Future of Mobility –
Staying on course between vision and reality

International Mobility Days 2023

Vienna, 23 November 2023


How did we
envision the
Future of Mobility
in the past and what
has changed?

The future of mobility is …

sustainable,

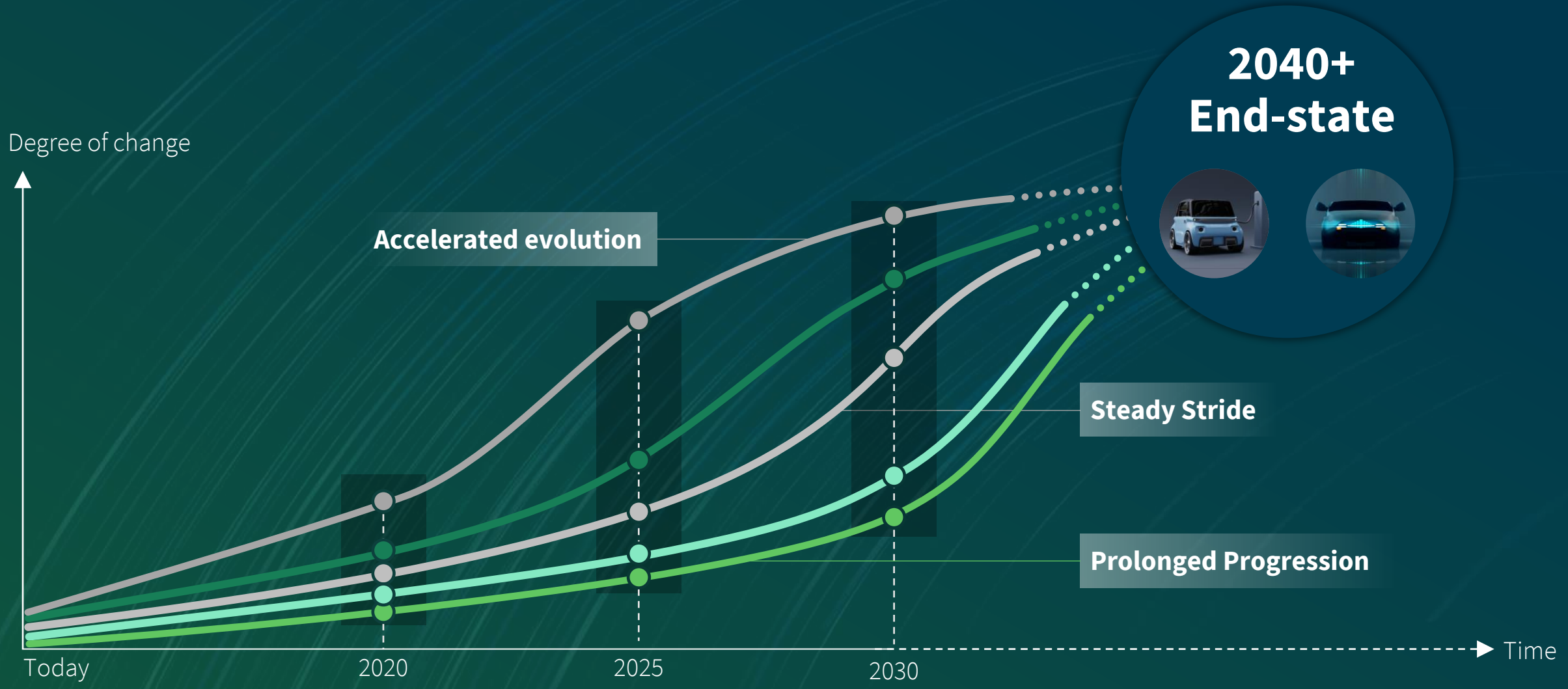
seamless,

affordable

with technology as the key enabler

Source: Roland Berger

The key question is “WHEN”



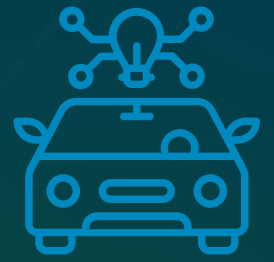
Source: Roland Berger

Focus topics for today

Transition to zero-emission vehicles

Long-distance mobility

Autonomous Driving



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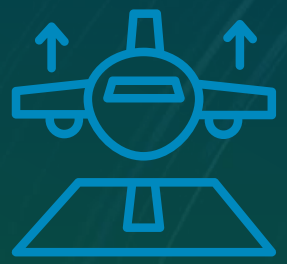

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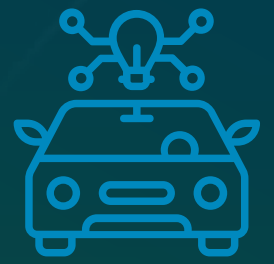
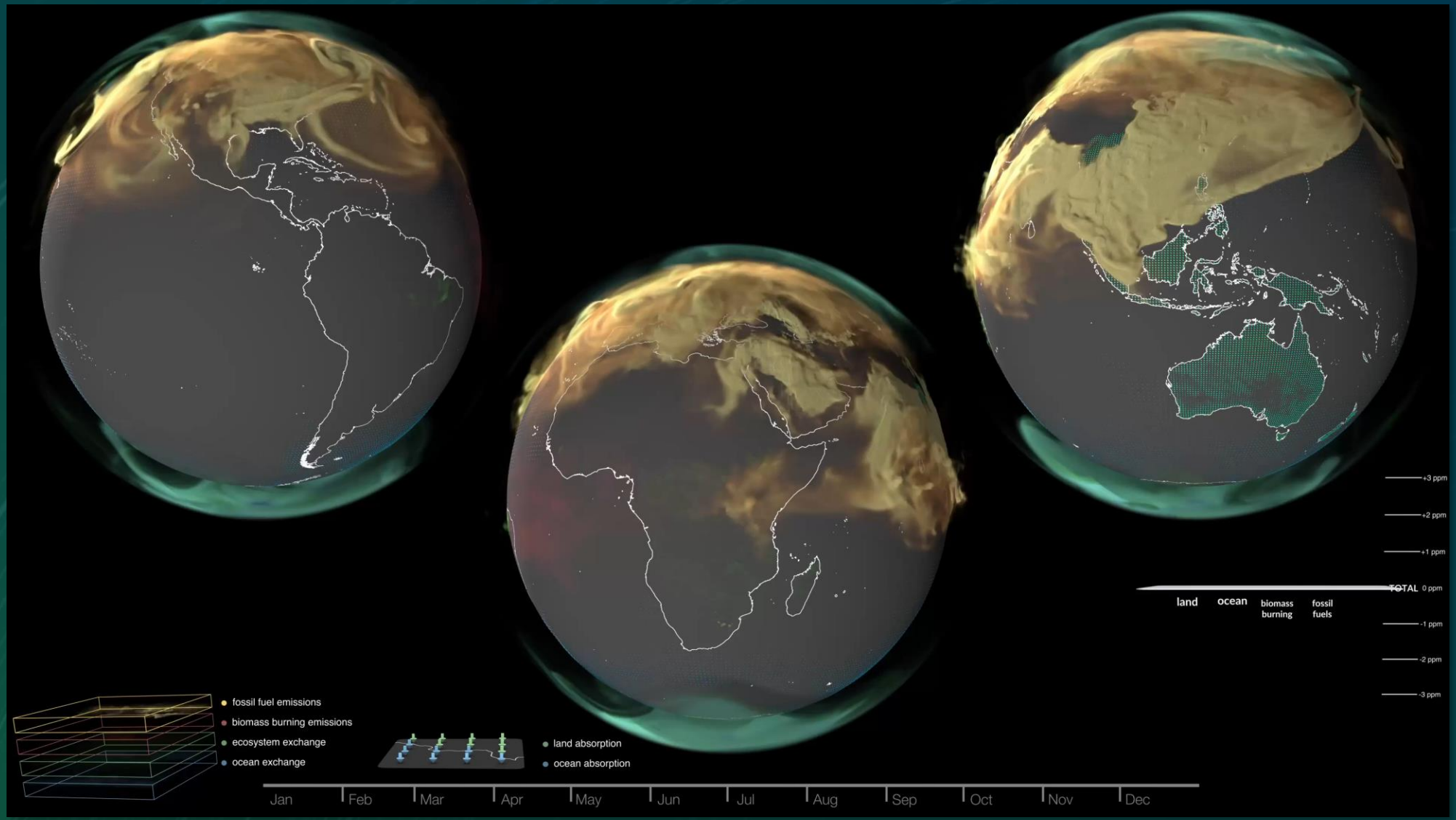


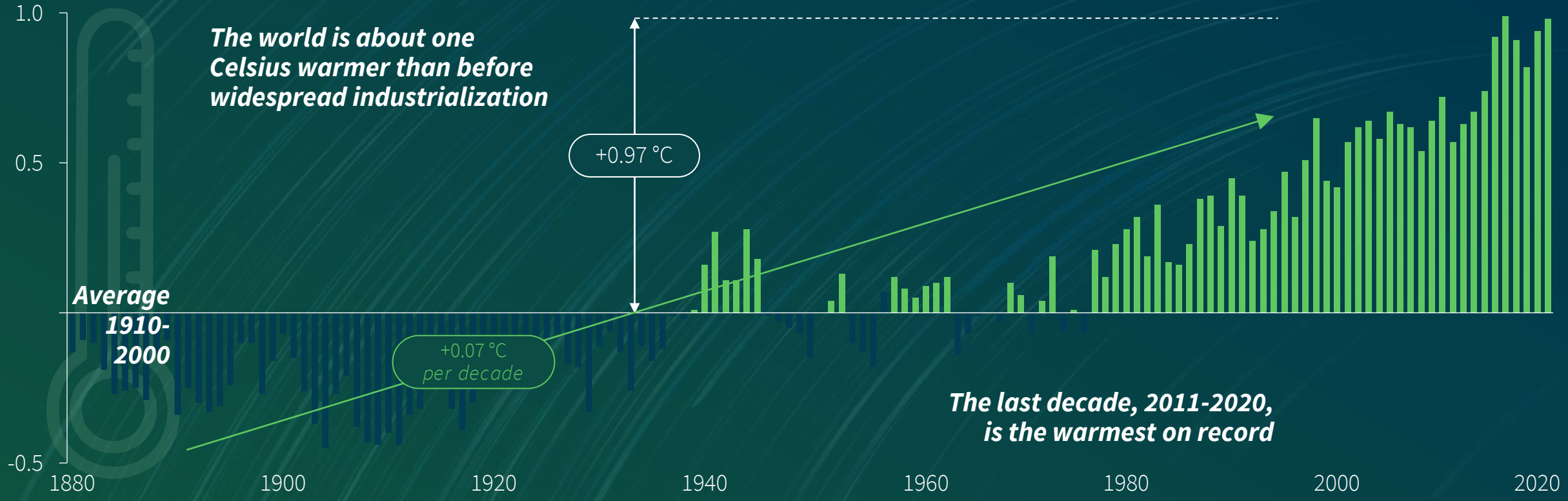
Global GHG emissions illustrated by NASA



Source: NASA's Scientific Visualization Studio, ID 5110, https://svs.gsfc.nasa.gov/5110

Year 2020 was one of the three warmest years on record – Global temperature was ~1°C above 20th century average

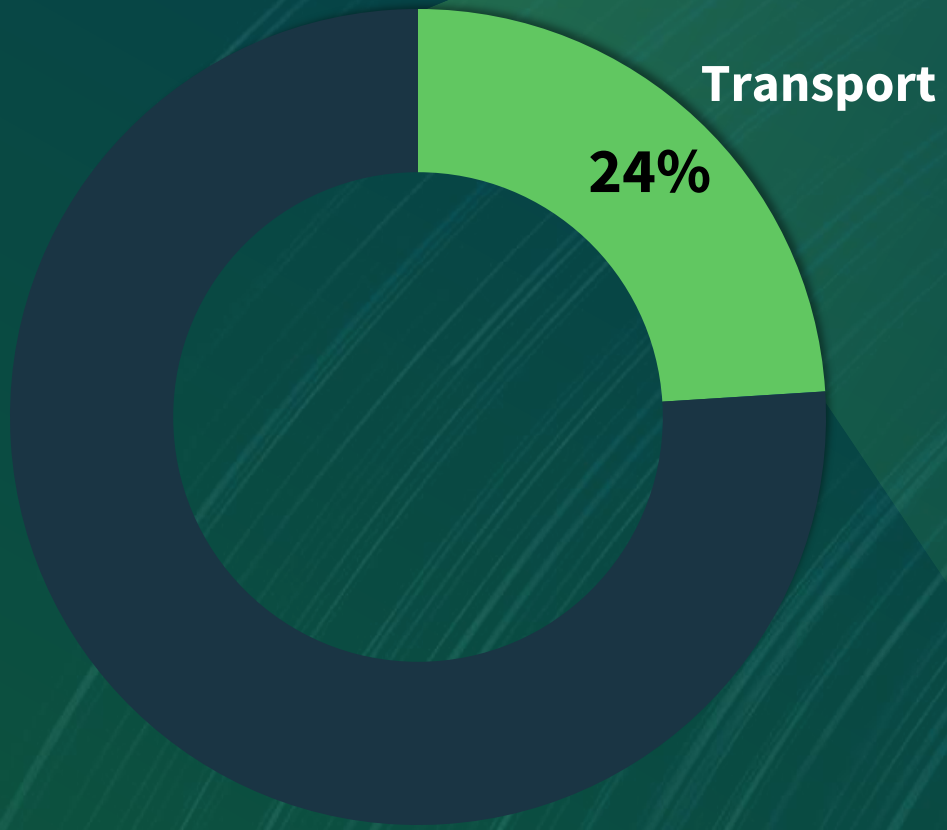
Development of global annual mean surface temperature (GMST)



NOAA data refer to observed global mean surface temperature

Source: NOAA (Global time series 2020), WMO, Roland Berger

Global CO2 emissions from Transport



2.2% **Other**
(mainly transport of oil, gas, water. Steam and other materials via pipelines)

1% **Rail**

10.6% **Shipping**

11.6% **Aviation**
(81% passenger; 19% from freight)

29.4% **Road** (freight)
(includes trucks and lorries)

45.1% **Road** (passenger)
(includes cars, motorcycles, buses and taxis)

1) Based on global CO2 emissions

Source: IEA 2020; ICCT

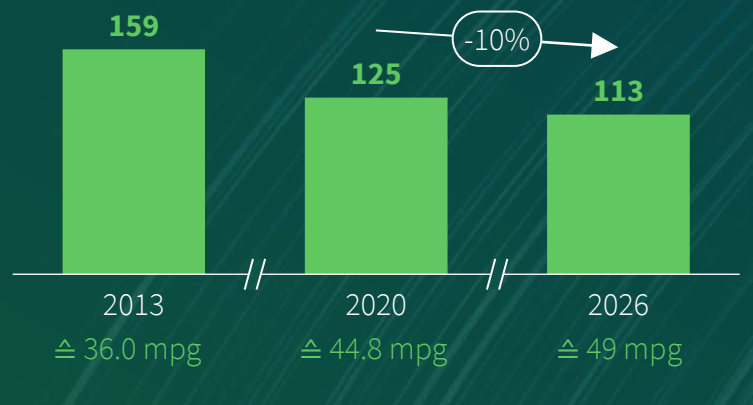
Vehicle emissions restrictions especially in Europe expected to greatly accelerate EV transition

Passenger car GHG emissions and fuel consumption regulations

GHG emissions/fuel consumption [in NEDC[1)] g/km equivalent]

USA

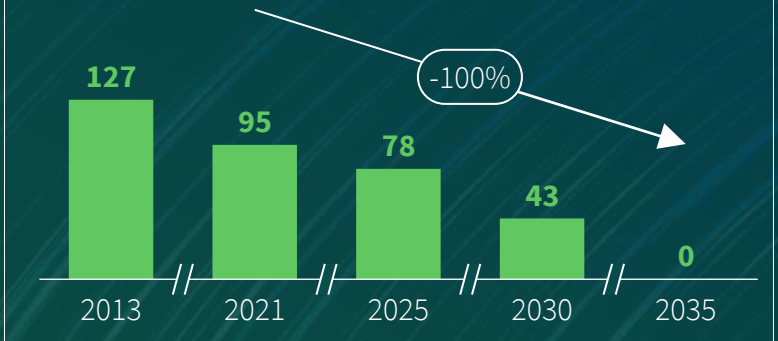
US federal – Corporate average fuel economy (CAFE) standards[2)]



CA and 12 other states to require all new passenger cars and trucks sold in 2035 to be zero emission

Europe

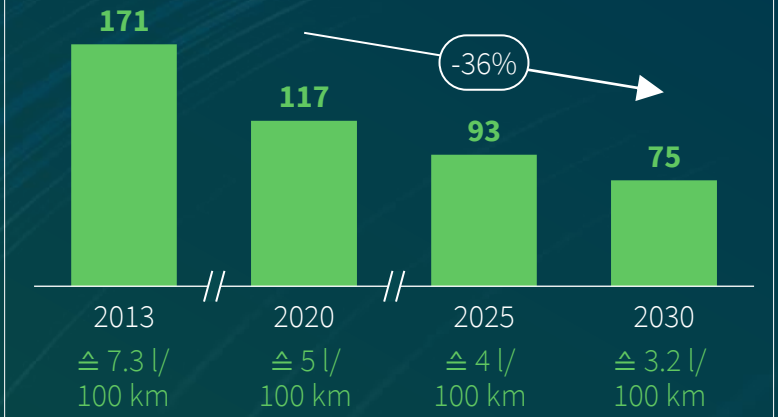
European CO_2 emissions target[3)]



EU to effectively ban sale of petrol and diesel cars beginning in 2035

China

China – Corporate average fuel consumption[4)] (CAFC) (Phase IV)



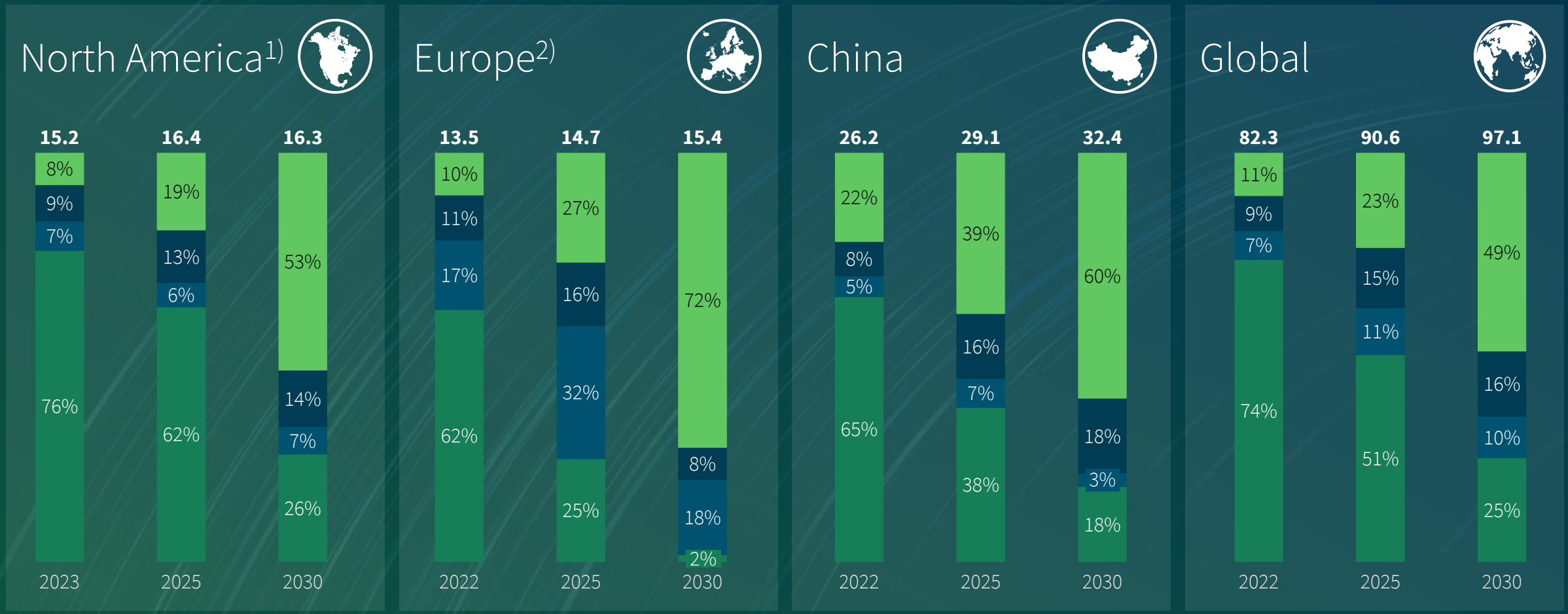
By 2035, all new vehicles must be NEVs and selected provinces to ban sales of ICEs by 2030

1) NEDC = New European Driving Cycle; 2) Footprint-based corporate average; converted to NEDC; 3) Weight-based corporate average; 4) Weight-class-based per vehicle and corporate average

Source: European Environment Agency, Government of California, ICCT, Reuters, NHTSA, Transport Policy, World Economic Forum

Battery electric vehicle demand expected to increase to c. 49% by 2030 globally

Light vehicle powertrain shares by region [m vehicles; %]



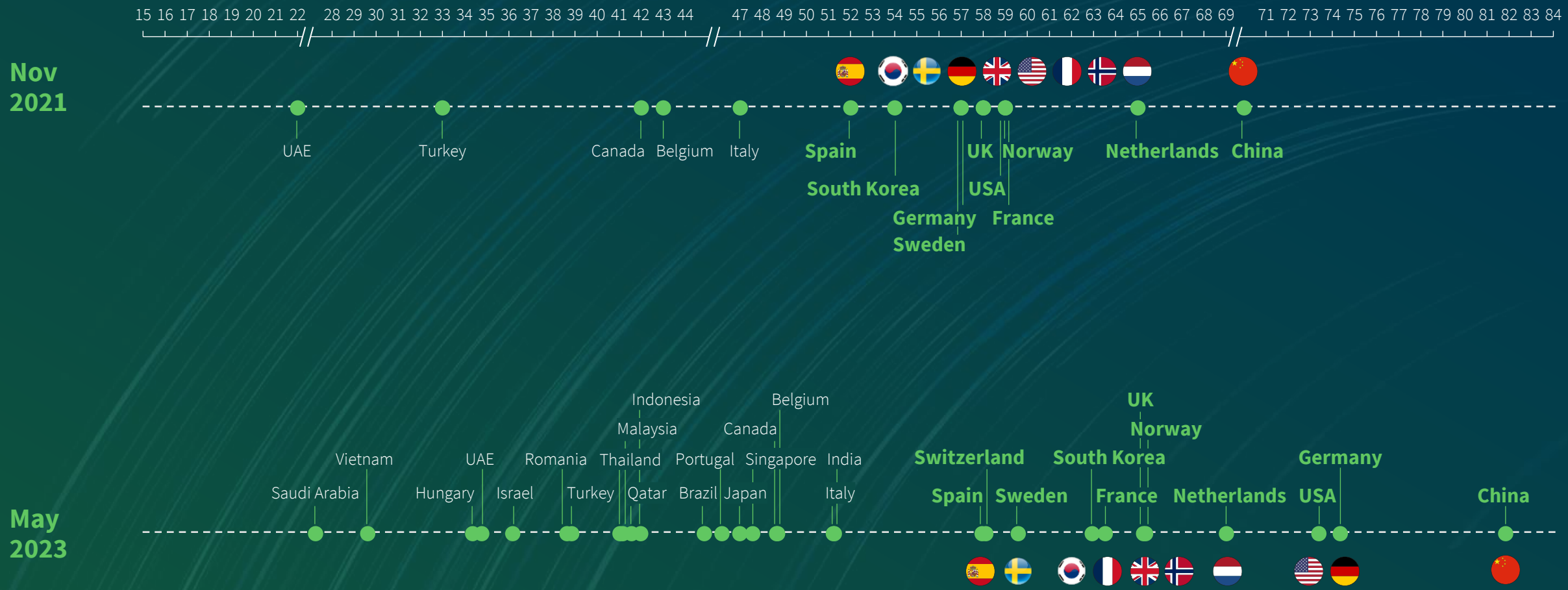
1) USA, Mexico and Canada 2) EU27+UK, Norway, Switzerland

BEV PHEV/FHEV MHEV ICE

Source: IHS Markit, Interviews with market participants, Roland Berger

Overall trend is clearly pointing towards improvement of EV charging infrastructure

Charging infrastructure: RB EV Charging Index 2021 vs. 2023



Source: Roland Berger EV Charging Index. Edition 1 and 4

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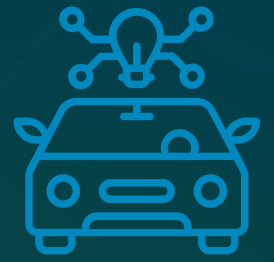
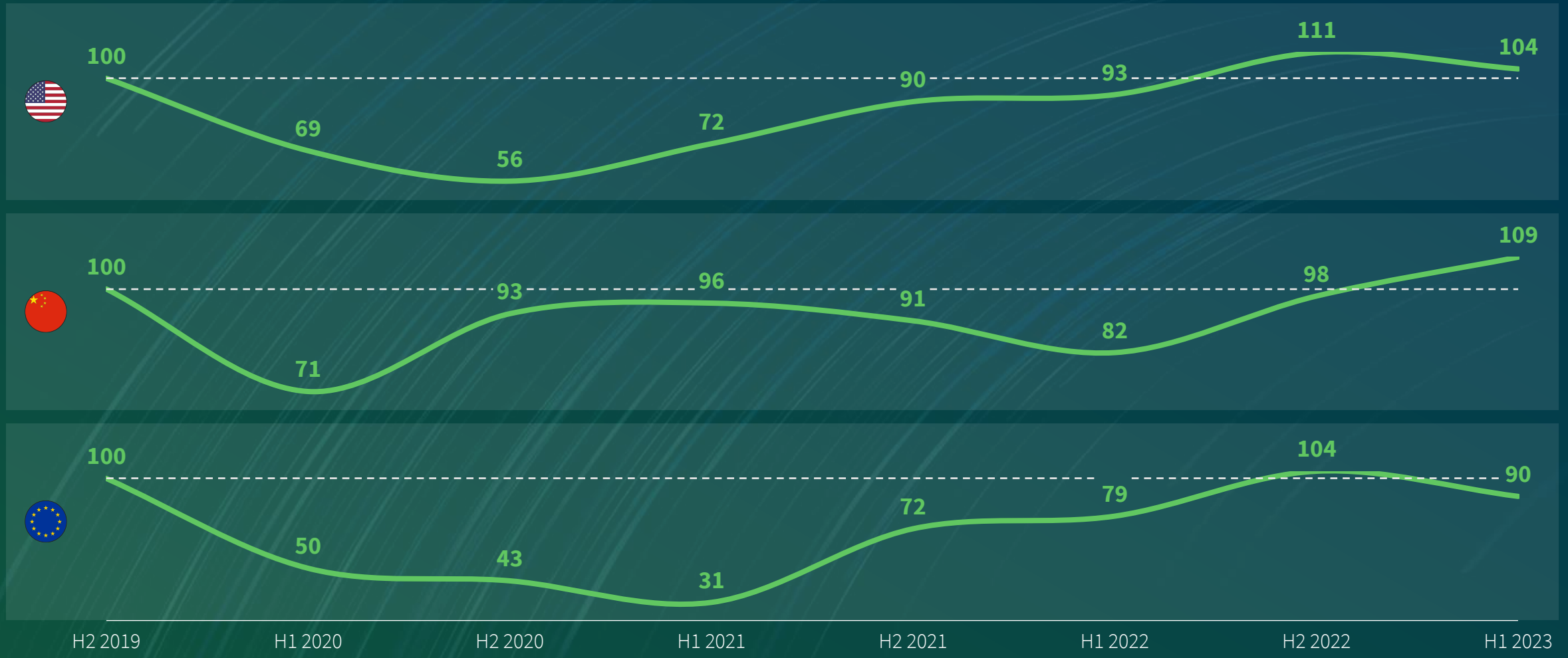


Airline capacities are recovering and reach pre-pandemic levels

Airline seat numbers [100=2019 level]



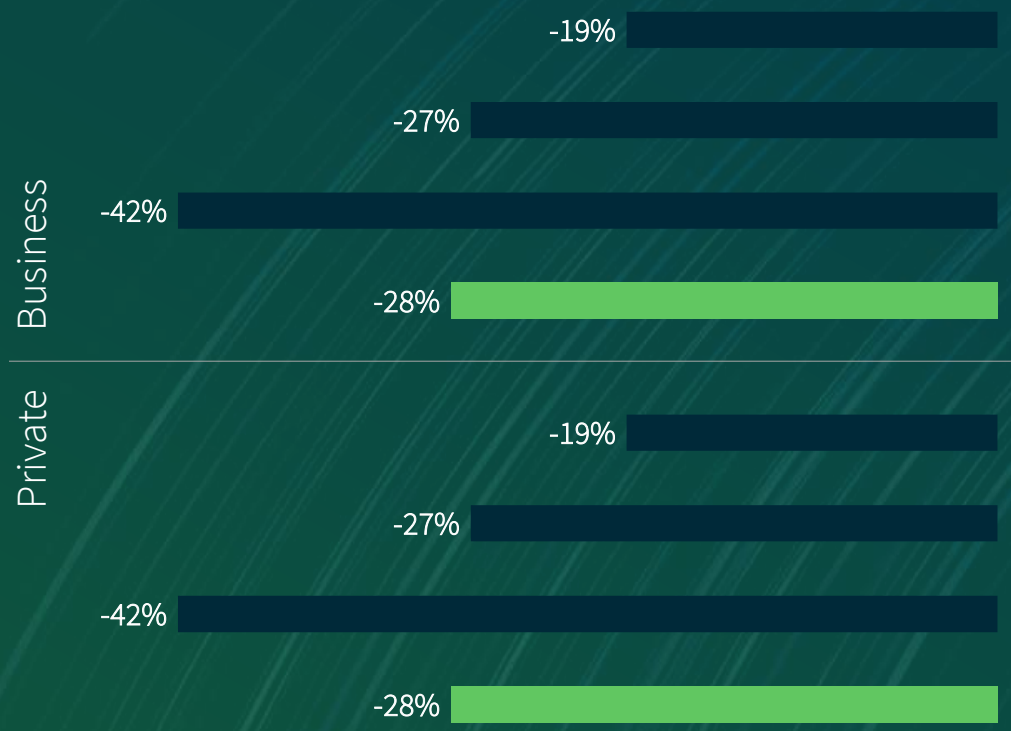
Source: Roland Berger Future of long-distance mobility study, 2023

However, air traffic may be hit by declining travel demands and preference shift to train due to sustainability concerns

Demand for trips is expected to fall…

of planned trips in the next few years

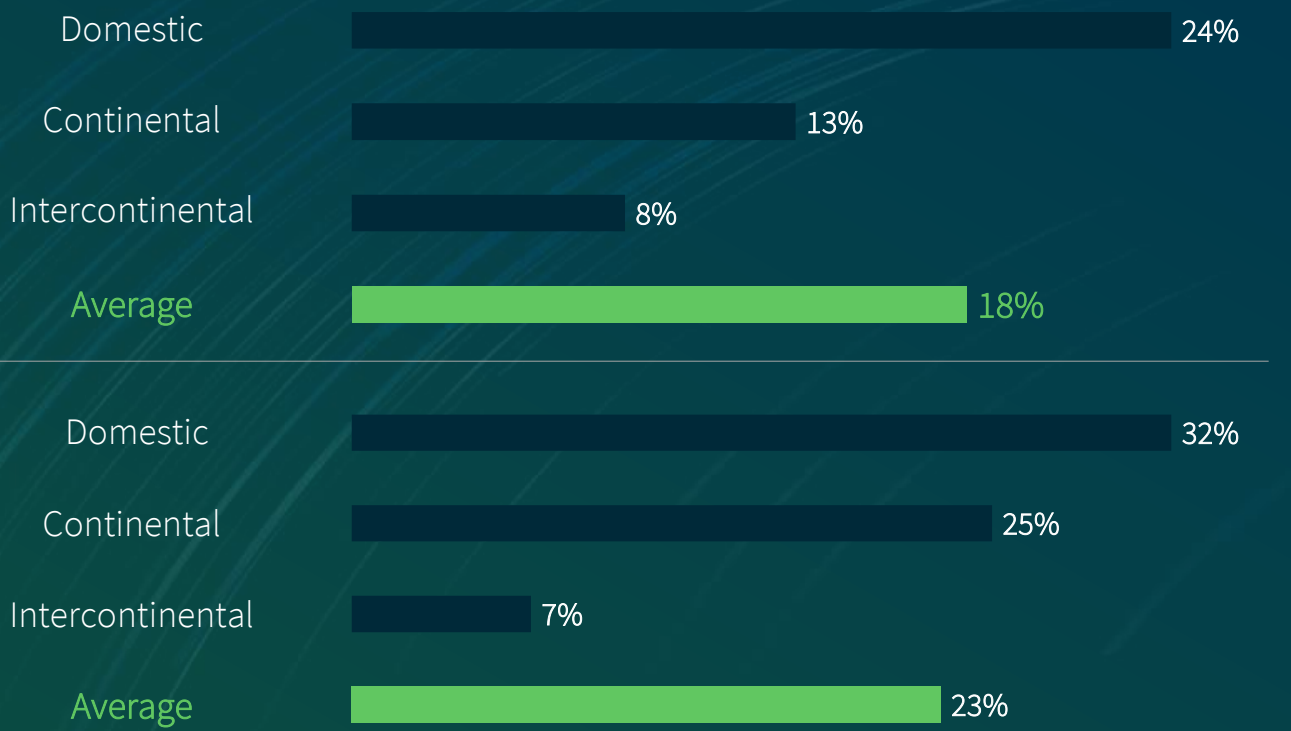
22' vs. pre-Covid survey [%]



…with some shift from air to train

Willingness to replace air with train

22' survey [%]



Source: Roland Berger Future of long-distance mobility study, 2023

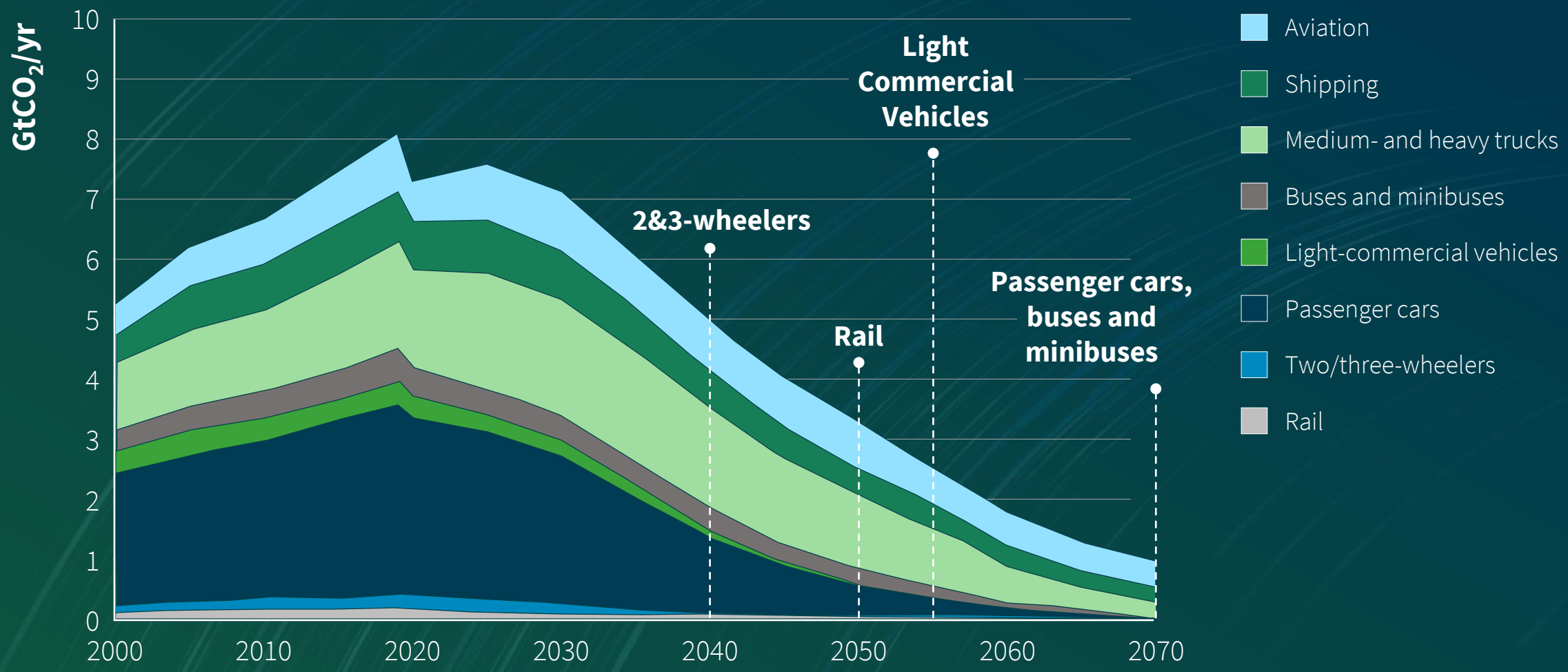
What are the reasons for your changed mobility behaviour in business travel in the next few years?

Reasons for changes in mobility behavior

	22 survey [%]	*Δ 22-21 survey [pts]*
Familiarity with virtual communication	61%	+19 pts
Corporate travel policies	43%	+7 pts
Regulations	38%	+0 pts
Environmental concerns	37%	+8 pts
Health concerns	34%	+4 pts
No change	6%	+0 pts

Source: Roland Berger Future of long-distance mobility study, 2023

Global CO2 emission in transport by mode in Sustainable Development Scenario



Notes: Dotted lines indicate the year in which various transport modes have largely stopped consuming fossil fuels and hence no longer contribute to direct emissions of CO_2 from fossil fuel combustion. Residual emissions in transport are compensated by negative emissions technologies, such as BECCS and DAC, in the power and other energy transformation sectors.

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While Europe is embarking on public AV ride sharing tests, leading players in the US are facing first severe setbacks

MOIA

- Project "ALIKE" aims at testing two different autonomous vehicle types in Hamburg, Germany
- SAE Level 4 grade, starting 2025
- Several private and public partners involved, including the local transport operator HVV and VW Commercial Vehicles

cruise

- Acquired by GM in 2016
- Started operation autonomous ride sharing fleet in November 2021, expanded to 5 US cities
- California DMV opened an investigation following "concerning incidents" involving Cruise AVs resulting in the immediate suspension of its permit to operate autonomous vehicles, effective October 24, 2023.

Source: Press research; company websites and press releases; https://getcruise.com/; https://www.volkswagen-newsroom.com/en/images/detail/volkswagen-group-drives-forward-intelligent-mobility-solutions-37511

Product innovation from OEMs and AD companies to move towards autonomous driving as driver assistance system

Mercedes-Benz

The first to bring SAE Level 3 automated driving to the US

- Approved for use in Nevada, with some limitations:
  - At speeds up to 40 mph
  - The driver must keep their face visible to the in-car cameras at all times

极越

JiYue 01 the "Robocar"

GEELY × apollo

- Pure vision-based intelligent driving solution
- Point-to-Point Pilot Assistance in complex urban scenario
- Collaboration between Geely and Baidu

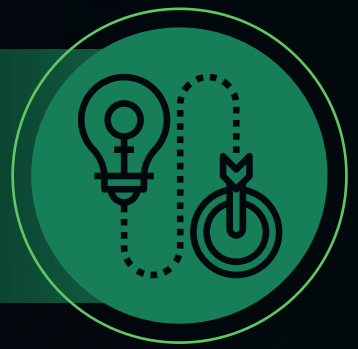
"As technology advances and matures rapidly, I see the potential to fully autonomous driving in 3-5 years"

— Yiping Xia, CEO of JiYue

Source: Company websites and press releases; https://zgh.com/media-center/news/2023-10-27-02/?lang=en; https://group.mercedes-benz.com/innovation/product-innovation/autonomous-driving/drive-pilot-nevada.html

Some suggestions for this conference

Remain
visionaries



Assume ambitious,
but realistic adoption

Be
pioneers


Thank you!