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HBEFA and emission measurements
Outlook and update plans

ERMES Plenary Meeting, May 10, 2021 (online)

Agenda

1. Overview
2. Content updates in HBEFA 4.2 and 5.1
3. Migration of HBEFA application
4. EF update HDV EURO VI
5. New measurement database „DBEFA"

Background - current state of HBEFA

- HBEFA 4.1 published in August 2019: Major update – revision of most inputs
- Already soon after publication of 4.1, demand for further content updates emerged, e.g.:
  - Inclusion of Euro VI D HGV
  - Inclusion of additional software updates of Diesel PC
  - Consideration of age-dependent NO2/NOx ratio
  - Country data updates
  - …
- With HBEFA 4.1, also need for IT migration due to limitations of MS Access became urgent:
  - HBEFA application mainly suffers from limitations of working memory (frequent out-of-memory errors with 4.1), user-unfriendliness, lack of automation
  - Measurement database exceeded limits of MS Access data storage capacity; possibility for remote access was lacking

Work programme „HBEFA 4+"

- HBEFA funding agencies adopted a work programme up to HBEFA Version 5.1 (ca. 2025) in October 2020:
  - Content updates for „Light update" HBEFA 4.2 → to be released ca. end of 2021
  - Content updates for major update HBEFA 5.1 → to be released 2025
  - New measurement database („DBEFA") as server-client solution hosted by TUG and remotely accessible by data providers and users
 - Migration of HBEFA application to Python-based server-client solution by INFRAS

Content updates with HBEFA 4.2

Category	Updates
Base emission/consumption factors	- HGV Euro-VI emission factors - Additional Diesel PC software updates - PHEM updates for e-vehicles - Vehicle settings for urban driving
Correction factors	Age-dependent NO2/NOx ratio
FC/CO2 calibration	- Integration of CO2 monitoring info for BEV/PHEV - Improved real-world consumption BEV/PHEV
WTT EF + energy mix	Update + addition of some fuel production types
Activity data	Country data updates DE, FR

Content updates with HBEFA 5.1 (details yet to be decided)

Category	Updates
Base emission/consumption factors	▪ Comprehensive update (all vehicle types) ▪ Euro 6/VI SCR heating strategies ▪ LDV cold start update ▪ HGV cold start (new) ▪ Cold start EF for N2O and NH3 (new) ▪ Update evaporation EF based on latest COPERT ▪ Include additional pollutants (e.g. POPs) for reporting based on EMEP/EEA
Correction factors (mileage, ambient T)	Update based on available RS findings
FC/CO2 calibration	CO2 calibration for HDV
Indirect EF + energy mix	Extend scope to vehicle production/recycling/scrappage?
Activity data	Comprehensive country data update
Overarching aspects	▪ Improve consideration of trip history on EF ▪ Uncertainty of EF and AD ▪ Guidelines for TS assignment

Server-client solution for migrated HBEFA
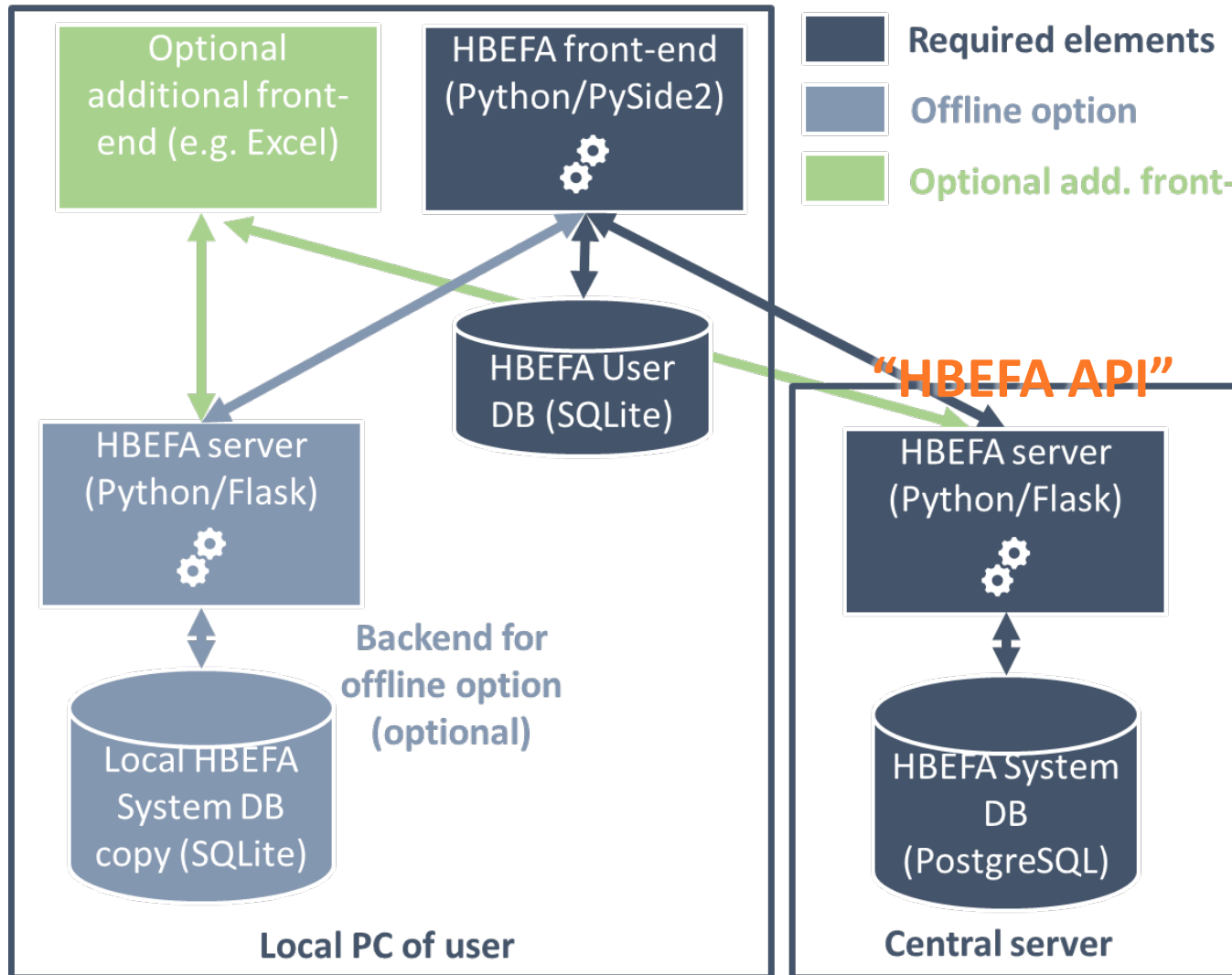
- Server application presents API and carries out calculations.
- Front-end is a GUI application running on user's computer, sending requests to API and displaying/saving result
- Option: "offline use" (local server application on user's computer)
- Option: Additional front-ends, possibly by third parties

API request/response example

Query parameter

Corresponding value (or value list)

API request

```
{'Country': 'CH', 'Weighted with fleet comp.': 'yes', 'Emcat(s)': "['hot']",
'Fleet aggregation level': 'vehcat', 'TS aggregation level': 'single_ts',
'Pollutant(s)': "['NOx']", 'Year(s)': '[2020]', 'IDvehcat': '[1]',
'IDTechnology': 'None', 'IDSegment': 'None', 'IDSubsegment': 'None', 'IDTS':
'[230051]', 'IDGrad': '[30]', 'IDLoad': 'None', 'IDTraffic_Scen': 'None',
'IDTSGrad': 'None', 'IDAmbientConditionPattern': 'None'}
```

API response

Repetition of input parameters

```
{"Input_pars":
"{"Country": "CH", "Weighted with fleet comp.": "yes", "Emcat(s)": "['hot']",
"Fleet aggregation level": "vehcat", "TS aggregation level": "single_ts",
"Pollutant(s)": "['NOx']", "Year(s)": "[2020]", "IDvehcat": "[1]",
"IDTechnology": "None", "IDSegment": "None", "IDSubsegment": "None", "IDTS":
"[230051]", "IDGrad": "[30]", "IDLoad": "None", "IDTraffic_Scen": "None",
"IDTSGrad": "None", "IDAmbientConditionPattern": "None"}",
```

Result table of hot emission factors in JSON format

```
"hot_ef":
"{"IDCountry":{"0":"CH"},"IDTraffic_Scen":{"0":1765},"YearRef":{"0":2020},"IDVeh
Cat":{"0":1},"IDTechnology":{"0":1},"IDSegment":{"0":1918},"IDEmConc":{"0":9192}
,"IDSubsegment":{"0":null},"Pollutant":{"0":"NOx"},"IDTSGrad":{"0":null},"IDTS":
{"0":230051},"IDGrad":{"0":30},"Weight":{"0":"Not yet
available"},"EFA":{"0":0.1943384246}}"
}
```
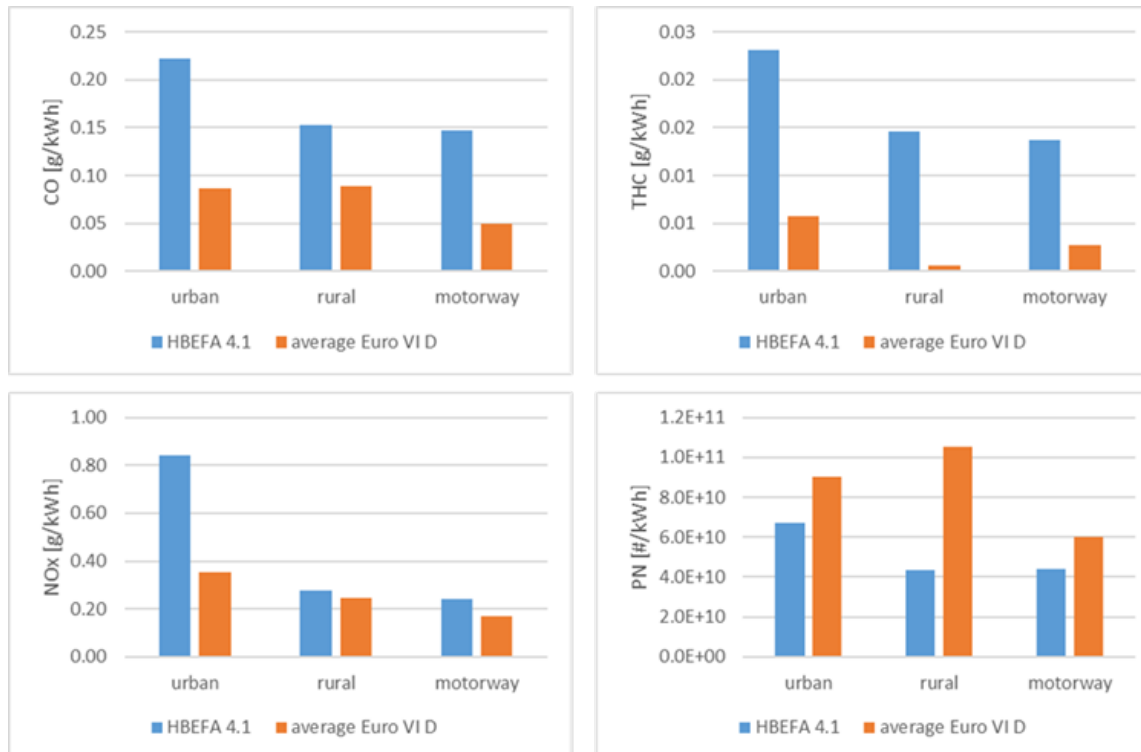
Update HDV EURO VI

In HBEFA 4.1 HDV test data up to EURO VI A to C was included.

With EURO VI D the ISC (PEMS) evaluation method was amended 09/2019 in the EU Regulation to go down to 10% power (20% up to EU VI C) → improvement in real world emissions

HBEFA 4.1 = EURO VI A to C

EURO VI D = Preliminary analysis of data from 7 diesel trucks, further test data expected

Open, if PN increase will remain with further vehicles tested.
Note: PN level is extremely low!

New Data Base „DBEFA"

New data base produced, hosted by TUG to collect all test data for HBEFA updates.

Frontend in C#, based on the .Net framework 4.5.; MySQL server version 5.6 acts as storage backend.

Allows queries and data export for multiple parameters (HDV, LDV, M-cat, make, model, test type,....)

Currently test phase at TUG with
all HBEFA 4.1 test data already included.

Next steps:

Access to the db via frontend to HBEFA group

Extension to other test labs possible

Thank you for your attention!

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