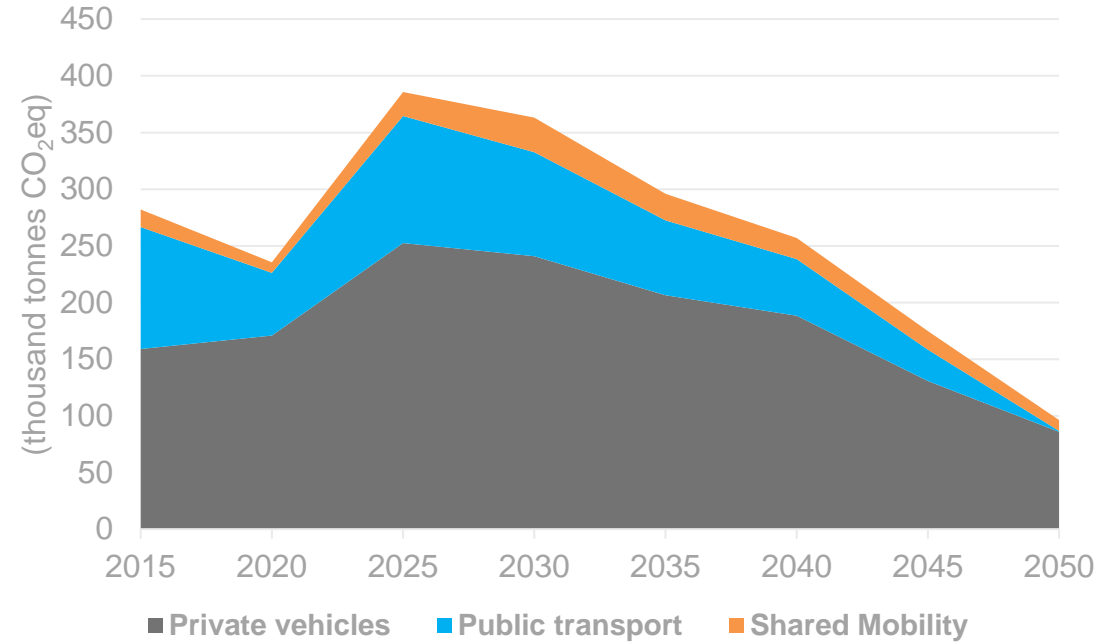


## Current Policies

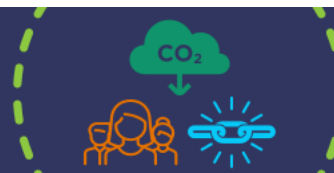


No significant reduction is observed: **current policies help mitigate the pressure on demand** from demographic and economic growth

## Climate Ambition



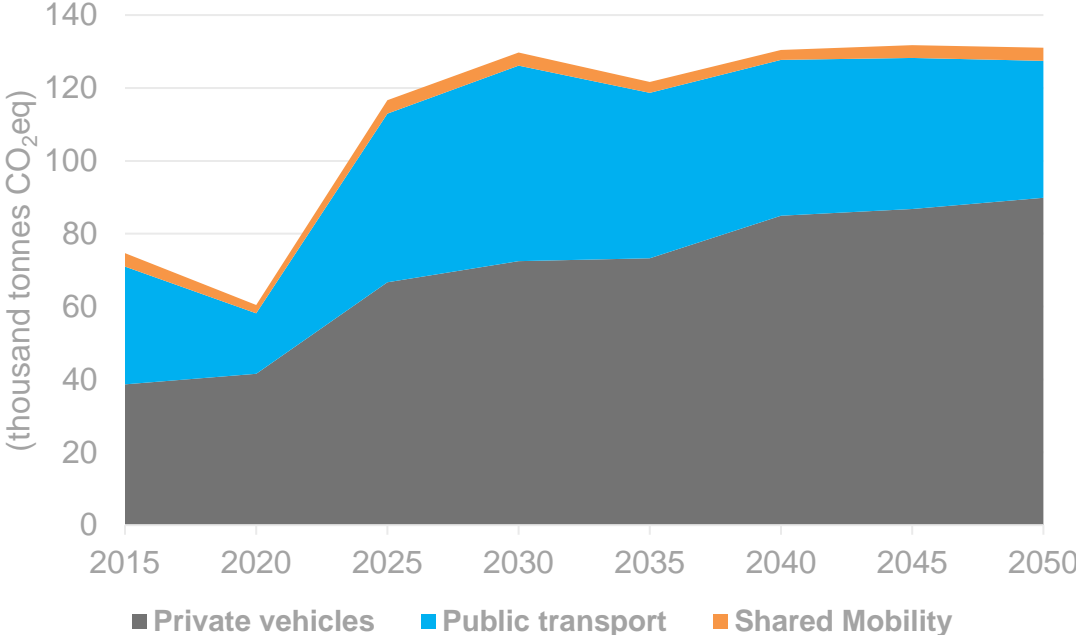
**Direct emissions of public transport disappear thanks to fleet electrification** while private vehicles are harder to electrify and demand policies boost its decarbonisation



# Indirect CO<sub>2</sub> emissions (Well to tank)

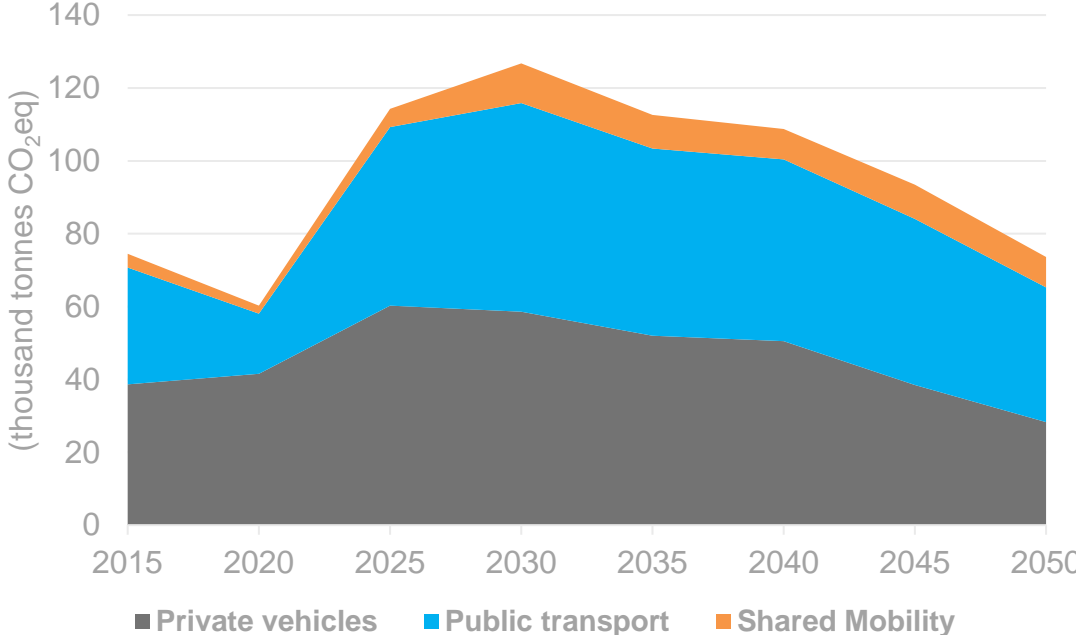


Current Policies

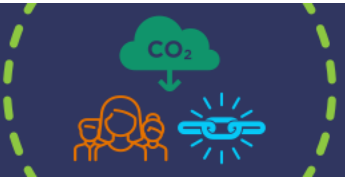


Going electric is not that clean depending on how energy is produced: in Ulaanbaatar, a large share of the emissions are indirect

Climate Ambition



Reducing indirect emissions from energy production and distribution is key: while not contributing to 2050 direct emissions, public transport is the main indirect emitter



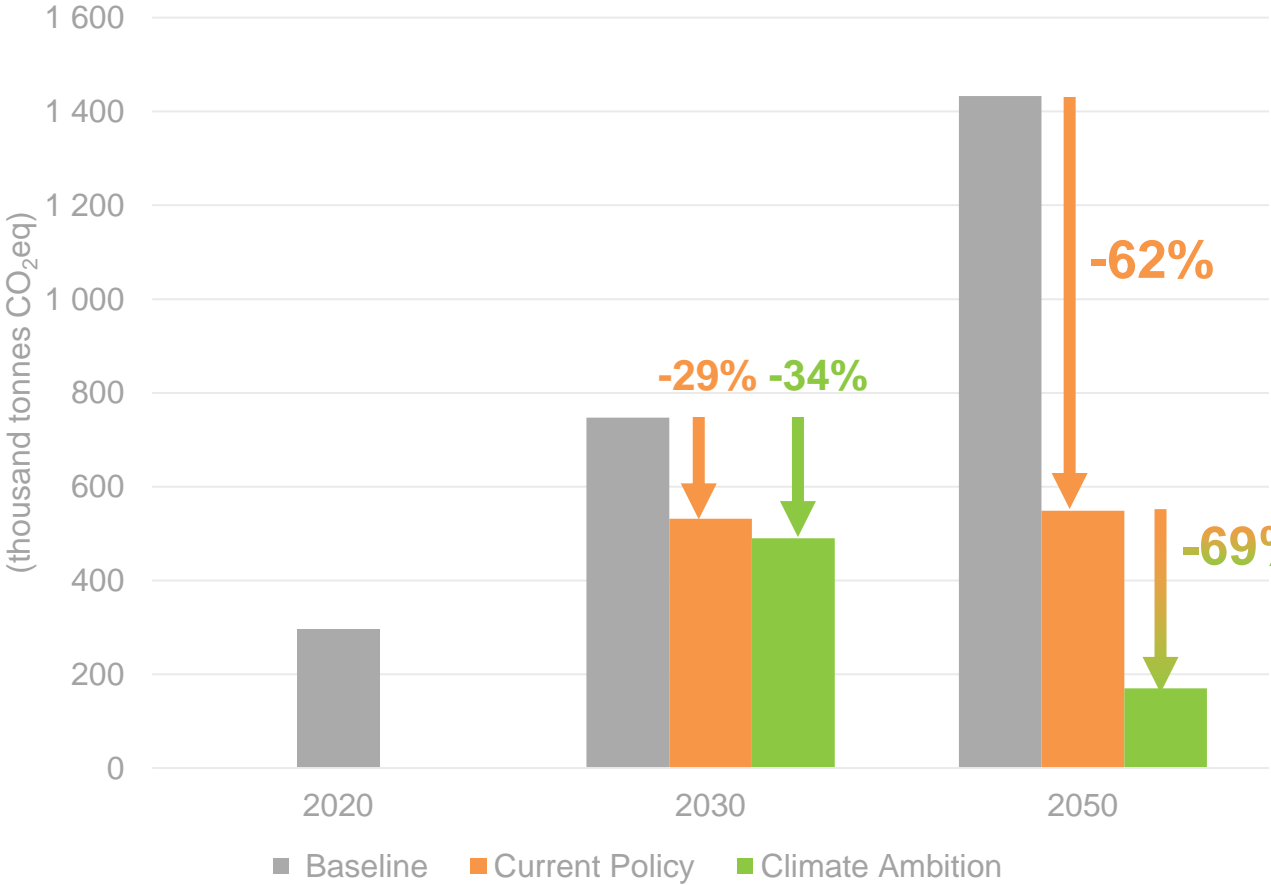
# Policy impacts

Specific impact of each policy measure

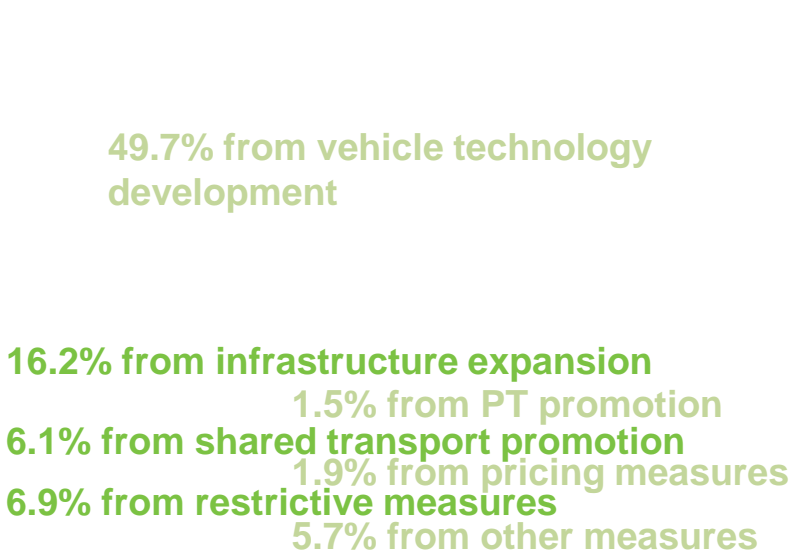


# Climate Ambition scenario

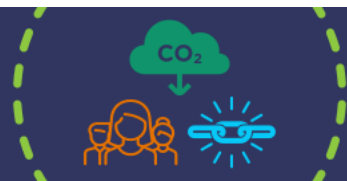
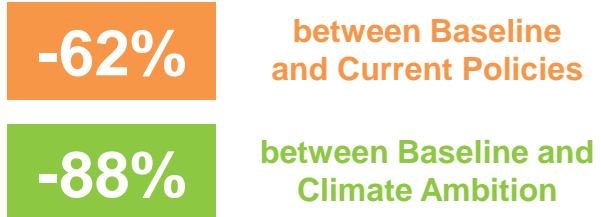
## Total CO<sub>2</sub> emissions from urban mobility



## Breakdown of CO<sub>2</sub> reduction by category of policy measures



## CO<sub>2</sub> emissions in 2050



# Vehicle Technology Development



## Implementation metrics

- Percentage of various vehicle technologies in the private vehicle and bus fleet

## Current Policies

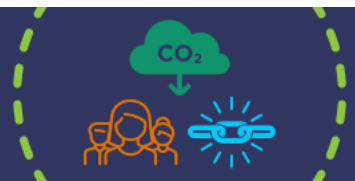
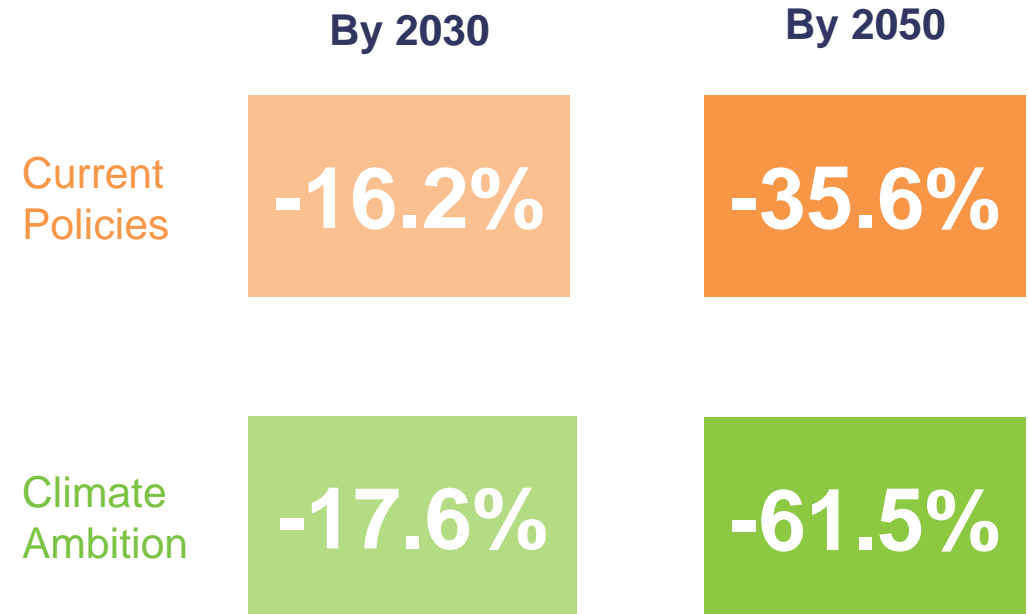
- Delivery of 230 electric buses by 2023
- Production of electric buses in Mongolia
- 16% of private electric cars and 70% of electric buses by 2050

## Climate Ambition

- 49% of private vehicles will be electric, thrice the share of Current Policies
- Full electrification of the bus fleet, compared to 70% in Current Policies

## Impact

Reduction in total urban passenger transport CO<sub>2</sub> emissions attributed to the measures for Ulaanbaatar



# Infrastructure Expansion



## Implementation metrics

- Total LRT, cable car, urban rail, bike and pedestrian network length infrastructure in kilometres

## Current Policies

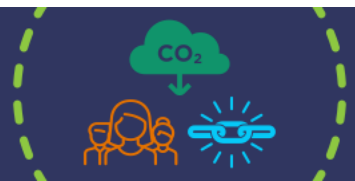
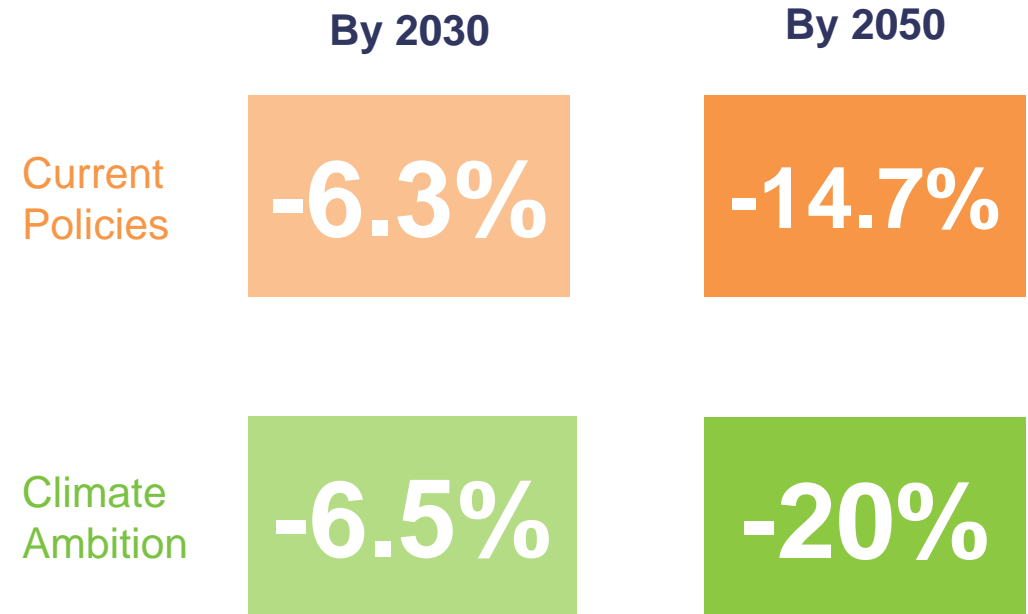
- Creation of LRT network (108km), cable car network (23km) and urban rail network (190km)
- Development of cycling (1600km) and pedestrian networks (1500km)

## Climate Ambition

- Double the expected cable car network to reach 50km
- Keep increasing the LRT network up to 150km
- Add 800 km of bike lanes to reach 2400km
- Increase the Pedestrian walkways by an additional 1100km

## Impact

Reduction in total urban passenger transport CO<sub>2</sub> emissions attributed to the measures for Ulaanbaatar



# Public Transport Promotion



## Implementation metrics

- Increase of operating speed, bus network share that has priority, average cost of a trip, share of population with a regular subscription, among others

## Current Policies

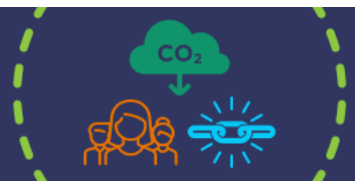
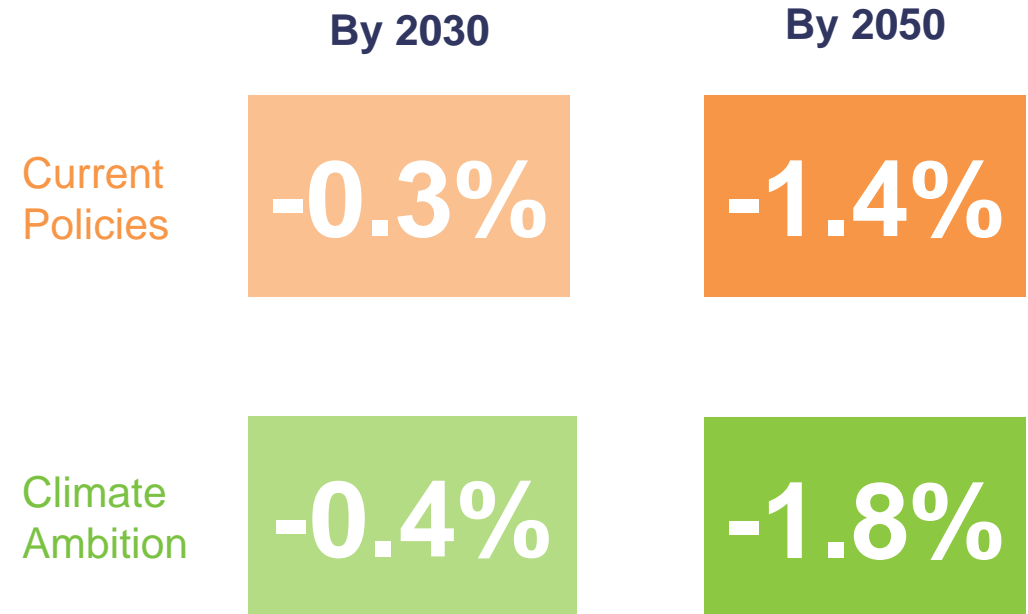
- Decrease average cost by 30%
- Introduce priority lanes for 30% of the bus network and increase the bus operating speed by 10%
- Promote public transport subscriptions for 35% of users and introduce a MaaS solution for 20% of users

## Climate Ambition

- Prioritise the whole bus network and double the increase in operating speed for buses
- Promote further public transport subscriptions to reach 80% of users

## Impact

Reduction in total urban passenger transport CO<sub>2</sub> emissions attributed to the measures for Ulaanbaatar



# Shared Transport Promotion



## Implementation metrics

- Total size of on-demand, taxi, ride sharing, car sharing, bike and scooter sharing fleet size of car, change in load factor per vehicle

## Current Policies

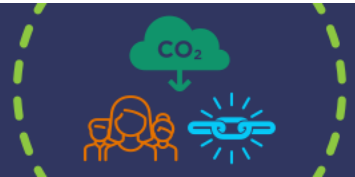
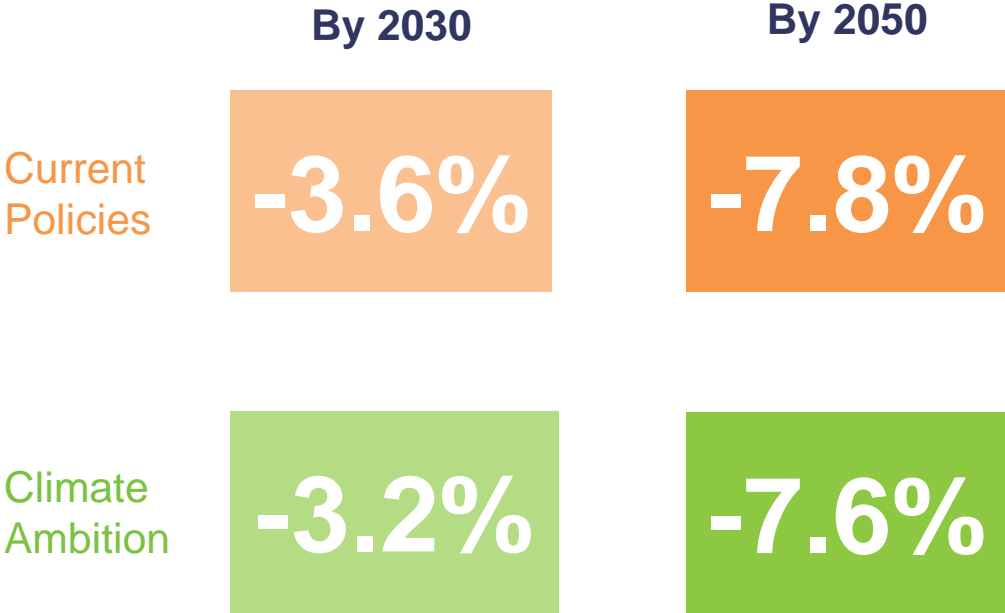
- Incentives for carpooling to increase the car occupancy rate by 10%
- Introduction of a bike and scooter sharing service with 3000 vehicles by 2050

## Climate Ambition

- Replace 2500 ride-sharing vehicles with regulated taxis
- Double the size of bike and scooter sharing fleet
- Introduce a service of 500 car sharing vehicles
- Launch of 500 on-demand taxibuses

## Impact

Reduction in total urban passenger transport CO<sub>2</sub> emissions attributed to the measures for Ulaanbaatar



# Pricing Measures



## Implementation metrics

- Share of total use cost, share of parking cost increase, increase in vehicle usage cost, increase in vehicle ownership and usage cost

## Current policies

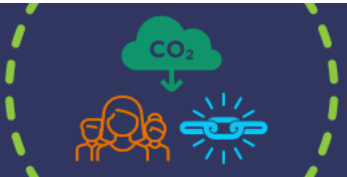
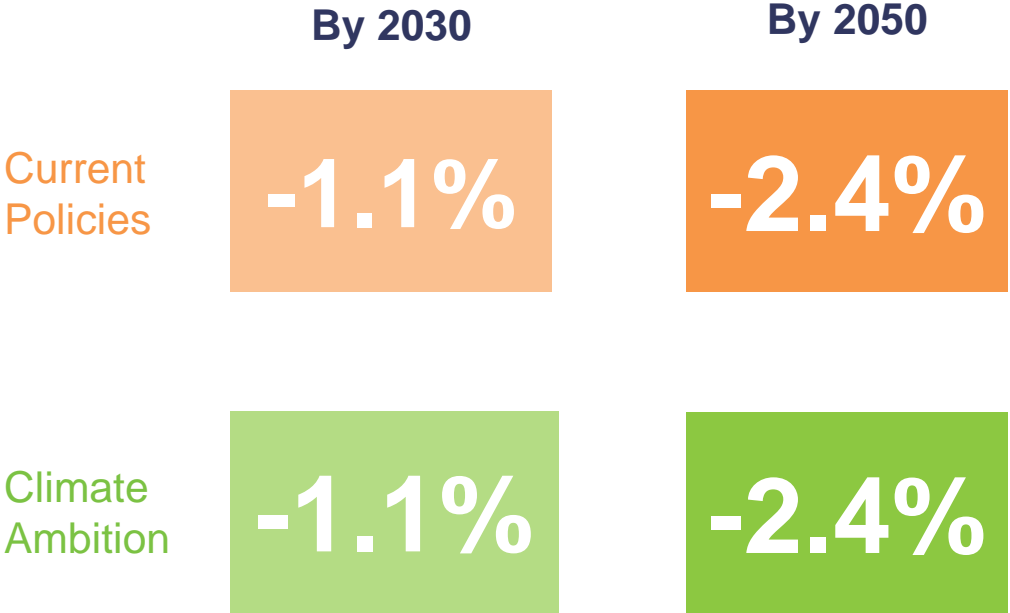
- Implement a road pricing scheme increasing non-fuel car use cost by 25%
- Increase parking pricing by 25%
- Introduce a fuel tax to increase the cost of fossil fuels by 25%
- Introduce a vehicle ownership and purchase tax increasing the cost by 30%

## Climate Ambition

- No change from Current Policies

## Impact

Reduction in total urban passenger transport CO<sub>2</sub> emissions attributed to the measures for Ulaanbaatar



# Restrictive Measures



## Implementation metrics

- Share of the city core that is under (strong) parking restrictions, share of cars that will be restricted from circulating within the city

## Current Policies

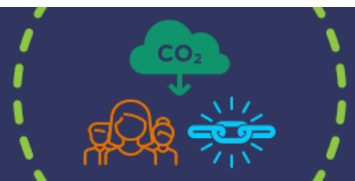
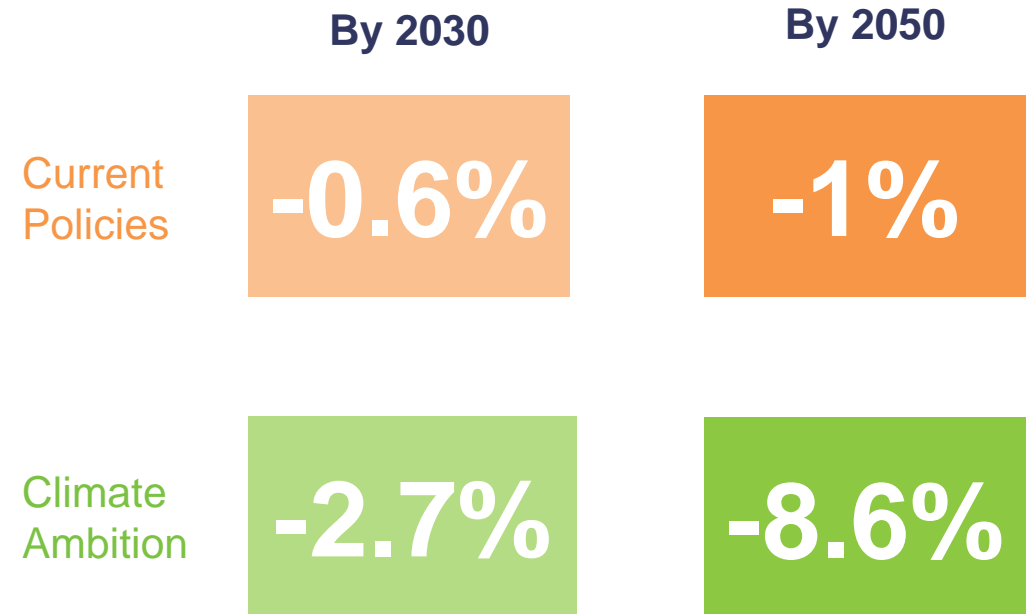
- Restrict 10% of the cars from circulating within the city centre
- Set up strong parking restrictions for 10% of the city centre

## Climate Ambition

- Further restrict up to 40% of the cars from circulating within the city centre
- Set up strong parking restrictions for up to 70% of the city centre

## Impact

Reduction in total urban passenger transport CO<sub>2</sub> emissions attributed to the measures for Ulaanbaatar



# Other Measures



## Implementation metrics

- Share of active population regularly teleworking, increase in diversity of land-use functions and density around public transport network

## Current Policies

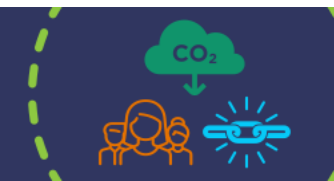
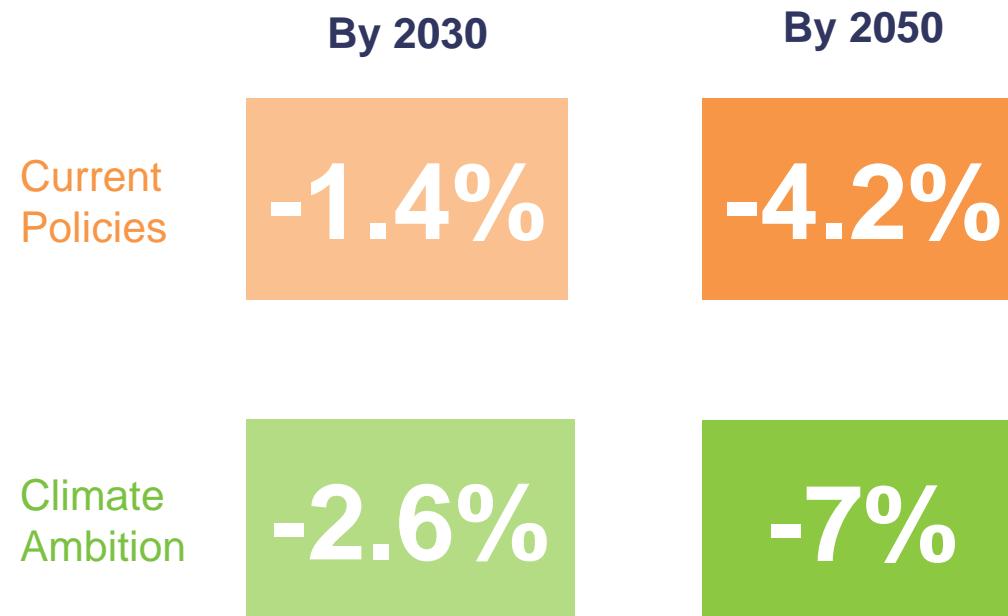
- Promote teleworking and have 5% of the active population regularly teleworking
- Develop a Transit-Oriented Development approach and increase the land-use mix and density around stations by 15%

## Climate Ambition

- Further promote teleworking to reach 10% teleworkers
- Improve the Transit-Oriented Development planning to increase the land-use mix and density at stations by 20%

## Impact

Reduction in total urban passenger transport CO<sub>2</sub> emissions attributed to the measures for Ulaanbaatar





# Individual impacts of policy measures - Synthesis

Current Policies	Vehicle Technology Development	Infrastructure Expansion	Public Transport Promotion	Shared Transport Promotion	Pricing Measures	Restrictive Measures	Other Measures
By 2030	-16.2%	-6.3%	-0.3%	-3.6%	-1.1%	-0.6%	-1.4%
By 2050	-35.6%	-14.7%	-1.4%	-7.8%	-2.4%	-1%	-4.2%

NB. The totals do not equal total CO<sub>2</sub> emissions reductions as the proposed sensitivity analysis by individual measure group does not account for combined effects

## Climate Ambition

By 2030	-17.6%	-6.5%	-0.4%	-3.2%	-1.1%	-2.7%	-2.6%
By 2050	-61.5%	-20%	-1.8%	-7.6%	-2.4%	-8.6%	-7%

NB. The totals do not equal total CO<sub>2</sub> emissions reductions as the proposed sensitivity analysis by individual measure group does not account for combined effects

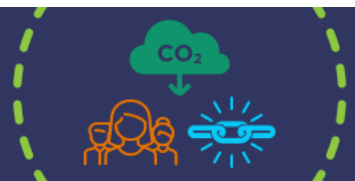
## Policy Priorities

Start with “low-hanging fruits” requiring fewer resources while planning for widescale structural measures

Develop an efficient, reliable and integrated public transport network as a backbone for urban mobility

In parallel, introduce and enhance shared and active mobility to further support public transport

Following the establishment of sustainable modes as a feasible alternative, disincentivise the use of private vehicles



# Other non-measured benefits



Decrease of local air pollutants

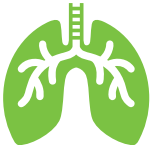


Increased use of active mobility and more walkable city



Decrease of PKM travelled by car

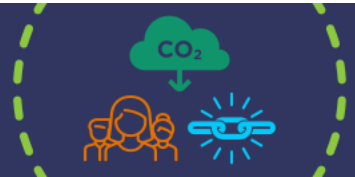
Healthier community



Increased safety



Reduced congestion



# Modelling tool

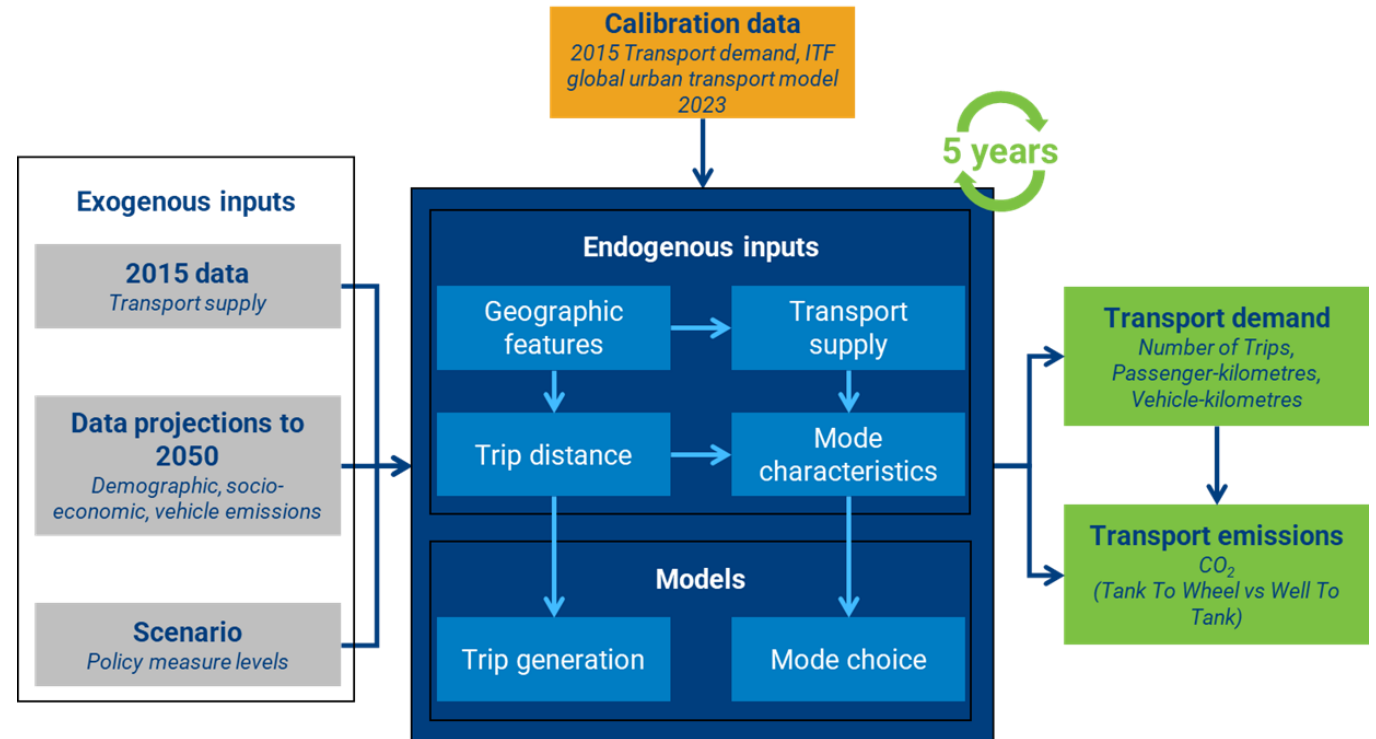
# Introduction to the modelling tool

The ITF Urban Mobility Model for Ulaanbaatar is a tool for testing policy packages. It enables building scenarios and evaluating the efficiency of transport decarbonisation measures in Ulaanbaatar, Mongolia.

The model covers the official administrative boundaries of Ulaanbaatar. It captures relationships at the city level by the population category and distance bin. The model analyses 14 modes, covering the existing and potential future modes.

It simulates the evolution of socio-economic, land use and transport characteristics between 2015 and 2050, presenting results with a five-year step.

Relationships between different inputs and sub-models are shown on the diagram.



# Project resources

# Download study materials



International Transport Forum SIPA  
Sustainable Infrastructure Programme in Asia

## DECARBONISING PATHWAYS FOR ULAANBAATAR'S URBAN MOBILITY

Model Manual for the Urban Mobility Model for Ulaanbaatar, Mongolia  
September 2023

On behalf of:  
Federal Ministry for the Environment, Nature Conservation and Nuclear Safety  
of the Federal Republic of Germany

IKI



International Transport Forum SIPA  
Sustainable Infrastructure Programme in Asia

## URBAN MOBILITY MODEL for ULAANBAATAR, MONGOLIA

**DISCLAIMER**

The results presented in the model should be regarded as an estimation derived from the best available data and information collected during the project. Its primary value lies in facilitating scenario comparisons rather than providing precise future values for certain indicators.

The ITF warrants the outputs of the default scenarios in the model: Baseline, Current Policy and Climate Ambition. These scenarios are validated by the technical team and the Ministry of Road and Transport Development of Mongolia. The model allows to manually create alternative scenarios by adjusting input, however, the ITF does not endorse the outcomes of this exercise and should not be quoted as the source of any manual scenario results.

The use of the model, its default scenarios and any other elements is free .

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Please cite this work as: ITF (2023), "Urban Mobility Model for Ulaanbaatar", *Sustainable Infrastructure Programme in Asia – Transport*, OECD Publishing, Paris.



International Transport Forum SIPA  
Sustainable Infrastructure Programme in Asia

## Decarbonising pathways for Ulaanbaatar's urban mobility

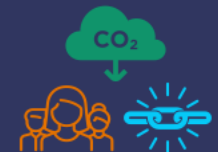
DISSEMINATION EVENT AGENDA  
Final stakeholder meeting and results presentation

22 March 2023  
Ulaanbaatar, Mongolia

IKI International Transport Forum Ministry of Road and Transport Development of Mongolia OECD UN DP

For more information related to the **Decarbonising Pathways for Ulaanbaatar's Urban Mobility** project, please access all the project materials from the

[ITF SIPA-T Mongolia repository](#)



# Thank you to our project partners

This project benefited from financing by the IKI initiative of the German government:

On behalf of:



of the Federal Republic of Germany



The Ministry of Road and Transport Development of Mongolia and the City of Ulaanbaatar who sponsored and validated the project outcomes:



Our international SIPA partners who directly supported this study, the OECD and UNDP Mongolia:





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