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European
Automobile
Manufacturers
Association

Analysis of WLTP Utility Factor Distributions

ACEA EV Group
IG WLTP Meeting, Vienna
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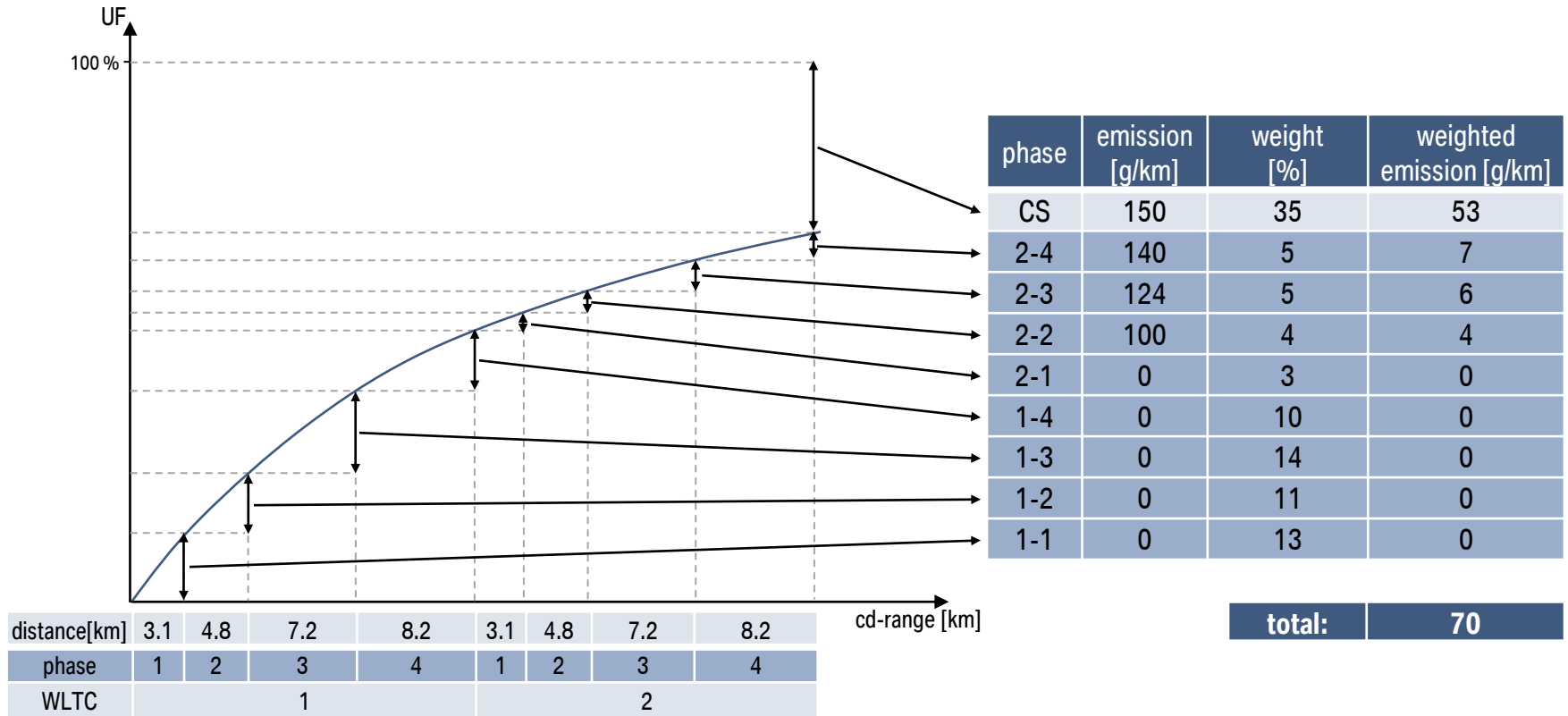


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Basics and usage of the Utility Factor in WLTP according to GTR 1A.



▶ A sequential UF weights the CO₂ of each CD-cycle phase with the CO₂ of the CS-cycle.

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ECE/TRANS/WP.29/2014/27

Annex 8 -Appendix 5

Utility factor (UF) for OVC-HEVs

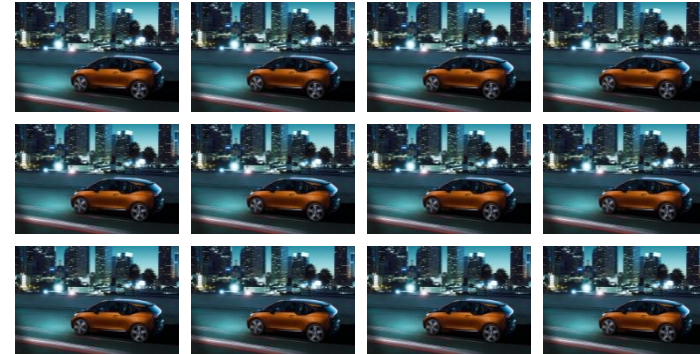
1. Utility Factor (UF) are ratios based on driver statistics and the ranges achieved in charge-depleting mode and charge-sustaining modes for OVC-HEVs and are used for weighting emissions, CO₂ emissions and fuel consumptions.
2. Each Contracting Party may develop its own UFs.

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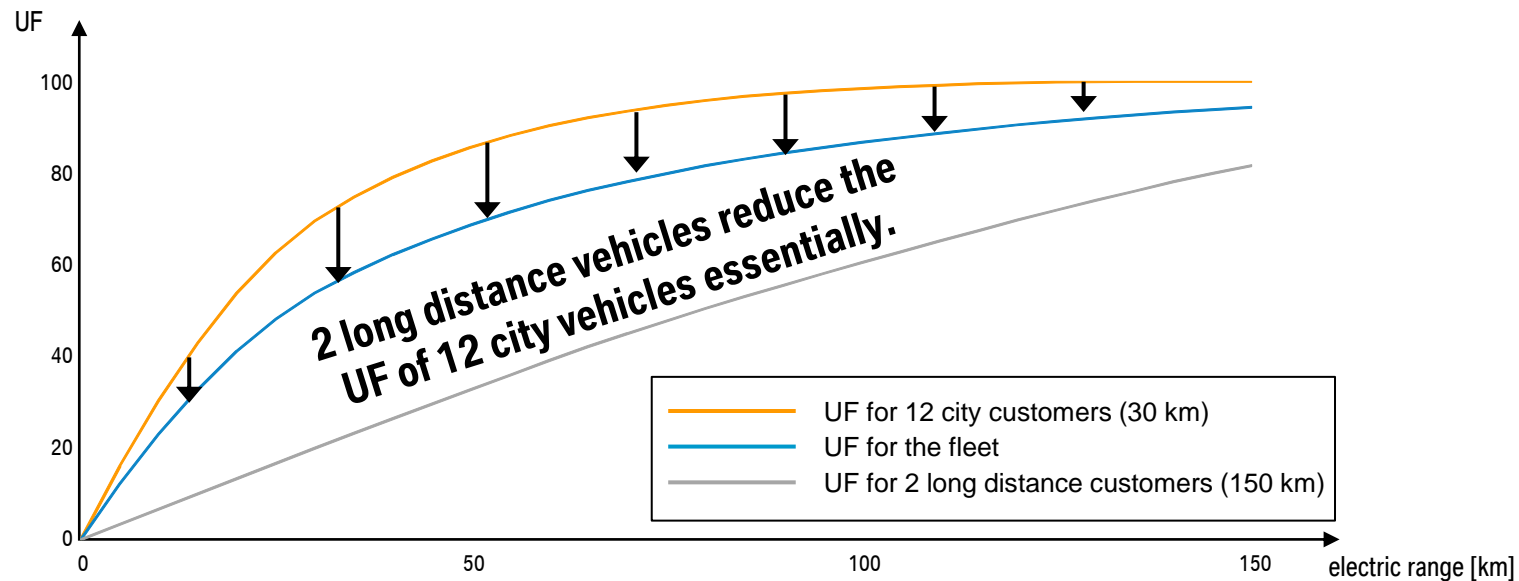
impact of long distance vehicles



2 customer with average daily traveled miles of 150 km



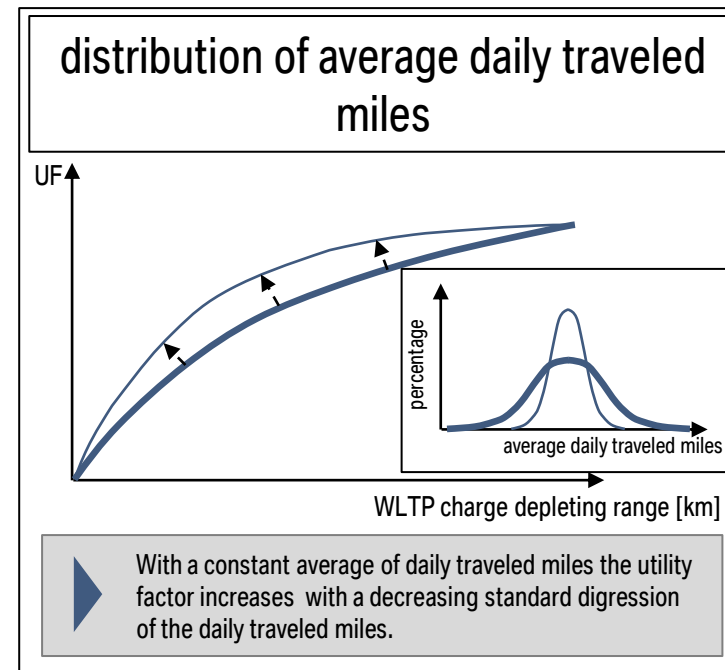
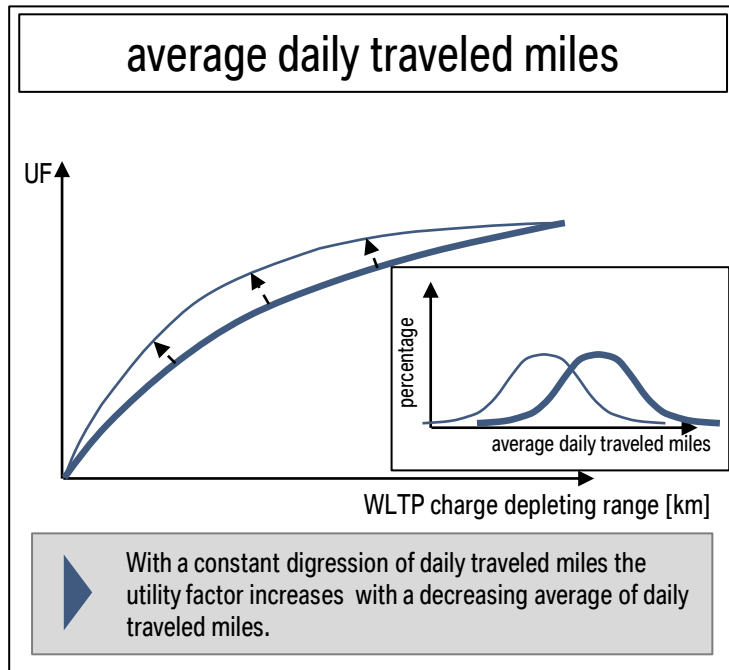
12 customers with average daily traveled miles of 30 km



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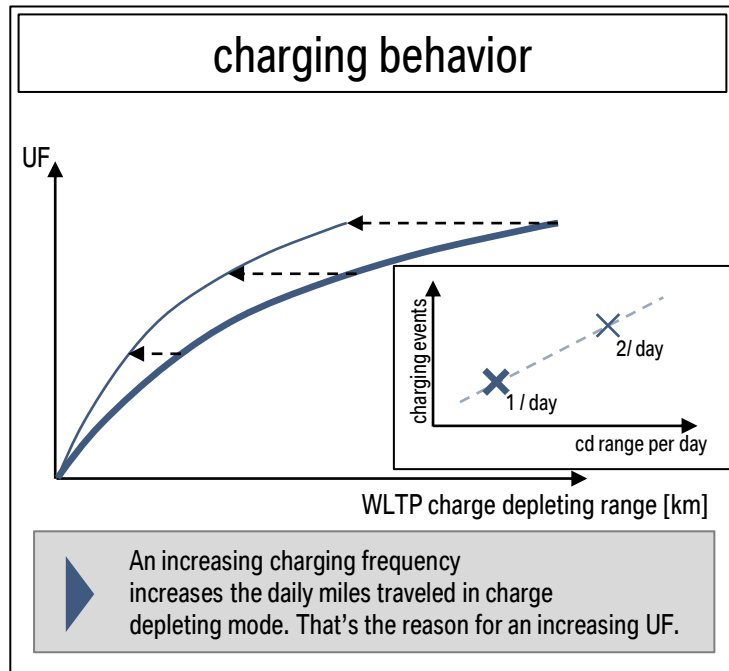
Main database influences on the utility factor



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Main database influences on the utility factor



- ▶ Up to now it is not possible to validate the future OVC-HEV customers charging behavior. According to SAE J2841 the assumption of **one charging event per day** (overnight charge) is used for the following analysis.
- ▶ Chevrolet Volt data in the EV project currently show a charging frequency 1.4 in US.

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Available Databases for Europe

▶ In addition to WLTP database (EU-only), the FIAT ECODRIVE database was analysed.

WLTP database

- 158 of 158 vehicles
- individual daily traveled miles: 58 km
- fleet daily traveled miles: 49 km
- milage: ~0,38 Mio. km
- driving days: 7811

- exclude N1- class vehicles (not representative for OVH-HEV customers – to be confirmed by COM)
- delete drives with implausible dates
- recalculation of driving days

- 132 of 158 vehicles
- individual daily traveled miles: 46 km
- fleet daily traveled miles: 47 km
- milage: ~0,34 Mio. km
- driving days: 7343

FIAT ECODRIVE database

- 1275 of 1275 vehicles
- individual daily traveled miles: 40 km
- fleet daily traveled miles: 37 km
- milage: ~1,8 Mio. km
- driving days: 49043

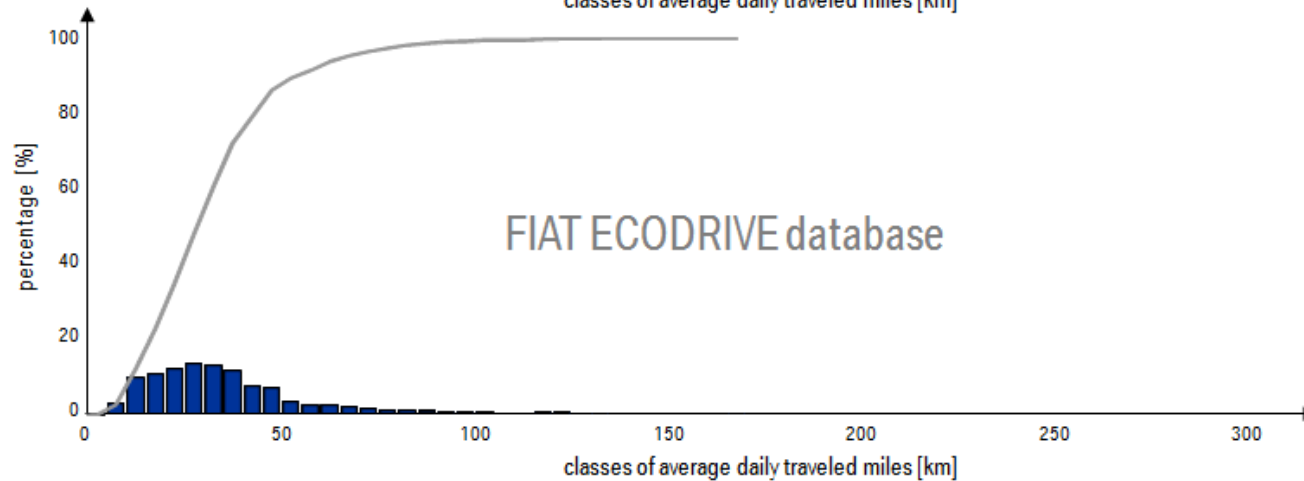
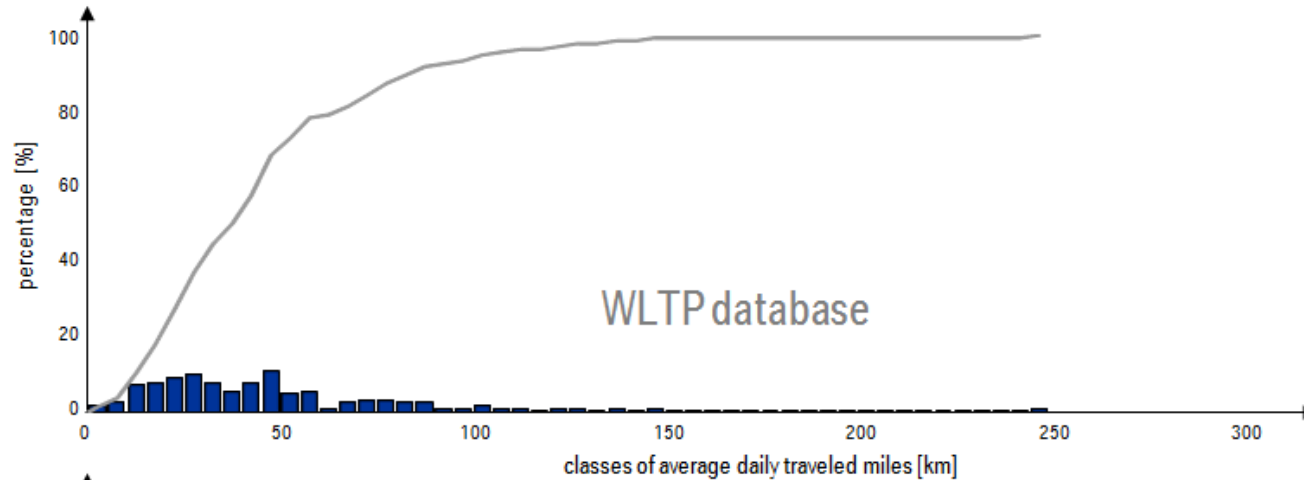
- delete drives with implausible dates
- recalculation of driving days

- 1275 of 1275 vehicles
- individual daily traveled miles: 39 km
- fleet daily traveled miles: 36 km
- milage: ~1,8 Mio. km
- driving days: 49769

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Distribution of daily traveled miles (European Data)



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Different kinds of Utility Factors according to SAE J2841

| database | | max. assumed electric range of the vehicle (40 km) | calculation | | | |
|---------------|----------------------|--|-------------|------------------|---------------|-----|
| vehicle | daily miles traveled | | elec. range | cs range | Individual UF | |
| | | | | IUF _i | IUF | FUF |
| 1 gasoline | 50 | 40 | 10 | 83% | 63% | 56% |
| | 30 | 30 | 0 | | | |
| | 60 | 40 | 20 | | | |
| 2 diesel | 35 | 35 | 0 | 43% | 63% | 56% |
| | 80 | 40 | 40 | | | |
| | 90 | 40 | 50 | | | |
| | 80 | 40 | 40 | | | |
| | 120 | 40 | 80 | | | |

First a distance weighted Individual UF for each vehicle is calculated (IUF_i).

The arithmetic average that includes all vehicles IUF_i ends up in the IUF.

Each vehicle IUF_i has the same weight.

The ratio of the totalized electric ranges and the totalized daily miles traveled.

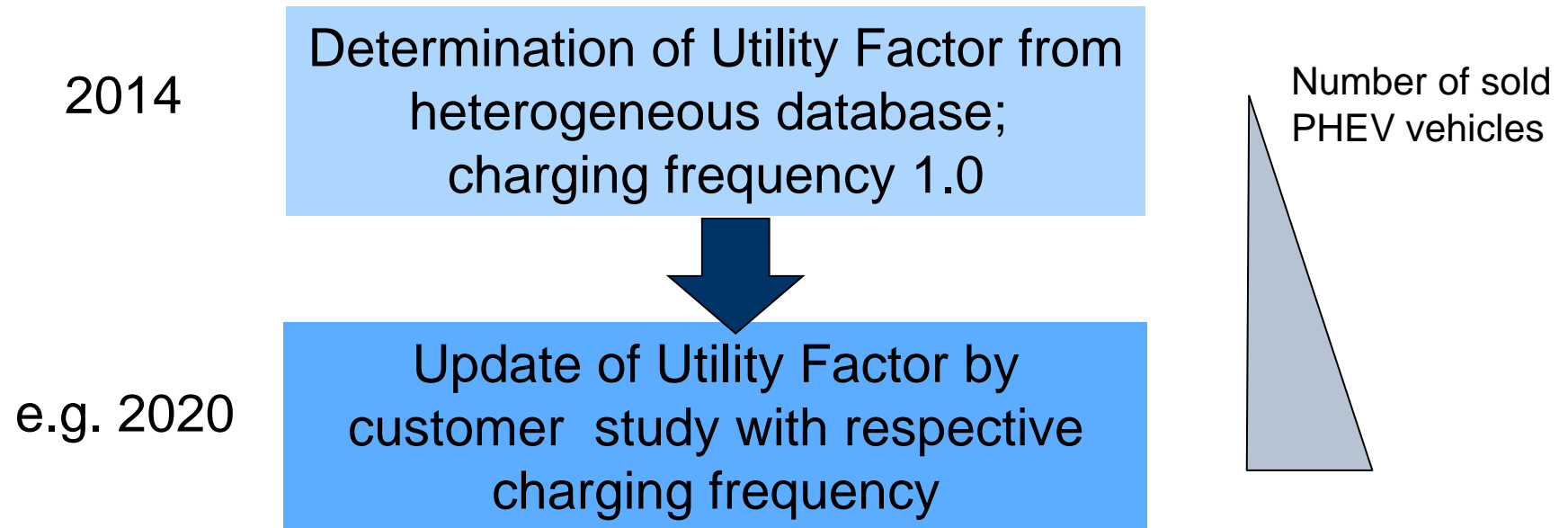
No arithmetic average means, that high daily traveled distances have a higher weight.

- ▶ The Fleet UF can only be used if the database represents a vehicle fleet of customers of plug-in hybrid vehicles.
- ▶ If the database consists of conventional vehicles of various kind, the Individual UF method should be applied.

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2 Step Approach for Europe:

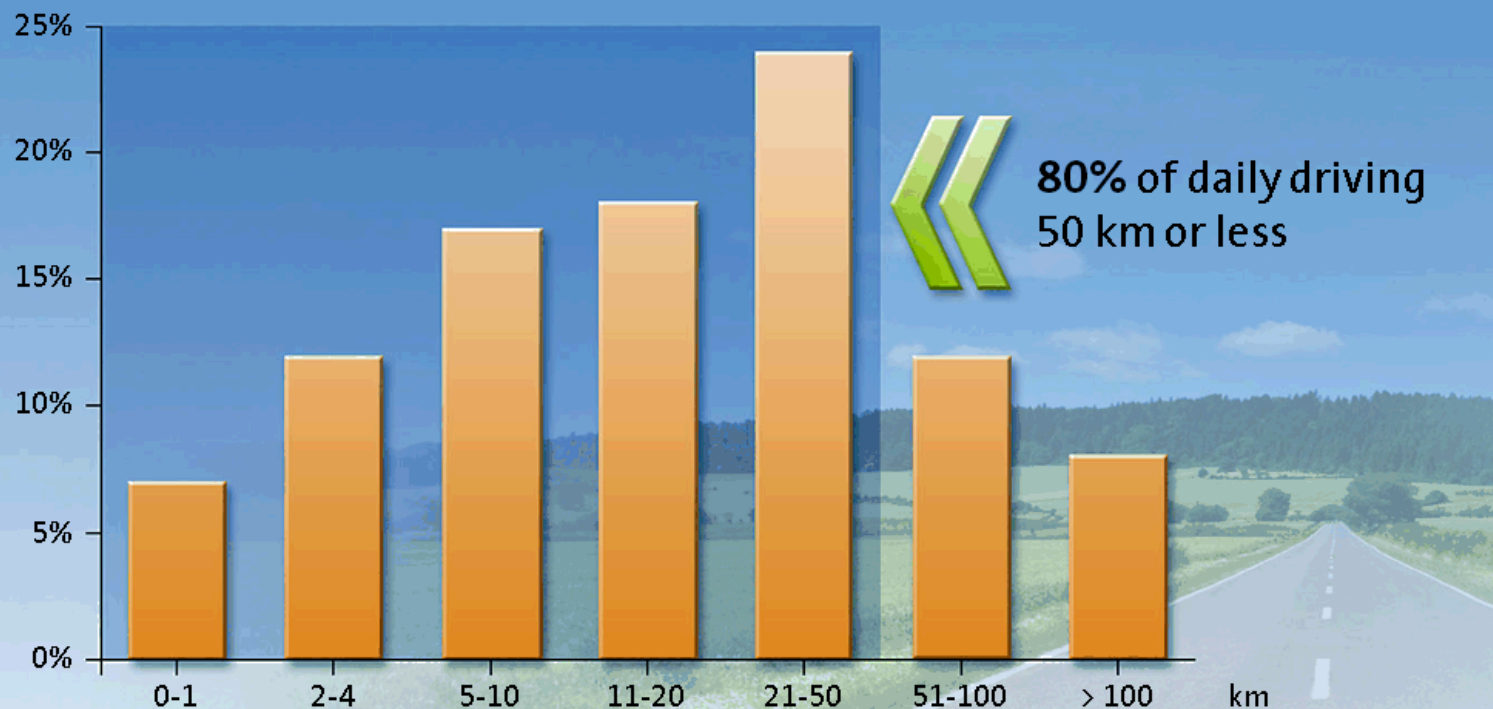


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Additional German statistics used for robustness check:

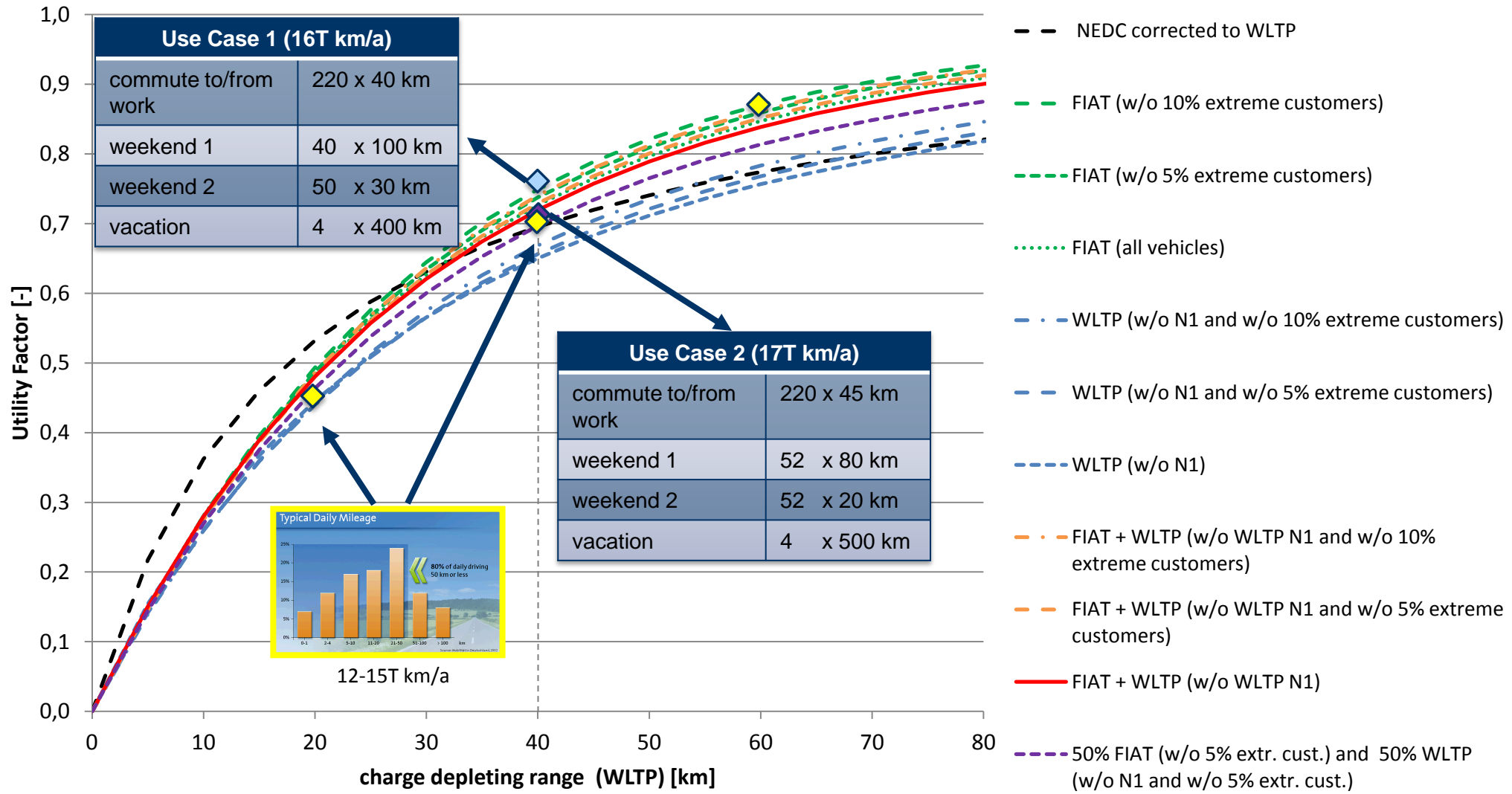
Typical Daily Mileage



Source: Mobilität in Deutschland, 2002

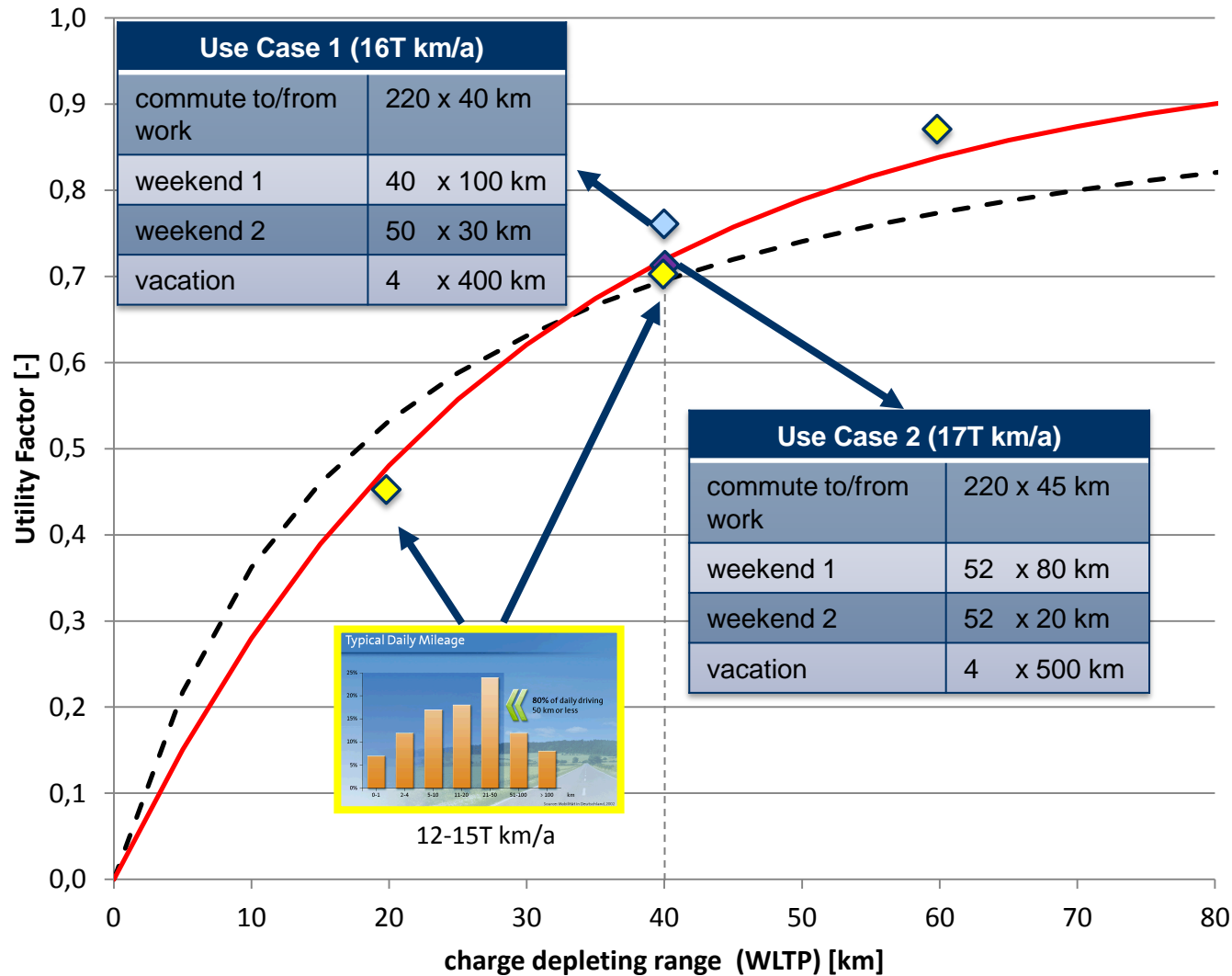
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-- NEDC corrected to WLTP
 — FIAT + WLTP (w/o WLTP N1)

EU-WLTP (1712/2013):
Fiat+WLTP Curve
 suggested as new UF
 Factor Curve for Europe

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WLTP phase 1B Utility Factor Recommendations

- Each contracting party shall develop its own Utility Factor based on regional driving data.
- Method for the determination of Utility Factor (based on SAE J2841) could be specified in GTR 1B, depending on the available data base.
- In case data for OVC HEV customers exist, ACEA E-Lab proposes to include the recharging behavior in the methodology to determine the Utility Factor function by considering recharging at non operation times.
- ACEA E-Lab proposes to investigate real world statistical driving and recharging behavior data for OVC HEV.