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# The Net Sustainability Impact of Shared Micromobility in Six Global Cities

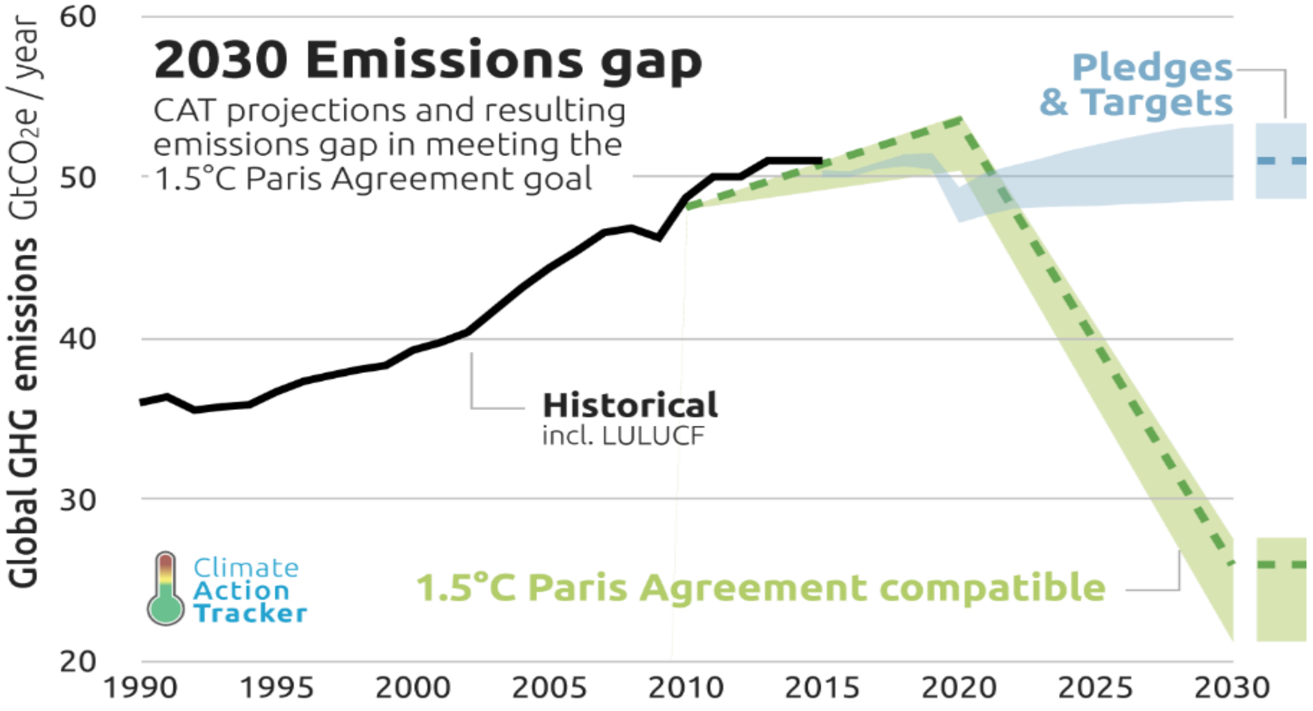
# Agenda



# Introduction

- Shared micromobility in this study refers to shared e-scooters and shared e-bikes
- Popularity of these services and vehicles has increased substantially in recent years
- Life cycle emissions of shared e-scooters has dropped considerably over the past years
- Shared micromobility is discussed as one potential solution to meet climate goals




- Source: Climate Action Tracker (2022)
  CAT Emissions Gap | Climate Action Tracker

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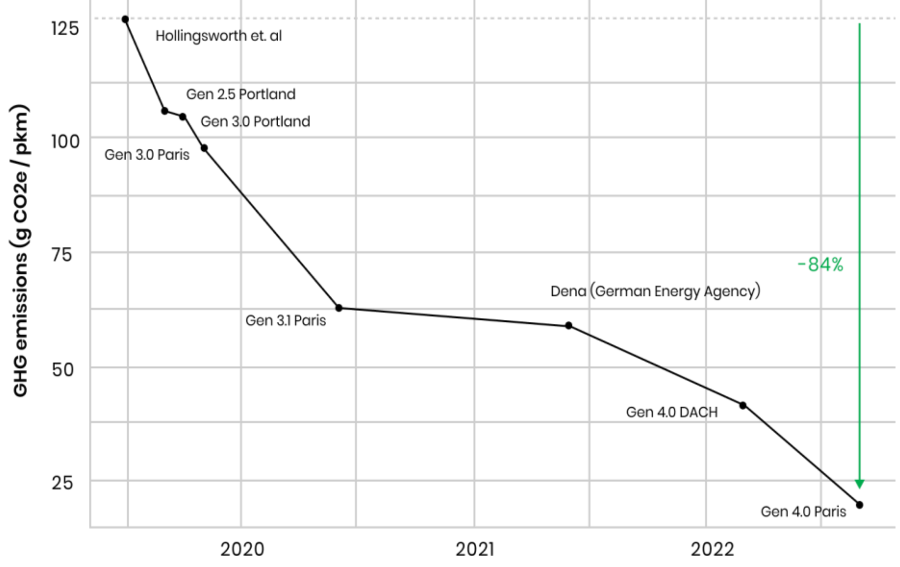
# Previous work and motivation for this study

- Largest mode shift to shared micromobility observed are from walking and public transport
  (Christoforou et al., 2021; Laa and Leth, 2020)
- Competition with taxi/ridehailing and private cars
  (Wang et al., 2022; Guo and Zhang, 2021)
- Positive, negative and no effects found regarding combination with public transport
  (Luo et al., 2021; Merlin et al., 2021; Ziedan et al., 2021)
- Shared micromobility is found to increase net emissions but a path towards net decrease seems possible
  (Reck et al., 2022; Bortoli, 2021; Hollingsworth et al., 2019; Weschke et al., 2022)

**GHG Intensity of e-scooters over time**

Literature review and Lime internal LCAs




- Lime and other shared e-scooter providers find steeply declining specific emissions per passenger kilometer
  (Graph on the right; Anthesis 2022)

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# Research question and objectives

- **Research questions:**
  - Do shared micromobility services reduce emissions in different cities?
  - Which transport policy measures increase the usage of shared micromobility?

- **Objectives:**
  - Generate a snapshot of net emission impacts of shared micromobility...
  - ...in six cities in five countries and three continents worldwide...
  - ...by using locally adapted LCA numbers and original user data


Graphics: niklasfotografics

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1. Introduction and Motivation
2. **Data and Method**
3. Results
4. Policy Implications
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# Data: Life Cycle Assessment

- Two sources as basis:
  - International Transport Forum (2020)
  - Anthesis (2022) on behalf of Lime
- Update to 2022 and making numbers locally specific
  - Increasing decarbonization of battery production of cars and buses (iea, 2022)
  - Declining $CO_2$ intensity of electricity production and improvement of fuel efficiency (Bieker, 2021)
  - Adaptation of road space use by vehicle type (FGSV, 2015)
  - Local congestion levels and infrastructure usage (TomTom, 2022)
  - Considering the operations emissions of shared micromobility services (ITF, 2020)
  - Summary of the 132 vehicle types by ITF (2020) to 24 considered in this study by applying average fleet compositions.

# Rider data of active shared micromobility users (n=4,167)

- Persons who have conducted a Lime ride within the last days, received an invitation for the survey
- Surveyed cities: Berlin, Dusseldorf (Germany), Paris (France), Stockholm (Sweden), Seattle (USA), Melbourne (Australia)
- Survey time: May 13th to June 13th 2022
- Survey asked questions regarding four topics:
  - Items about last shared micromobility usage incl. item about replaced mode
  - General mobility behavior
  - Likely response to proposed policy measures
  - Socio-demographic information

**Some characteristics of the sample cities:**

Varying sizes, car dependencies and GHG intensities

| City | Population (1000) [1] | Car modal share [2] | Electricity ($gCO2/kWh$)[3] |
|---|---|---|---|
| Berlin | 3 677 | 26 % | 268 |
| Düsseldorf | 592 | 35 % | 268 |
| Paris | 12 532 | 25 % | 51 |
| Stockholm | 950 | 46 % | 6.8 |
| Seattle | 4 019 | 83 % | 324 |
| Melbourne | 4 976 | 72 % | 519 |

1) Source: Wikipedia; metropolitan regions
2) Sources: SrV / MiD, Deloitte City Mobility Index, Censusreporter.org
3) Source: ICCT, Bieker (2021)

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# Overview about the sample

**Large sample size (n=4,167)**

- But not normalized against local population
  - i.e. self selection, not representative.
- Only Lime users via Lime app. This excludes Lime trips booked via Uber

**Typical respondent:**
Higher income young man with limited public transport season ticket and private car availability.

## Sample statistics (selected indicators)

| Indicator | Value | Sample |
|---|---|---|
| Women | | 29 % |
| Income | Below median | 36 % |
| | Above median | 64 % |
| Age | 18-39 | 68 % |
| | 40-59 | 29 % |
| | > 60 | 3 % |
| PT season ticket availability | | 55 % |
| Car(s) in household | | median = 1 |

 

# Calculation of net emissions

- Difference of emissions regarding...
- ...usage of shared micromobility ($e_{micromobility}$) and...
- ...usage of replaced mode ($e_{replaced}$)...
- ...under consideration of the trip distance ($d_{trip}$).


Source: KVV (2021)

$$E_{net} = \left(e_{micromobility} - e_{replaced}\right) * d_{trip}$$

  

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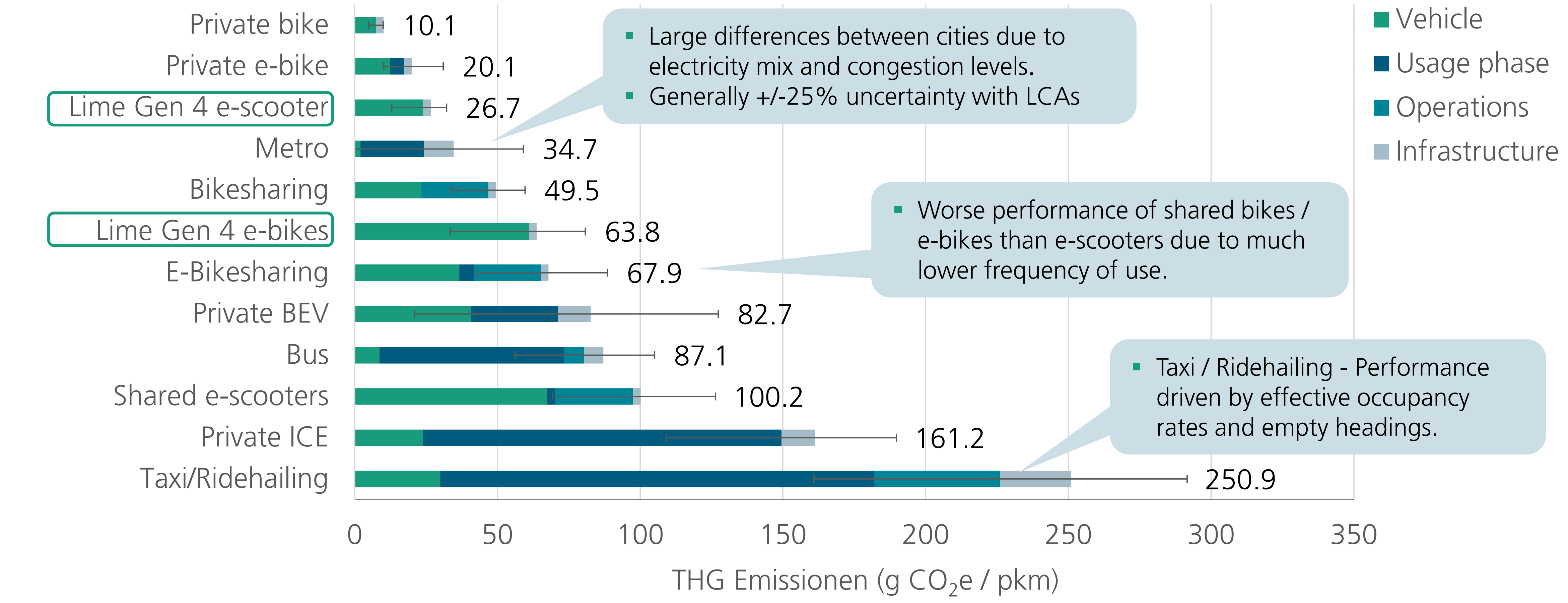
# Average life cycle results for selected modes and vehicle classes

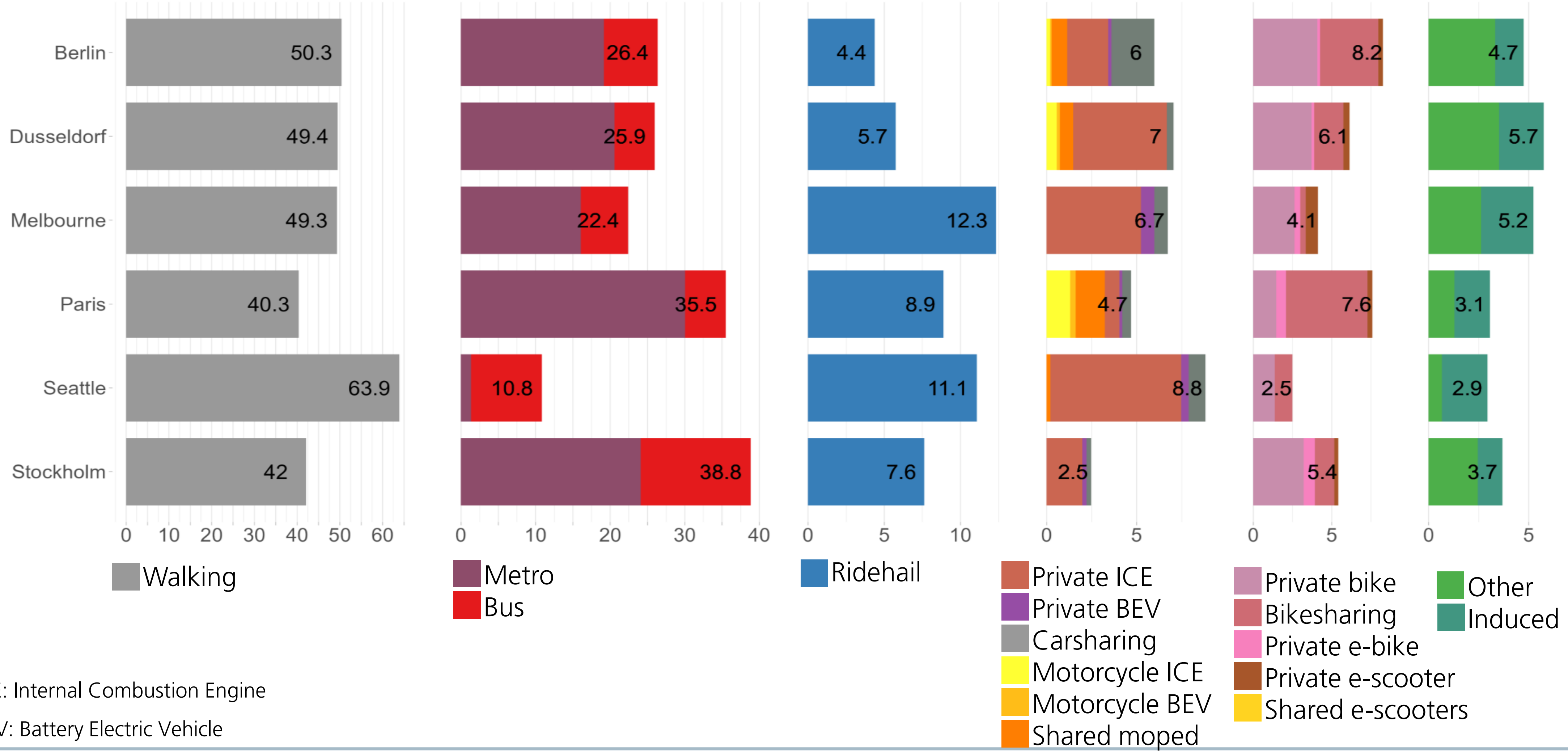
## Gen-4 e-scooters below metro and shared bikes: usage frequency and energy efficiency




Error bars indicate (a) variations between cities due to electricity grid emissions or congestion and (b) a general uncertainty of +/- 25 % across all LCA estimates.

# Shared e-scooters: mode shift

## Mainly (80%) from walking, cycling and PT, but 10-20% from car-based mobility; ~3% induced trips

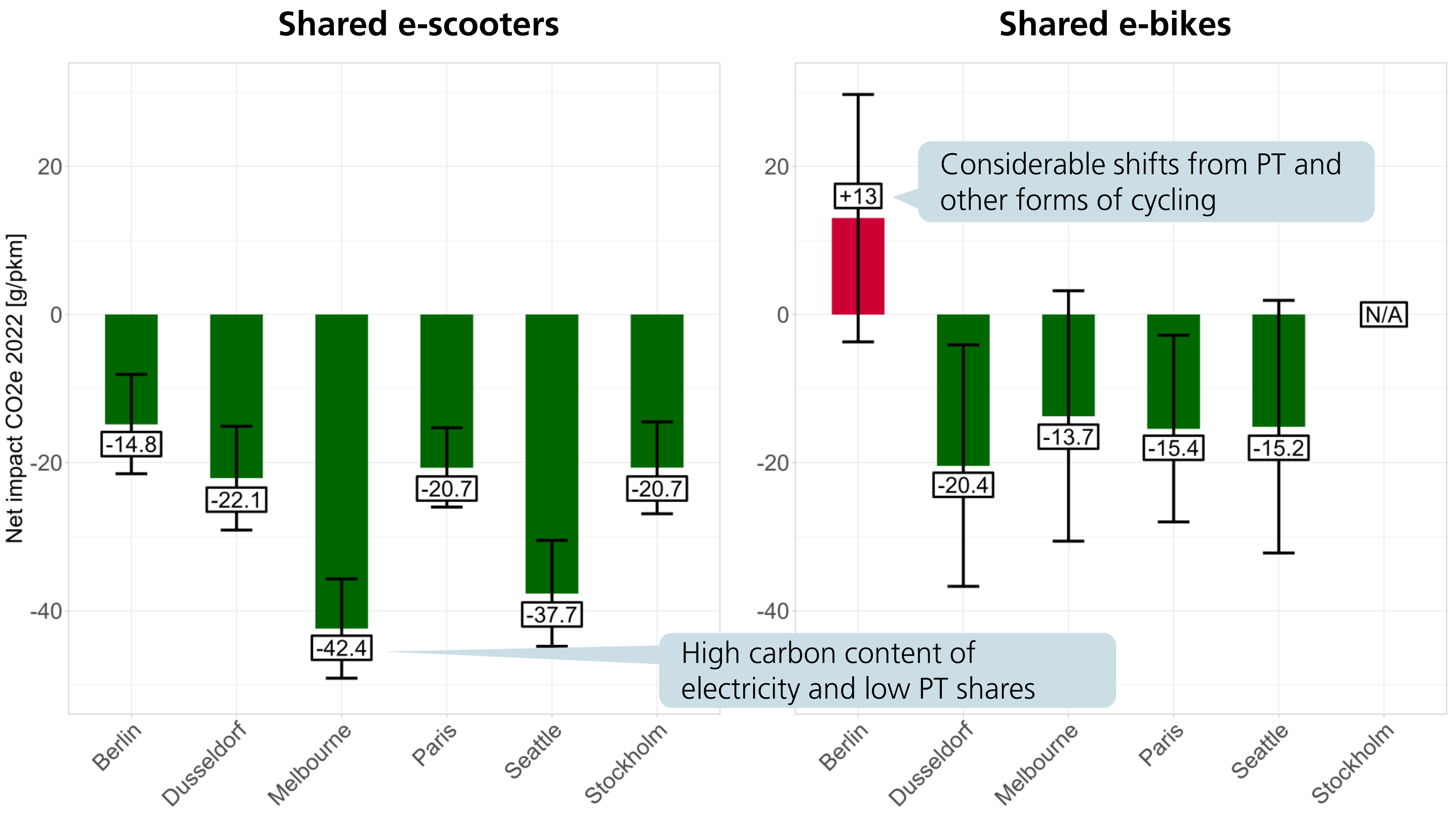



ICE: Internal Combustion Engine

BEV: Battery Electric Vehicle

# Net impact per passenger kilometer in cities surveyed

## Net savings for nearly all cities with shared e-scooters & e-bikes: ~15 - 20 g $CO_2$e/pkm



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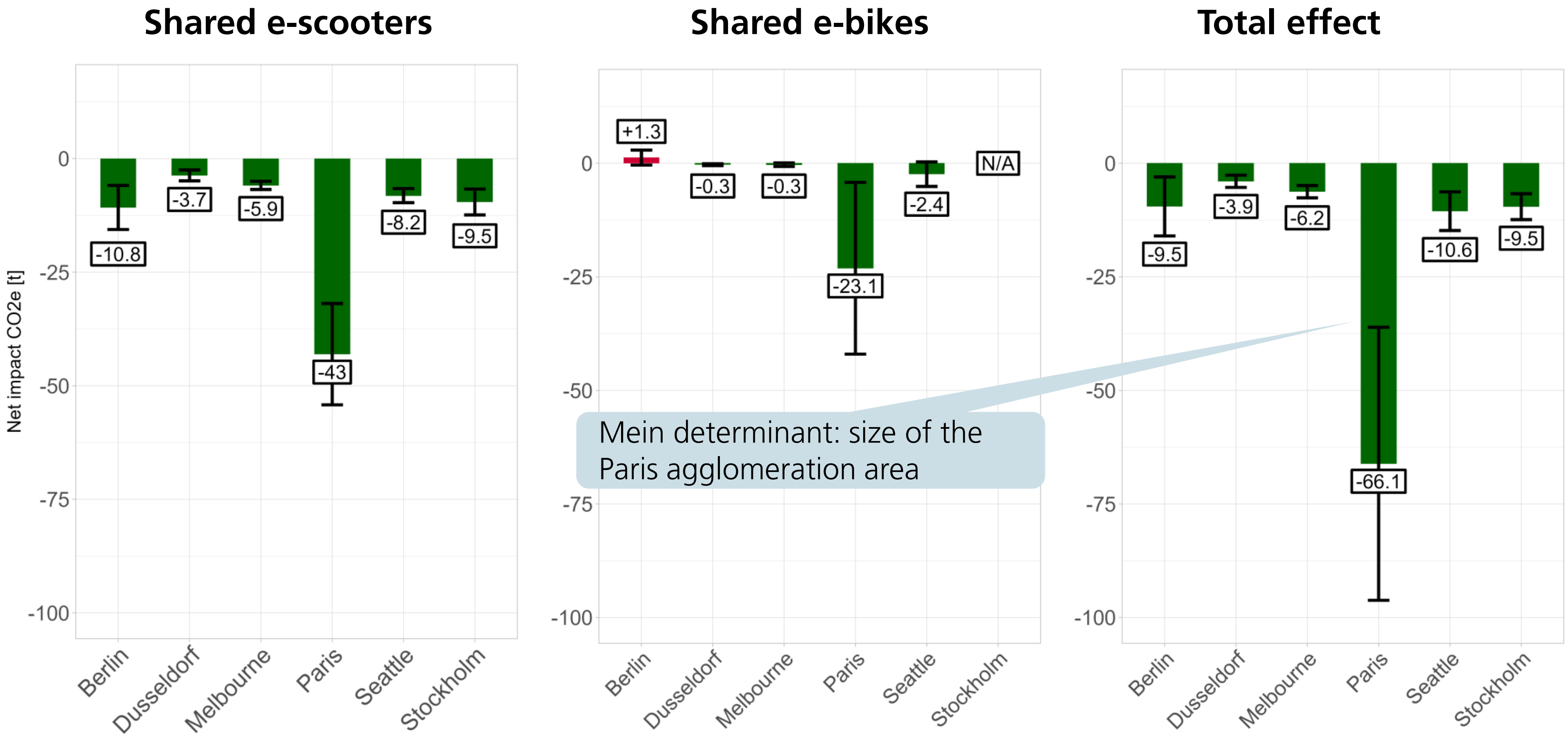
# Total net impact on city-level in time of survey (4 weeks)

## Survey results scaled to all Lime services offered. Main drivers: fleet size and city size



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# Potential of policy measures

## Speed and price changes for taxi more intensive than for car; least effect with bike investments

| **Policy Instruments & targets** | | **Increase of usage of shared micromobility...** | |
|---|---|---|---|
| **Measure** | **Affected mode** | **...more than twice as before** | **...somewhat more than before** |
| Increase of travel time... | ...for car | 38 % | 29 % |
| | ...for taxi/ridehail | 47 % | 28 % |
| Increase of travel cost... | ...for car | 29 % | 29 % |
| | ...for taxi/ridehail | 42 % | 30 % |
| Improving cycling infrastructure... | ...for car | 27 % | 29 % |
| | ...for taxi/ridehail | 32 % | 30 % |

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# Conclusion

## Implications for the industry and for policy-makers

### Implications for the Industry

- Further **electrification of service vehicles** needed for shared services operations (e.g. fleet swaps and recharging)
- **Balanced offer** between ease of use and avoidance of additional traffic
- Encourage shift from **taxi and ridehailing services**
- Coordinate shared micromobility with **public transport** to overcome the last mile challenge

### Implications for policy

- **Speed limits** for cars can be levers to higher use of shared micromobility
- Increasing the cost of using private motorized transport through **taxes and charges** is another lever
- Providing **safe infrastructure** for cycling and micromobility to increase use: expensive, long investment times and more limited effects only.
- "**Mobility hubs**" could provide easy transfers to public transport

# Thank you for your attention!
# Do you have questions?

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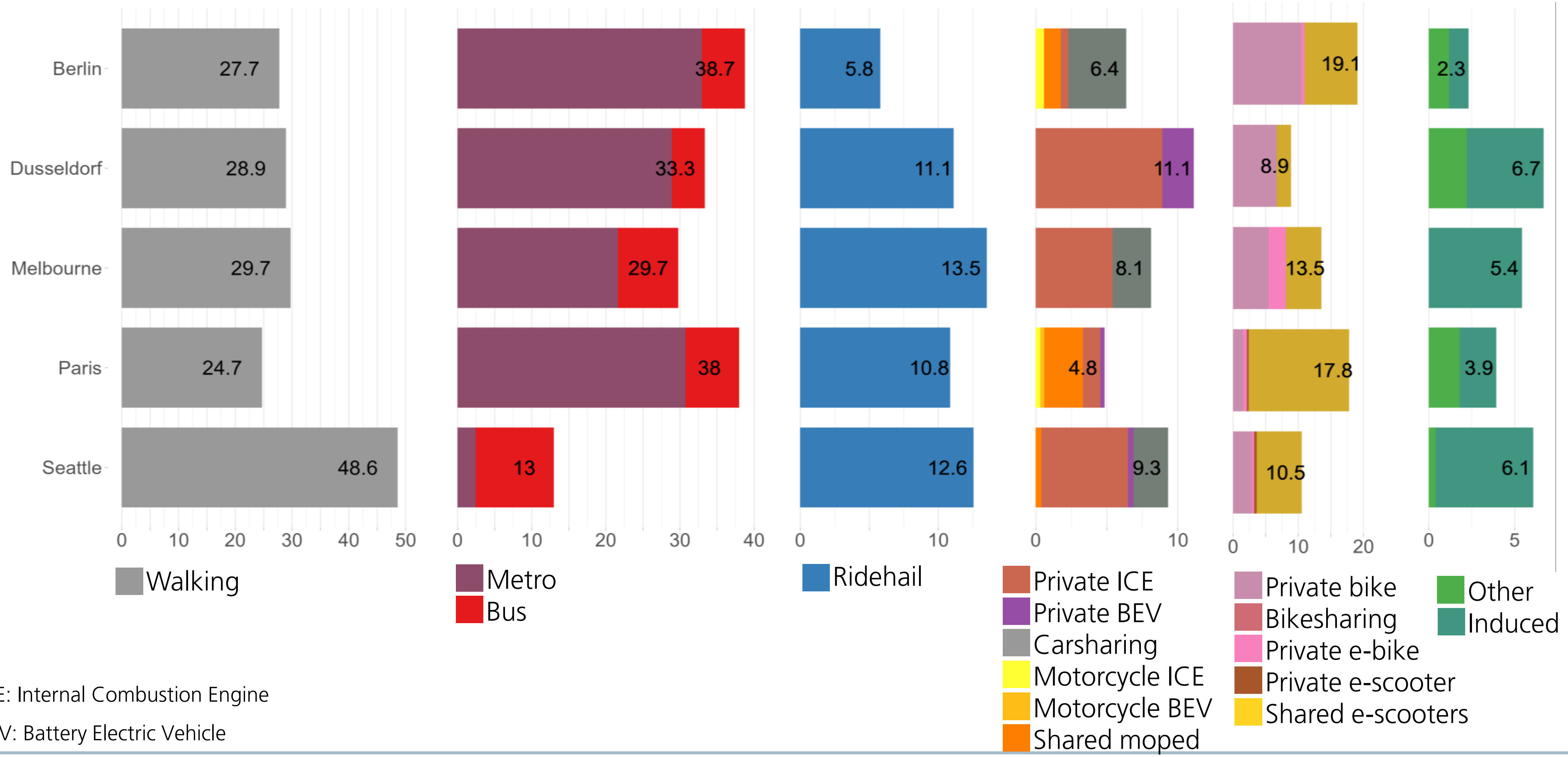
# Shared e-bikes: mode shift

## Mainly (~75%) from walking, PT and other forms of cycling; ~5% induced trips

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