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Benefits of decarbonising Nigerian transport sector

Analysis of sustainable development indicators associated with mitigation measures in Nigeria’s 2021 NDC update

Developed with support from:
ICAT INITIATIVE FOR Climate Action Transparency

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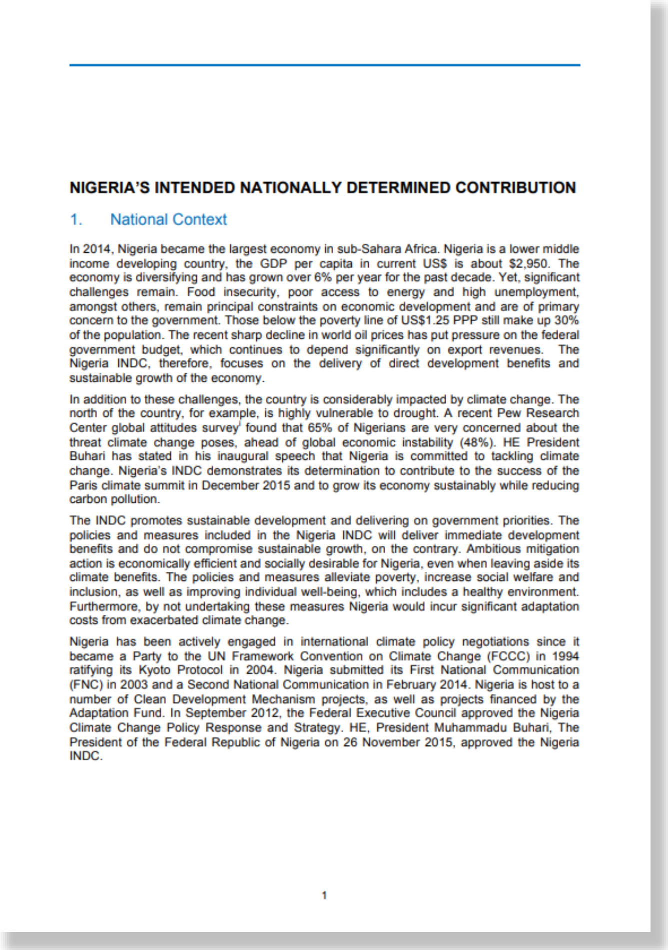
1. Overview of road transport scenarios
2. Identification of decarbonisation co-benefits and data needs
3. Quantification of co-benefits

Overview of road transport scenarios

Mitigation measures in Nigeria’s NDC and details of underlying modelling analysis in LEAP

Nigeria’s first NDC included a number of measures in transport sector albeit with limited detail



NIGERIA’S INTENDED NATIONALLY DETERMINED CONTRIBUTION

1. National Context

In 2014, Nigeria became the largest economy in sub-Sahara Africa. Nigeria is a lower middle income developing country, the GDP per capita in current US$ is about $2,950. The economy is diversifying and has grown over 6% per year for the past decade. Yet, significant challenges remain. Food insecurity, poor access to energy and high unemployment, amongst others, remain principal constraints on economic development and are of primary concern to the government. Those below the poverty line of US$1.25 PPP still make up 30% of the population. The recent sharp decline in world oil prices has put pressure on the federal government budget, which continues to depend significantly on export revenues. The Nigeria INDC, therefore, focuses on the delivery of direct development benefits and sustainable growth of the economy.

In addition to these challenges, the country is considerably impacted by climate change. The north of the country, for example, is highly vulnerable to drought. A recent Pew Research Center global attitudes survey[i] found that 65% of Nigerians are very concerned about the threat climate change poses, ahead of global economic instability (48%). HE President Buhari has stated in his inaugural speech that Nigeria is committed to tackling climate change. Nigeria’s INDC demonstrates its determination to contribute to the success of the Paris climate summit in December 2015 and to grow its economy sustainably while reducing carbon pollution.

The INDC promotes sustainable development and delivering on government priorities. The policies and measures included in the Nigeria INDC will deliver immediate development benefits and do not compromise sustainable growth, on the contrary. Ambitious mitigation action is economically efficient and socially desirable for Nigeria, even when leaving aside its climate benefits. The policies and measures alleviate poverty, increase social welfare and inclusion, as well as improving individual well-being, which includes a healthy environment. Furthermore, by not undertaking these measures Nigeria would incur significant adaptation costs from exacerbated climate change.

Nigeria has been actively engaged in international climate policy negotiations since it became a Party to the UN Framework Convention on Climate Change (FCCC) in 1994 ratifying its Kyoto Protocol in 2004. Nigeria submitted its First National Communication (FNC) in 2003 and a Second National Communication in February 2014. Nigeria is host to a number of Clean Development Mechanism projects, as well as projects financed by the Adaptation Fund. In September 2012, the Federal Executive Council approved the Nigeria Climate Change Policy Response and Strategy. HE, President Muhammadu Buhari, The President of the Federal Republic of Nigeria on 26 November 2015, approved the Nigeria INDC.

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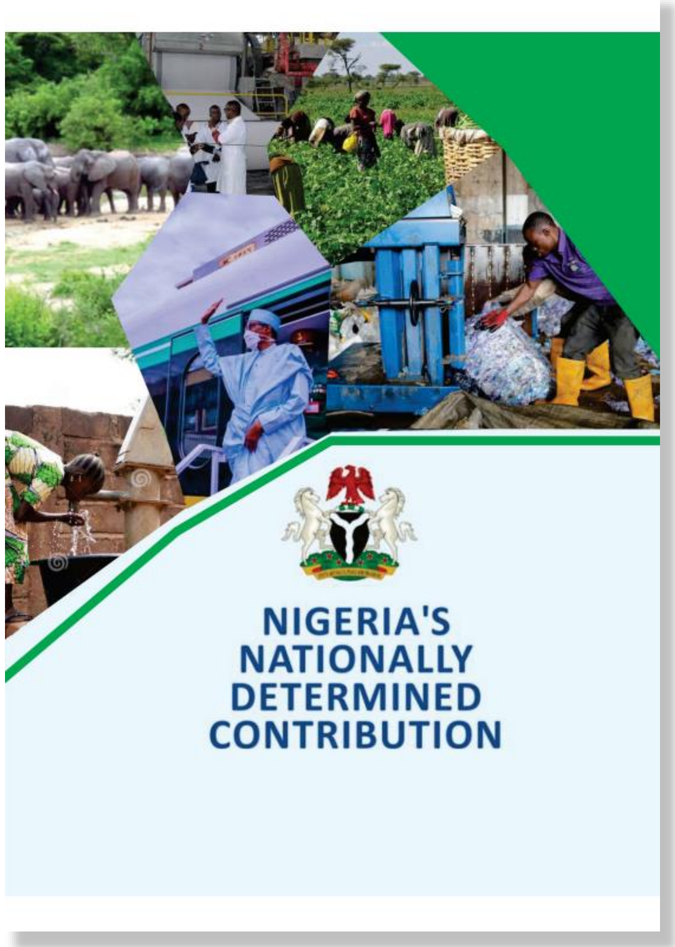
First NDC of Nigeria (based on INDC)

Submission:	**16 May 2017**
Target year:	**2030**
Unconditional:	**20% reduction compared to BAU**
Conditional:	**45% reduction compared to BAU**
Key measures: (transport)	**Transport shift car to bus**
Detailed measures: (transport)	**Modal shift from air to high speed rail** **Moving freight to rail** **Upgrading roads** **Urban transit** **Toll roads / road pricing** **Increasing use of CNG** **Reform petrol / diesel subsidies**

https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Nigeria%20First/Approved%20Nigeria's%20INDC_271115.pdf

Nigeria’s 2021 updated NDC includes four headline mitigation measures for the transport sector



2021 updated NDC of Nigeria

Submission:	**30 July 2021**
Target year:	**2030**
Unconditional:	**20% reduction compared to BAU**
Conditional:	**47% reduction compared to BAU**

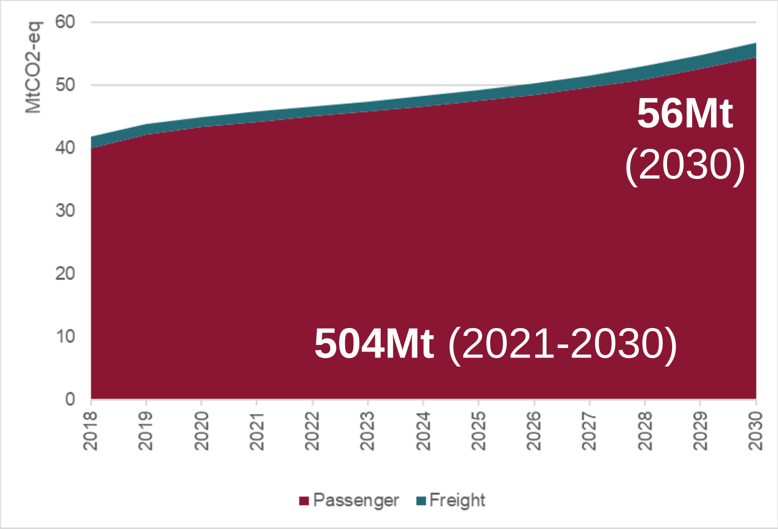
Detailed measures: (transport)	**100,000 extra buses by 2030** **BRT will account for 22.1% of passenger-km by 2035** **25% of trucks and buses using CNG by 2030** **All vehicles meet EURO III limits by 2023; EURO IV by 2030**

→ References Lagos State subnational climate action plan (2020-25) which foresees expansion of BRT network (Box 4)

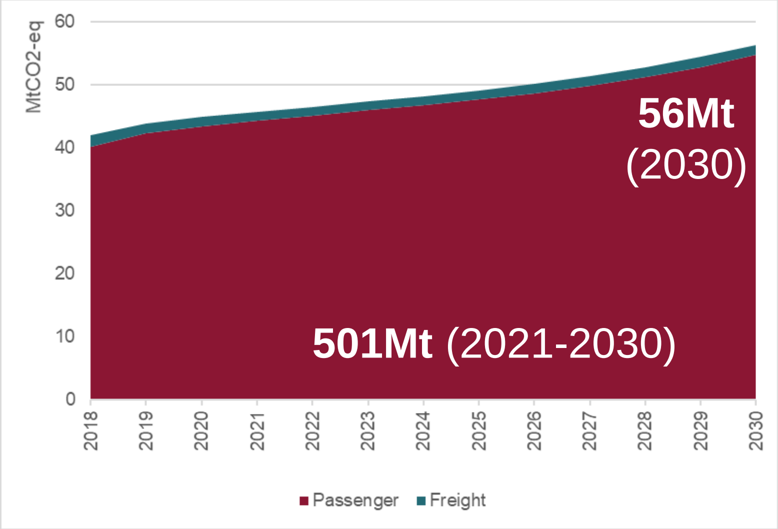
https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Nigeria%20First/NIGERIA%202021%20NDC-FINAL.pdf

Road transport emissions account for 13% of 2030 economy-wide emissions in Baseline

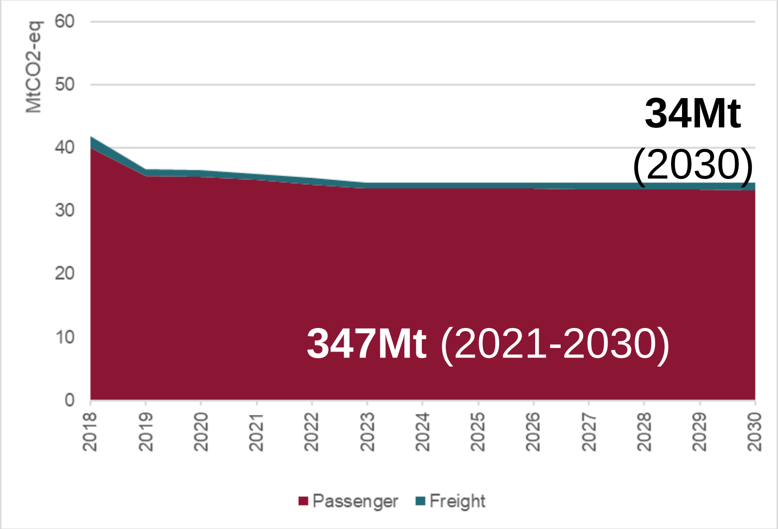
BASELINE



INDC



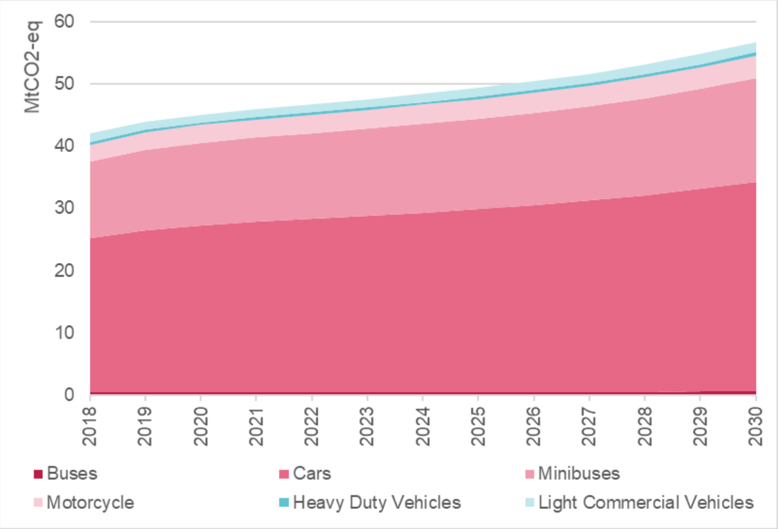
UNCONDITIONAL

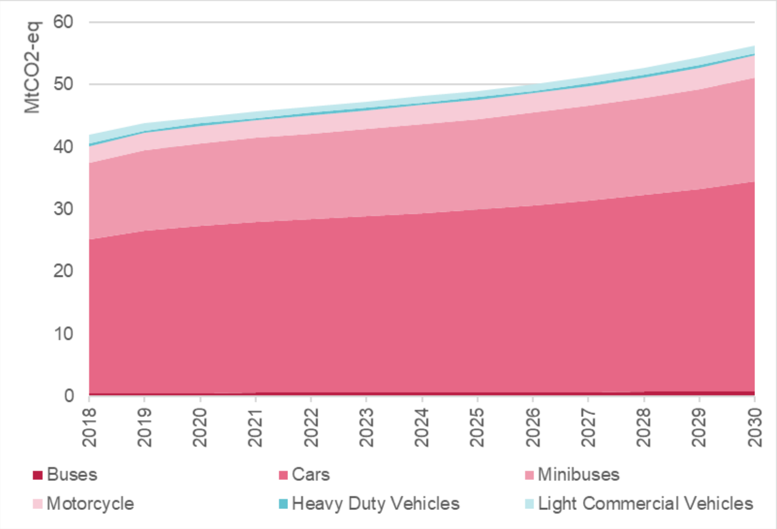


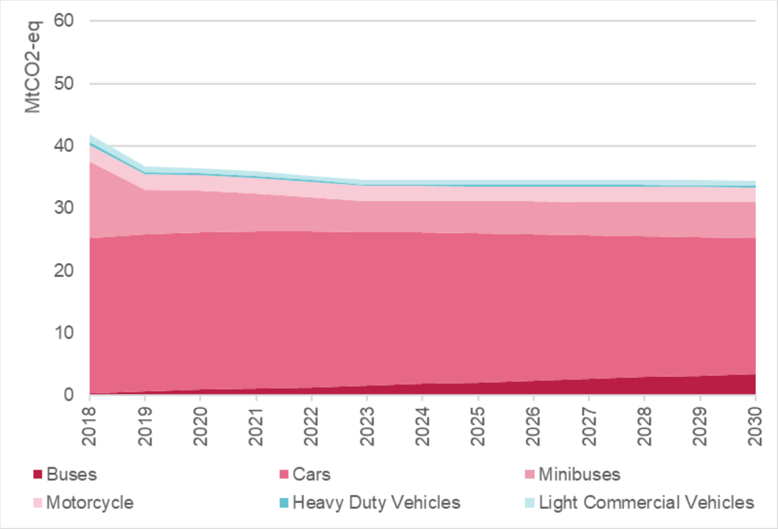
- Passenger travel accounts for vast majority of road transport emissions, with only limited impact from freight
- Baseline and INDC emissions trajectories are almost identical: rising emissions driven by GDP and population growth
- Emissions initially fall sharply, followed by slower decline in Unconditional scenario

Cars and minibuses are the dominant drivers of road transport emissions in all scenarios

BASELINE	INDC	UNCONDITIONAL



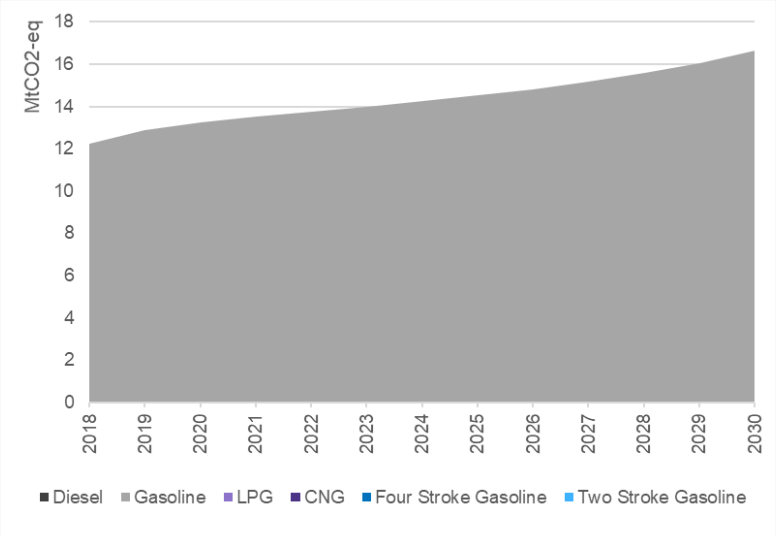




- Tightening of emissions standards drives down emissions for most vehicle types in Unconditional scenario
- Improvements to minibus emissions standards has sudden, pronounced impact in reducing their emissions (next slide)
- Modal shift from cars to buses drives down emissions in the Unconditional scenario (see later slides with activity data)

Minibus carbon emissions are materially reduced through imposition of emission standards

BASELINE



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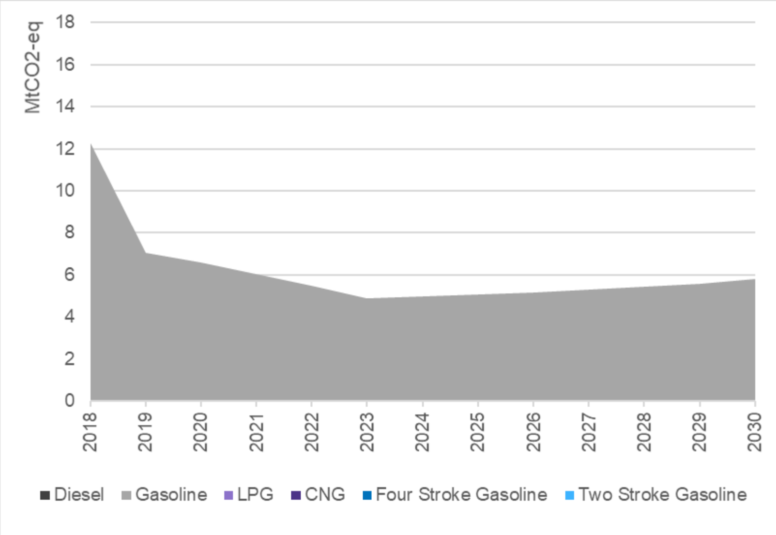
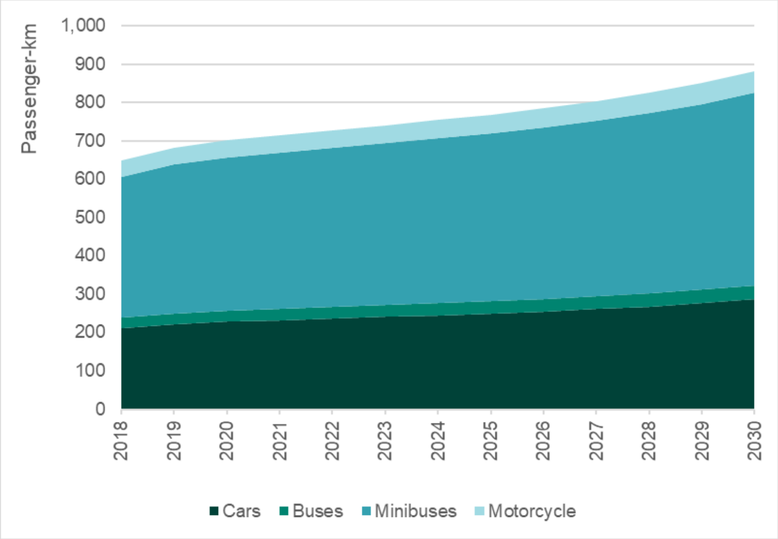


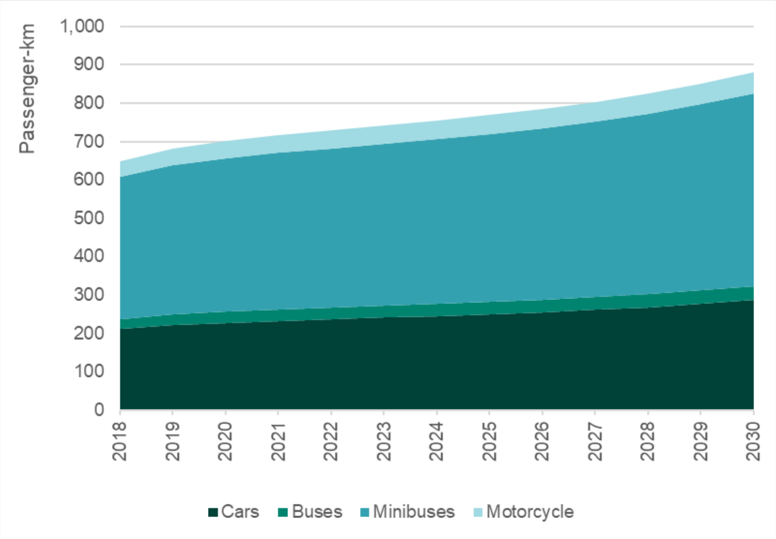
- Minibus activity (passenger-km) is assumed to be the same in both Baseline and Unconditional scenarios
- All minibus activity is fuelled by gasoline (all scenarios)
- Unconditional scenario includes initial sharp drop in emissions that is sustained over time due to meeting more stringent emissions standards (large share of emissions are “uncontrolled” in Baseline)

Transport activity in cars, and to lesser extent motorcycles, shifts to buses in Unconditional scenario

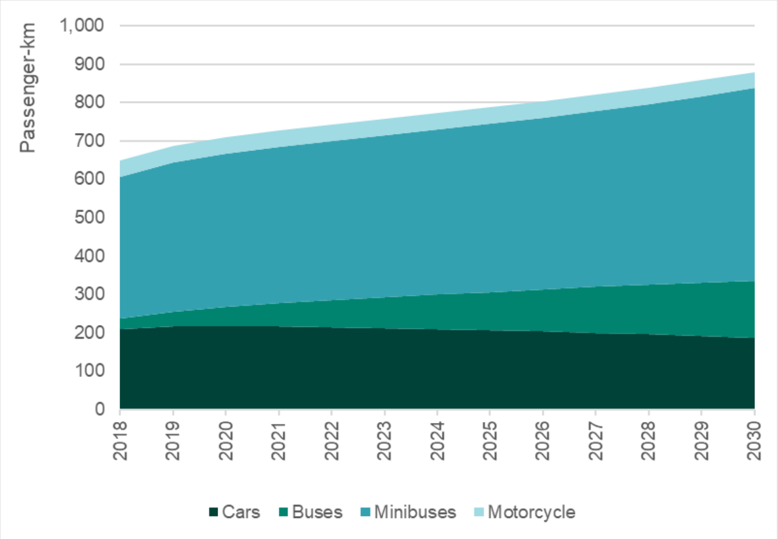
BASELINE



INDC



UNCONDITIONAL



- Total passenger transport activity in passenger-km is similar in all scenarios (as for freight – not shown)
- Buses account for 17% of passenger transport activity by 2030 in Unconditional scenario (en route to 2035 target)
- Unconditional scenario includes 70,000 *more* buses in 2030 than in the Baseline; 3.2 million *fewer* cars and 1.7 million *fewer* motorcycles. There is no change in minibus activity across scenarios.

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Identification of decarbonisation co-benefits and data needs

Options for analysing road transport mitigation measure co-benefits, data needs and overview of calculation approach

Identification of potential sustainable development impacts of mitigation measures

	Congestion (travel time)	Fuel savings	Air pollution health impacts
100,000 extra buses by 2030	Modal shift can reduce congestion	Modal shift can reduce spending on fuel	Modal shift can reduce adverse health impacts
25% trucks and buses using CNG by 2030	No impact	Fuel switch can impact overall spending on fuel	Fuel switch can impact health outcomes
BRT will account for 22.1% of passenger-km by 2035	Modal shift can reduce congestion	Modal shift can reduce spending on fuel	Modal shift can reduce adverse health impacts
All vehicles meet EURO III limits by 2023; EURO IV by 2030	No impact	Emissions standards can reduce fuel consumption	Emissions standards reduce adverse health impacts

Identification of potential sustainable development impacts of mitigation measures

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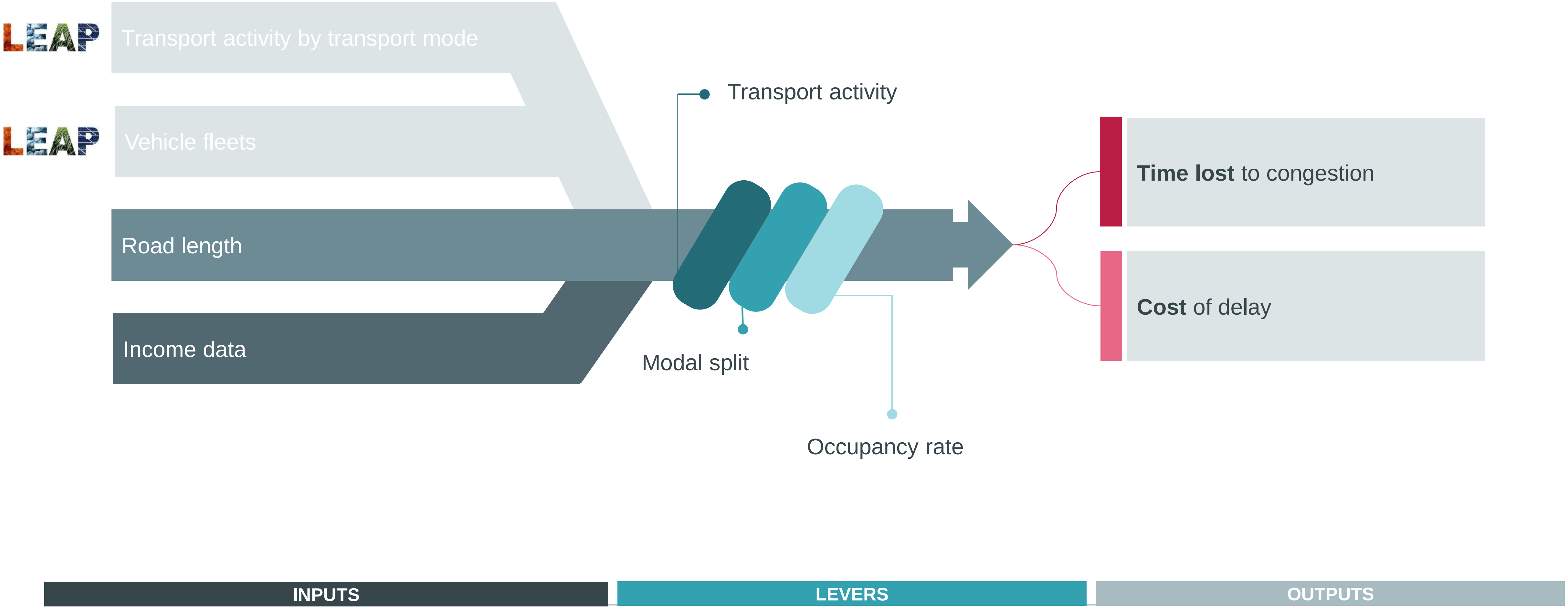
Inconsistencies in modelling of these two scenarios in LEAP limit usefulness of supplementary co-benefits analysis

Congestion impact assessment



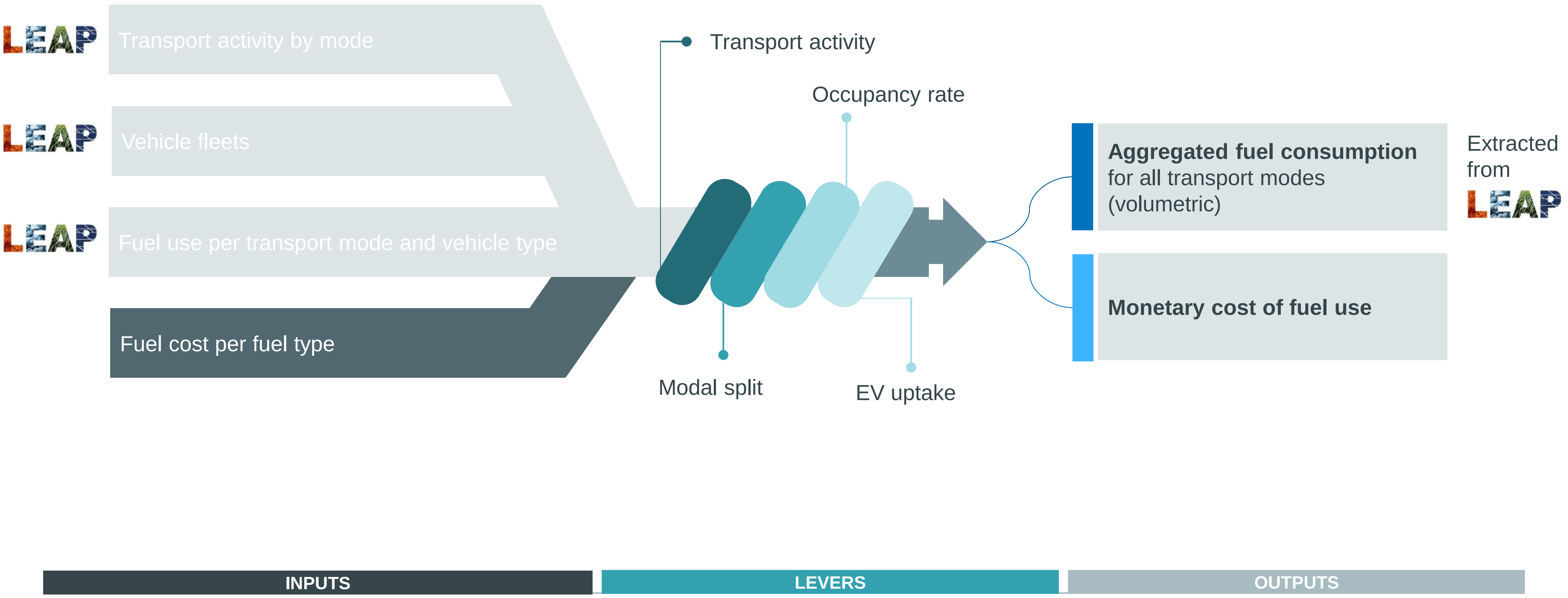
Congestion: calculation steps

STEP 1
Estimate average delay per kilometre based on variables, including e.g. cars per capita, road capacity and GDP, and default coefficients for their impact on delay

STEP 2
Estimate total delay by transport mode using activity information, such as annual distance travelled and vehicle occupancy rates

STEP 3
Convert delays into congestion costs based on a valuation of travel time

Fuel savings impact assessment



Fuel savings: calculation steps

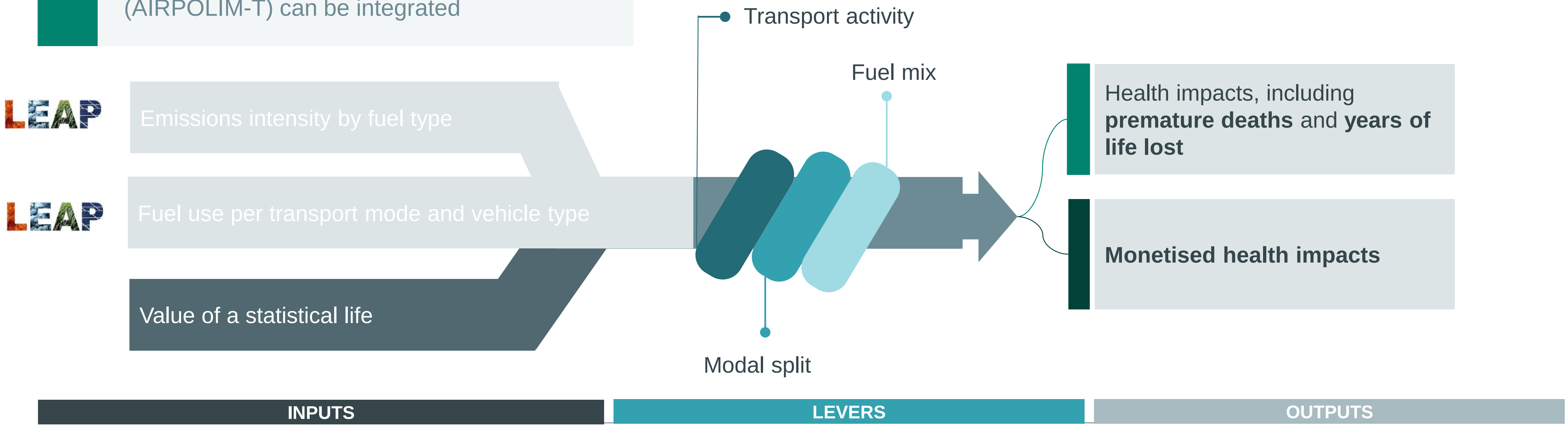
STEP 1
Convert fuel consumption into litres of gasoline equivalent (Lge) for all fuel types

STEP 2
Calculate fuel consumption in Lge by transport mode

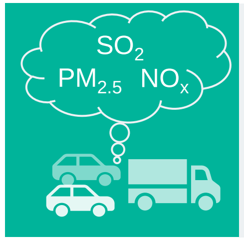
STEP 3
Monetise fuel consumption

Air pollution health impacts

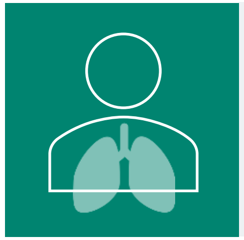
To include the health impacts of air pollution from transport sector emissions into TRACE, results from NewClimate Institute's Air Pollution Impact Model for Transport (AIRPOLIM-T) can be integrated



Air pollution health impacts: calculation steps



STEP 1
Estimate air pollutant emissions



STEP 2
Estimate the intake of air pollutants by the exposed population

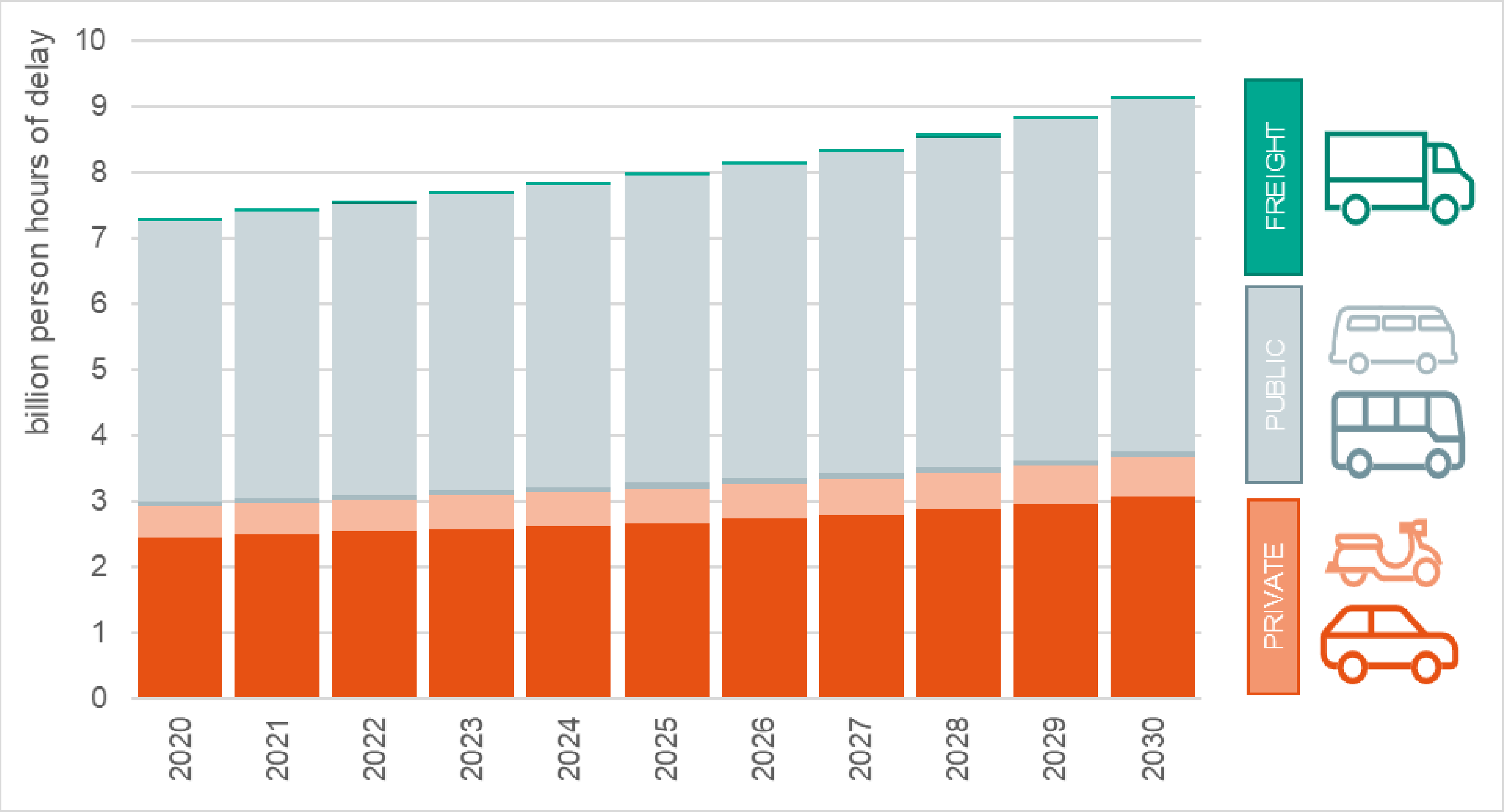
STEP 3
Apply dose-response functions and country-specific, age-weighted mortality rates

STEP 4
Derive air pollution induced health impacts including premature deaths and years of life lost, and related costs

Quantification of co-benefits

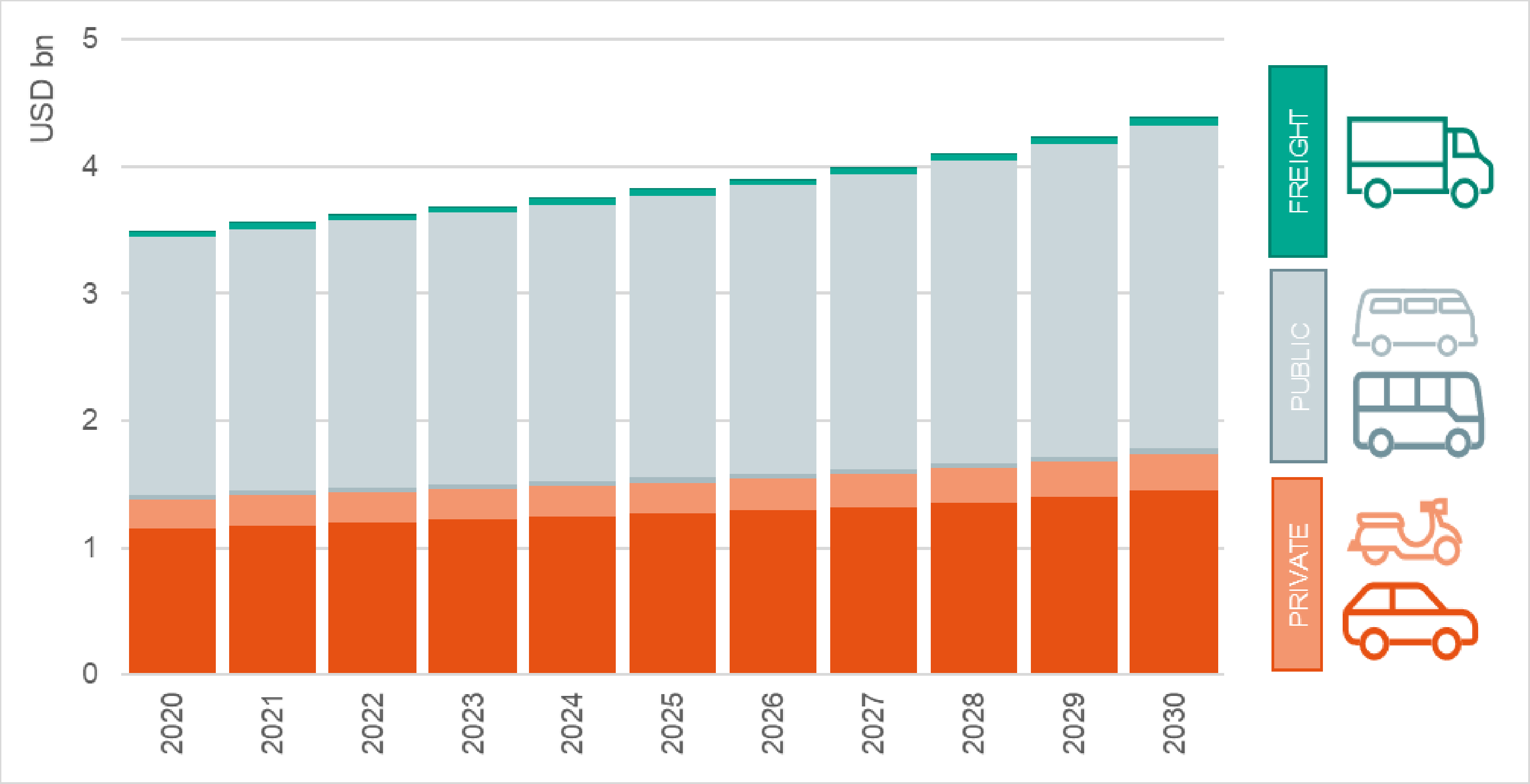
Estimates of non-climate sustainable development impacts associated with road transport mitigation measures in Nigeria's NDC

Billions of hours are lost in congested traffic every year representing major economic losses



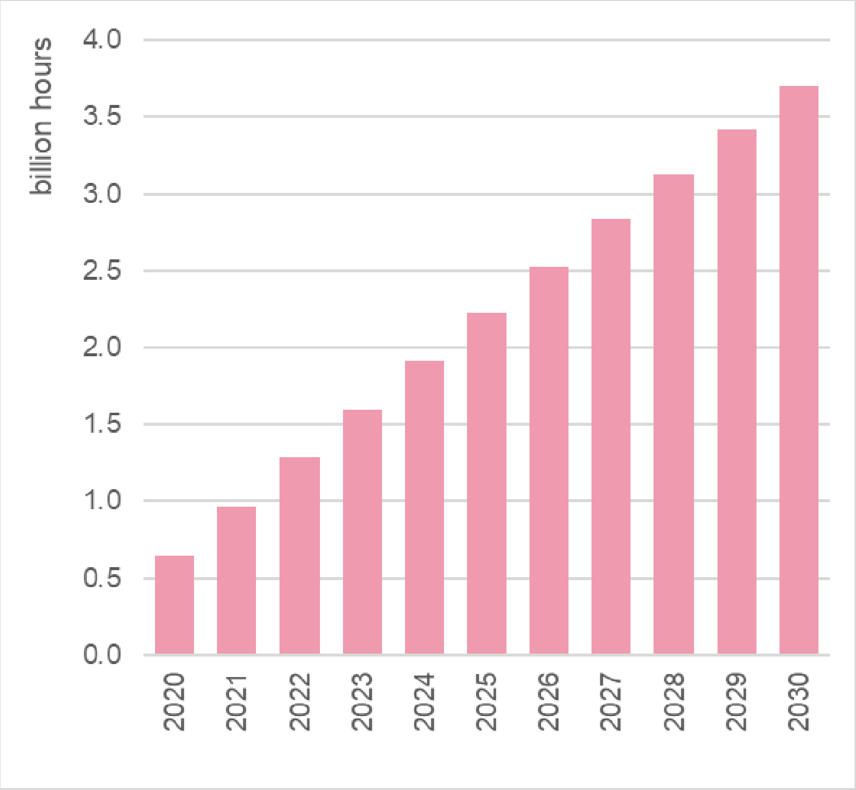
- Road transport modelling in LEAP is conducted at *national* level. Congestion is predominantly a problem in *urban areas* where high vehicle volumes prevent free-flowing traffic.
- Our analysis covers a **representative version of Lagos**, which accounts for 30% of national road transport activity.
- We estimate average vehicle speed of 19km/h, leading to **7.3bn person hours of delay** in 2020, rising to **9.2bn hours** by 2030 in the Baseline scenario.

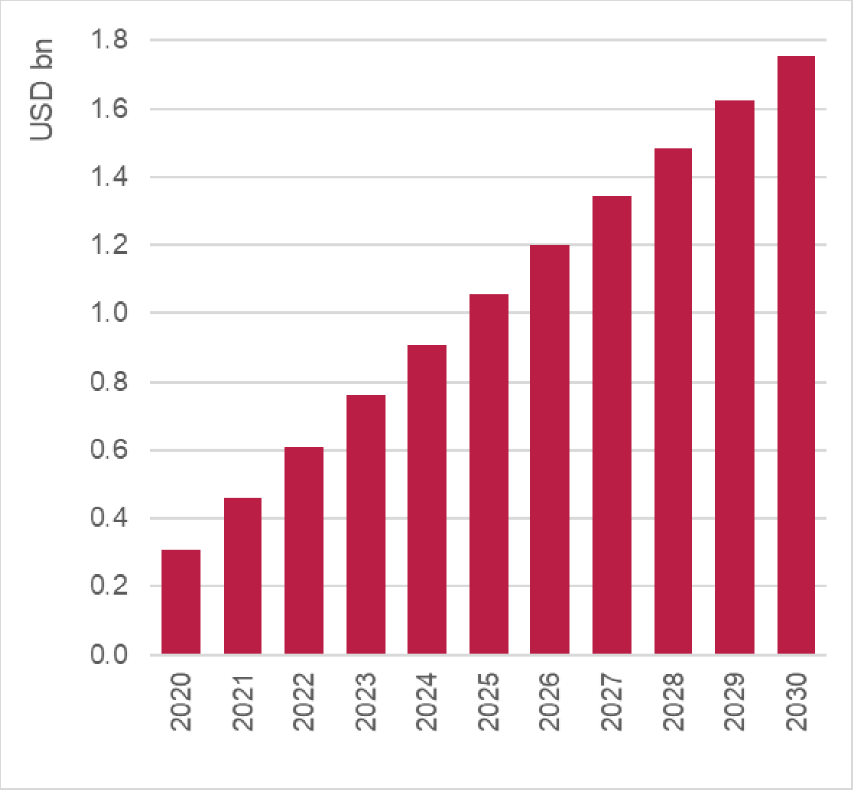
Economic losses from delays exceed USD 3.5bn per year in Lagos alone



- Car users account for **USD 1.5bn** economic losses by 2030 and motorcyclists account for **USD 0.29bn**
- Unconditional scenario includes **national modal shift** of similar amount of motorcycle users and 40% more car users to BRT by 2030 (next slide)
- Analysis based on monthly average wages of **USD 167 (NGN 68, 600)**
- Additional economic losses due to increased fuel use in congestion and higher emissions are not included

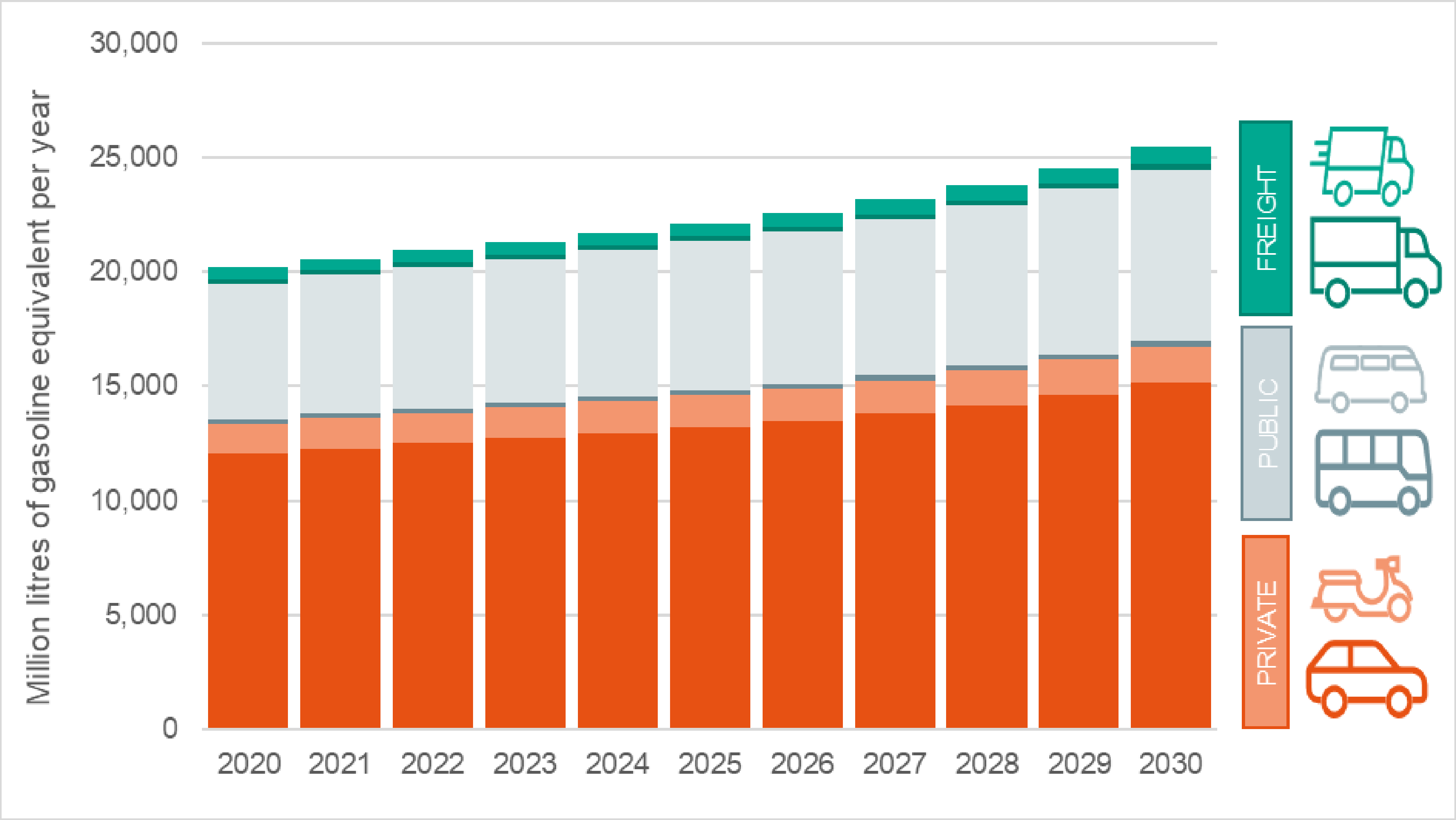
Phasing in 70,000 new buses (BRT) save 24bn hours and USD 11.5bn over the decade





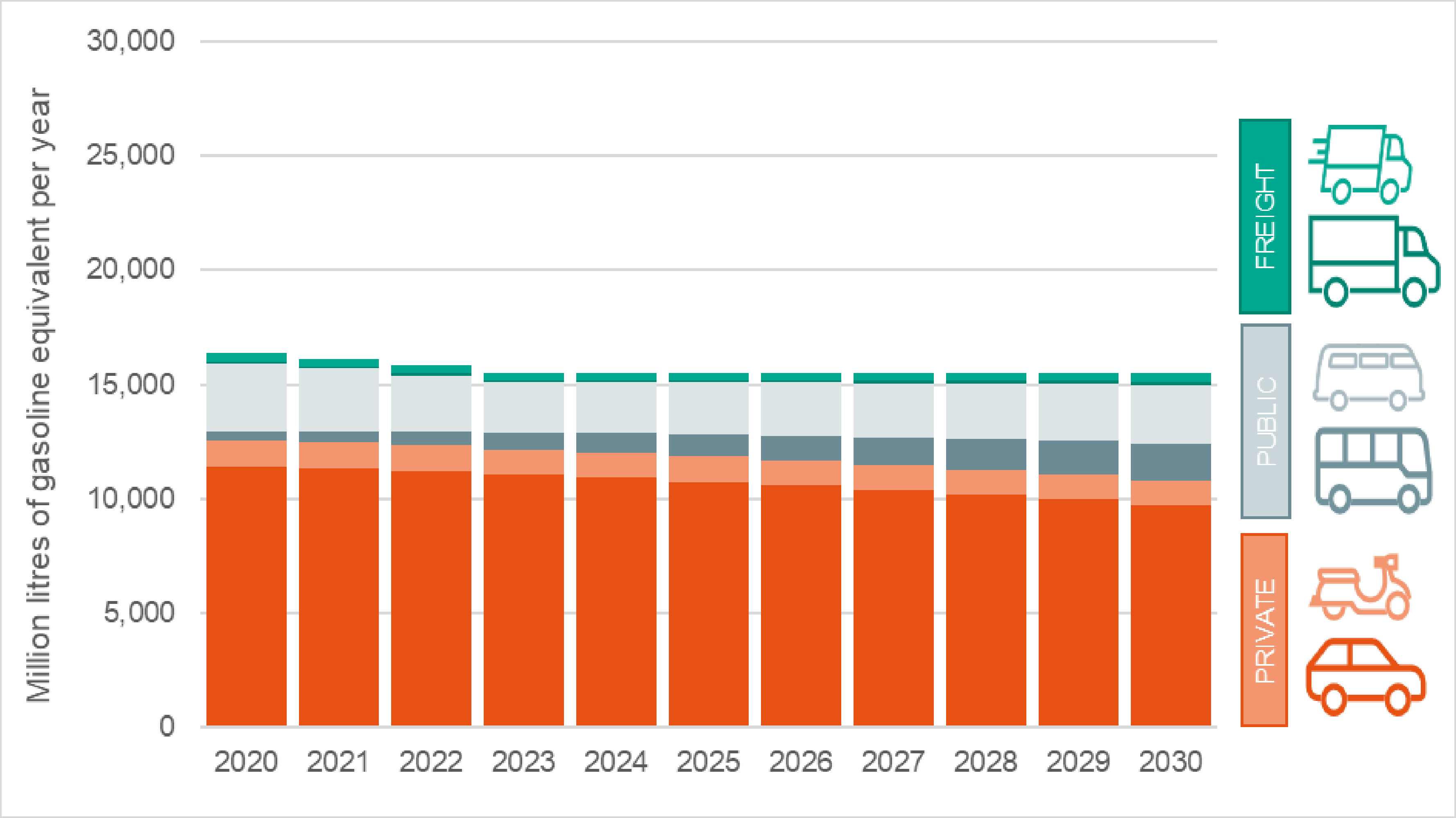
- By 2030, 70k new buses displace 3.2m cars and 1.7m motorcycles, accounting for 111bn passenger-kms
- **Annual economic savings** for bus users can reach **USD 1.8bn** by 2030
- We assume BRT is largely uncongested and can travel at an average speed of 50km/h
- Average speed of cars and motorcycles is 19km/h

Fuel consumption in the Baseline scenario continues to rise year-on-year



- Fuel consumption in the Baseline scenario is **20bn** litres of gasoline equivalent in 2020, rising to **25bn** litres by 2030
- **Cars and minibuses** represent 90% of total road transport fuel consumption between 2020 and 2030

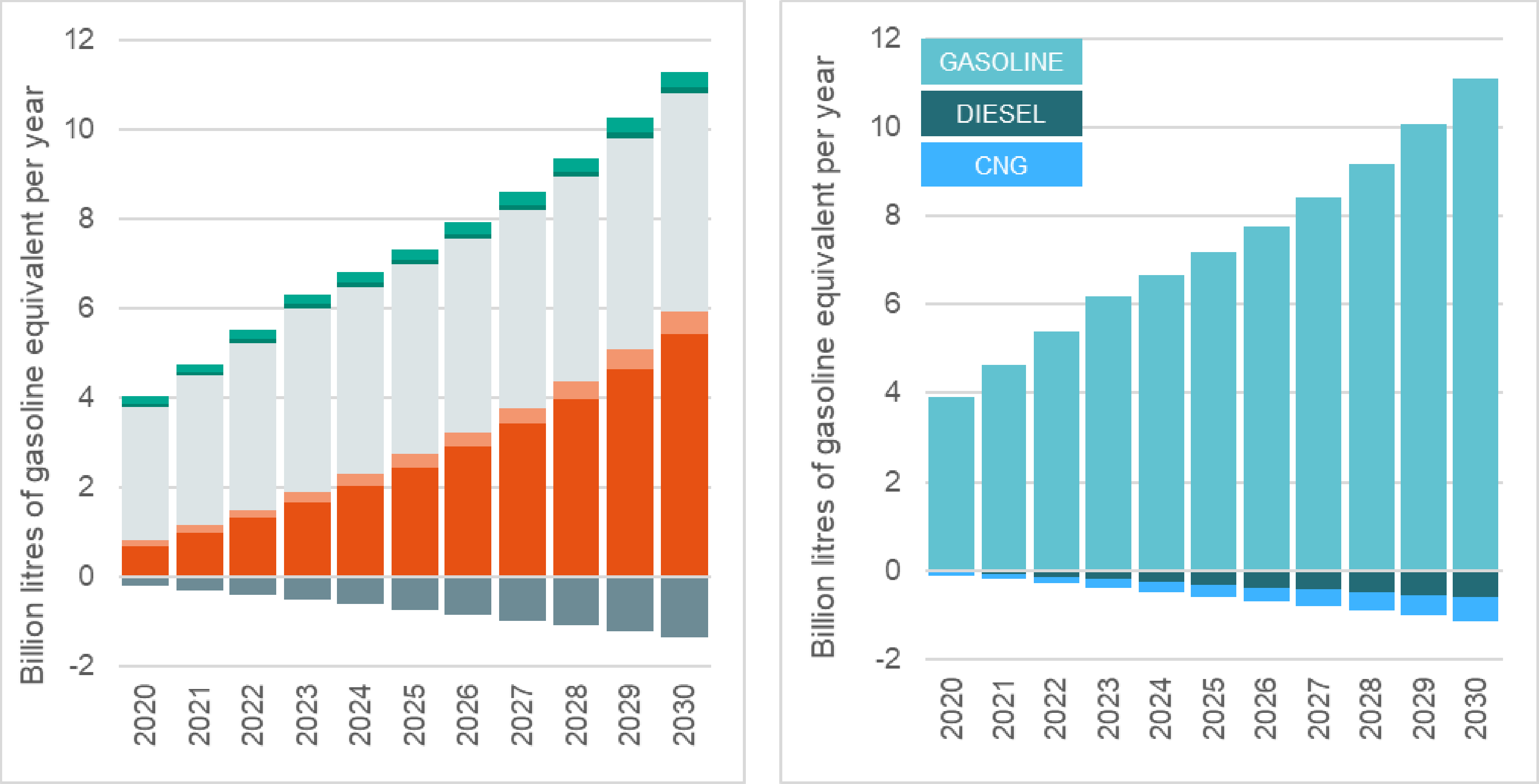
Fuel consumption is limited in the Unconditional scenario by emissions standards and modal shift



- **More stringent emissions standards** implemented from 2020 reduce fuel consumption by **20%** for all vehicle types
- **Shift in activity to buses** displaces gasoline consumption from cars and to a lesser extent motorcycles
- Annual fuel consumption remains approximately **15bn lge** up to 2030

Unconditional scenario saves equivalent of 74bn litres of gasoline over the decade

Volume of annual fuel savings by vehicle and fuel type in Unconditional scenario

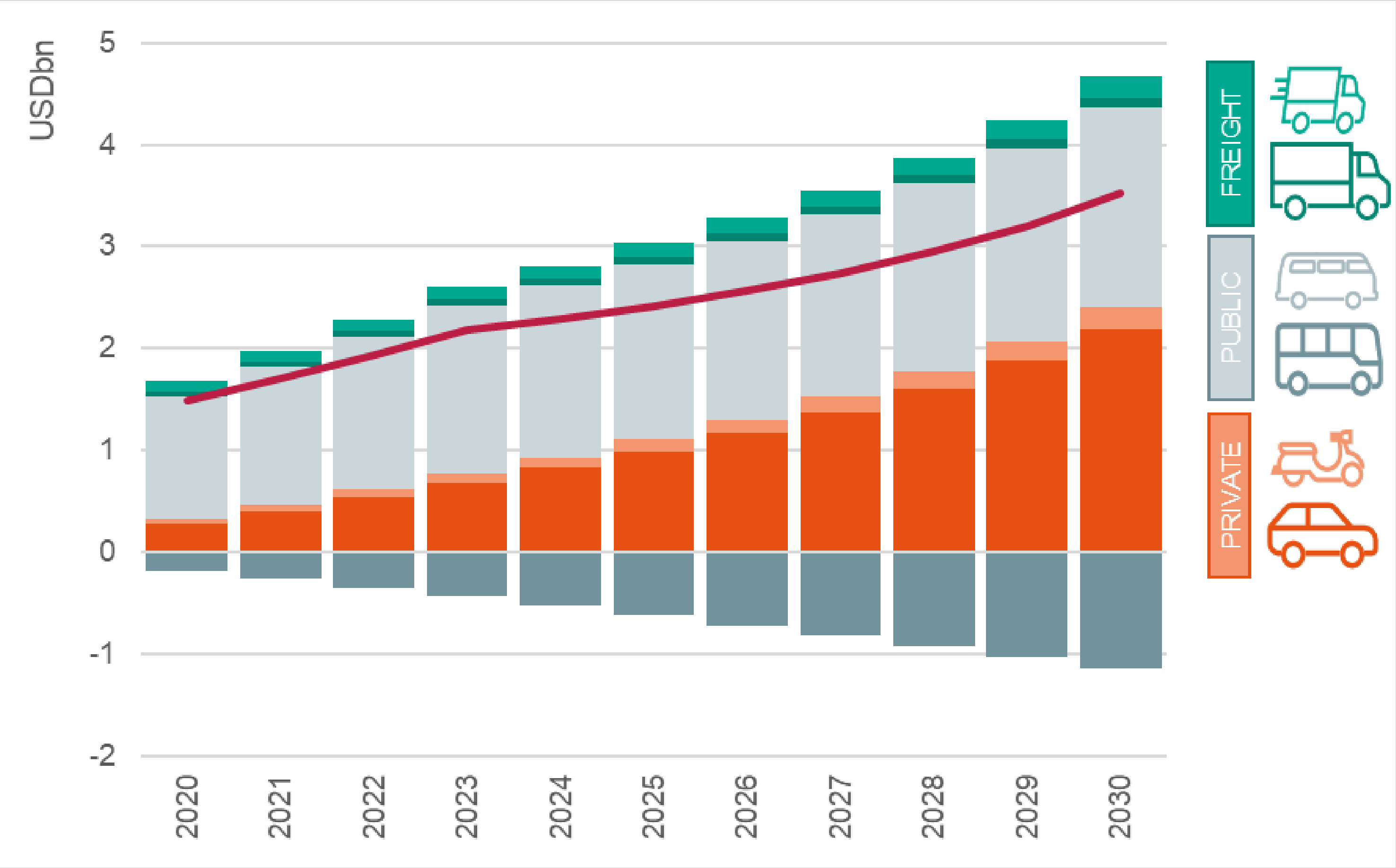


- Fuel savings rise from close to **4bn lge** in 2020 to approximately **10bn lge** in 2030
- Minibuses and cars drive the reduction in fuel use
- Fuel consumption by buses rises over time due to the increase in transport activity by bus

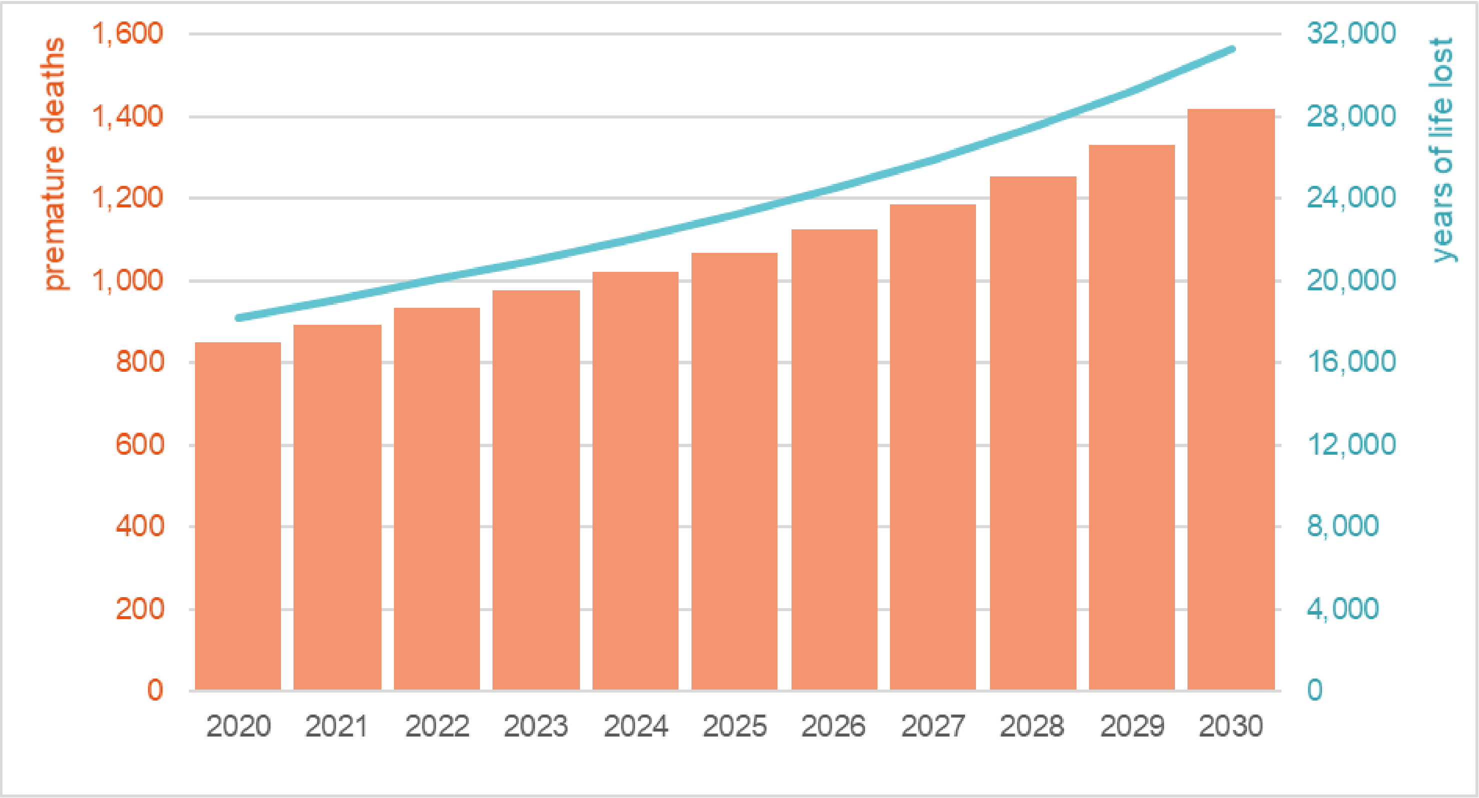
Spending on fuel is approximately USD 27bn lower in Unconditional scenario

- Annual spending on fuel is **USD 3.5bn** lower in 2030, with cumulative savings of **USD 27bn** over the decade
- Fuel savings are equivalent to around **0.5% of national GDP**
- Reduced fuel consumption can also lower government outgoings on fuel subsidies

Savings represent **conservative estimates** based on simplified assumption that fuel costs remain at current levels…



Health impacts from road transport air pollution rise steeply over time in the Baseline scenario

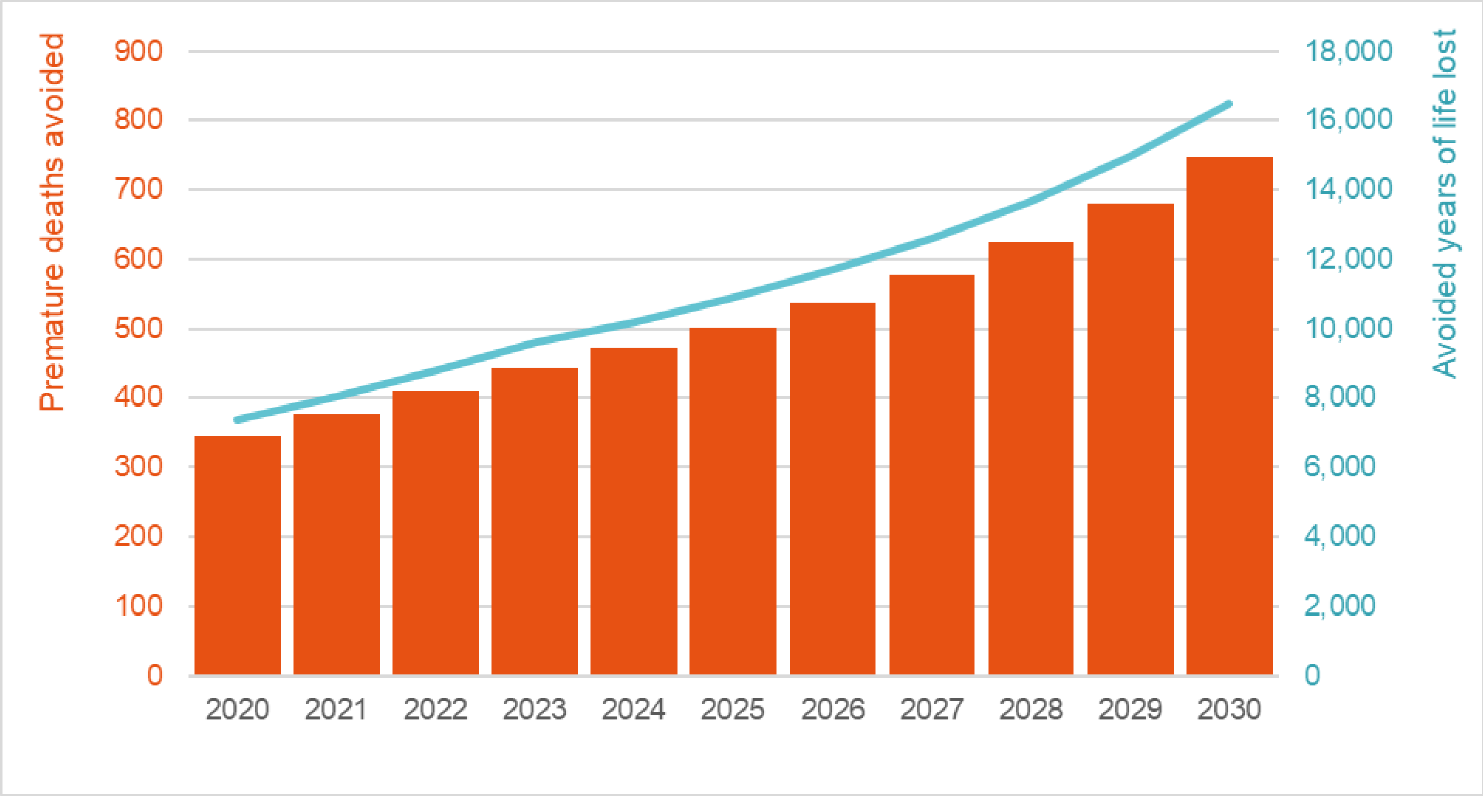


- Road transport emissions in the Baseline scenario would lead to **12,000 premature deaths**, or **260,000 years of life lost** between 2020-2030
- Health impacts from road transport emissions have an economic cost on the order of **USD 2bn** over the decade

Note: Impact estimates do not include the effects on children and therefore likely represent **significant underestimates of the true cost.** A World Bank study for Lagos found that children under 5 account for approximately 60% of total air pollution impacts (from all sources).

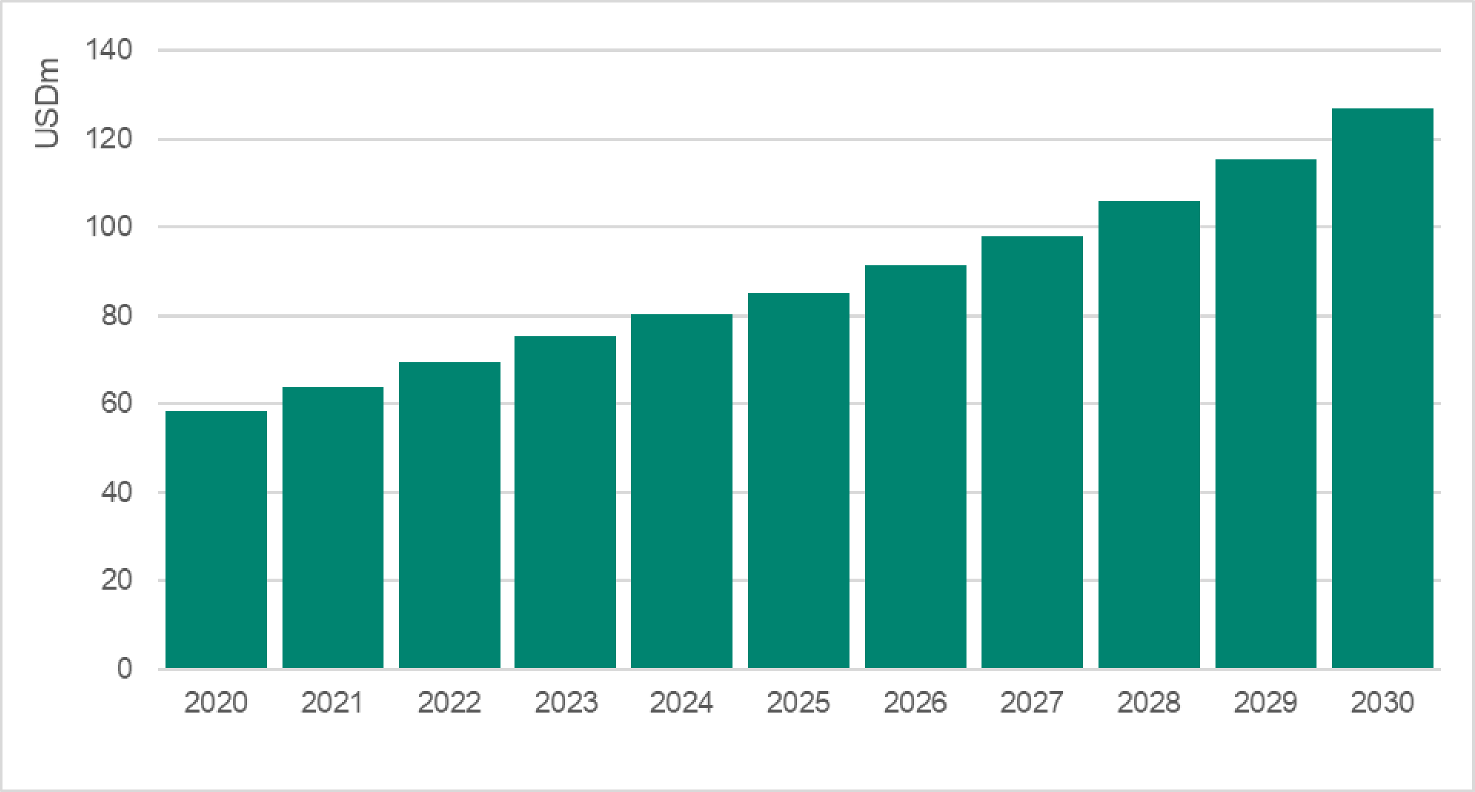
https://openknowledge.worldbank.org/bitstream/handle/10986/33038/The-Cost-of-Air-Pollution-in-Lagos.pdf?sequence=5&isAllowed=y

Mitigation measures in the Unconditional scenario prevent around 6,000 premature deaths



- Reduced fuel combustion (due to emissions standards and modal shift) can **prevent 750 deaths a year** by 2030 and **16,500 years of life lost**
- Cumulatively over the decade measures can prevent **5,700 premature deaths** and **124,000 years of life lost**

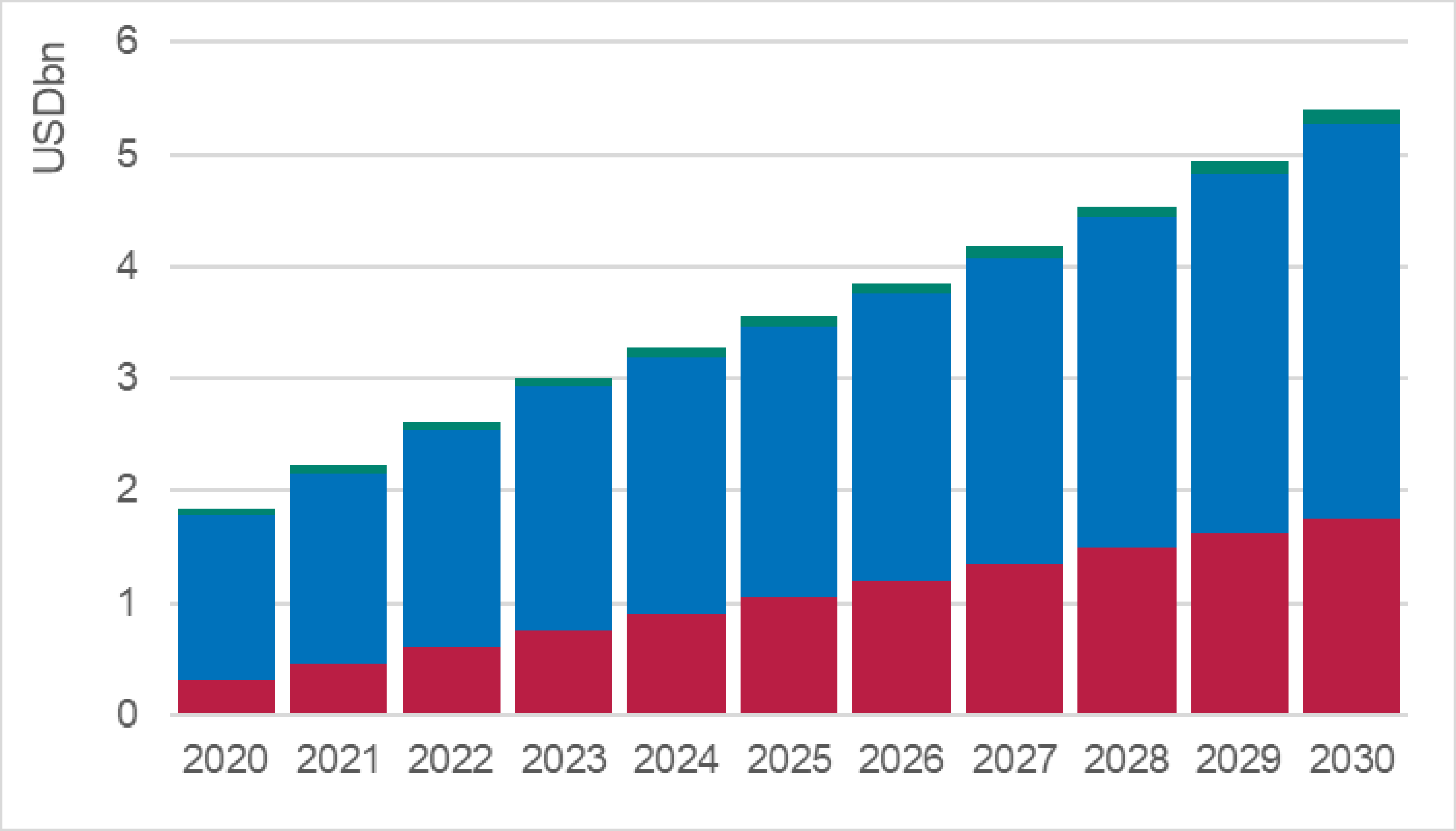
Mitigation measures in the updated NDC reduce costs from air pollution by USD 560m

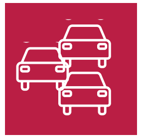


- Economic value of avoided health costs rises to over **USD 125m** a year in 2030
- Cumulative benefits over the decade are on the order of **USD 1bn**
- Magnitude of benefits likely to be materially higher when considering additional impacts such as:
  - Premature deaths amongst children
  - Increased prevalence of non-fatal illness (e.g. respiratory problems)

Mitigation measures for Nigerian road transport sector can drive USD 39bn economic benefits

- Annual economic benefits of mitigation measures set out in Unconditional scenario rise to **USD 5.4bn** by 2030
- Cumulative quantified benefits over the period of **USD 39bn (NGN 16tr)**
- Fuel savings account for the largest economic benefits, followed by reduced congestion and air pollution health impacts





Note: Estimates across all impact types are based on conservative assumptions and are likely to reflect underestimates of the true value of economic benefits (see individual impact slides for further details).

QUESTIONS / COMMENTS / FEEDBACK

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