Gefördert durch:

Bundesministerium für Wirtschaft und Technologie

Bundesministerium für Verkehr, Bau und Stadtentwicklung

aufgrund eines Beschlusses des Deutschen Bundestages

Quantification of the Mitigation of Greenhouse Gas Emissions in Transport through the Use of Electric Vehicles

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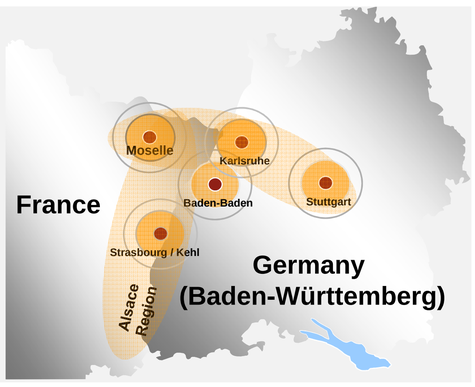
Introduction

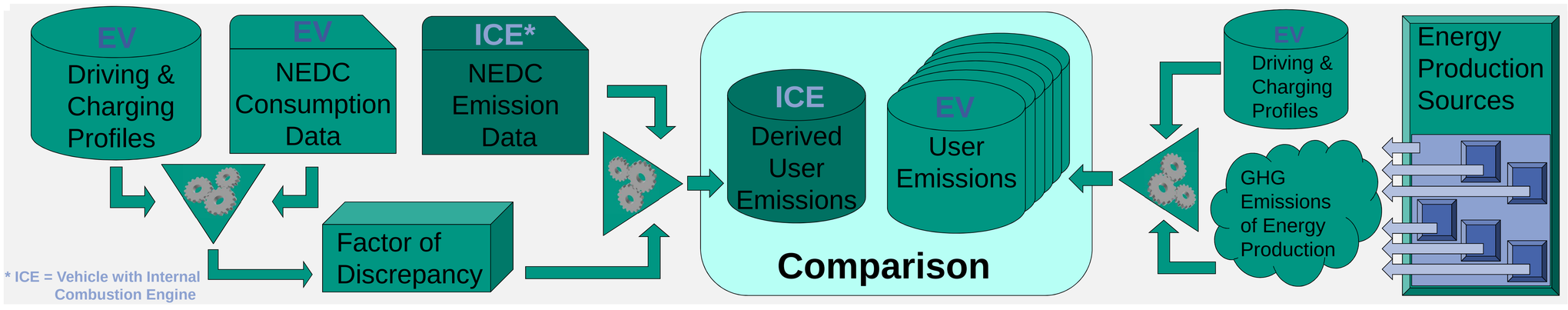
- Transport as major CO_2 emitter, emissions expected to double by 2050 [1]
- Electric Vehicles (EVs) with potential to reduce CO_2 emissions
- Net mitigation of Greenhouse Gas Emission (GHG) dependant on energy production
- Driving profile with big influence on consumption and emissions

Study Overview

- Binational field operational test with EVs in Germany and France
- 2 car models from the “Minis” segment in commercial use ➡ > 60 EVs
- Multi-user scenario with “average” drivers (no pre-selection of drivers)
- Long-time study with over 12 months of data collection
- On board data acquisition systems to collect driving and charging data
- More than 550.000 km trip data and corresponding charging events analysed



Methods

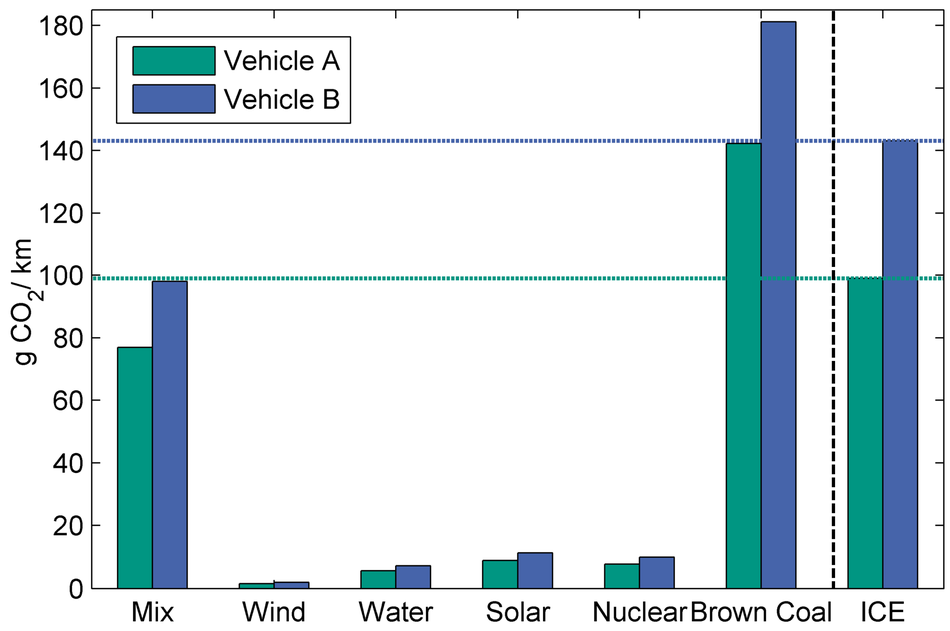


Research Questions

- How much CO_2 can be saved by using EVs in real-world driving scenarios?
- What influence does the energy production have?

Results

- Average consumption of 0.124 kWh/km for EV type A and 0.158 kWh/km for type B
- Resulting emissions of 76.9 g CO_2/km for A and 97.9 g CO_2/km for B in German electricity mix [2] with charging efficiency of 0.88 [3]
- Large variation of emissions depending on energy production [4]
- Emission reduction of over 90 % vs. ICE possible
- Annual emission reduction of 140 kg CO_2 in German electricity mix in considered use scenario
- Potential reduction of approx. 460 kg CO_2 per year



Discussion

- Vehicle consumption largely dependant on individual driving cycle
- Significant discrepancy between NEDC consumption and real-world consumption
- Quantification of user-relevant GHG mitigation only possible with real-world consumption
- EV with lower emissions than ICE for German electricity mix and especially renewable energy sources
- Consumption data presumably transferable to private use
- Holistic approach with consideration of total life cycle emissions as consequential next step

References

[1] http://www.de-ipcc.de/_media/ipcc_wg3_ar5_summary-for-policymakers_approved.pdf, accessed on 14.04.2014
[2] „Entwicklung der spezifischen Kohlendioxid-Emissionen des deutschen Strommix in den Jahren 1990 bis 2012“, P. Icha, Umweltbundesamt, 2013
[3] M. Duvall, E. Knipping, and M. Alexander, “Environmental assessment of plug-in hybrid electric vehicles”, EPRI,: Nationwide Greenhouse Gas Emissions, vol. 1, 2007.
[4] „Der nichterneuerbare kumulierte Energieverbrauch des deutschen Strommix im Jahr 2012“, U. Fritsch, H.-W. Greß, IINAS, 2013