2050 CliMobCity

Interreg Europe

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Reflection on cities' demonstrations

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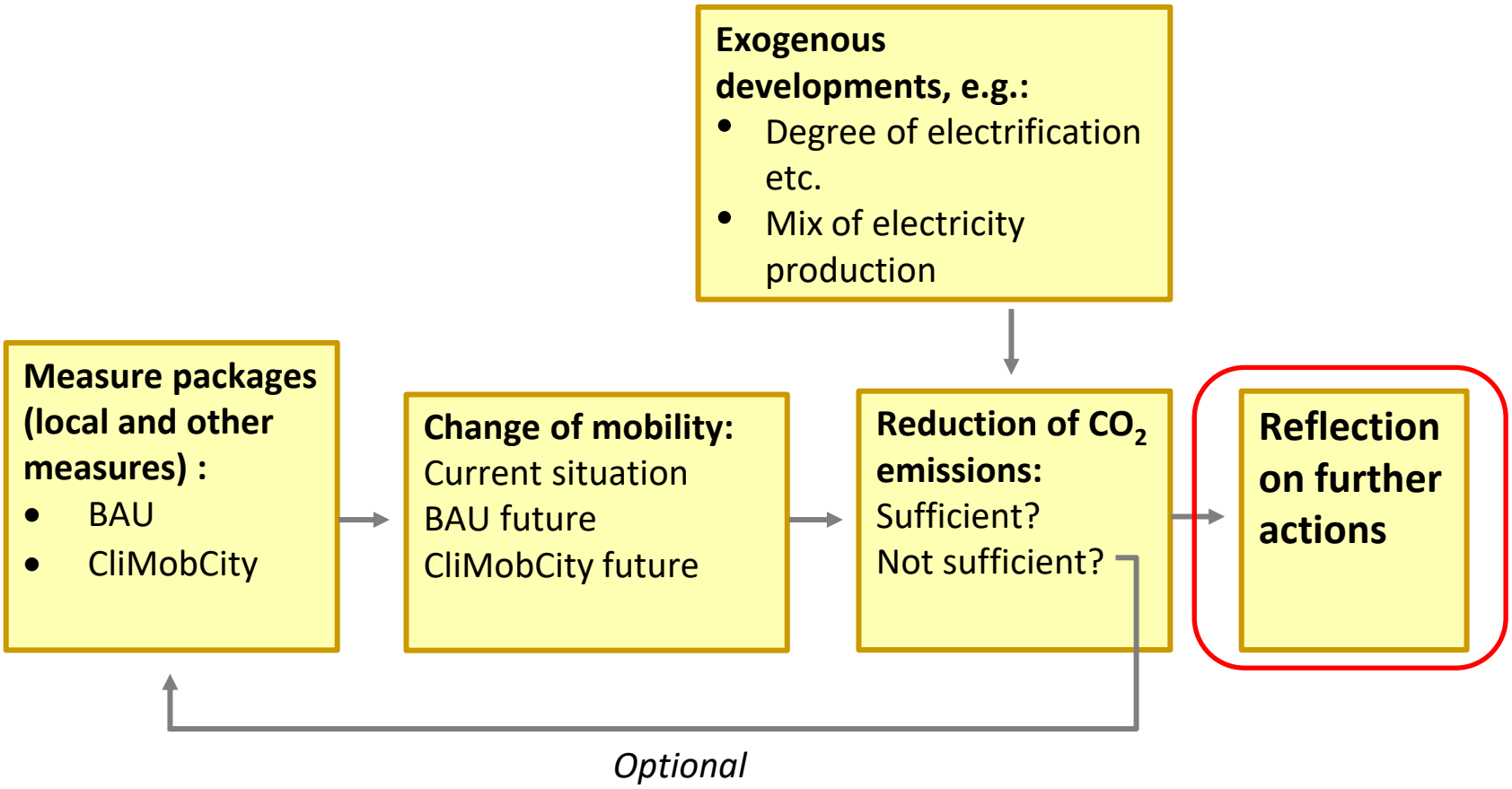
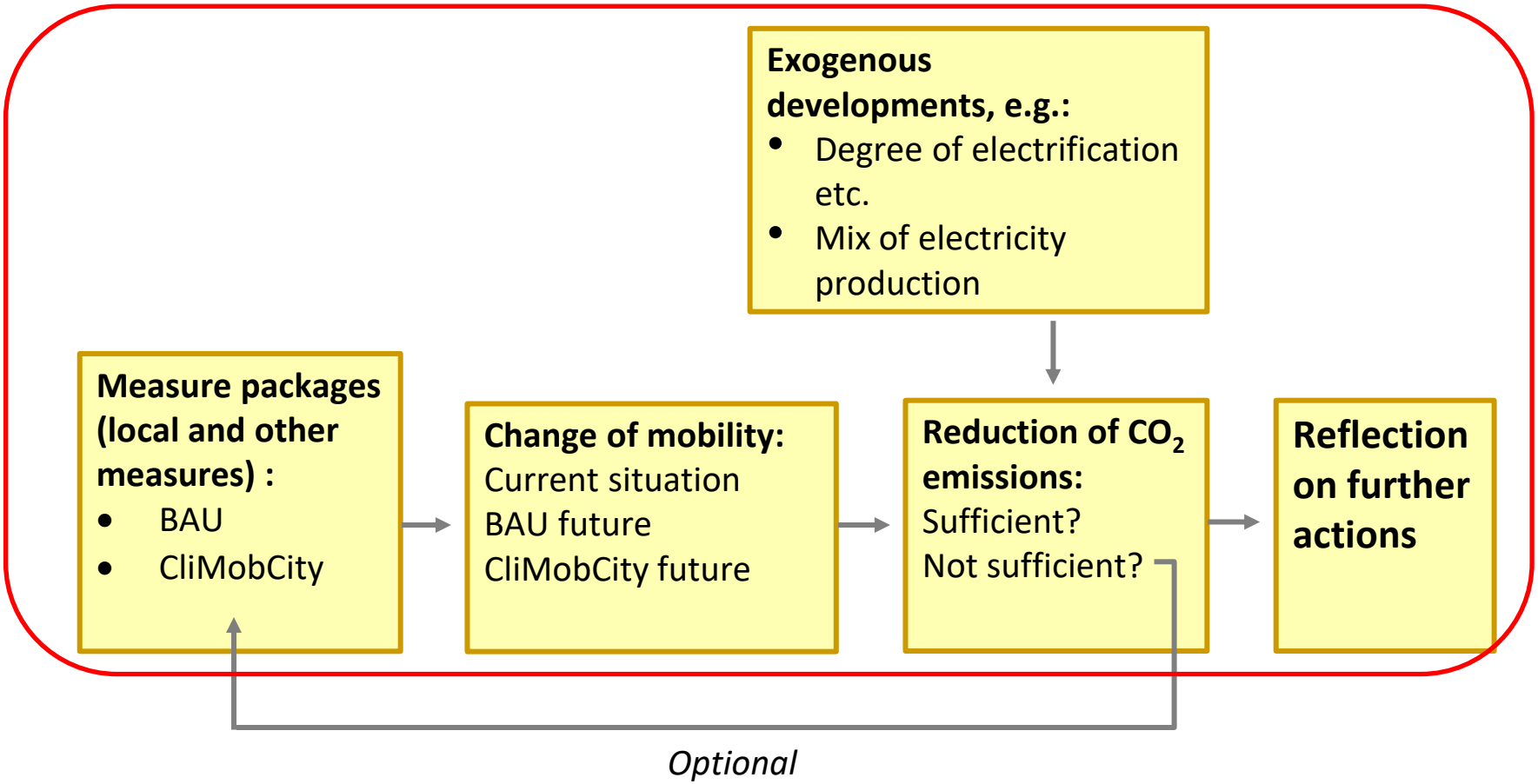
Step “Reflection in the cities’ demonstrations”



Content of the step “Reflection in the cities’ demonstrations”

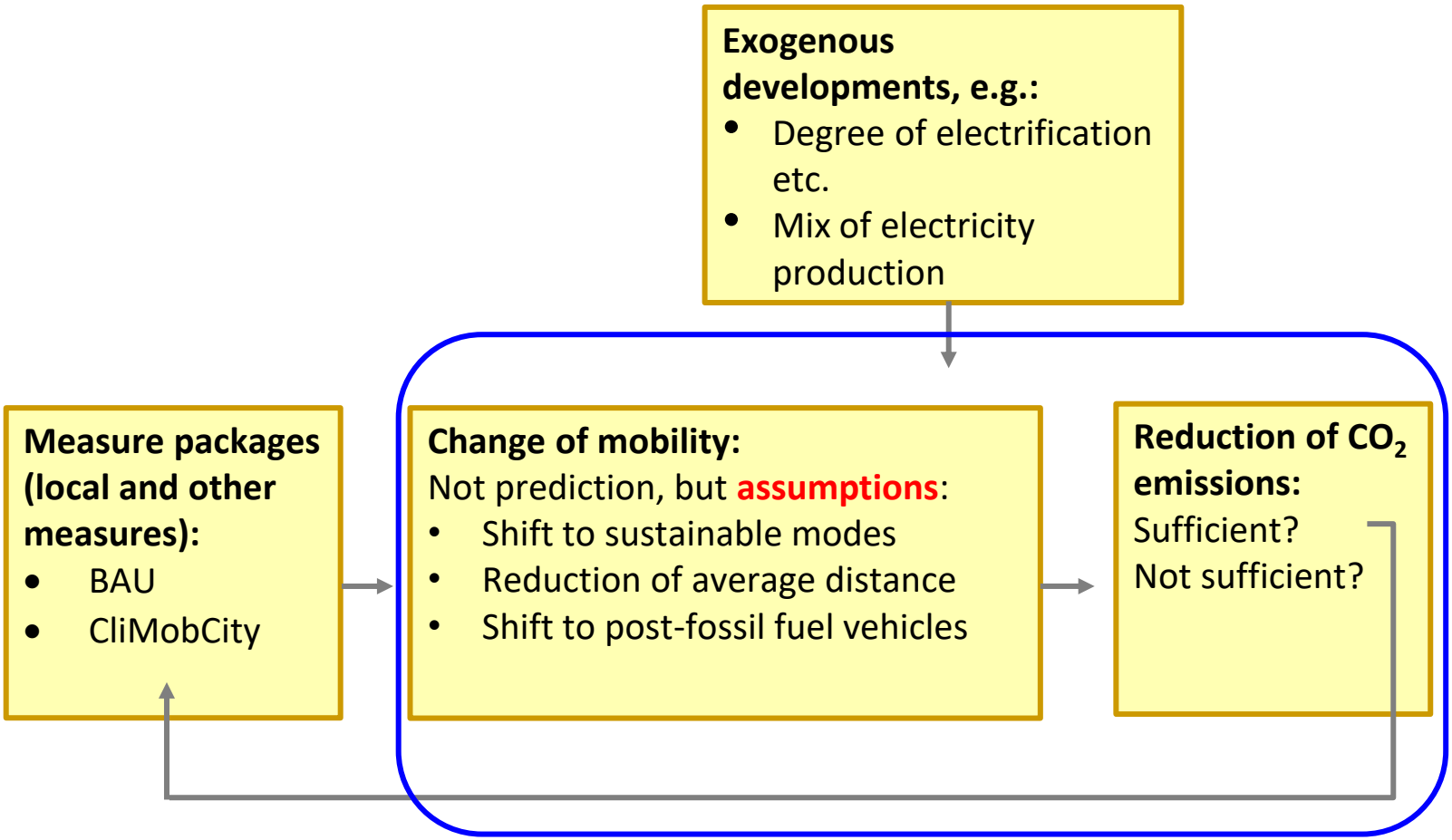


Red thread

- Cities have developed measure packages
- Some more experimental than others
- Some more change of mobility and CO_2e reduction
- But in all cities: the reductions are not sufficient.
- *What if* exercises (forecasting lever exercises): more modal shift, shorter distances, more shift to post-fossil vehicles.

  Reductions still not sufficient in forecasting
- *What if* exercises (backcasting lever exercises)
- Potential measure content in
- *What if* lever exercises

What if approach



CO_2e reduction aims

- **Bydgoszcz: climate neutral in 2050**
- **Plymouth: climate neutral in 2030**
- **Thessaloniki: 42% reduction 1990-2030.**
  Since recently: climate neutral in 2030
- **Leipzig: climate neutral in 2040.**
  Since recently: climate neutral in 2030

Findings: Mobility and CO_2e reduction

From measures to mobility effects

	Measures	Change car-kms (%). From base year to BAU	Measures	Change car-kms (%). From base year to CliMobCity car-kms (%)
Bydgoszcz	• Road widening and new links • New tram infra links and service lines	+38	W2: • Re-urbanisation • Frequency PT central area • Cancel suburban ring road • Limitation through traffic centre	+31
Plymouth	• PT infra improvements • Road junctions, roundabouts and links	+19	• Bus infra improvements • P+R bus Sherford • Tavistock rail • Hubs and electric charging	+5 *
Thessaloniki	• New metro • Suburban train • Active travel infra development	-18	• Shared electric car nodes (small scale) • Public bus electrification	-18
Leipzig	• Road infra links and widening • Regional train infra • Tram infra links and services	-8	• Accelerate electric charging points • Hub network with shared vehicles • Public bus electrification	-8

* Based on expert calculations without demand modelling.

From mobility effects to CO_2e reductions

	Change car-kms (%) from base year to BAU	Change CO_2e (%) from base year to BAU *
Bydgoszcz	+38	+1
Plymouth	+19	-5
Thessaloniki	-18	-8
Leipzig	-8	-39

* Share of post-fossil fuel vehicles as in EU Reference scenario.

Take Thessaloniki and Leipzig: how is such difference between reduction car-kms and CO_2e emissions possible?

% post-fossil fuel cars according to the EU reference scenario

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Answer: because of difference in electrification etc. of cars (table below) and greening of electricity production. Both affect the still remaining car-kms

	% post-fossil fuel cars
Bydgoszcz 2021	0.2
Bydgoszcz 2050	23
Plymouth 2015	1
Plymouth 2034	18
Thessaloniki 2018	0.2
Thessaloniki 2030	1.5
Leipzig 2015	1
Leipzig 2035	17

From measures to mobility effects

Reduction CO2e emissions			Base year = 2018	
City →	Bydgoszcz	Plymouth	Thessaloniki	Leipzig
Mobility scenario →	W2	UK max	Sh. Electr.	Int. Mob.
↓ Techology and energy scenario	CliMobCity	CliMobCity	CliMobCity	CliMobCity
Scenario BAU (EU reference, present energy mix)	1	-5	-8	-39
Scenario 1 (CliMobCity, EU reference, expected future energy mix)	-1	-9	-14	-40
Scenario 2 (CliMobCity, Tech, expected future energy mix)	-6	-24	-15	-49
Scenario 3 (CliMobCity, Tech, green energy mix)	-19	-32	-21	-57
Scenario 4 (= scenario 3, additional modal shift *)	-25	-36	-22	-62
Scenario 5 (= scenario 3, decrease time spent **)	-22	-34	-21	-58
Scenario 6 (= scenario 3, additional electrification ***)	-24	-39	-22	-61
Scenario 7 (= combinations of scenario 3, 4, 5 and 6)	-32	-45	-24	-67
Scenario 8) Backcasting scenario 1: scenario 3, further modal shift ****			-42	
Scenario 9) Backcasting scenario 2: scenario 3, further shift to post-fossil fuel vehicles *****			-54	
Scenario 10) Backcasting scenario 3: further modal shift and shift to post-fossil fuel vehicles ******				-80

* Share: -10%-points LDVs (e.g. cars), +5%-points public transport busses, +5%-points active travel.

** 10% less time spent, because of less road vehicle-kms and/or more fluent traffic flow.

*** Share: 10%-points extra shift to post-fossil fuel vehicles.

**** Thessaloniki: Share: -26 %-points LDV (e.g. cars), -5%-points 2W, +8%-points bus, +8%-points metro, +3%-points rail, +3%-points walk, +9%-points bike

***** Thessaloniki: Share: + 61% BEV; -15% diesel, -46% gasoline

****** Leibzig: Share of modes: -25%-points cars and other LDV, +15%-points public transport busses, +10%-points active travel.
Share of powertrains: +32% post-fossil vehicles (BEV), -20%-points gasoline, -12%-points diesel.

CO_2e reduction in the CliMobCity measure packages of the 4 cities

	Reduction CO_2e (%)	
	min	max
Scenario BAU (EU reference, present energy mix)	1	-39
Scenario 1 (CliMobCity, EU reference, expected future energy mix)	-1	-40
Scenario 2 (CliMobCity, Tech, expected future energy mix)	-6	-49
Scenario 3 (CliMobCity, Tech, green energy mix)	-19	-57

In Plymouth, Thessaloniki and Leipzig *increasing* population.

Nominal reductions per capita are about 2-7 %-points higher.

Reduction not sufficient: what now?

Forecasting
‘Lever’ exercises

Back-casting
‘Lever’ exercises

CO_2e reduction (Forecasting) lever exercises

	Reduction CO_2e (%)	
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Scenario 3 (CliMobCity, Tech, green energy mix)	-19	-57
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CO_2e reduction (Backcasting) lever exercises

	Reduction CO_2e (%)	
Scenario 3 (CliMobCity, Tech, green energy mix)	-19	
Scenario 8) Backcasting Thessaloniki 1 = Scenario 3 plus further modal shift *	-42	
Scenario 9) Backcasting Thessaloniki 2 = Scenario 3 plus further shift to post-fossil fuel vehicles **	-54	Sufficient
Scenario 10) Backcasting Leipzig = Scenario 3 plus further modal shift and shift to post-fossil fuel vehicles ***	-80	Sufficient

* Thessaloniki: Share: -26 %-points LDV (e.g. cars), -5%-points 2W, +8%-points bus, +8%-points metro, +3%-points rail, +3%-points walk, +9%-points bike.

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Which measures for further CO_2e reduction ?

What about …

novel mobility modes and services: hubs, shared vehicles?

Why not already incorporated in the prediction of mobility changes?

- "Shared e-mobility systems are still in its **infancy period** in most places".

- "Research on micromobility is still in its **nascent stage**" (Liao and Correia, 2022).

- And "… there is a **lack of a wide academic literature** about shared e-scooters" (Badia and Jenelius, 2021).

Sustainability expectations regarding shared cars

- Fewer car kms driven in comparison to private car (this is partly implicitly modal shift) -> less use CO_2e
- Fewer cars needed per driven km -> less CO_2e emitted in car production and recycling
- Less parking demand -> supports compact city layout -> more active travel -> less CO_2e
- More car efficiency: newer models, more circulation -> less use CO_2e

Similar with shared micromobility

Selection of indications about performances

- Shared electric car use with 150 cars in Thessaloniki reduced the city's car-kms by 1% (CERTH/HIT applying Momentum tools)
- Survey amongst shared car users. Shared car decreases car-kms of users by 15-20% and CO_2e emissions by 13-18% (LCA). Reduction by use (less car-kms plus shift from sustainable modes is only 5-8% (Nijland and Meerkerk, 2018, NL, not city-specific)
- Survey amongst shared car and share bicycle users at 9 new mobility hubs, 9 existing car stations and 7 existing bicycle stations in Würzburg, most in city centre. Reduces city's CO_2e emissions by 1% (use) (Pfertner, 2016)

Selection of indications about performances

- **Survey amongst private e-bike users in south and northern Sweden. Per person reduction of 15-20% CO_2e emissions (use).** Hiselius and Svensson (2016)

- **Shared e-bicycle reduces CO_2e emissions in Paris and Düsseldorf, not in Berlin (LCA)** (Krauss et al. 2021)

Selection of indications about performances

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Selection of indications about performances

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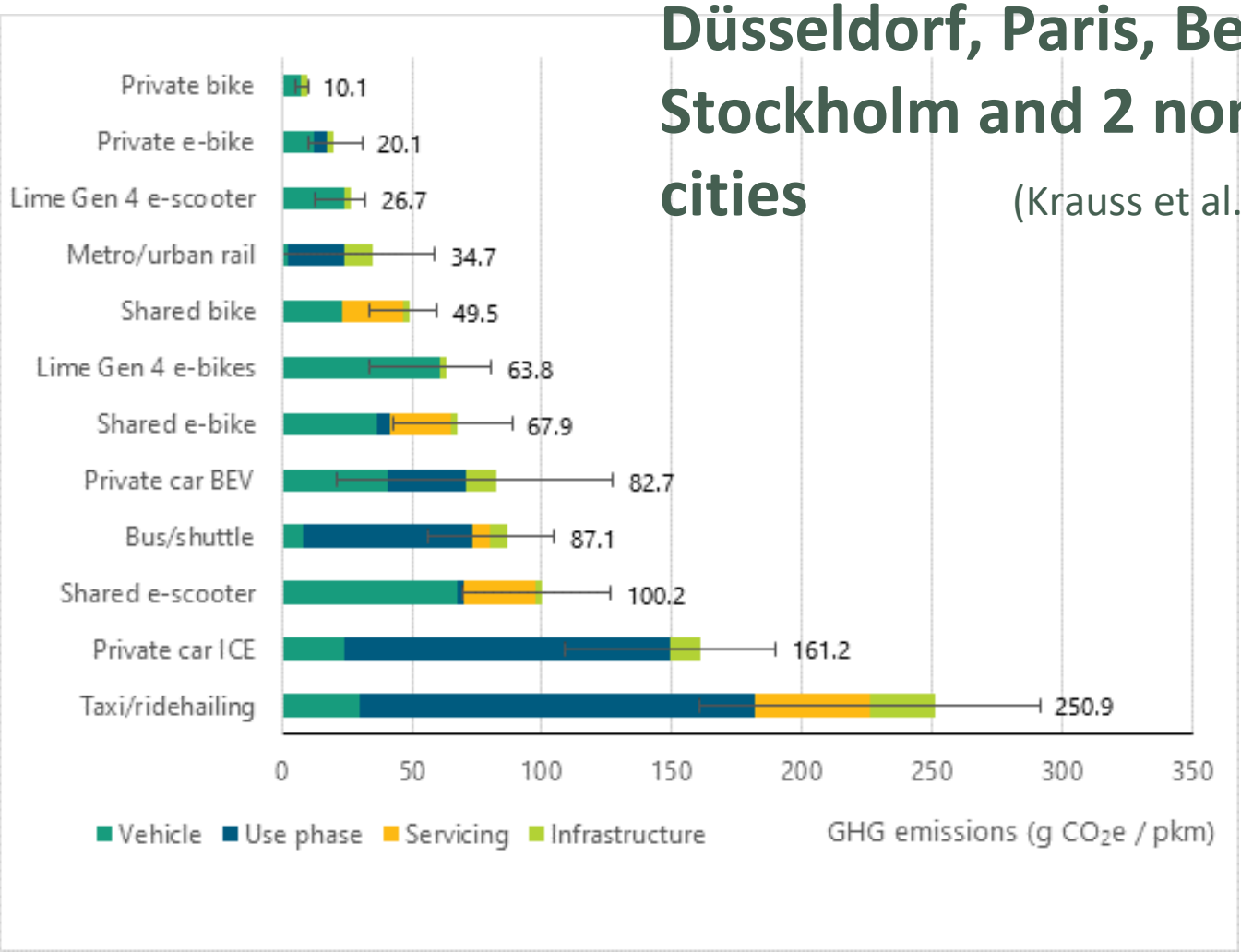
Average LCA CO_2e emissions in Düsseldorf, Paris, Berlin, Stockholm and 2 none-European cities (Krauss et al. 2021)



Selection of indications about performances: substitution of modes

Source: Own table on the basis of Figures 2 and 3 in Krauss et al. (2021)

Shared e-scooter

SHARED E-SCOOTER	Paris	Berlin	Düsseldorf	Stockholm	
From walk	40,3	50,3	49,4	42,0	%
From public transport	35,5	26,4	25,9	38,8	%
From car, motorcycle, moped, e-cooter, bicycle	12,3	14,2	13,1	7,9	%
Taxi and ridehailing	8,9	4,4	5,7	7,6	%
Would not have made the trip	3,1	4,7	5,7	3,7	%
	100,1	100	99,8	100	%

Share e-bicycle

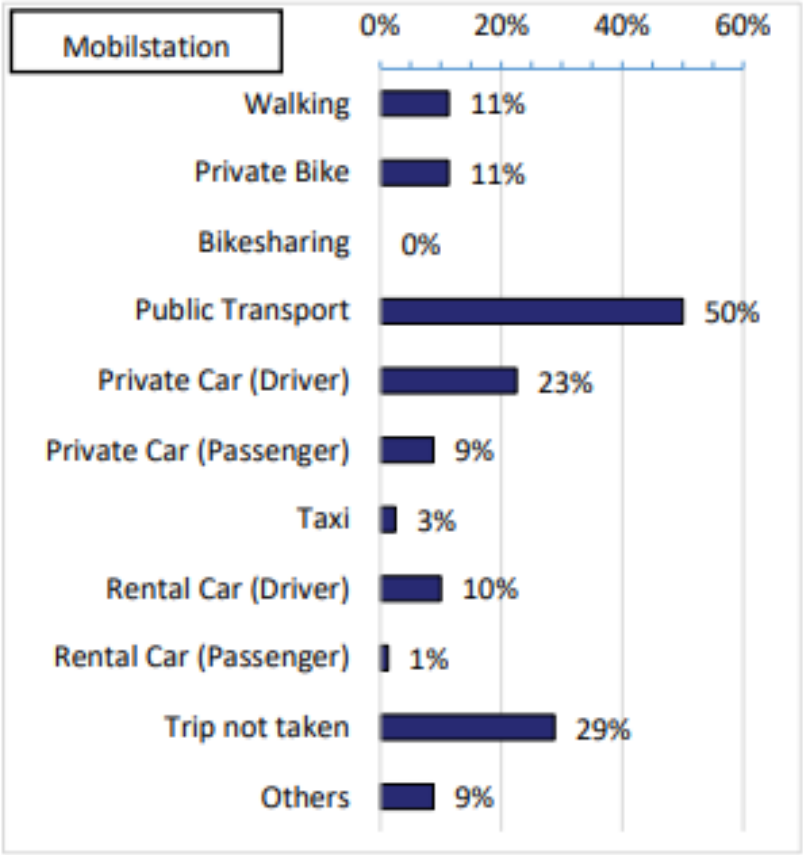
(Stockholm not mentioned)

SHARED E-BICYCLE	Paris	Berlin	Düsseldorf	
From walk	25	28	29	%
From public transport	38	39	33	%
From car, motorcycle, moped, e-cooter, bicycle	23	26	20	%
Taxi and ridehailing	11	6	11	%
Would not have made the trip	4	2	7	%
	100	100	100	%

Selection of indications about performances: substitution of modes

Würzburg: modes of shared car users at mobility stations before implementation of mobility stations

Source: Pfertner (2016)



Selection of indications about performances: CO_2e impact of modal shift

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NL-case:

CO_2e reduction because of shared cars (use only)

	From	To	
Change in car kilometres	-15	-13	%
Change in mode of transport	9	8	%
Change in car ownership	-7	-13	%
Total	-13	-18	%

Source: Nijland and Meerkerk (2018)

Würzburg:

CO_2e reduction because of shared cars and bicycles (use and fewer cars [LCA])

More efficient vehicles	-0,01	%
Additional car trips	0,05	%
Reduction of private car use	-0,97	%
Total reduction	About -1	%

Source: Pfertner (2016)

Selection of indications about performances: space requirement

- **1 shared car replaces x private cars: ranging from 1:2 to 1:20 for station-based carsharing and 1:1 to 1:3.6 for freefloating systems**

(Bundesverband CarSharing, 2016" according to Pfertner, 2017)

Selection of indications about performances: indicative conclusions

- **Shared cars and e-scooters do not support PT, despite of being used for first and last mile**
- **Shift to shared car reduces road vehicle-kms and CO_2e.**
  - Reduction of car-kms
  - Despite of modal shift from sustainable modes to (shared) car
  - In LCA also: less emissions prod./recycle. cars
- **Shared micromobility on LCA basis seems to reduce CO_2e, but not necessarily (example e-bicycles in Berlin)**

Selection of indications about performances: indicative conclusions

- Reductions CO_2e per passenger OK, but niche market

  CO_2e reduction requires:
  niche -> mainstream configuration.
  Which scale is this?

- Space saving is a fact.
  Strengthening compact city makes more people walk and cycle. Positive CO_2e effect is not part of reviewed studies.

Which measures for further CO_2e reduction?

- Address freight transport, incl. electrification
- More of the same set of measures
- More new measures

Measures for further CO_2e reduction (reduction of fossil fuel (road) vehicles in this planning period)

- **Freight substantial contributor to remaining CO_2e emissions**
- **Reduce fossil freight-kms in the city**
  - Electric vans = quick win
  - Large trucks:
    - Like busses electric?
    - What happens on intercity-network:
      - Catenary? Hydrogen?
      - If catenary: decoupling points at city edge
      - Large scale?
      - If yes more/other decoupling points at city edge

Measures for further CO_2e reduction (reduction of fossil fuel (road) vehicles)

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More of the same types of measures

- PT as in Thessaloniki, Leipzig or Bydgoszcz.
- Shared electric cars, shared bicycles, amnesties for private bicycles at mobility hubs. Relevance of PT location for first/last mile
- More effective push pull combinations. Example Limiting development road (Bydgoszcz). More restrictive parking measures
- Accelerate electrification
- Access limitations (Bydgoszcz)
- Active travel infrastructure

Measures for further CO_2e reduction (reduction of fossil fuel (road) vehicles)

More of the same types of measures

Spatial measures:

- average distance,
- more active travel,
- more public transport,
- regional commuting

Pricing measures (re)activate?

Awareness raising

Measures for further CO_2e reduction (reduction of fossil fuel (road) vehicles). Including governance issues

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More of new types of measures

- New combinations of push/pull/technological/behavioural measures
- Pricing/taxing measures more effective and inclusive, e.g. income dependant
- Pricing/taxing measures more sustainable, e.g. more effective encouragement of heavy cars
- Sufficient financing and staff for transition making
- UK: reorganise local public transport, its planning and financing

Measures for further CO_2e reduction (reduction of fossil fuel (road) vehicles): willingness to innovate

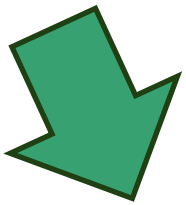
- **Make use of willing potential**
  - Check/improve quality of service
  - Awareness and support campaigns

- **In project**
  - Plymotion
  - Action Thessaloniki
  - Employers' mobility management
  - Leipzig: presentstion Simone

Indications concerning willingness of residents to innovate

- **Leipzig (2019) survey:**
  - 75% can't imagine life without private car ->
    - Conclusion survey: improve service product.
    - Potential other conclusion: 25% can imagine.
- **Würzburg: responses from users, city non-users:**
  - "A life without a private car is desirable, but not realistic" (1/4 – ¾ disagrees).
  - "I don't like sharing items" (< ½ agrees).
  - "Future mobility consists more of using than of owning" (> ½ - ¾ agrees).
  - "I am reluctant to the idea of sharing my private vehicle" (< ½ - ¾ agrees).
- **Use this potential: awareness raising, incentives etc.**

Never forget, when wanting to develop more effective measure packages to reduce CO_2e emissions of mobility



CO_2e reduction by fewer (road) carbon vehicle-kms will only be achieved if one or more of the following central mobility changes occurs

- **Reduce number of trips/capita** → Work home
- **Reduce average travel distance** → Land use
- **Shift to more sustainable modes** → Attractive PT
- **Increase vehicle occupation** → Incentives
- **Decrease share of fossil-fuel vehic.** → Charging points
- **Reduce vehicle weight** → Localization.
- **Smoothen traffic flows** → Traff. Managem.

Example measure:

Other important ways to reduce CO_2e emissions are

- **Reduce car parking demand:**
  supports compact city
  -> shorter distance
  -> more walking and bicycling
  (lies within the impact scope of the project)

Example measure:

→ Shared cars and other shared vehicles

- **Reduce number of cars**
  -> less CO_2e emissions for producing, maintaining and recycling cars
  (lies outside of the impact scope of the project)

→ Shared cars and other shared vehicles

General conclusions from the project

Conclusions regarding climate mitigation perspectives in urban mobility

- Climate neutrality in around 2030 is needed to limit global warming to 1.5° Celsius

- Given the current governance frameworks, it is not possible to achieve climate neutrality for mobility in 2030 (e.g. insufficient financing for more shift to public transport or more shift to post-fossil fuel vehicles and faster greening of electricity production; e.g. inappropriate legal assignment of competences to cities)

Conclusions for climate mitigation policies

- Stick to ambitious climate mitigation aims like climate neutrality in 2030
- Strive for climate neutral mobility as soon as possible
- Conduct strategic city and mobility planning including quantitative projections/checks for the future -> will there be sufficient mobility change and sufficient CO_2e reduction? Achieving climate neutrality for mobility in 2040 can also be a very good result
- Cities should avoid laisser-faire or climate-cynicism in in their city and mobility development planning and other activities

Conclusions for climate mitigation policies of cities

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Important flanking policies:

- Awareness raising, information and incentives to mobilise cooperation of residents and organisations
- Awareness raising to regional and national governments directed towards changing governance frameworks in favour of effective climate mitigation
- Carbon capture is not a governance subject on the municipal level. Mobility in cities may be a reason to search for carbon capturing on (inter)national levels

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Thank you!