POLIS
CITIES AND REGIONS FOR TRANSPORT INNOVATION
ANNUAL CONFERENCE 2024

Quantification of the impact of fleet renewal and electrification on air quality through microscopic traffic simulation with detailed emission modelling

09:00 AM - 10:30 AM

27 November 2024

Dr.-Ing. Matthias Pfriem, PTV Planung Transport Verkehr GmbH

Umovity – One Brand to unite Mobility Expertise

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Immediate Action is Needed for Clean Mobility

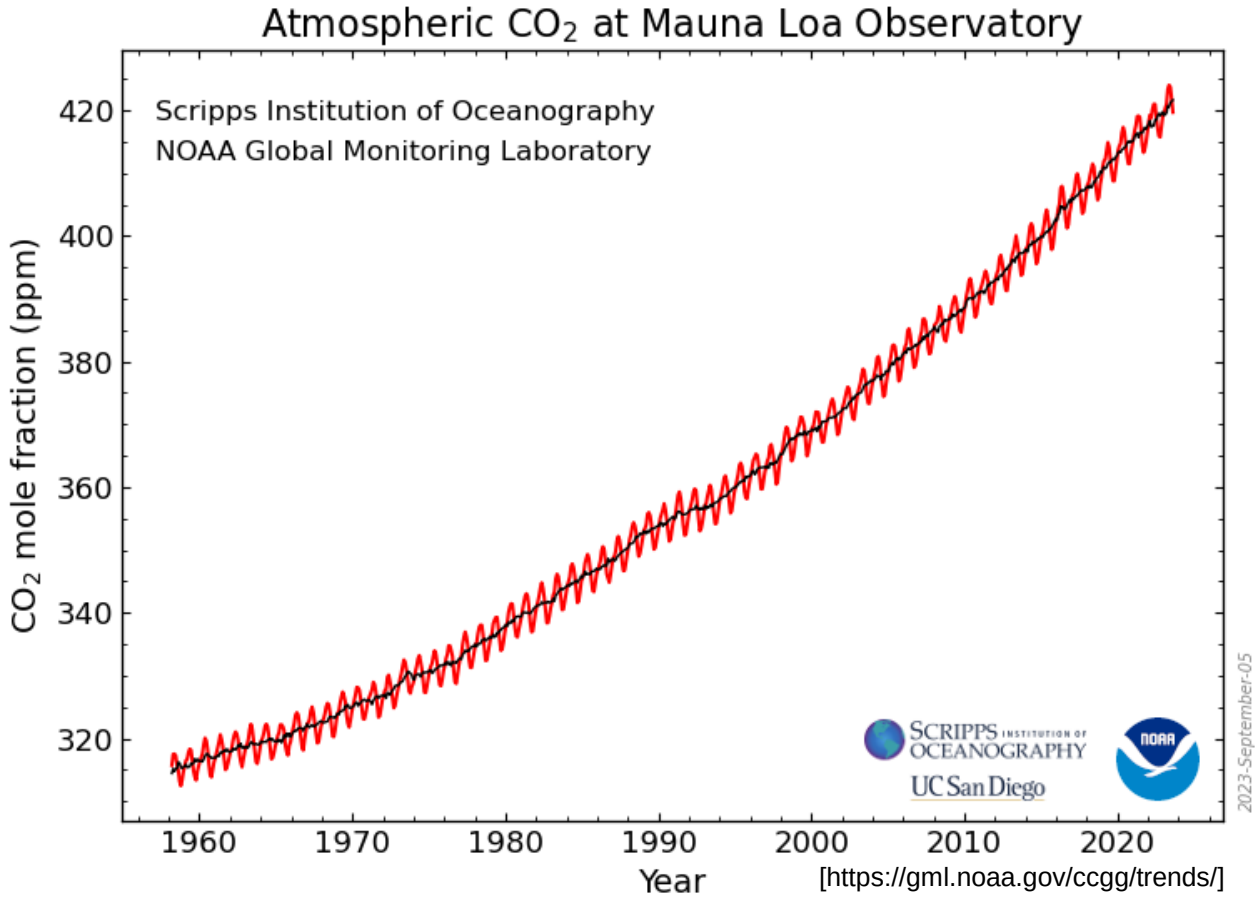
"Everything has already been said,

but since nobody was listening,

we always have to start again."

–

André Gide



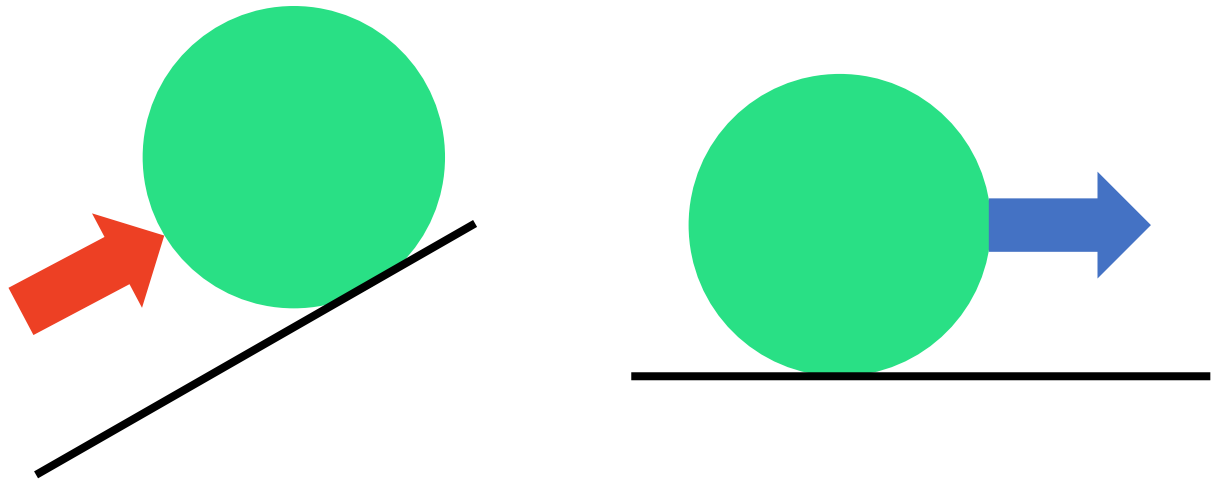
[https://gml.noaa.gov/ccgg/trends/]

Drivers of Change in a Balanced Policy Mix

Mobility is a „people thing“!

- How far do you come with pull approaches?
- What gap do you need to fill with push measures?
- What‘s the „*right*“ speed for change?

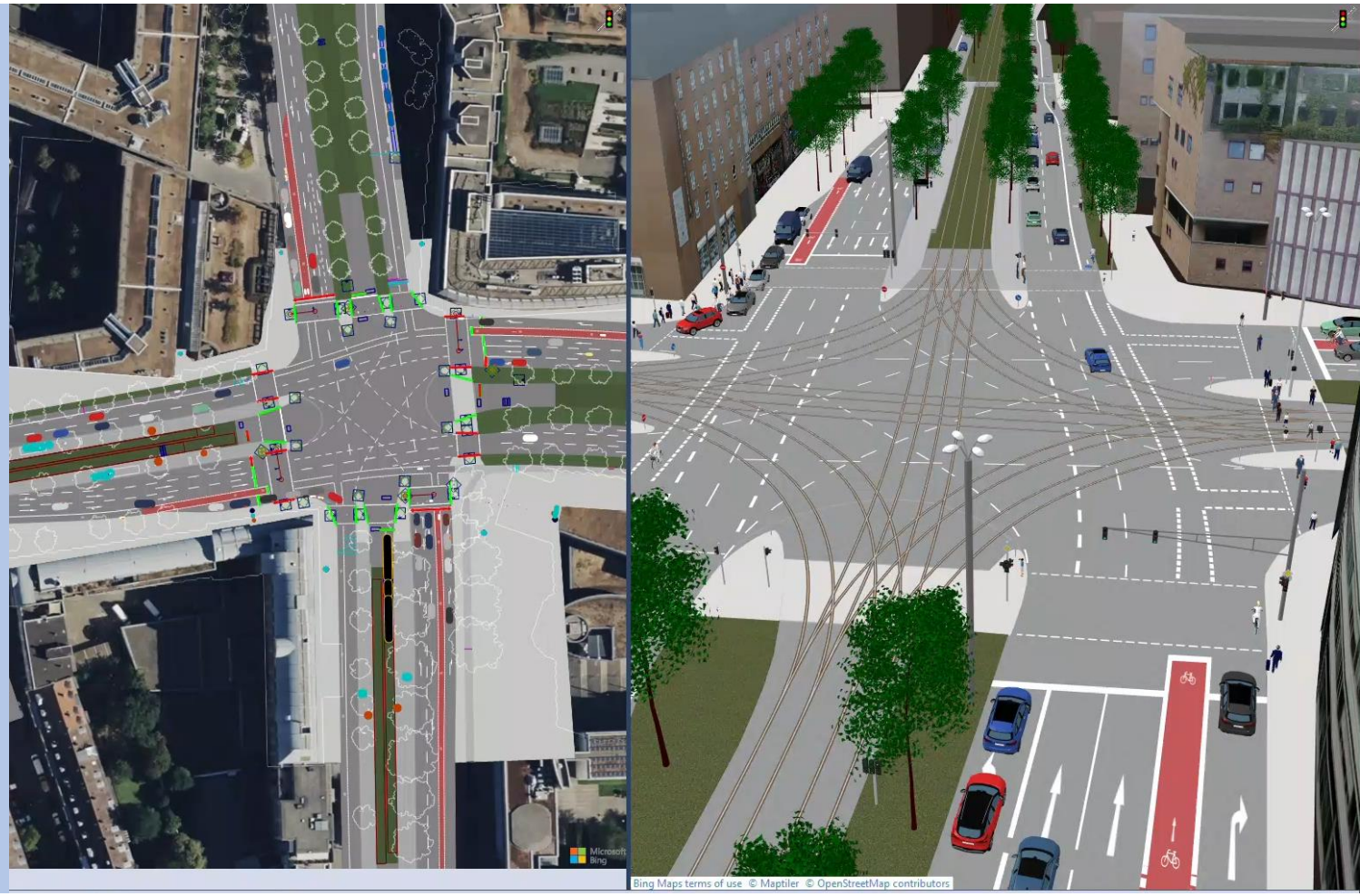
→ Need for **quantification** of the impact of measures and expected developments



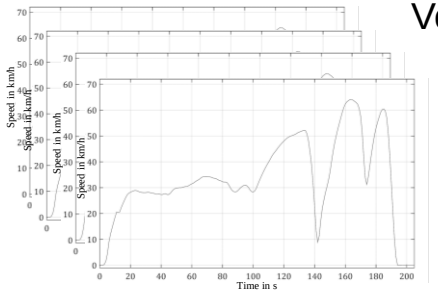
Methodology – Traffic Simulation

Multimodal Microscopic Traffic Simulation
PTV Vissim

- Detailed representation of the multimodal traffic environment
- Individual actors interact on basis of behavior models
- Simulation of advanced traffic control measures, ITS etc.

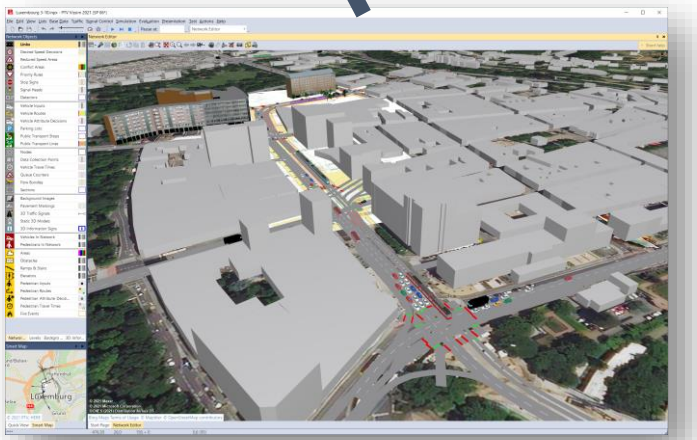


Methodology – Integrated Emission Calculation



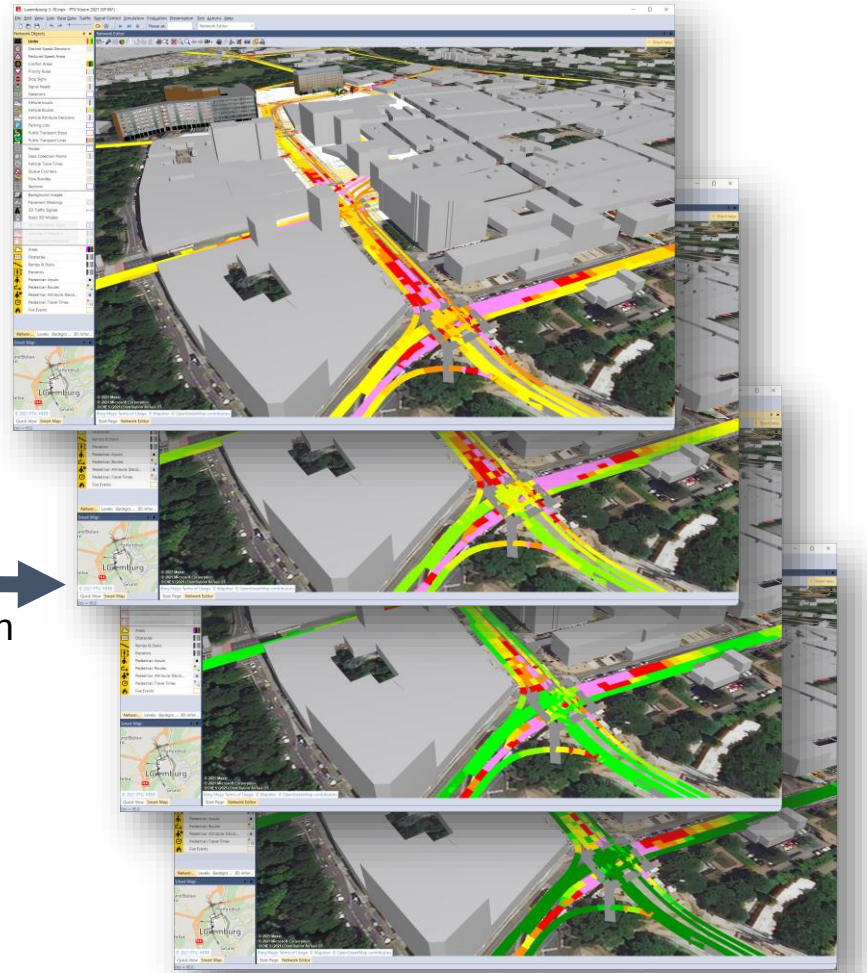
Vehicle trajectories

- Vehicle type (passenger car, truck,…)
- Fuel Type
- Emission Class (EU4, EU5,…)



ESTM
BOSCH

- Fuel consumption
- Emissions
  - CO_2
  - CO
  - NO_X
  - PM
  - HC



Scenarios

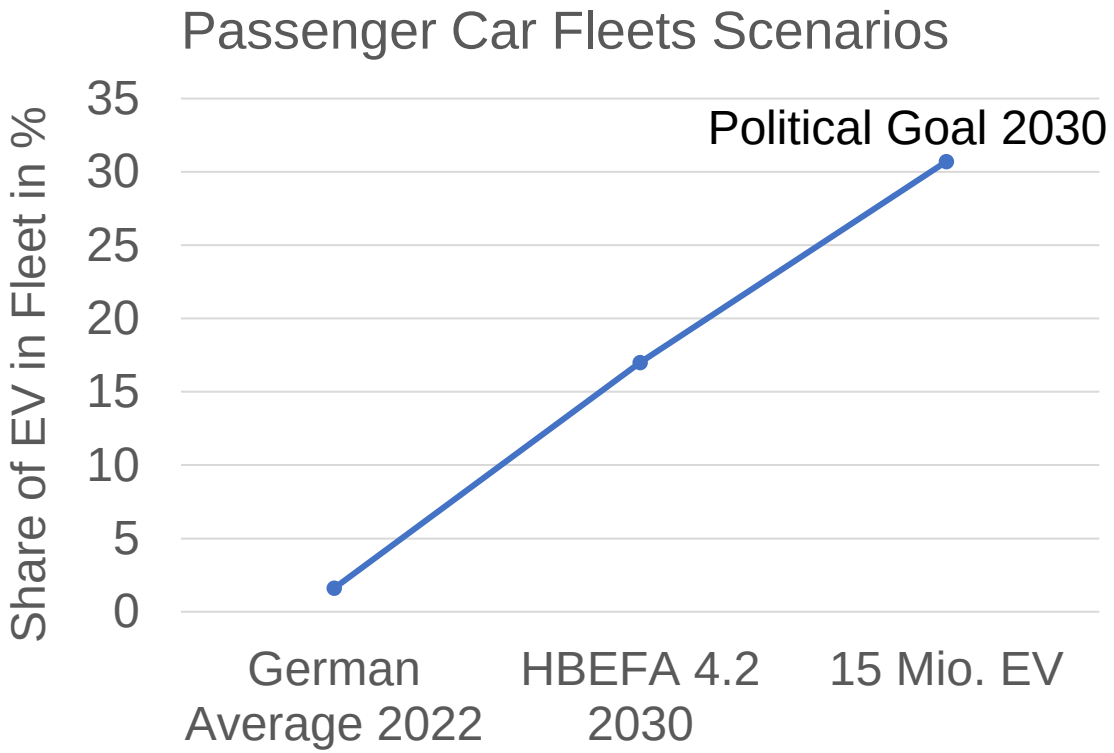
Study Set-Up: Model and Scenarios

What effect will fleet renewal and electrification contribute?

Microscopic Simulation Model

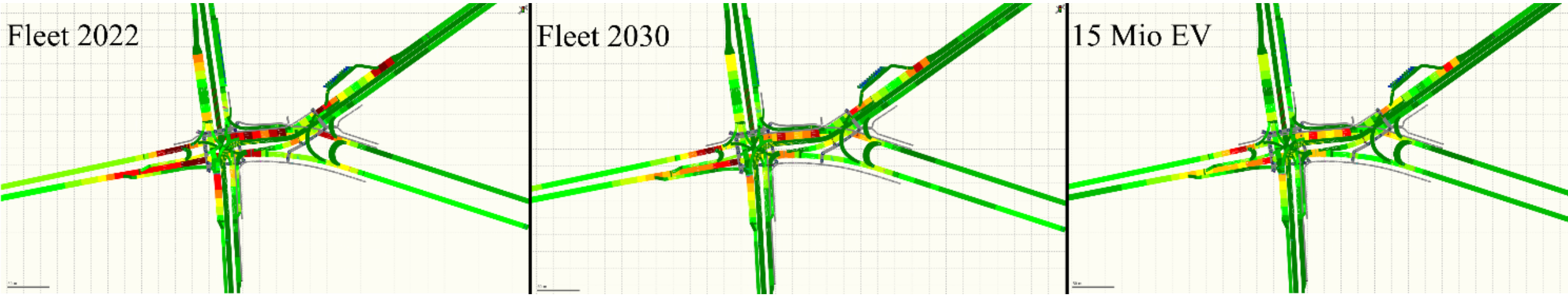
- Urban intersection at major street
- Multimodal traffic scene

Simulated Scenarios



Results

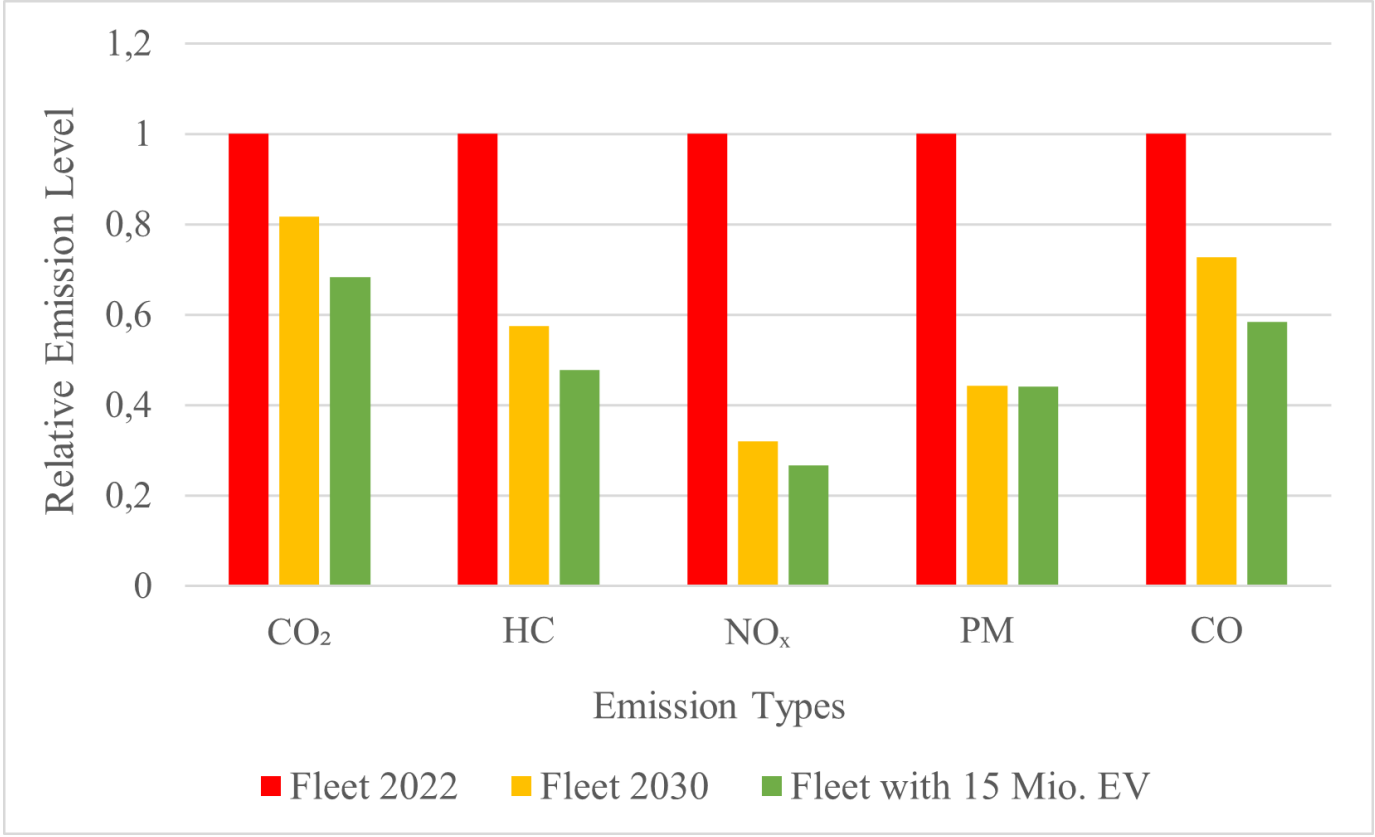
- Simulation of one hour with ca. 4,600 trajectories and ca. 3,500 km traveled
- Trajectories can be kept constant between simulation runs
  → fleet composition is only variable
- Simulation allows for spatial analysis to identify emission hotspots,
  e.g. from accelerations at signalised intersection



Relative comparison of the spatial distribution of NO_X emissions for the three fleet compositions

Results – Overview

- Strong sensitivity to fleet composition for all investigated substances
- Strongest effect observed for NO_X due to old vehicles being replaced
- Up to 32 % CO_2 reduction with 15 Mio. EV (production of electric energy not considered)



Key Takeaways

- Clean mobility needs **immediate action**
- A balanced **policy mix** combines **push** and **pull** measures
- Planning the **right amount** of push requires **quantification** of effects
- **Microscopic simulation** creates digital **twins of mobility system** for what-if-analysis
- In combination with **detailed emission calculation**, it can **foresee effect** of measures **on clean air** in transport sector
- Fleet renewal and electrification will have **significant influence** on emissions with e.g. over 80 % of NO_X in 15 Mio. BEV Scenario
- It’s not the future. It’s available today. **Let’s use it!**

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KARLSRUHE (DE)

Thank you for your attention!

For more information:

Dr.-Ing. Matthias Pfriem
PTV Planung Transport Verkehr GmbH
Matthias.Pfriem@ptvgroup.com

Baden-Württemberg
Ministry of Transport

Karlsruhe