2050 CliMobCity

Interreg Europe

European Union
European Regional Development Fund

The reduction of CO2 emissions

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Outline

- **Modified transport emission model**
- **Scenarios and results partner cities**

Structure and calculation trees

Carbon transport calculator

General informations I

- The modelling approach was inspired by the family of so-called 2050 Calculators; EuCalculator, CityCalculator

- A key feature of the model is the use of so-called levers that show potential changes towards decarbonisation, each of which can be set for different urban plans.

- These levers and levels describe the model for the respective urban reference and target year, e.g. 2015-2050 for both behaviour (e.g. time spent in transport every day) and technologies (e.g. technology share in passenger transport).

General informations II

- The model is based on a bottom-up approach to compute energy consumption and GHG emissions from the transport sector. This calculation is based on projections until the target year, formulated by the cities.
- The aim for the future is to use the model without prior traffic forecasts
- The main outputs of the transport module are:
  - *The direct GHG emissions from transport;*
  - *The energy demand from transport;*
  - *Transport activity demand*
  - *Vehicle demand*

Adapted transport emission model

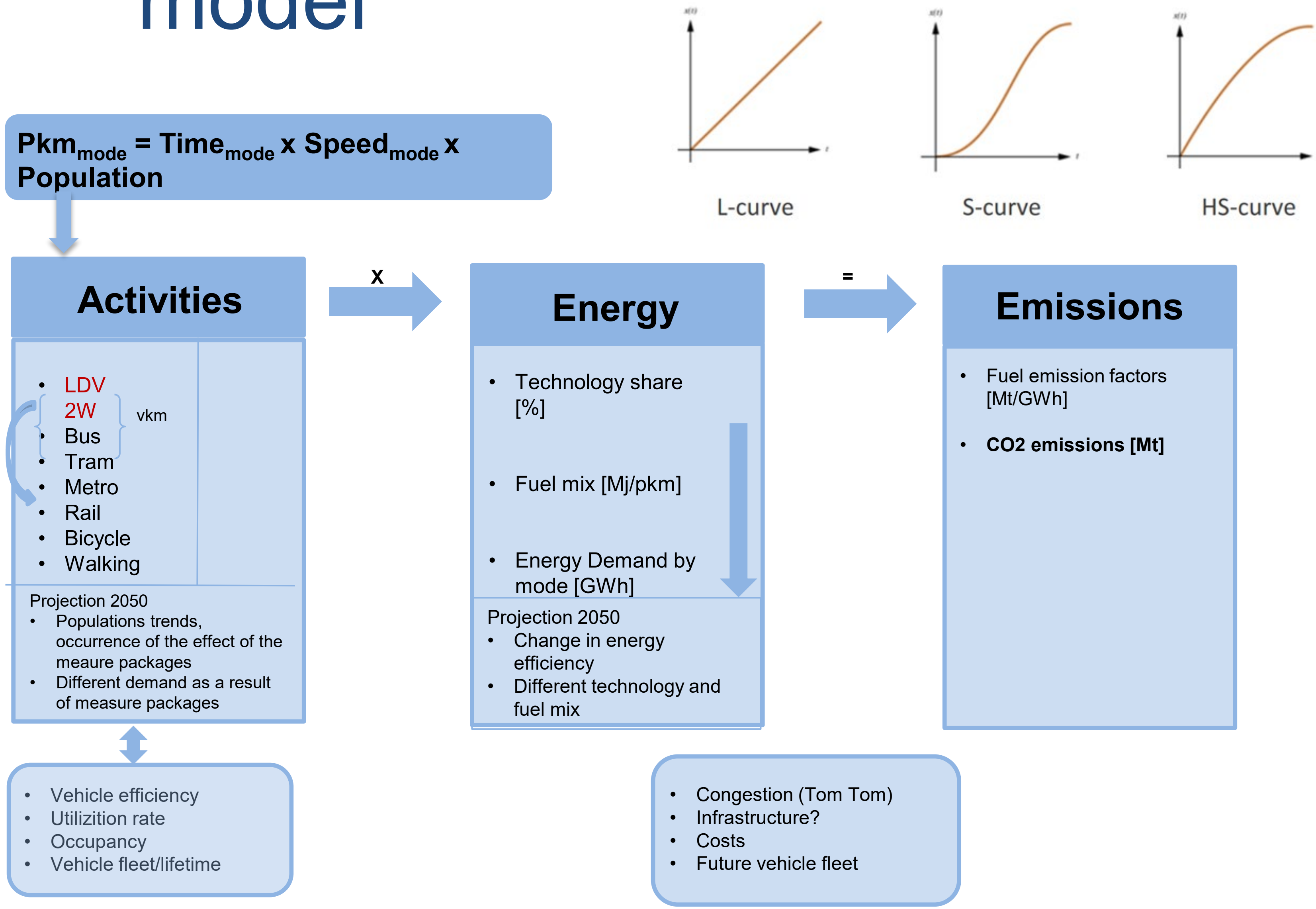


Fig.1 Structure of adapted transport emission model

Calculation tree

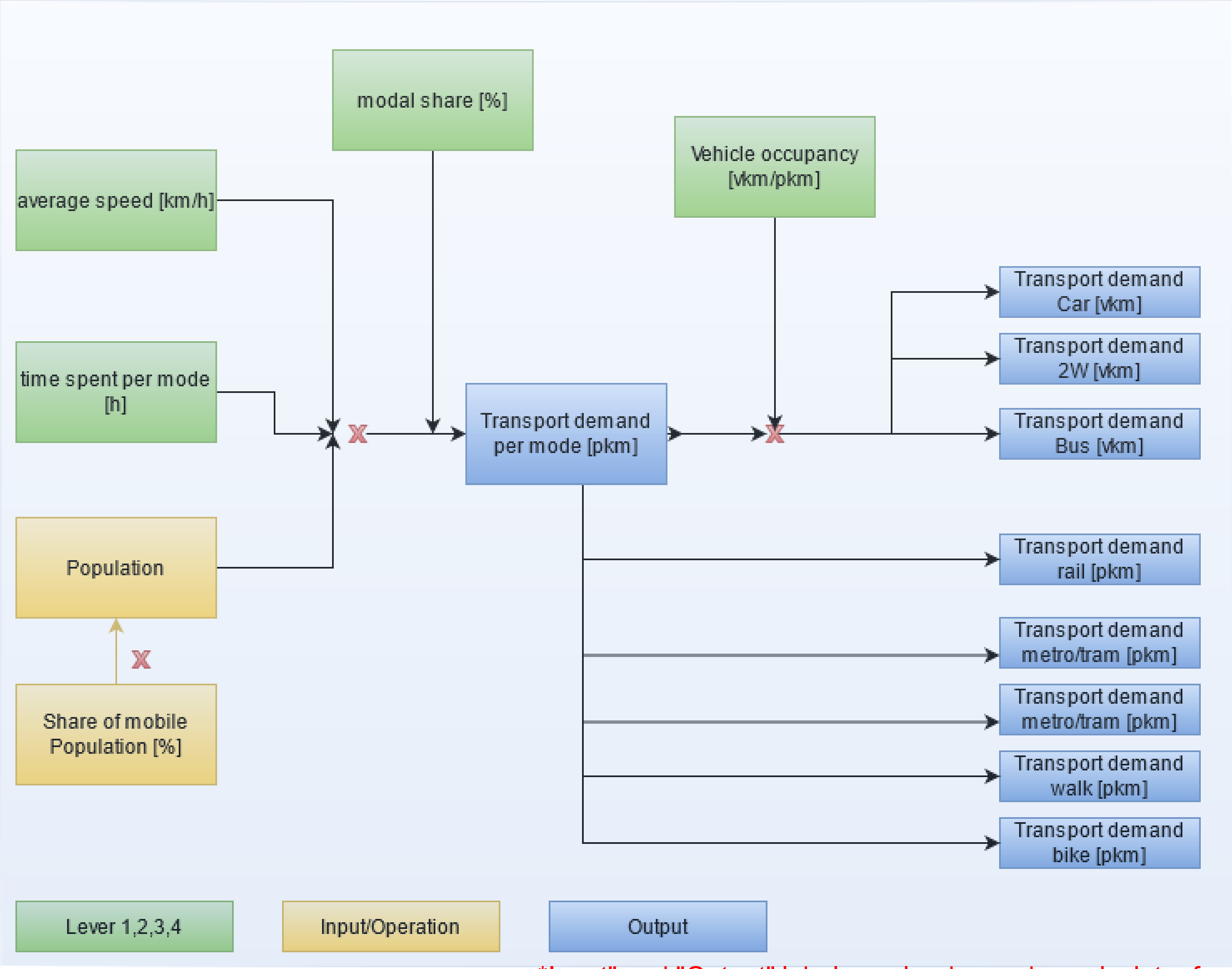


Fig.2 Calculation tree transport demand

*Input" and "Output" labels apply when using calculator for cities directly, without prior traffic forecast

Calculation tree II

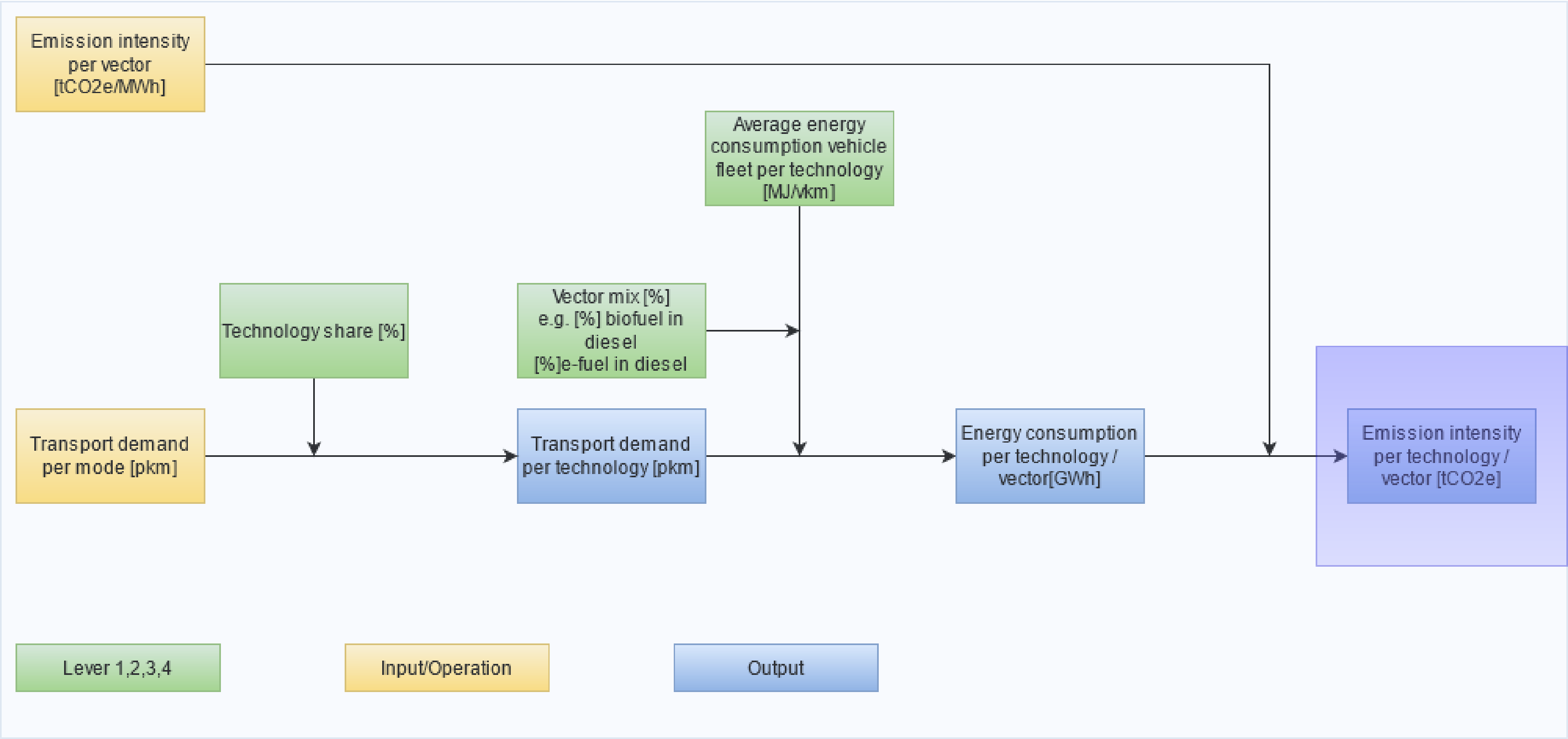
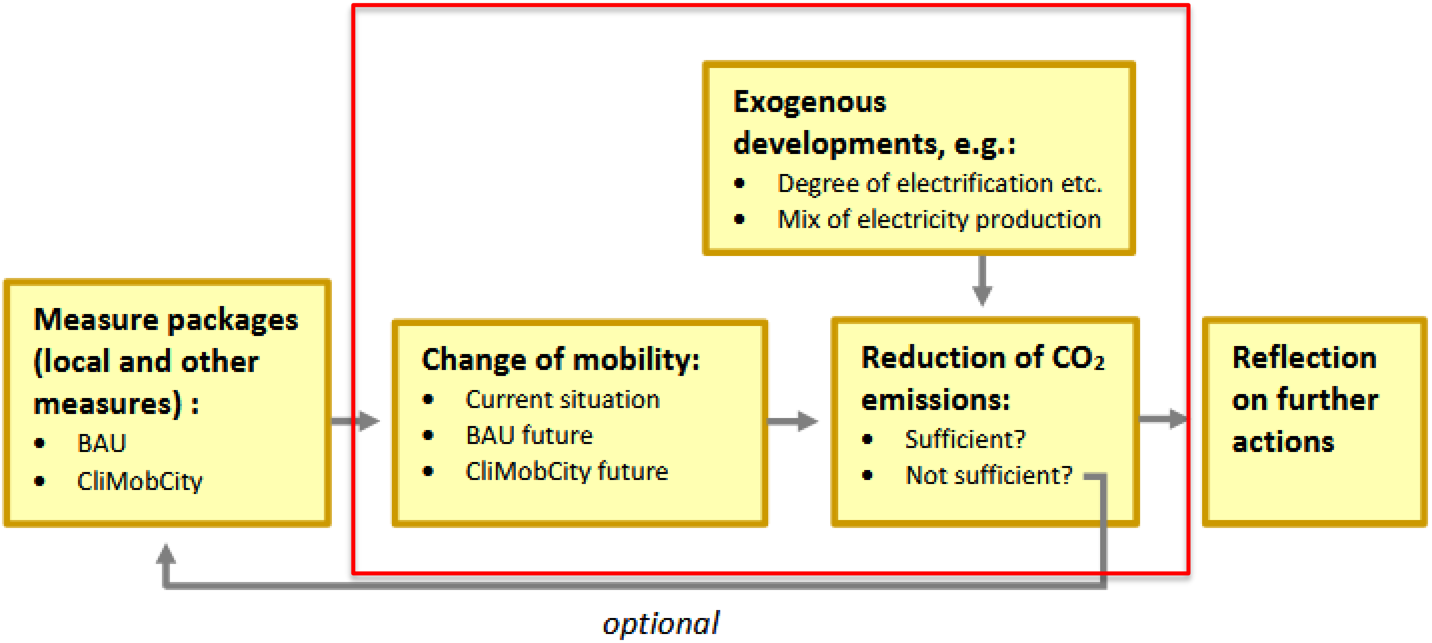


Fig.3 Calculation tree emission intensity

Scenarios and results partner cities

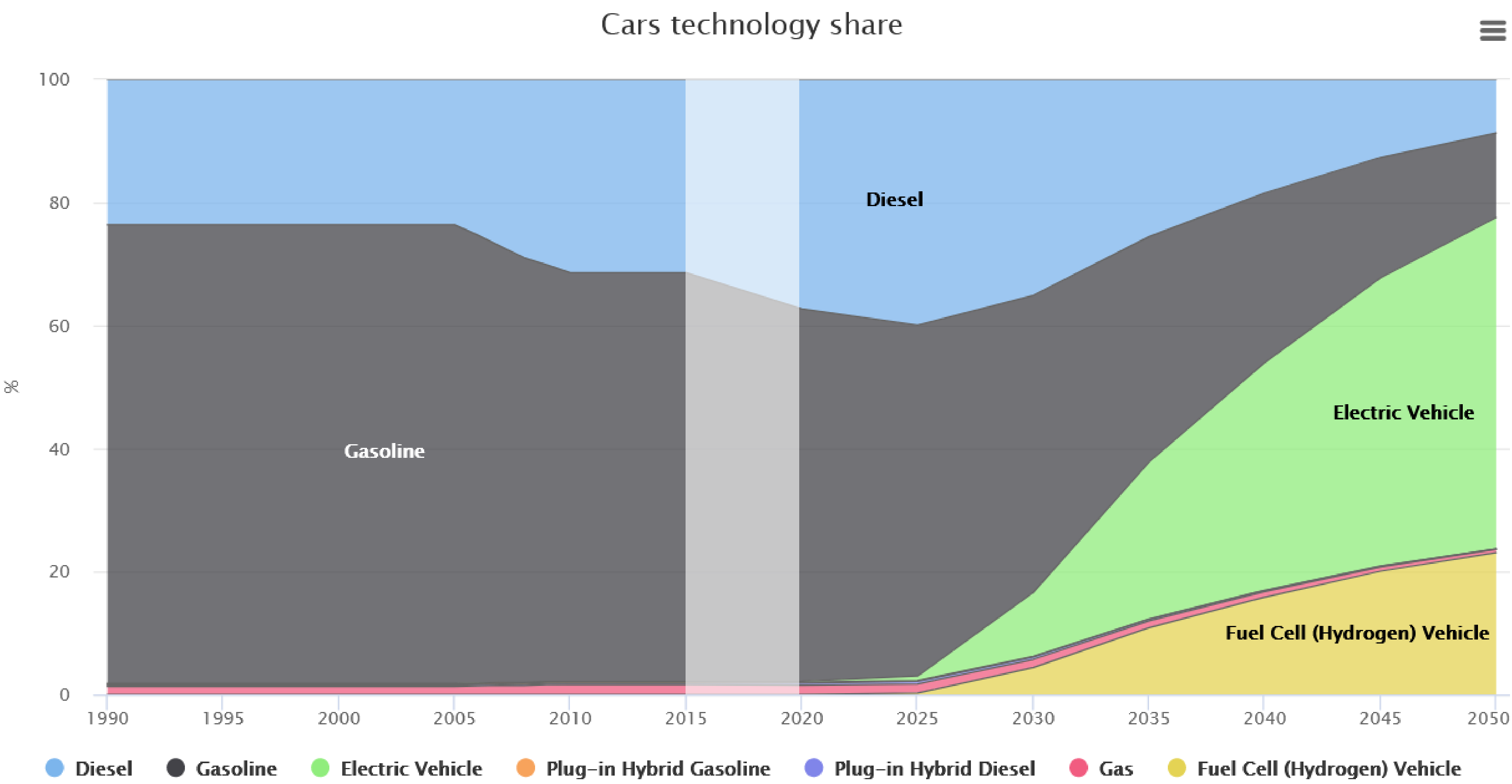
Process chain



Scenario Setting

	Content of scenarios for the analysis of CO_2e emissions			
Scenario number	**Mobility and city measure packages**	**Levers**	**Share of power-trains ***	**Energy mix of electricity production**
A	Base year		EU ref	Mix A
B	BAU scenario		EU ref	Mix A
C1	CliMobCity 1 scenario		EU ref	Mix A
C2	Optional: CliMobCity 2 scenario		EU ref	Mix A
D	CliMobCity scenario with most CO_2e reduction (1 or if present 2)		Tech	Mix A
E	CliMobCity scenario with most CO_2e reduction (1 or if present 2)		Tech	Green
F	CliMobCity scenario with most CO_2e reduction (1 or if present 2)	Show how much the different levers in the carbon model for municipal measures could still be pushed further to reach the city's climate aims or achieve climate neutrality	Tech	Green

Selection of technological scenarios



Plymouth

Plymouth Scenario Setting

- Target has been to achieve net zero carbon emissions by 2030
- The BAU is based on current policies of the Plymouth Plan and the JLP
- In the framework of 2050 CliMobCity, Plymouth has defined a more ambitious measure package, referred to as the **UK Max scenario**
- The **UK Max scenario** includes “all known interventions, both physical measures and policy, …” “that have been applied elsewhere in the UK and go beyond BAU policies”
- **UK Max scenario** “is a theoretical exercise and assumes that funding is available for each of the proposed measures, therefore monetary constraints have not been factored into the assessment” (WSP, 2021).

Type	Intervention
Bus	Bus gates at all viable locations
	Bus lanes along all viable links / lengths
	City-wide bus service improvements in line with 'Bus Back Better Guidance' following the Brighton example
	Park & Ride at Sherford
Rail	Devon Metro
Walking & Cycling	Implementation of undelivered routes on our Strategic Cycle Network
	Implementation of all routes in our Local Cycling and Walking Implementation Plan
	School Streets delivered across city
	Clean Air Zone across city centre, waterfront and key corridors?
	Bikeability in every school[36]
	Walk to School Programme
	Increased number of cars equipped with anti-collision capabilities, resulting in reduced collisions with cyclists
	Further increase in online shopping and deliveries from LGVs
	Plymouth to be one of governments 12 'Mini-Holland' funding (Gear Change report)
	Improved cycle parking at rail stations
	Low Traffic Neighbourhoods
	Buses that carry bikes (Go Ahead subsidiary East Yorkshire)
	Closing street to through traffic (Hackney Council)
Electric vehicles	New Council Staff Travel Policy to encourage sustainable business travel
	Mobility Hubs including EV charge points, e-bike charge points, and e-car club cars)
	Assume as many charge points per capita as the best local authority
	Replacement of (fossil fuel) bus fleet with battery and fuel cell electric vehicles
	Introduction of public e-scooter hire facility
Behaviour change	Promote / provide free eco-driving training
	Plymotion continues at increased scale
Parking	Increase council parking charges
	Clear Air zones with charges for non-compliant vehicles ~~(check options)~~
	Workplace Parking Levy based on Nottingham model
Other	e-Car club (successful)
	20 mph *(ca. 30km/h)* speed limits on all residential streets

Mobility changes

- The number of car trips increases substantially (22%) between 2015 and **JLP 2034 (BAU)**, but the increase can be limited to 4% in **UK Max (CliMobCity)** despite a 13% population increase.
- The **UK Max 2034 (CliMobCity) scenario** leads to less growth of road vehicle-kms than **the JLP 2034 (BAU) scenario** does: car-kms still increase by 5%. For freight vehicles the growth is even higher, for LGVs (vans etc.): 35%.
- The shift of passenger trips from car to other modes in the UK max scenario mainly takes place in Plymouth's central area and for trips with shorter distances.

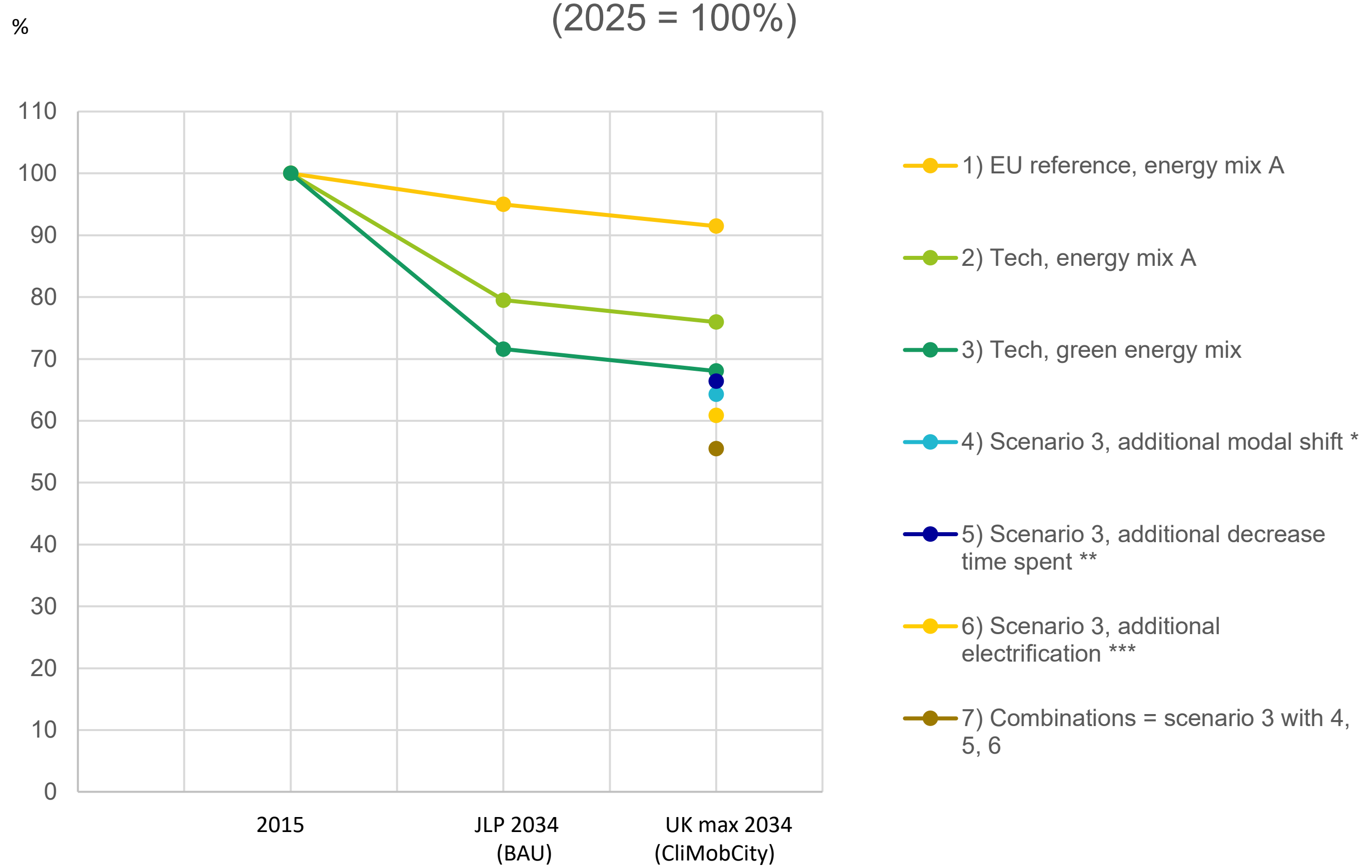
	EU reference			
	% BEV cars	% Hydrogen cars	% Together	% Fossil fuel remainder
Plymouth, 2015	1	0	1	99
Plymouth, 2034	13	5	18	82
Plymouth, 2050	31	13	44	56

	Tech			
	% BEV cars	% Hydrogen cars	% Together	% Fossil fuel remainder
Plymouth, 2015	1	0	1	99
Plymouth, 2034	39	17	56	44
Plymouth, 2050	66	28	94	6

Model Input

Lever	Base Year 2015	BAU 2034	CliMob 2034
Modal share	Walk 15%, LDV 63%, Bike 5%, 2W 2%, Bus 11%, Rail 1 %, HO 3%	No changes	Walk 16%, LDV 51%, Bike 8%, 2W 2%, Bus 14%, Rail 2 %, HO 5%
Vehicle occupancy	LDV 1,6; 2W 1,1; Bus 18	No changes	LDV 1,8; 2W 1,1; Bus 19
T-Share	Based on national data	EU-reference Scenario; 10% BEV	EU-reference Scenario+increased Electrification
LDV Avg km/d/p	35,6km	38,7km	36,5km
Avg Speed	Bus 38; LDV 44	No changes	-1 LDV;+1Bus
Time spent	LDV 0.45h; Bus 0.5h	No changes	-3min LDV, +2 Bus

Comparison CO_2e emissions (2025 = 100%)



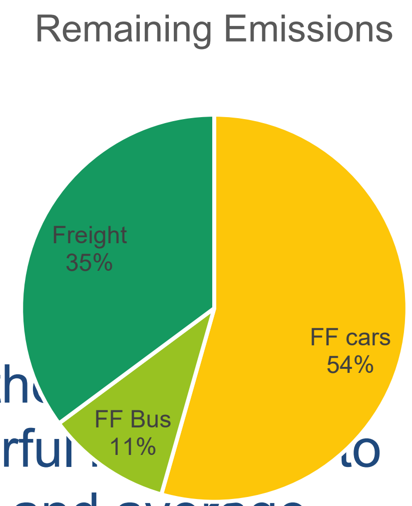
This type of presentation supports understanding of the relation between different results (dots).
But be aware of that:

- lines between the base year dot and BAU dots represent alternative developments in time;
- lines between BAU and CliMobCity dots serve the comparison, but don’t represent developments in time.

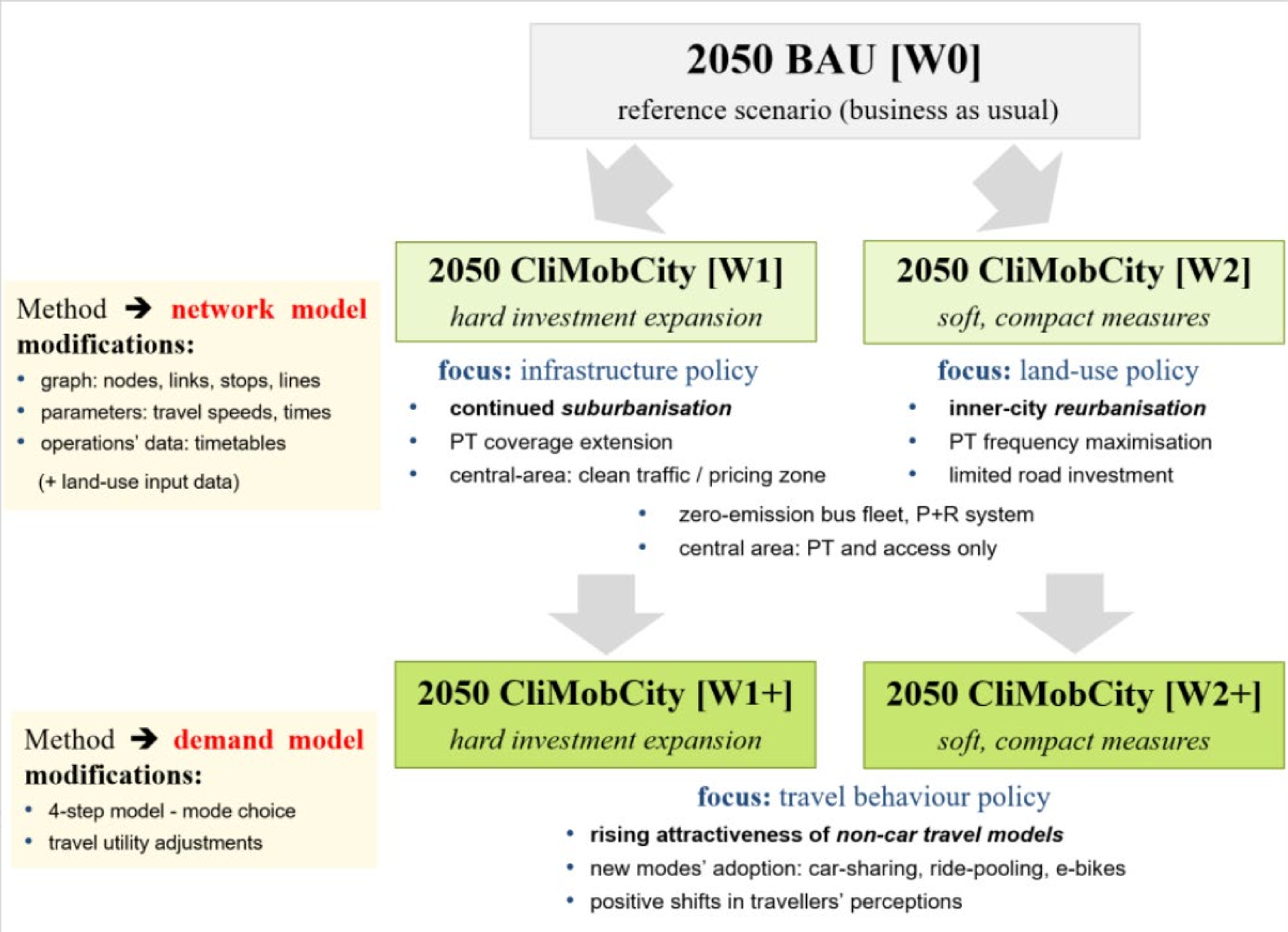
* Share of cars and other LDVs: -10%-points; of public transport busses and active travel: each +5%-points.
** 10% less time spent, because of less road vehicle-kms and/or more fluent traffic flow.
*** 10% extra shift to post-fossil fuel vehicles.

Conclusion

- Half way towards the target (50% reduction per capita)
- High share of freight transport emissions
- Still 50% LDV's
- Closing the remaining gap would/will still require th
implementation of a whole set of additional, powerful to
reduce the number of fossil fuel road vehicle-kms and average travel distance, increase the shift to sustainable modes of travel, increase vehicle occupancy rates, and accelerate the shift from fossil fuel to post-fossil fuel vehicles



Bydgoszcz


2050 BAU [W0]
reference scenario (business as usual)
2050 CliMobCity [W1]
hard investment expansion
2050 CliMobCity [W2]
soft, compact measures
Method ➔ network model modifications:
• graph: nodes, links, stops, lines
• parameters: travel speeds, times
• operations' data: timetables
(+ land-use input data)
focus: infrastructure policy
• continued suburbanisation
• PT coverage extension
• central-area: clean traffic / pricing zone
focus: land-use policy
• inner-city reurbanisation
• PT frequency maximisation
• limited road investment
• zero-emission bus fleet, P+R system
• central area: PT and access only
2050 CliMobCity [W1+]
hard investment expansion
2050 CliMobCity [W2+]
soft, compact measures
Method ➔ demand model modifications:
• 4-step model - mode choice
• travel utility adjustments
focus: travel behaviour policy
• rising attractiveness of non-car travel models
• new modes' adoption: car-sharing, ride-pooling, e-bikes
• positive shifts in travellers' perceptions

Mobility changes

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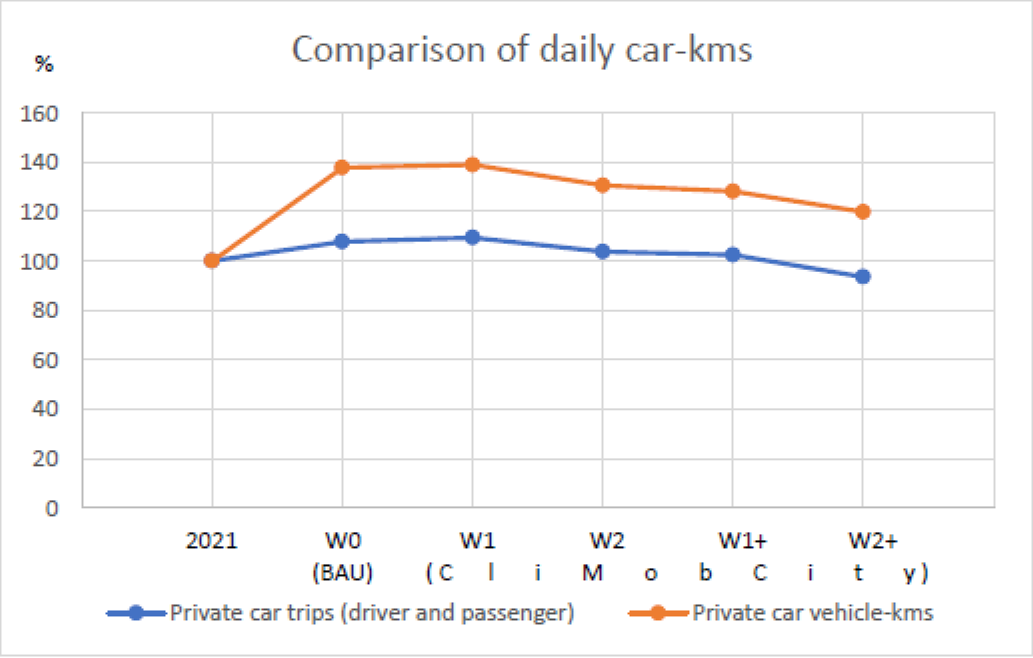
- Ultimate result of mobility changes from 2021 to 2050 **W0 (BAU)** is the increase of road vehicle-kms by about 30% (LGVs) to almost 40% (cars). Without shift to post-fossil vehicles this would mean an increase in CO_2e emissions as well

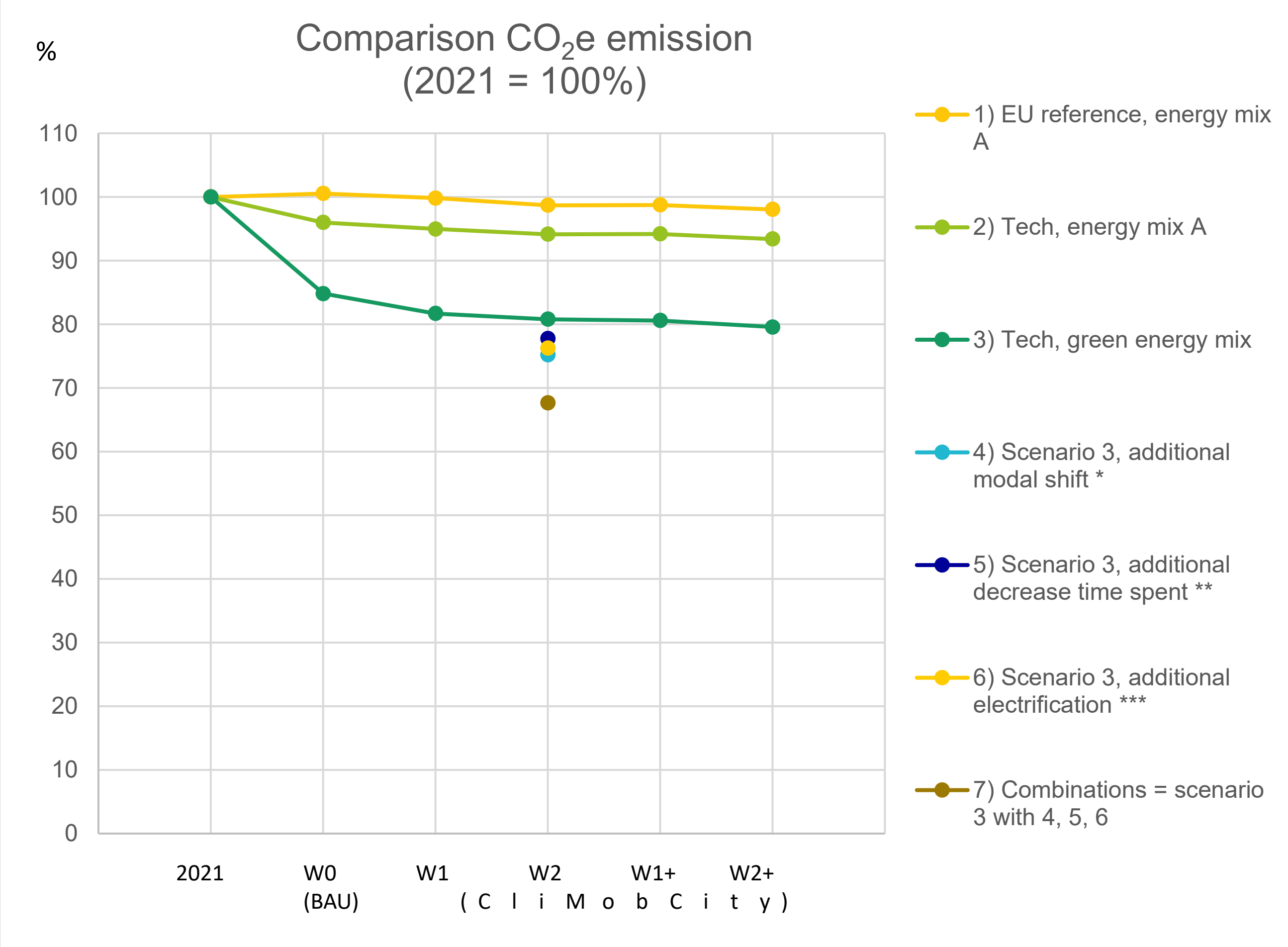
- In **W1** the situation car-kms are on a similar level as in **W0 (BAU)** as the nu … r. In **W2** the car-kms … with the shorter a … or **W2+** is smaller t … e lower valuatior … r of trips.



Electrification

	EU reference			
	% BEV cars	% Hydrogen cars	% Together	% Fossil fuel remainder
Bydgoszcz, 2021	0,2	0	0,2	99,8
Bydgoszcz, 2050	16	7	23	77

	Tech			
	% BEV cars	% Hydrogen cars	% Together	% Fossil fuel remainder
Bydgoszcz, 2021	0,2	0	0,2	99,8
Bydgoszcz, 2050	30	13	43	57



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**	10% less time spent, because of less road vehicle-kms and/or more fluent traffic flow.
***	10% extra shift to post-fossil fuel vehicles.

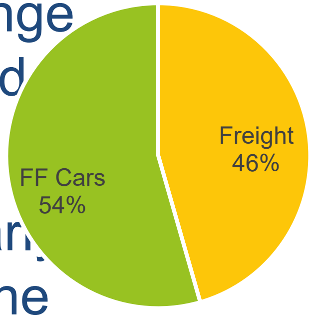
Conclusion

- best of all envisaged scenarios, the remaining CO2e emissions are 67% of the 2021 emissions. The highest share of the reductions is accounted for by the increased electrified and hydrogen t-share (technology share). The difference between low and high tech becomes smaller in the scenarios with a **lower LDV modal share**. This is due to the fact that with a lower LDV share there are also fewer cars in the system.

- Further reduction will depend on further measures to change mobility. Further shift to post-fossil fuel vehicles is required.

- Regarding post-fossil road vehicles, what Bydgoszcz clearly shows on the basis of current strategic policies, is that if the decarbonisation focus is mainly technical, the carbon reduction will take place much to slow.

Remaining Emissions



Thessaloniki

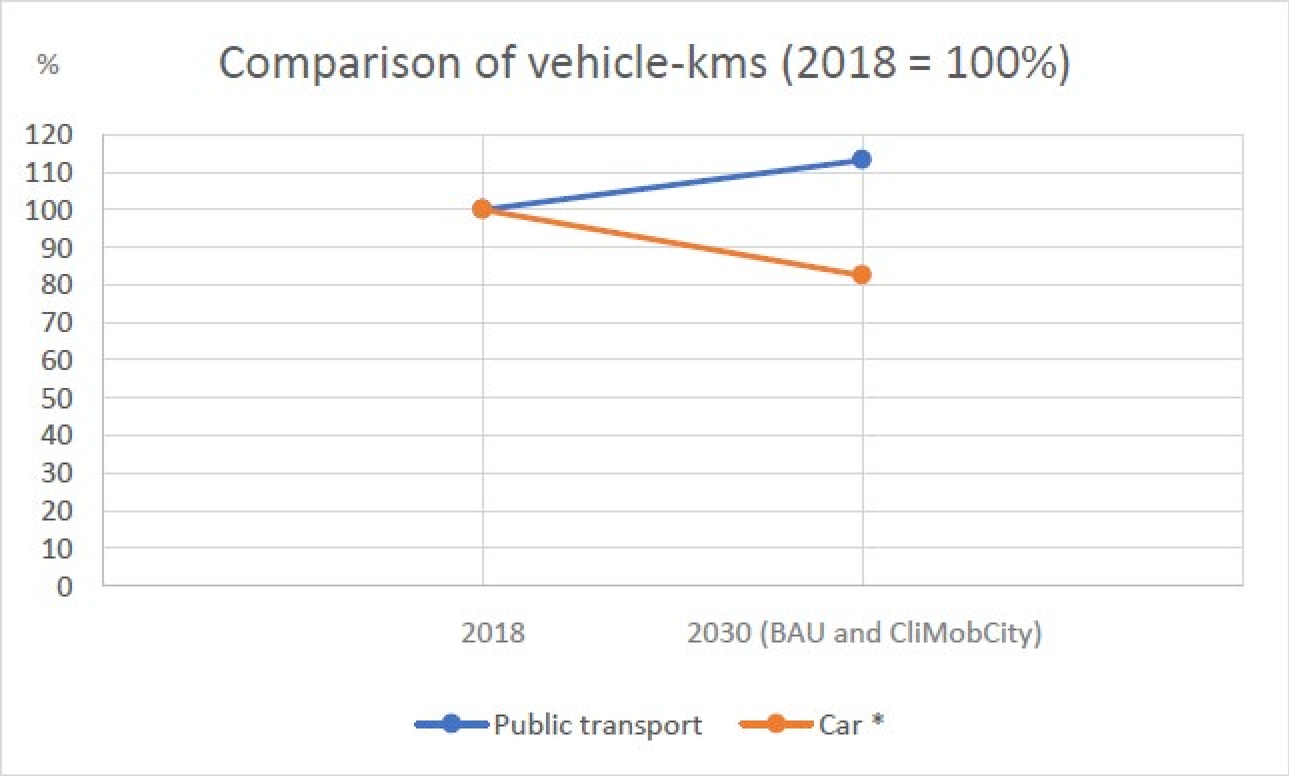
Scenario setting

- The climate mitigation aim of the municipality of Thessaloniki is, in line with the national aim (National Plan for Energy and Climate of Greece, 2019), to reduce CO2e emissions by 42% between **1990** and 2030.

Scenario	A. Modal shift pillar	B. Innovation pillar	C. City Logistics pillar	D. Energy pillar
SUMP 2030 intermodal public transport strategy & scenario (BAU scenario for 2050CliMobCity)	• Pedestrianization and public space reallocation in the city • METRO operation • Bus Network reorganization & redesign • Maritime Public transport • New Bike infrastructure (total 46 km of bike lanes) • West Suburban railway	• Advanced traffic management & Control • Park & ride (1500 places) •	• New supervision to the parking slots for deliveries • Development of SULP	
2050CliMobCity scenario for 2030 (Electromobility and awareness raise campaigns)	• Shared electric mobility introduction scenario considered from municipality participation to MOMENTUM project) (2030) • Triggering behavioural changes through awareness campaigns for citizens' mode choice and the, associated to the choice, impact for the environment, the city and the individuals	• Electric fleet in bus network (2030 & 2050) • Cooperation with and use of THESSM@LL services for fact-based and data-driven decision making in sustainable mobility management and planning	• Electrification of the Municipal fleet	• Energy savings from street lighting

Mobility changes

- Share of public transport is predicted to increase significantly by 2030. The share of public transport will then pass the share of car mobility and reach a level of 38-40%, share of car trips declines from 36% in 2018 to 24-28% in 2030



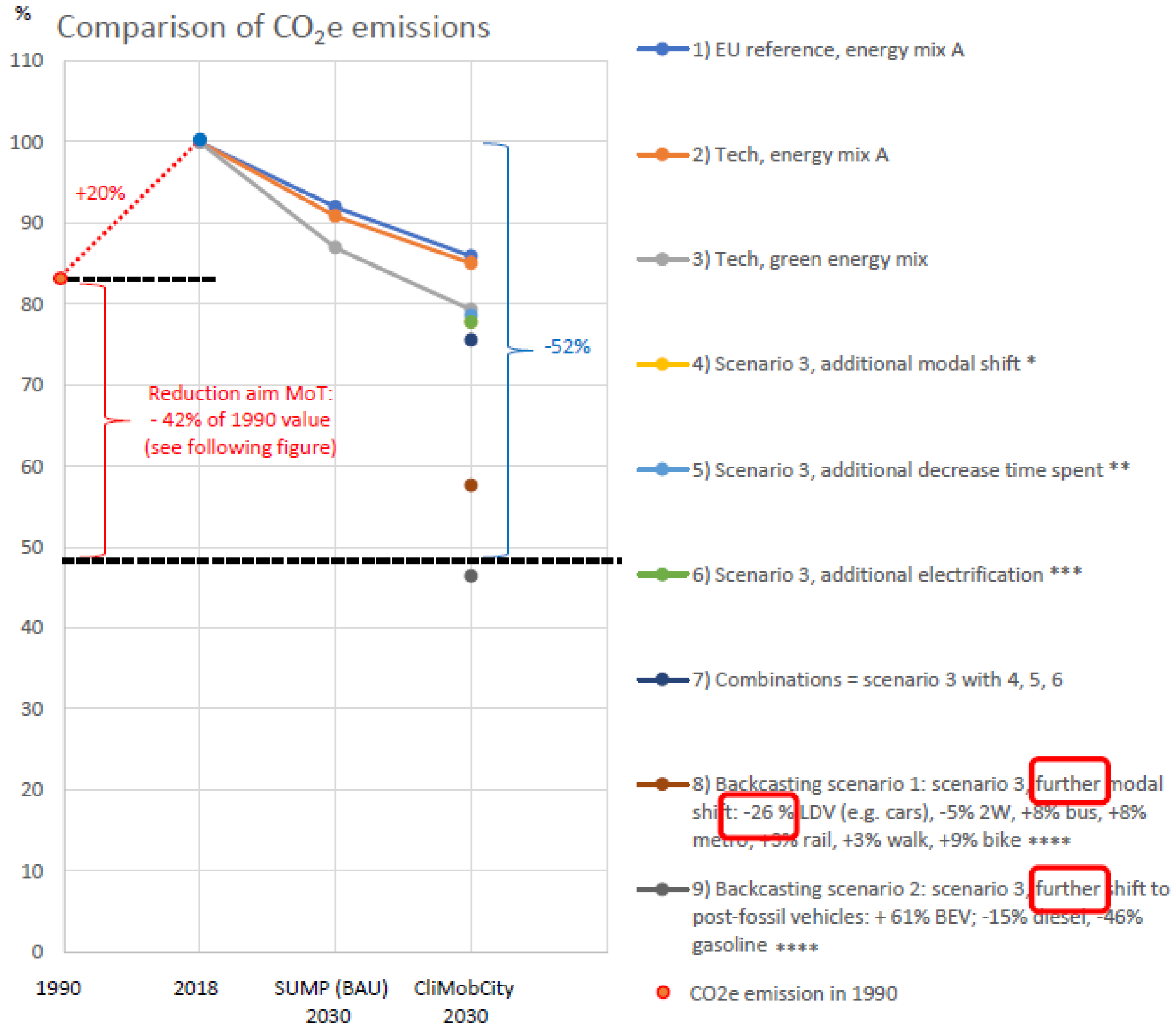
Electrification aims

- The municipal *Electric Vehicle Charging Infrastructure Plan* (MoT, 2021) has the target for 2030 of 37% of being cars are electric ones.

- Goes beyond the targets of the *National Plan for Energy and Climate* aiming for 30% of private cars to be electric by 2030, and also further than the *National Climate Law* stating that ⅓ of private cars electric ought to be electric ones by 2030

	EU reference			
	% BEV cars	% Hydrogen cars	% Together	% Fossil fuel remainder
Thessaloniki, 2018	0,2	0	0,2	99,8
Thessaloniki, 2030	1,3	0,2	1,5	98,5
Thessaloniki, 2050	25	11	36	64

	Tech			
	% BEV cars	% Hydrogen cars	% Together	% Fossil fuel remainder
Thessaloniki, 2018	0,2	0	0,2	99,8
Thessaloniki, 2030	8	3	11	89
Thessaloniki, 2050	52	22	74	26



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**** "%" is to say %-points.

Conclusion

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- Emissions have increased since 1990, leading to lower reductions than between 2018-2030. 8% is saved in the best Scenario.
- The sustainable production of electricity is important, however, this is primarily a national task.
- Remaining emissions being 58% of the 2018 emissions is mainly caused by HGVs (trucks, non-public transport busses), also by public transport busses (1/3 of them still has diesel propulsion) and by 2-wheelers
- The carbon reduction will partly depend on national and EU measures discouraging the use of fossil fuel vehicles and privileging alternatives (like electric cars or other modes) to make them more attractive. But also more local measure packages can relevantly contribute to reducing fossil fuel (road) vehicle-kms

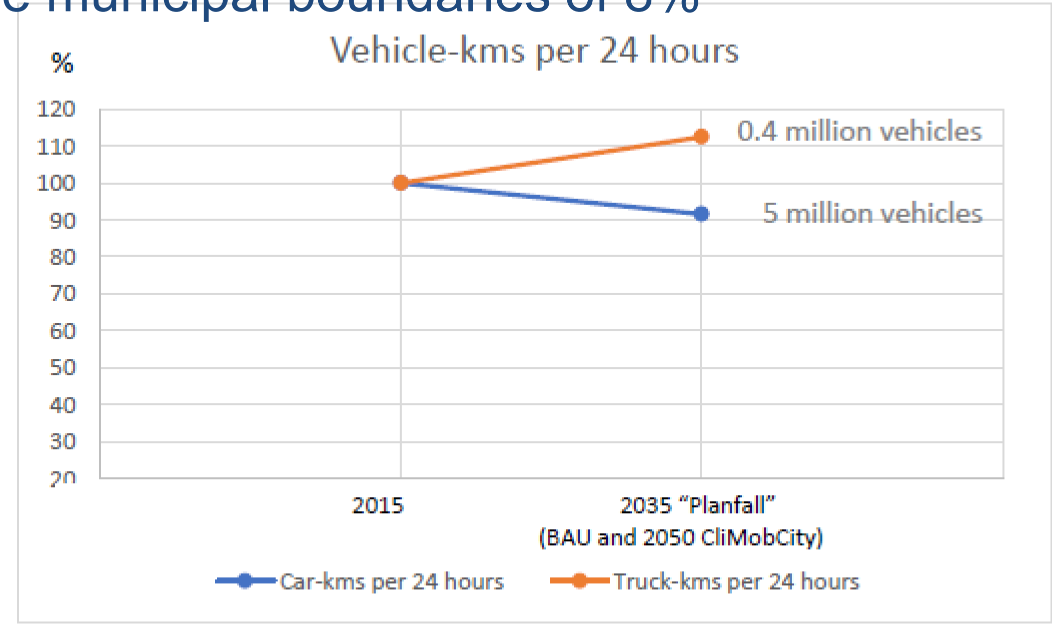
Leipzig

Scenario Setting

- The measure package in the new draft Leipzig - City of Smart Mobility policy and corresponding with the draft Infrastructure Charging Concept Leipzig 2030, consists of more and an accelerated implementation of existing types of measures, and of some new types of measures. Most important are:
  - expanding the network of vehicle charging points corresponding with the aim of 30% electric vehicles by 2030 (see section Post-fossil vehicle policies below);
  - 100% electrification of all public transport vehicles by 2030;
  - targeting passenger mobility: creating new public mobility stations where one can park and pick up shared vehicles (bikes, cars), charge e-vehicles, shared or not (cars) and park private bicycles;
  - expanding private electric car charging and sharing nodes or making such accessible to other users);

Mobility Changes

- The total number of daily person trips increases by +10% (0.5% per year), roughly corresponding with the growth of population. Car trips decreasing (9%)
- Average travel distances by car slightly increasing
- The combination of decreasing number of car trips and increasing average distance of car trips leads to a decrease of daily car-kms within the municipal boundaries of 8%



Electrification aims

	EU reference			
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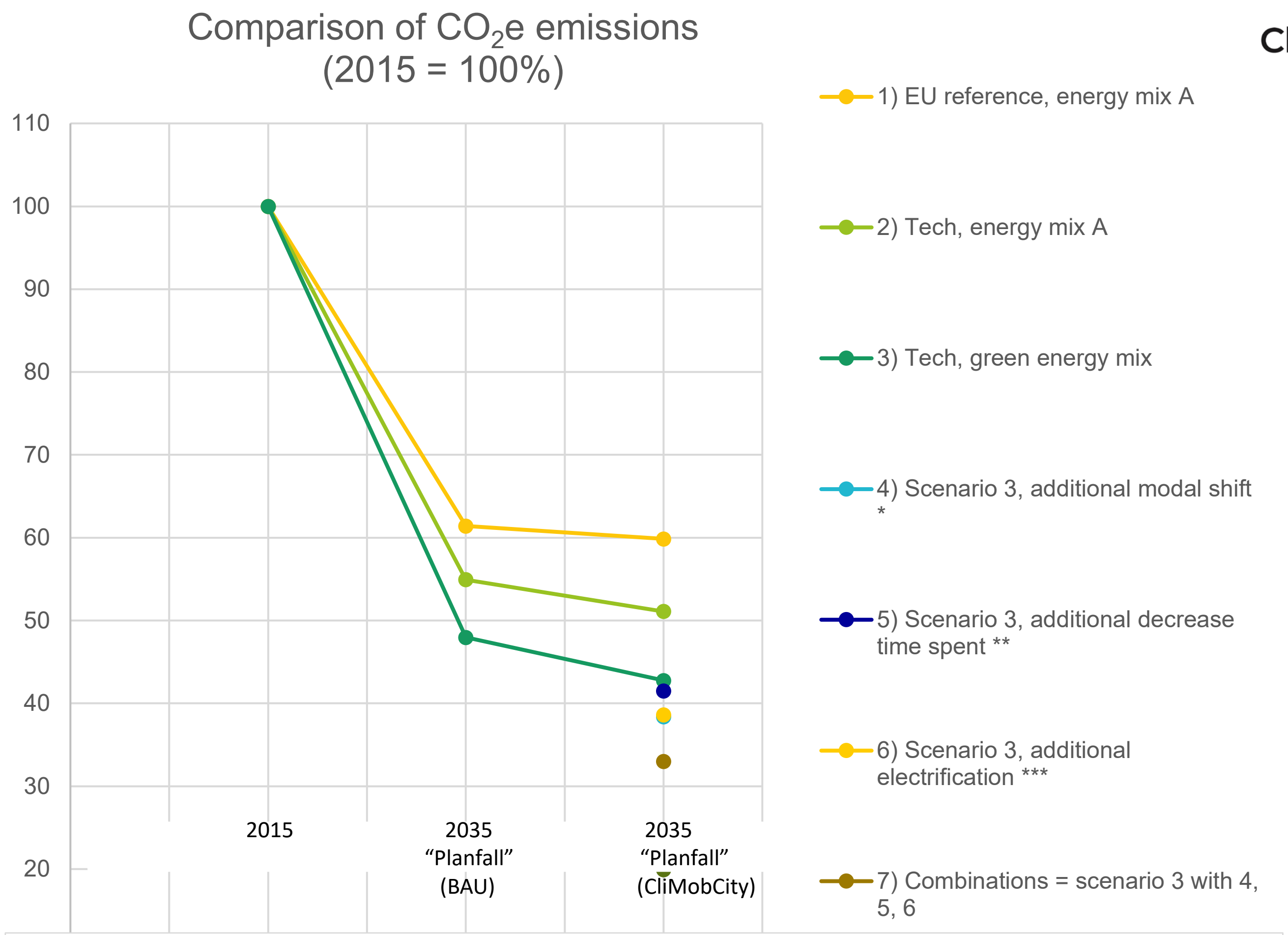
Leipzig, 2035	12	5	17	83
Leipzig, 2050	31	13	44	56

	Tech			
	% BEV cars	% Hydrogen cars	% Together	% Fossil fuel remainder
Leipzig, 2015	1	0	1	99
Leipzig, 2035	36	15	51	49
Leipzig, 2050	65	28	93	7



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

**** Share of cars and other LDVs: -25%-points LDV, share of public transport busses +15%-points, of active travel +10%; share of post-fossil vehicles: +32%-points BEV, -20%-points gasoline, -12%-points diesel.

Conclusion

- The analysed reduction of CO2e emissions from passenger and freight mobility in the partner cities is not sufficient to meet the targets
- CO2e emissions per ton-km are high in comparison to those per passenger-km, and that the volume of vehicle-kms is expected to grow in all four cities (between more than 10% and 30% for HGVs) while there is only a small shift to post-fossil fuel trucks.
- Shift to post-fossil vehicles can interrupt the relation of reduction of vkm, energy consumption and emission reductions

Development between base year and BAU (EU reference applies)

	1	2	3	4	5
	Change car-kms (%)	"Middle" of 2 and 3	Change HGV-kms (%)	Change CO2e emissions (%)	Nominal gap between 2 and 4
Bydgoszcz	+40	+35	+30	0	+35
Plymouth	+20	+30	+40	-5	+25
Thessaloniki	-18	-9	0	-8	1
Leipzig	-8	+2	+12	-37	+39

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Thank you!

Questions welcome

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