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HBEFA and emission measurements: Current state and Update Plans

ERMES Plenary, October 11, 2022

Agenda

1. Current version HBEFA 4.2
2. Migration of the HBEFA application
3. The new measurement DB „DBEFA“
4. Version update HBEFA 5.1

Current version HBEFA 4.2

- HBEFA 4.2 was published in February 2022
- It being a «light» update, only selected aspects were updated compared to HBEFA 4.1:

Category	Updates
Base emission/consumption factors	▪ HGV Euro-VI: Separation EF Euro VI A-C and D-E ▪ Additional Diesel PC software updates ▪ Consumption factors BEV (PHEM update)
Correction factors	▪ Age-dependent NO2/NOx ratio ▪ Deterioration functions for regulated pollutants for HDV updated based on remote sensing data
FC/CO2 calibration	▪ Integration of CO2 monitoring info for BEV/PHEV ▪ Updated real-world consumption BEV/PHEV
WTT EF + energy mix	WTT CO2e EF updated for biofuels and PtX
Activity data	Country data updates DE, FR

HBEFA 4.2 vs. 4.1

NOx (and most other pollutants):

- Increase of HDV EF when Euro-VI A-C trucks dominate due to updated deterioration functions
- Decrease from 2025 onwards when D-E trucks dominate

NO2:

- Decrease due to consideration of aging in NO2/NOx ratio by 7% (2010) to 55% (after 2030)

Figure 3: Average NO_x EF for HDV in Norway, 1990 – 2035, in HBEFA 4.1 and 4.2

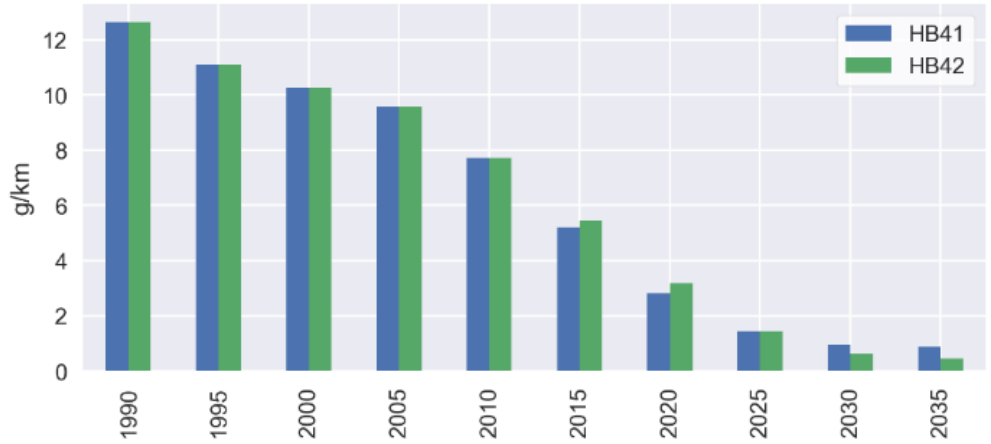
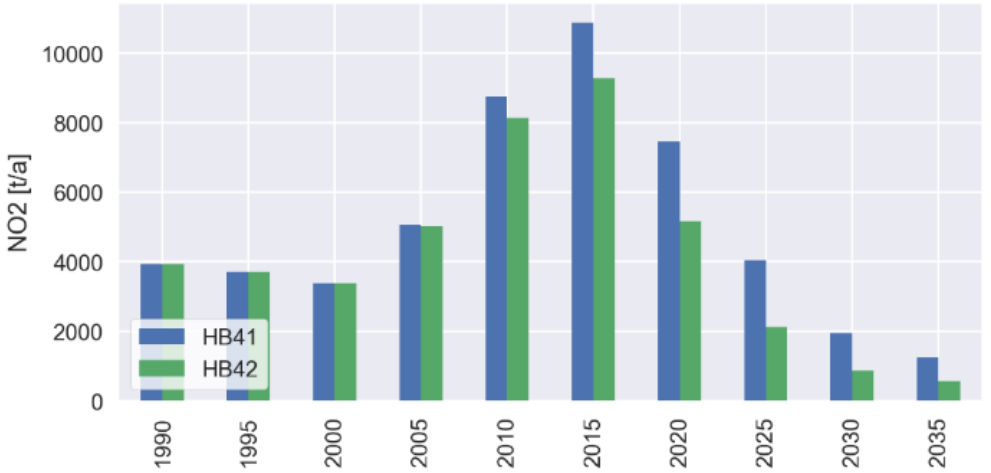


Figure 4: Total road transport NO_2 emissions for Norway, 1990 – 2035, using HBEFA 4.1 and 4.2



Graphics by INFRAS. Source: HBEFA 4.1, HBEFA 4.2

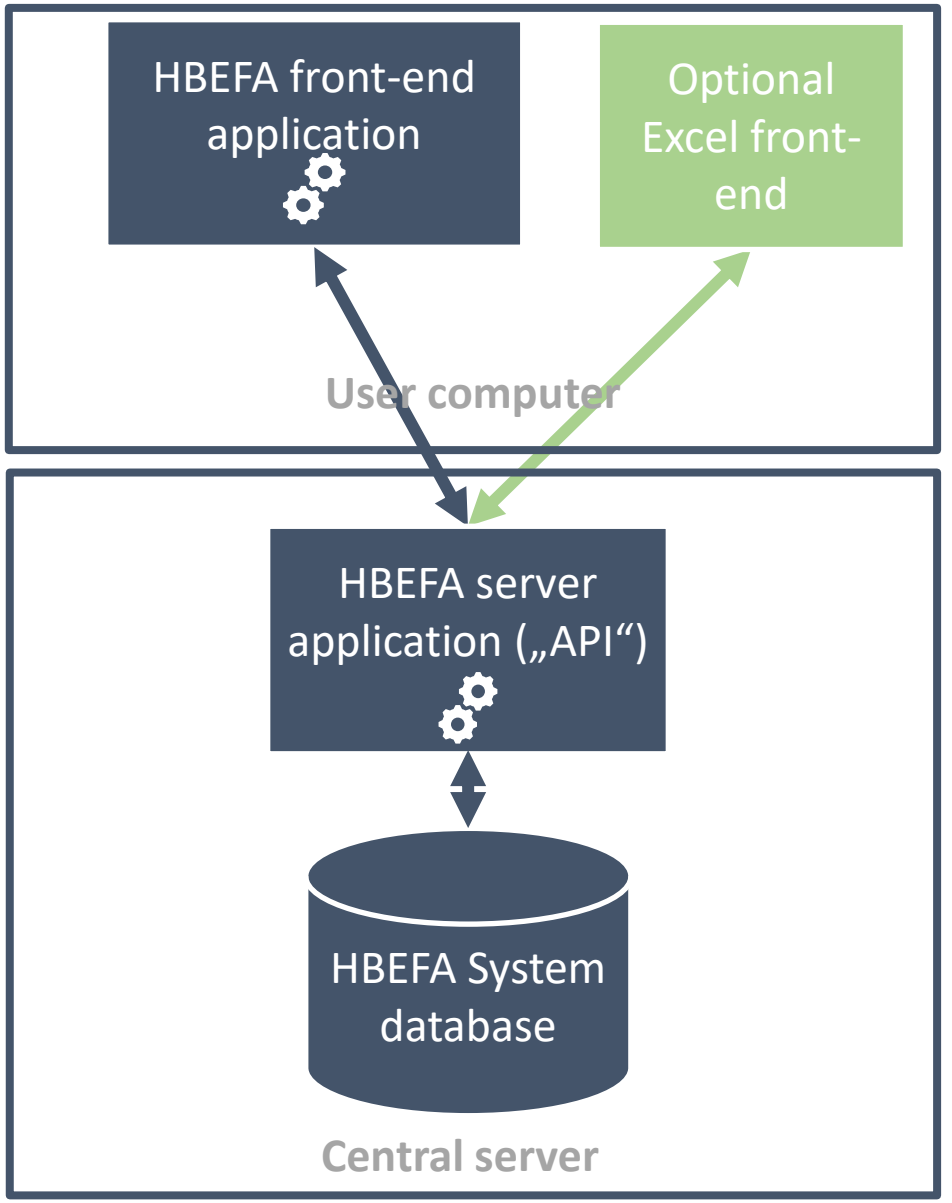
HBEFA application migration: Background

- The current MS Access application is at its limits regarding data contents and memory usage.
  Increasing differentiation of fleet (technologies, emission standards etc.) have led to growing data amounts.
  → Users have been experiencing out-of-memory errors
  → Additional features or differentiations could not be implemented anymore
- Therefore, migration of the application to Python has been decided and is currently being implemented
- The migrated application
  - Will be more user-friendly
  - Can accommodate future additions and differentiations
  - Will allow automated emission factor queries via the new HBEFA API
  - Will be less time-consuming in quality control and deployment

Components of the migrated HBEFA

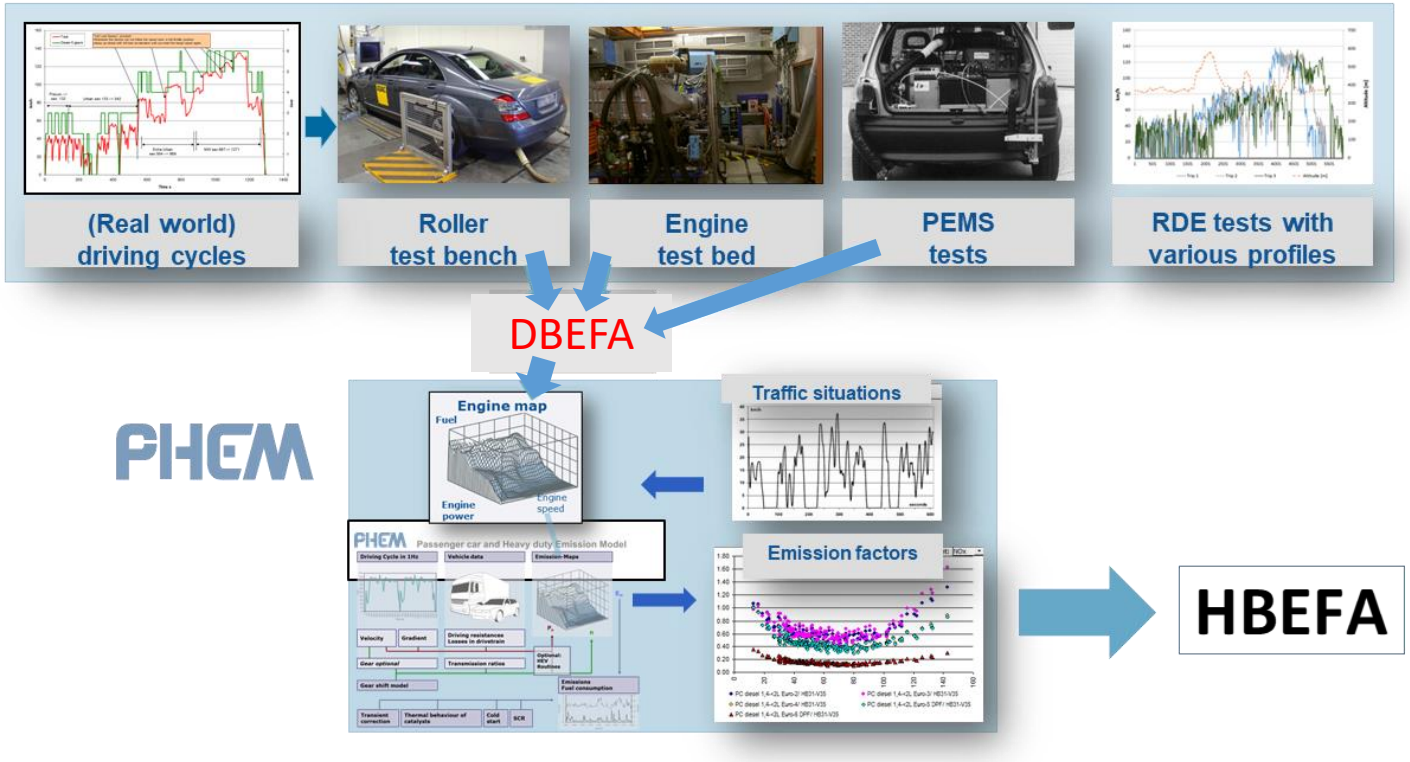
- A server application (running on a central server) presents an API and carries out calculations.
- The front-end is a GUI application running on the user's computer, sending requests to API and displaying/saving result. Will have similar functionality as the current application.
- Optionally, additional front-ends (or third-party applications) can use the API.
  E.g. an Excel front-end for easy extraction of emission factors into Excel is planned

The migrated application is planned to become available with the HBEFA 5.1 update, ca. 2025



The new measurement DB „DBEFA“: Workflow

- Real world test data of different European emission test laboratories flow into DBEFA
- Everyone who delivers data gets access to DBEFA and can download emission test data → simple GUI allows a detailed data selection and export
- DBEFA enables handling of the huge amount of data → HBEFA workflow works



The new measurement DB „DBEFA“: Data for HBEFA 5.1

- Excerpt of DBEFA: Euro 6 PC and LCV data (status: 07.10.2022)

Category	Euro 6 a,b,c	Euro 6d-Temp	Euro 6d
Diesel cars	108	10	4*
Petrol cars	77	10	5*
Diesel LCV	21	8	2*

- Excerpt of DBEFA: HDV data (status: 07.10.2022)

Category	# Euro VI ABC	# Euro VI D	# Euro VI E
HGV	62* (0)	22* (1)	4* (4)
Coach	3 (0)	0 (0)	0 (0)
Urban bus	10 (0)	2 (0)	0 (0)

XX = total # in DBEFA (XX = # new for HBEFA 5.1)
* = implementation in progress

Version update HBEFA 5.1: Overview

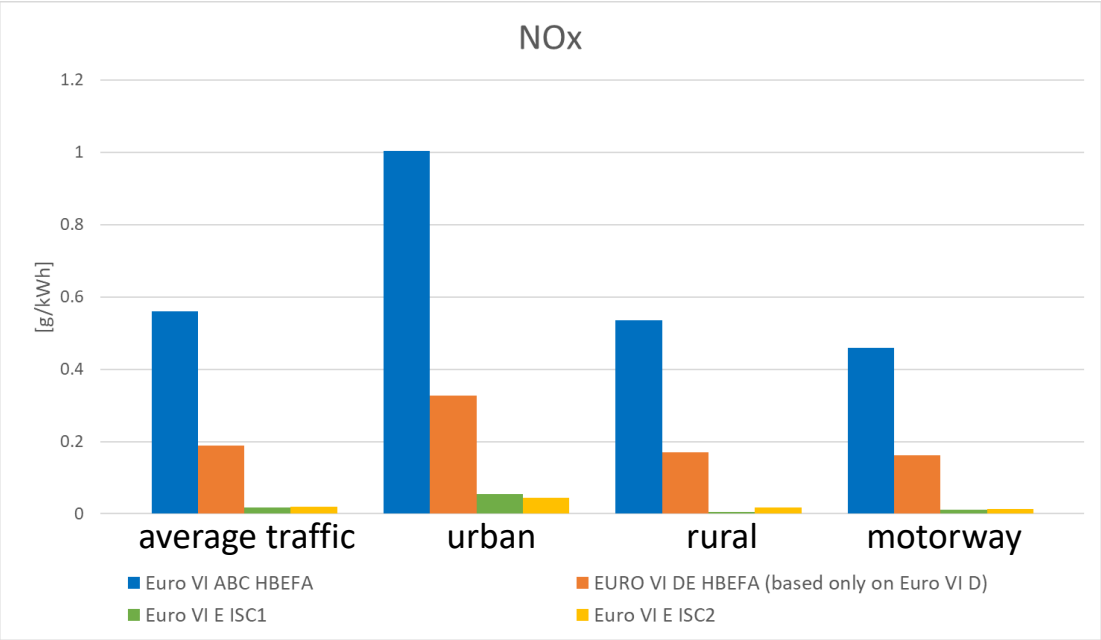
HBEFA 5.1 is planned to be released in 2025.

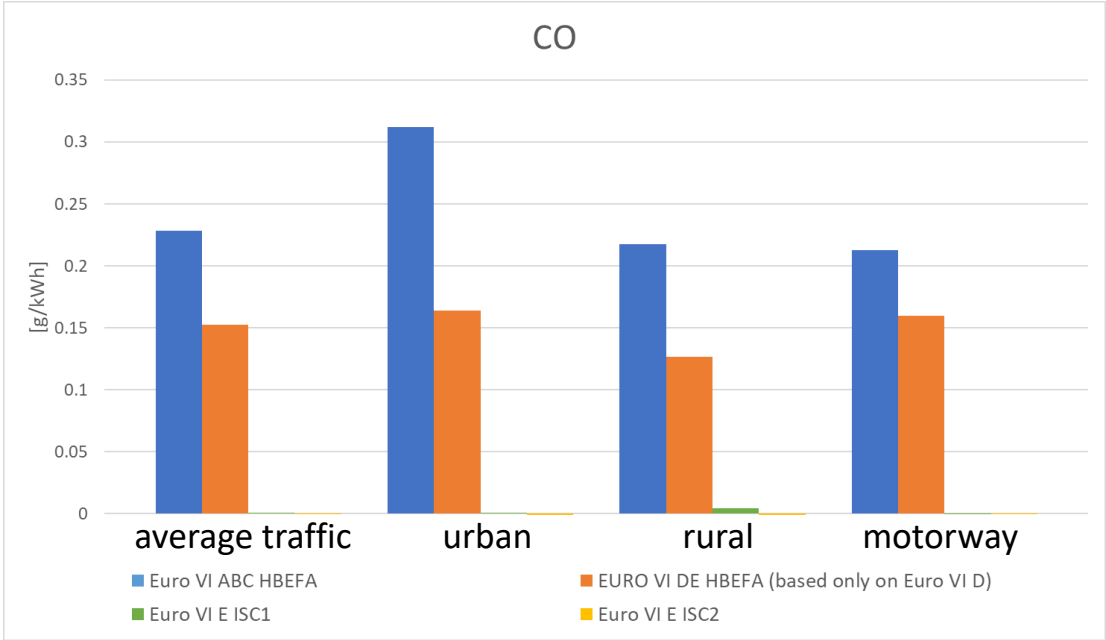
The planned updates in a nutshell:

- **Emission factor update:** Comprehensive update of all EF based on new measurement data, incl. estimates on Euro 7/VII
- **Cold start:** New cold start model, cold starts also for HDV
- **Non-exhaust emissions:** New non-exhaust model, differentiation of processes (brake, tire, road wear and resuspension)
- **Driving behaviour:** Improvements in driving profiles, better guidance for traffic situation assignment
- **Country data:** Comprehensive update incl. future scenarios

Version update HBEFA 5.1: HDV Euro VI E test data

- Emission tests of 4 Euro VI E heavy goods vehicles so far
- Comparison of first euro VI E measurement data to HBEFA Euro VI emission factors
  - HBEFA 4.2: RT 14-20 tons, average German traffic situation
  - Euro VI DE in HBEFA 4.2 is only based on Euro VI D measurement data
  - Analysis of further Euro VI E test data → Split of Euro VI D and Euro VI E?





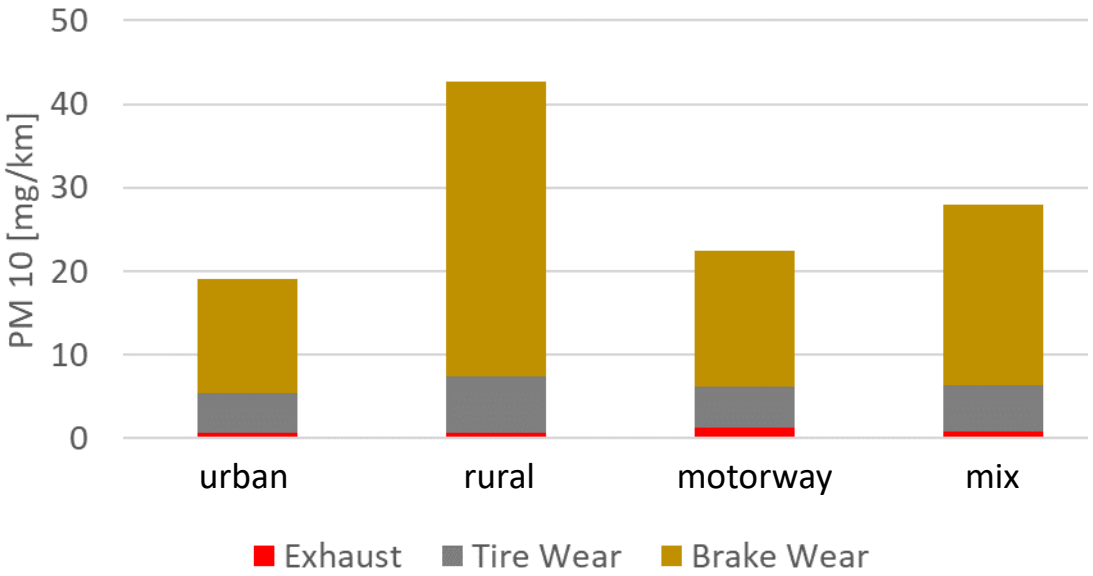
Version update HBEFA 5.1: Non-exhaust emissions

Tire, brake and road wear emissions until now very unsafe

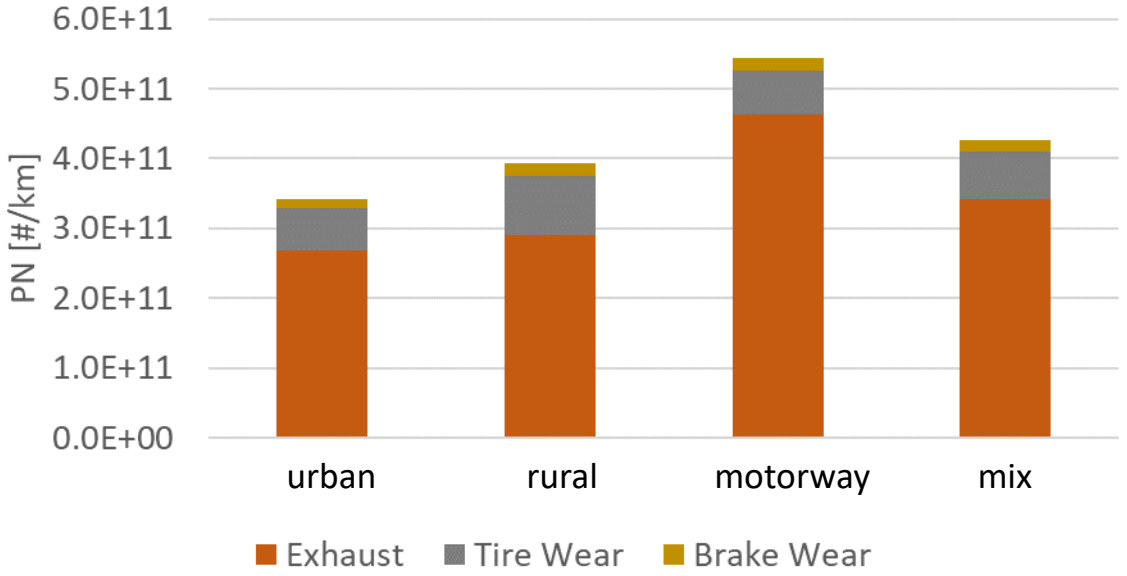
H2020 uCARe project → new model that considers brake and wheel power

Notice: A high uncertainty remains!

Euro 6 PC PM10 calculated with uCARe model



Euro 6 PC PN23 calculated with uCARe model



Preliminary estimate: non-exhaust in modern vehicles has > 95% share of PM10 but < 25% of PN

Relevance of tyre wear (microplastics, soot) and brake wear (multitude of components) strongly increasing!

Thank you for your attention!