

COPERT Training

5. COPERT 5 vs COPERT 4

New and updated elements

- Software improvements
 - new and faster calculation kernel
 - improved COPERT data file
 - interface improvements
- Methodological improvements
 - new methodology
 - eg vehicle categories, methodological elements
 - updated methodology
 - eg energy balance, emission factors (NOx emission factors for post Euro 5 vehicles), biofuel use

Software improvements

Improvements over COPERT 4

	COPERT 4	COPERT 5	
	COPERT file	Access mdb file	SQL compact
Temporal analysis	7-10 years in one file	40 years	
Calculation time	2 min per year	10 sec per year	
File size	Unzipped file	Zipped file	

New software elements

- Form design:
 - Undo/Redo
 - Import/Export in all forms
 - Track changes in input forms
- Implied emission factors
- Error report
- “Updates” notification
- COPERT 4 files consolidation
- “Cancel” during calculation

Form design (1/2)

Stock & Activity Data

All

Undo Redo Import Export

Category	Fuel	Segment	Euro Standard	[n]	[km]	[km]
Passenger Cars	Petrol	Mini	Euro 4	0	0	0
Passenger Cars	Petrol	Mini	Euro 5	0	0	0
Passenger Cars	Petrol	Mini	Euro 6 up to 2016	0	0	0
Passenger Cars	Petrol	Mini	Euro 6 2017-2019	0	0	10,000
Passenger Cars	Petrol	Small	PRE ECE	0	0	0
Passenger Cars	Petrol	Small	ECE 15/00-01	0	0	0
Passenger Cars	Petrol	Small	ECE 15/02	0	0	0
Passenger Cars	Petrol	Small	ECE 15/03	0	0	0
Passenger Cars	Petrol	Small	ECE 15/04	10,658.11	3,862.28	202,677.1
Passenger Cars	Petrol	Small	Improved Conventional	44,304.77	4,412	192,137.69
Passenger Cars	Petrol	Small	Open Loop	74,451.78	5,040.35	192,444.38
Passenger Cars	Petrol	Small	Euro 1	1,105,145.15	5,759.26	179,363.25
Passenger Cars	Petrol	Small	Euro 2	838,332.65	6,582.84	157,413.85
Passenger Cars	Petrol	Small	Euro 3	1,620,813.2	7,528.75	143,250.71
Passenger Cars	Petrol	Small	Euro 4	5,641,544.25	8,611.38	73,229.9
Passenger Cars	Petrol	Small	Euro 5	2,636,427.34	9,855	21,735.67
Passenger Cars	Petrol	Small	Euro 6 up to 2016	0	0	0
Passenger Cars	Petrol	Small	Euro 6 2017-2019	0	0	10,000
Passenger Cars	Petrol	Medium	PRE ECE	0	0	0
Passenger Cars	Petrol	Medium	ECE 15/00-01	0	0	0
Passenger Cars	Petrol	Medium	ECE 15/02	0	0	0
Passenger Cars	Petrol	Medium	ECE 15/03	0	0	0

OK Apply Cancel

Form design (2/2)

Hot Emissions Parameters

All All Undo Redo Import Export

Category	Fuel	Segment	Euro Standard	Technology	Pollutant	Mode	Road Slope	Load	Min Speed [km/h]	Max Speed [km/h]	Alpha
Passenger Cars	Petrol	Mini	Euro 4	GDI	CO				5	130	0.00000000000549670697736
Passenger Cars	Petrol	Mini	Euro 4	GDI	NOx				5	130	0.0000385566953442
Passenger Cars	Petrol	Mini	Euro 4	GDI	VOC				5	130	0.00000354913026550
Passenger Cars	Petrol	Mini	Euro 4	GDI	PM Exhaust	Urban Peak			10	130	
Passenger Cars	Petrol	Mini	Euro 4	GDI	PM Exhaust	Urban Off Peak			10	130	
Passenger Cars	Petrol	Mini	Euro 4	GDI	PM Exhaust	Rural			10	130	
Passenger Cars	Petrol	Mini	Euro 4	GDI	PM Exhaust	Highway			10	130	
Passenger Cars	Petrol	Mini	Euro 4	GDI	FC				15	110	0.0000000000004040
Passenger Cars	Petrol	Mini	Euro 4	GDI	CH4	Urban Peak			15	110	
Passenger Cars	Petrol	Mini	Euro 4	GDI	CH4	Urban Off Peak			15	110	
Passenger Cars	Petrol	Mini	Euro 4	GDI	CH4	Rural			10	130	
Passenger Cars	Petrol	Mini	Euro 4	GDI	CH4	Highway			10	130	
Passenger Cars	Petrol	Mini	Euro 4	PFI	CO				5	110	0.00000000000549670697736
Passenger Cars	Petrol	Mini	Euro 4	PFI	NOx				5	110	0.0000385566953442
Passenger Cars	Petrol	Mini	Euro 4	PFI	VOC				5	130	0.00000354913026550
Passenger Cars	Petrol	Mini	Euro 4	PFI	PM Exhaust	Urban Peak			10	130	
Passenger Cars	Petrol	Mini	Euro 4	PFI	PM Exhaust	Urban Off Peak			10	130	
Passenger Cars	Petrol	Mini	Euro 4	PFI	PM Exhaust	Rural			10	130	
Passenger Cars	Petrol	Mini	Euro 4	PFI	PM Exhaust	Highway			10	130	
Passenger Cars	Petrol	Mini	Euro 4	PFI	FC				5	130	0.0050823704040

Copy
Copy with headers
Set default values
Cancel changes

OK Apply Cancel

Implied emission factors

Implied Emission Factors For All Years

FC Segment

All digits Export

Category	Fuel	2014						
		Hot				Cold		
		Urban Off Peak [MJ/km]	Urban Peak [MJ/km]	Rural [MJ/km]	Highway [MJ/km]	Total [MJ/km]	Urban Off Peak [MJ/km]	U...
Passenger Cars	Petrol	2.9309	2.9309	2.2314	2.4094	2.4771	1.0562	
	Diesel	2.5374	2.5374	2.0478	2.2864	2.2564	0.6683	
	Petrol Hybrid	1.3922	1.3922	1.3855	1.7891	1.5165	1.1391	
	LPG Bifuel	2.6147	2.6147	2.0947	2.6507	2.3914	0.9675	
	CNG Bifuel	2.9623	2.9623	2.3195	2.4952	2.5493	1.2025	
Passenger Cars Total		2.7173	2.7173	2.1312	2.3472	2.3587	0.8622	
Light Commercial Vehicles	Petrol	3.9254	3.9254	2.5205	2.9302	3.2253	1.3674	
	Diesel	3.305	3.305	2.5939	3.7257	3.2095	0.6281	
Light Commercial Vehicles Total		3.333	3.333	2.5906	3.6899	3.2102	0.6614	
Heavy Duty Trucks	Petrol	0	0	0	0	0		
	Diesel	10.8812	10.8812	8.0039	8.3822	8.6206		
Heavy Duty Trucks Total		10.8812	10.8812	8.0039	8.3822	8.6206		
Buses	Diesel	15.7443	15.7443	9.852	8.1981	11.2519		
	CNG	22.5409	22.5409	20.07	18.631	21.4065		
	Biodiesel	0	0	0	0	0		
Buses Total		16.1264	16.1264	10.0803	8.2783	11.5536		

Close

Error report

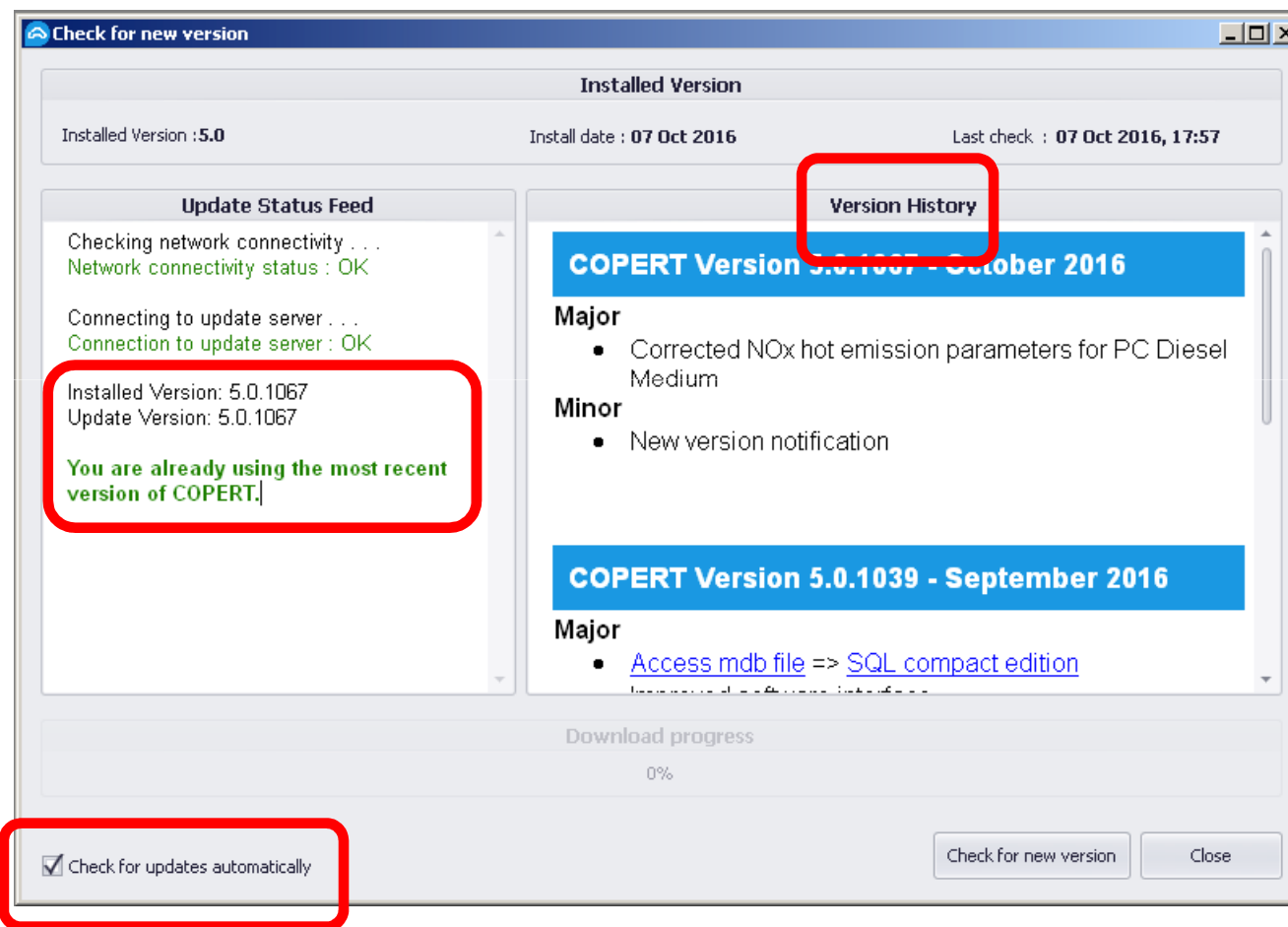
Notification send to support@emisia.com



The screenshot shows a dialog box titled "Error Report Submission" with a red warning triangle icon. The main heading is "COPERT Error Report Submission". Below the heading, there is a message: "Please send us this error report to help us fix any problems with this software." followed by "Provide us your details in order to contact you if necessary." The form includes input fields for "Name" and "Email", and a larger text area for "Comments". At the bottom, there is a confirmation message: "By pressing the 'Send Error Report' button, I confirm that I am familiar with the contents of the report and accept to send it to COPERT technical team." Below this, there is a section labeled "Error Report" with a link "[See what this report contains.](#)" and two buttons: "Send error report" and "Cancel".

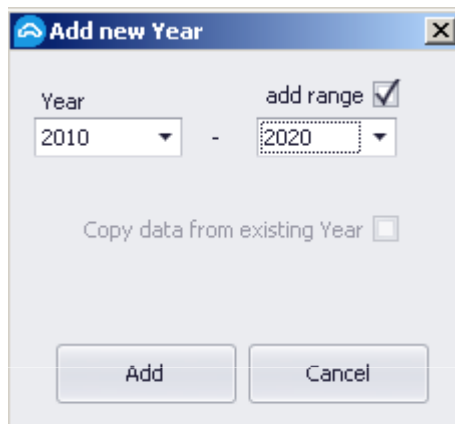
*requires internet connection

“Updates” notification



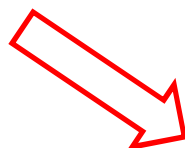
*requires internet connection

COPERT 4 files consolidation

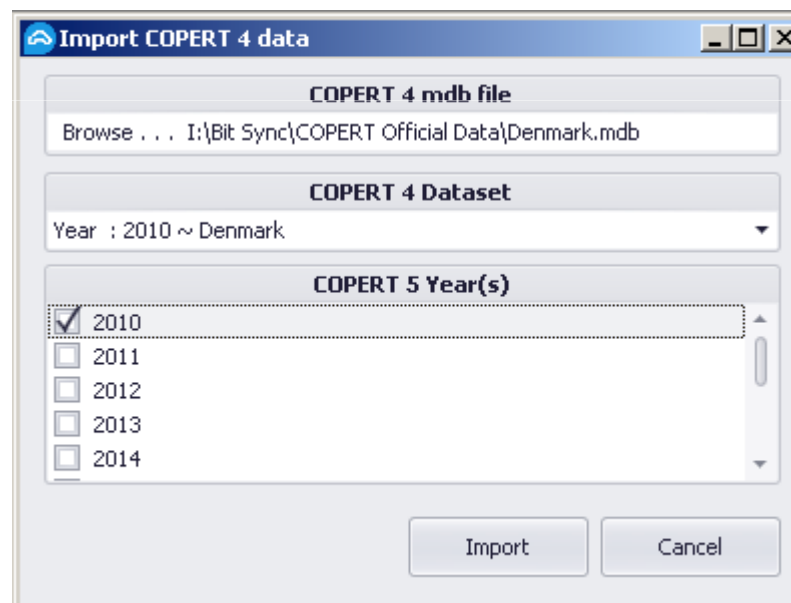


The 'Add new Year' dialog box contains the following elements:

- Year: 2010 (selected in dropdown)
- add range:
- Year: 2020 (selected in dropdown)
- Copy data from existing Year:
- Buttons: Add, Cancel



Repeat process



The 'Import COPERT 4 data' dialog box contains the following elements:

- COPERT 4 mdb file: Browse . . . I:\Bit Sync\COPERT Official Data\Denmark.mdb
- COPERT 4 Dataset: Year : 2010 ~ Denmark
- COPERT 5 Year(s):
 - 2010
 - 2011
 - 2012
 - 2013
 - 2014
- Buttons: Import, Cancel

“Cancel” during calculation

Status

File

Country : **Italy**
Run Mode : **Timeseries**
Created : **13 Oct 2016, 20:48**
Saved : **Never**

Year : 2014

Fuel Balance : **YES**
Improved Fuel Quality Year : **1996**
Mileage Degradation : **No Effect**
Lube-Oil CO2 Effect : **NO**
A/C Effect : **NO**
CO2 Effect : **NO**

Fuel Balance Calculated : **YES**
Emissions Calculated : **NO**

Calculate Fuel Balance

Calculate Emissions

All Years

Calculate All Years

Cancel

Updated software elements

- Interface: DevExpress
- Form design:
 - Pivot table forms
 - Copy and Paste in all forms
- Improved “import from COPERT 4” capabilities
- Updated Excel interface
- Online help file
- Ticketing for COPERT questions
- No serial number required

Pivot table forms

Emissions For All Years

FC Segment

All digits Export

Year Emission

2014

Category	Fuel	Hot					Cold	
		Urban Off Peak [TJ]	Urban Peak [TJ]	Rural [TJ]	Highway [TJ]	Total [TJ]	Urban Off Peak [TJ]	Urban...
Passenger Cars	Petrol	103,668.306	103,668.306	239,354.7239	204,954.542	651,645.8778	37,357.8107	37,357
	Diesel	94,966.5493	94,966.5493	232,575.8725	201,171.9743	623,680.9455	25,012.7142	25,012
	Petrol Hybrid	798.1386	798.1386	2,412.2749	2,431.2778	6,439.8299	653.0611	653
	LPG Bifuel	3,402.8361	3,402.8361	8,314.4624	6,099.0795	21,219.2142	1,259.1273	1,259
	CNG Bifuel	897.0599	897.0599	2,133.2549	1,791.0527	5,718.4274	364.1569	364
Passenger Cars Total		203,732.8899	203,732.8899	484,790.5887	416,447.9263	1,308,704.2949	64,646.8702	64,646
Light Commercial Vehicles	Petrol	1,373.2562	1,373.2562	1,259.6485	1,366.765	5,372.9259	478.3648	478
	Diesel	24,523.8527	24,523.8527	27,495.463	36,860.1753	113,403.3436	4,660.9162	4,660
Light Commercial Vehicles Total		25,897.1088	25,897.1088	28,755.1115	38,226.9404	118,776.2695	5,139.2811	5,139
Heavy Duty Trucks	Petrol	0	0	0	0	0		
	Diesel	44,261.8891	44,261.8891	130,470.2104	293,162.9902	512,156.9788		
Heavy Duty Trucks Total		44,261.8891	44,261.8891	130,470.2104	293,162.9902	512,156.9788		
Buses	Diesel	8,451.7643	8,451.7643	18,378.7701	5,937.2017	41,219.5003		
	CNG	720.6456	720.6456	855.5322	104.4989	2,401.3224		
	Biodiesel	0	0	0	0	0		

Close

Copy and Paste

Stock & Activity Data

All

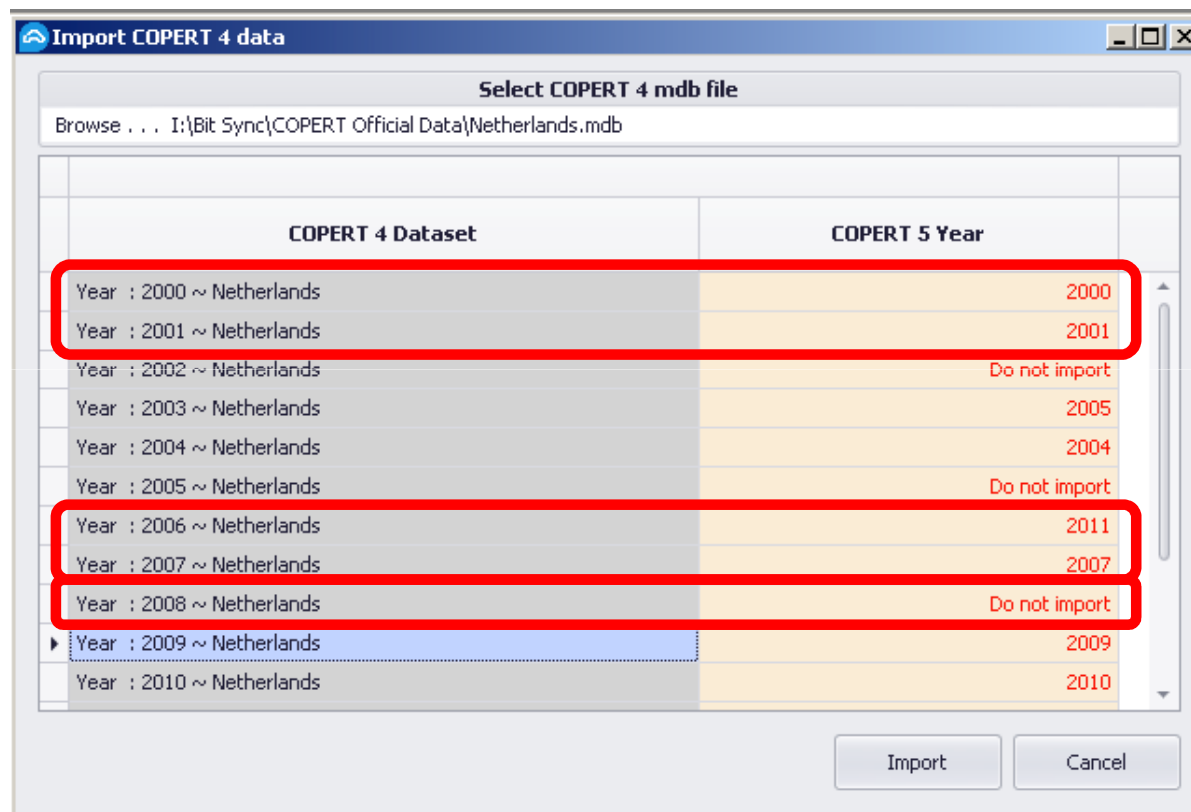
Undo Redo Import Export

Category	Fuel	Segment	Euro Standard	Stock [n]	Mean Activity [km]	Lifetime Cumulative Activity [km]	Fu
Passenger Cars	Petrol	Mini	Euro 4	0	0	0	
Passenger Cars	Petrol	Mini	Euro 5	0	0	0	
Passenger Cars	Petrol	Mini	Euro 6 up to 2016	0	0	0	
Passenger Cars	Petrol	Mini	Euro 6 2017-2019	0	0	10,000	
Passenger Cars	Petrol	Small	PRE ECE	0	0	0	
Passenger Cars	Petrol	Small	ECE 15/00-01	0	0	0	
Passenger Cars	Petrol	Small	ECE 15/02	0	0	0	
Passenger Cars	Petrol	Small	ECE 15/03	0	0	0	
Passenger Cars	Petrol	Small	ECE 15/04	10,658.11	3,862.28	202,677.1	
Passenger Cars	Petrol	Small	Improved Conventional	44,304.77	4,412	192,137.69	
Passenger Cars	Petrol	Small	Open Loop	74,451.78	5,040.35	192,444.38	
Passenger Cars	Petrol	Small	Euro 1	1,105,145.15	5,7	33.25	
Passenger Cars	Petrol	Small	Euro 2	838,332.65	6,5	43.85	
Passenger Cars	Petrol	Small	Euro 3	1,620,813.2	7,5	20.71	
Passenger Cars	Petrol	Small	Euro 4	5,641,544.25	8,6	229.9	
Passenger Cars	Petrol	Small	Euro 5	2,636,427.34	9,	735.67	
Passenger Cars	Petrol	Small	Euro 6 up to 2016	0		0	
Passenger Cars	Petrol	Small	Euro 6 2017-2019	0	0	10,000	
Passenger Cars	Petrol	Medium	PRE ECE	0	0	0	

Copy
Copy with headers
Paste
Set default values
Cancel changes

OK Apply Cancel

Import from COPERT 4 (1/5)



Import from COPERT 4 (2/5)

- Imported information
 - Activity Data
 - Evaporation data
 - Vehicle structure
 - Country temperatures
 - RVP
 - Urban share split 50-50 to Urban Peak and Off-Peak
- Not imported
 - advanced selections
 - load, slope, CO₂ correction etc
 - user data (eg user emission factors)
 - fuel specifications
 - statistical fuel consumption

Import from COPERT 4 (3/5)

COPERT 4				COPERT 5		
Sector	Subsector	Fuel		Category	Fuel Label	Segment
Passenger Cars	Gasoline <0,8l	Gasoline Unleaded	=>	Passenger Cars	Petrol	Mini
Passenger Cars	Gasoline 0,8 - 1,4l	Gasoline Leaded	=>	Passenger Cars	Petrol	Small
Passenger Cars	Gasoline 0,8 - 1,4l	Gasoline Unleaded	=>	Passenger Cars	Petrol	Small
Passenger Cars	Gasoline 1,4 - 2,0l	Gasoline Leaded	=>	Passenger Cars	Petrol	Medium
Passenger Cars	Gasoline 1,4 - 2,0l	Gasoline Unleaded	=>	Passenger Cars	Petrol	Medium
Passenger Cars	Gasoline >2,0l	Gasoline Leaded	=>	Passenger Cars	Petrol	Large-SUV-Executive
Passenger Cars	Gasoline >2,0l	Gasoline Unleaded	=>	Passenger Cars	Petrol	Large-SUV-Executive
Passenger Cars	Diesel <1,4l	Diesel	=>	Passenger Cars	Diesel	Mini
Passenger Cars	Diesel 1,4 - 2,0l	Diesel	=>	Passenger Cars	Diesel	Small
Passenger Cars	Diesel >2,0l	Diesel	=>	Passenger Cars	Diesel	Large-SUV-Executive
Passenger Cars	Hybrid Gasoline <1,4l	Hybrid Gasoline	=>	Passenger Cars	Petrol Hybrid	Mini
Passenger Cars	Hybrid Gasoline 1,4 - 2,0l	Hybrid Gasoline	=>	Passenger Cars	Petrol Hybrid	Small
Passenger Cars	Hybrid Gasoline >2,0l	Hybrid Gasoline	=>	Passenger Cars	Petrol Hybrid	Large-SUV-Executive
Passenger Cars	LPG	LPG	=>	Passenger Cars	LPG Bifuel	Small
Passenger Cars	CNG	CNG	=>	Passenger Cars	CNG Bifuel	Small
Light Commercial Vehicles	Gasoline <3,5t	Gasoline Leaded	=>	Light Commercial Vehicles	Petrol	N1-II
Light Commercial Vehicles	Gasoline <3,5t	Gasoline Unleaded	=>	Light Commercial Vehicles	Petrol	N1-II
Light Commercial Vehicles	Diesel <3,5 t	Diesel	=>	Light Commercial Vehicles	Diesel	N1-II

Import from COPERT 4 (4/5)

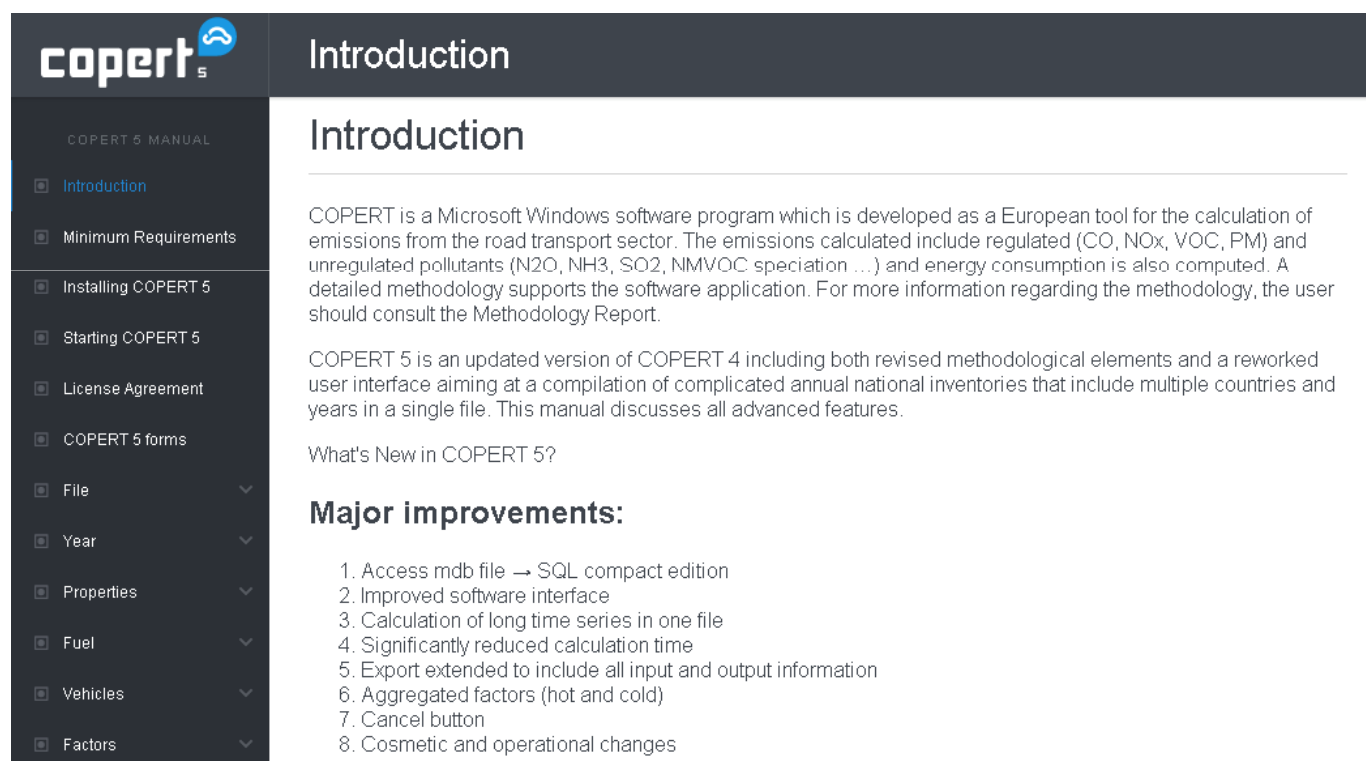
COPERT 4				COPERT 5		
Sector	Subsector	Fuel		Category	Fuel Label	Segment
Heavy Duty Trucks	Gasoline >3,5 t	Gasoline Leaded	=>	Heavy Duty Trucks	Petrol	>3,5 t
Heavy Duty Trucks	Rigid <=7,5 t	Diesel	=>	Heavy Duty Trucks	Diesel	Rigid <=7,5 t
Heavy Duty Trucks	Rigid 7,5 - 12 t	Diesel	=>	Heavy Duty Trucks	Diesel	Rigid 7,5 - 12 t
Heavy Duty Trucks	Rigid 12 - 14 t	Diesel	=>	Heavy Duty Trucks	Diesel	Rigid 12 - 14 t
Heavy Duty Trucks	Rigid 14 - 20 t	Diesel	=>	Heavy Duty Trucks	Diesel	Rigid 14 - 20 t
Heavy Duty Trucks	Rigid 20 - 26 t	Diesel	=>	Heavy Duty Trucks	Diesel	Rigid 20 - 26 t
Heavy Duty Trucks	Rigid 26 - 28 t	Diesel	=>	Heavy Duty Trucks	Diesel	Rigid 26 - 28 t
Heavy Duty Trucks	Rigid 28 - 32 t	Diesel	=>	Heavy Duty Trucks	Diesel	Rigid 28 - 32 t
Heavy Duty Trucks	Rigid >32 t	Diesel	=>	Heavy Duty Trucks	Diesel	Rigid >32 t
Heavy Duty Trucks	Articulated 14 - 20 t	Diesel	=>	Heavy Duty Trucks	Diesel	Articulated 14 - 20 t
Heavy Duty Trucks	Articulated 20 - 28 t	Diesel	=>	Heavy Duty Trucks	Diesel	Articulated 20 - 28 t
Heavy Duty Trucks	Articulated 28 - 34 t	Diesel	=>	Heavy Duty Trucks	Diesel	Articulated 28 - 34 t
Heavy Duty Trucks	Articulated 34 - 40 t	Diesel	=>	Heavy Duty Trucks	Diesel	Articulated 34 - 40 t
Heavy Duty Trucks	Articulated 40 - 50 t	Diesel	=>	Heavy Duty Trucks	Diesel	Articulated 40 - 50 t
Heavy Duty Trucks	Articulated 50 - 60 t	Diesel	=>	Heavy Duty Trucks	Diesel	Articulated 50 - 60 t
Buses	Urban Buses Midi <=15 t	Diesel	=>	Buses	Diesel	Urban Buses Midi <=15 t
Buses	Urban Buses Standard 15 - 18 t	Diesel	=>	Buses	Diesel	Urban Buses Standard 15 - 18 t
Buses	Urban Buses Articulated >18 t	Diesel	=>	Buses	Diesel	Urban Buses Articulated >18 t
Buses	Coaches Standard <=18 t	Diesel	=>	Buses	Diesel	Coaches Standard <=18 t
Buses	Coaches Articulated >18 t	Diesel	=>	Buses	Diesel	Coaches Articulated >18 t
Buses	Urban CNG Buses	CNG	=>	Buses	CNG	Urban CNG Buses
Buses	Urban Biodiesel Buses	Biodiesel	=>	Buses	Biodiesel	Urban Biodiesel Buses

Import from COPERT 4 (5/5)

COPERT 4				COPERT 5		
Sector	Subsector	Fuel		Category	Fuel Label	Segment
Mopeds	2-stroke <50 cm ³	Gasoline Leaded	=>	L-Category	Petrol	Mopeds 2-stroke <50 cm ³
Mopeds	4-stroke <50 cm ³	Gasoline Leaded	=>	L-Category	Petrol	Mopeds 4-stroke <50 cm ³
Motorcycles	2-stroke >50 cm ³	Gasoline Leaded	=>	L-Category	Petrol	Motorcycles 2-stroke >50 cm ³
Motorcycles	4-stroke <250 cm ³	Gasoline Leaded	=>	L-Category	Petrol	Motorcycles 4-stroke <250 cm ³
Motorcycles	4-stroke 250 - 750 cm ³	Gasoline Leaded	=>	L-Category	Petrol	Motorcycles 4-stroke 250 - 750 cm ³
Motorcycles	4-stroke >750 cm ³	Gasoline Leaded	=>	L-Category	Petrol	Motorcycles 4-stroke >750 cm ³

Online help file

<http://copert.emisia.com>



copert₅

COPERT 5 MANUAL

- Introduction
- Minimum Requirements
- Installing COPERT 5
- Starting COPERT 5
- License Agreement
- COPERT 5 forms
- File
- Year
- Properties
- Fuel
- Vehicles
- Factors

Introduction

COPERT is a Microsoft Windows software program which is developed as a European tool for the calculation of emissions from the road transport sector. The emissions calculated include regulated (CO, NO_x, VOC, PM) and unregulated pollutants (N₂O, NH₃, SO₂, NMVOC speciation ...) and energy consumption is also computed. A detailed methodology supports the software application. For more information regarding the methodology, the user should consult the Methodology Report.

COPERT 5 is an updated version of COPERT 4 including both revised methodological elements and a reworked user interface aiming at a compilation of complicated annual national inventories that include multiple countries and years in a single file. This manual discusses all advanced features.

What's New in COPERT 5?

Major improvements:

1. Access mdb file → SQL compact edition
2. Improved software interface
3. Calculation of long time series in one file
4. Significantly reduced calculation time
5. Export extended to include all input and output information
6. Aggregated factors (hot and cold)
7. Cancel button
8. Cosmetic and operational changes

*requires internet connection

Ticketing

- e-mail to: support@emisiam.com
- Unique ID
- Multiple EMISIA experts can engage
- Trace all answers and questions
- Use mailing system for communication

Requirement: Do not modify the subject

Methodological improvements

New methodological elements

- Calculation
 - Tier 2
 - Entity mode
 - Uncertainty (under development)
 - Lubricant consumption and specifications
- Fuel
 - Energy instead of fuel mass calculations
 - Automated energy balance
 - Distinction between primary and end (blends) fuels
 - Bi-fueled vehicles
- Vehicle Types
 - New vehicle types (under development)
 - Emission control technology level

Tier 2

Create file

Country name

Continent : EUROPE

Country : Greece

Custom name

Name :

Run mode

Timeseries Entity :

Tier mode

Tier 2 Tier 3

Required input

- Environmental information (temperature and humidity)
- Statistical energy consumption (required for energy balance only)
- Stock and activity data (stock, activity, lifetime cumulative activity)

Entity mode (1/2)

Create file

Country name

Continent : EUROPE

Country : Greece

Custom name

Name :

Run mode

Timeseries Entity : Region

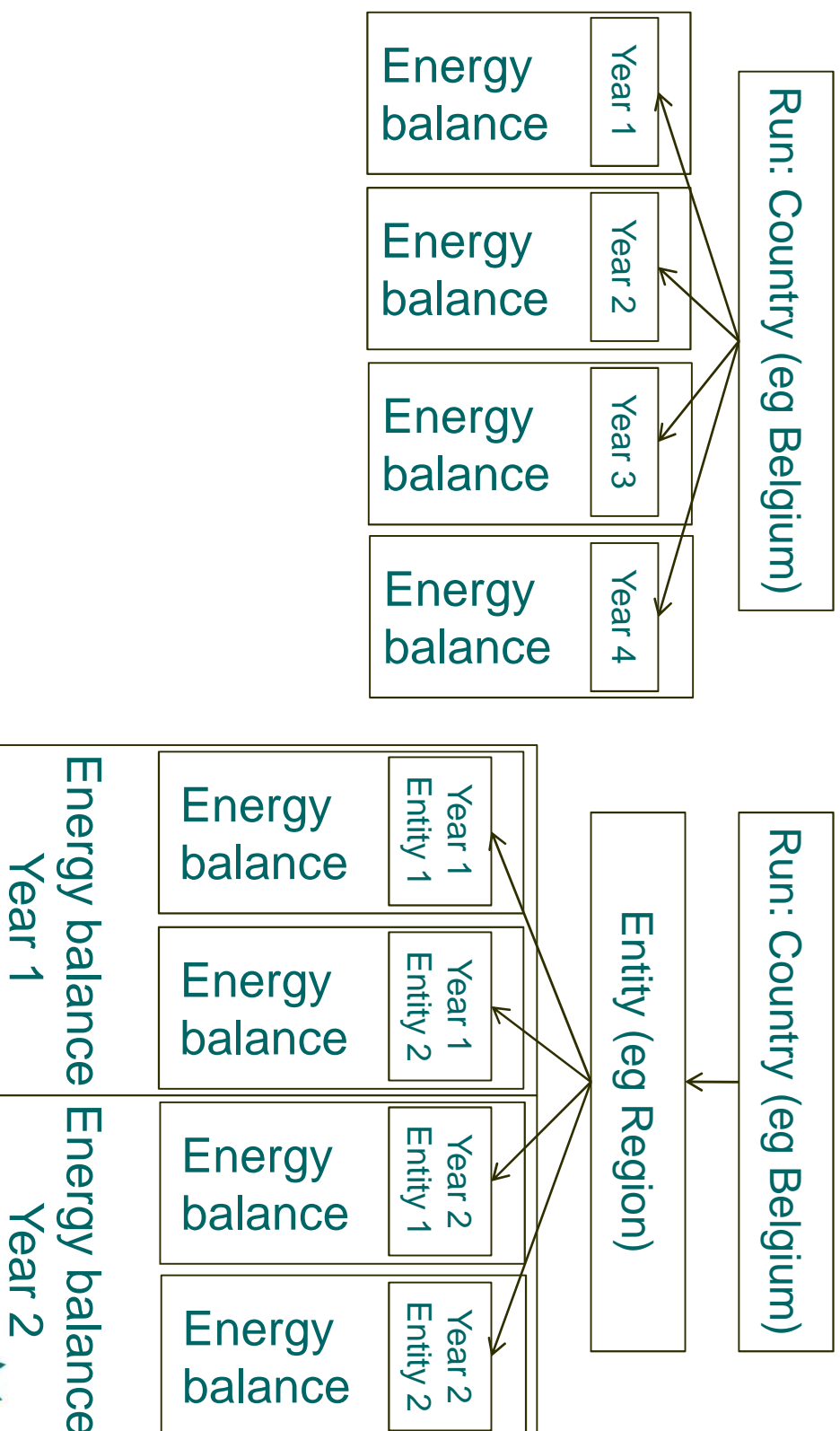
Tier mode

Tier 2 Tier 3

Create Cancel

- Adds a new level to input information
- Each **entity** requires the same level of information as a year in **timeseries**
- Currently energy balance is performed in entity level (under revision)

Entity mode (2/2)



Inventory uncertainty estimation

- Methodology currently under development
- Quantified 'error' propagation calculations
 - Final expression may be quality rather than quantity indicator
- Uncertainty range to final inventory value to be given per pollutant
- Minimum user input to be required

Lubricant consumption and specifications

- Lubricant consumption as a function of mileage [g/km]
- Heavy metals emissions
 - In COPERT 4 it was assumed that a part of the HM emissions from fuel was actually from lubricant consumption – significant reduction of default values in fuel specifications in COPERT 5
- Optional

Lubricant Type	Content In Species										Specifications	
	S [ppm wt]	Pb [ppm wt]	Cd [ppm wt]	Cu [ppm wt]	Cr [ppm wt]	Ni [ppm wt]	Se [ppm wt]	Zn [ppm wt]	Hg [ppm wt]	As [ppm wt]	H:C Ratio [-]	O:C Ratio [-]
Type 1	0	0.0332	4.56	778	19.2	31.89	4.54	450.2	0	0	2.08	0

Energy consumption calculation

In order to facilitate new vehicle types (eg electric or PHEV) COPERT 5 calculates energy and not fuel consumption

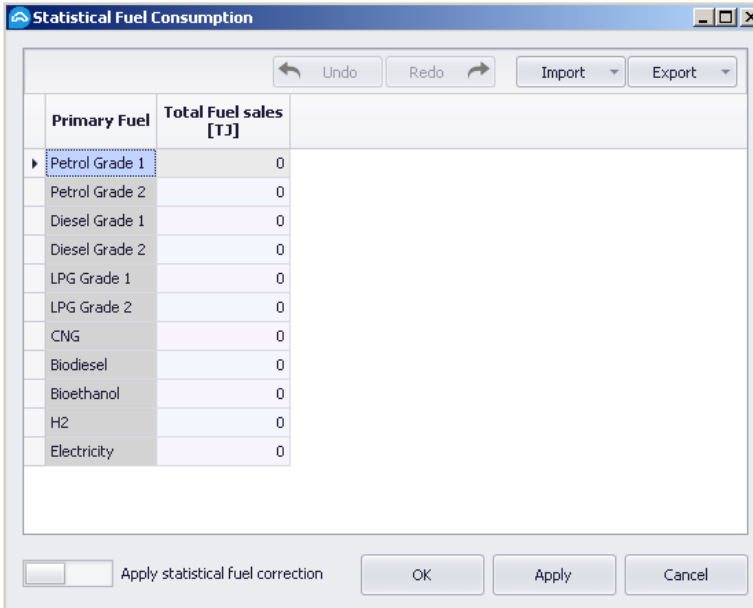
Automated energy balance

- In COPERT 4 by providing statistical fuel consumption and performing a fuel balance, CO₂ and fuel consumption dependant emissions were corrected accordingly
- COPERT 5 compares statistical and calculated energy consumption, modifies a number of input data (eg mileage, blend share) and recalculates emissions

Distinction between primary and end (blends) fuels (1/2)

Primary fuels: energy consumption

- Consistent to IPCC: Fuel sales in TJ for each primary fuel
- Two grades for major fuels: User-specific properties
- Addition of electricity and H₂ as separate fuels

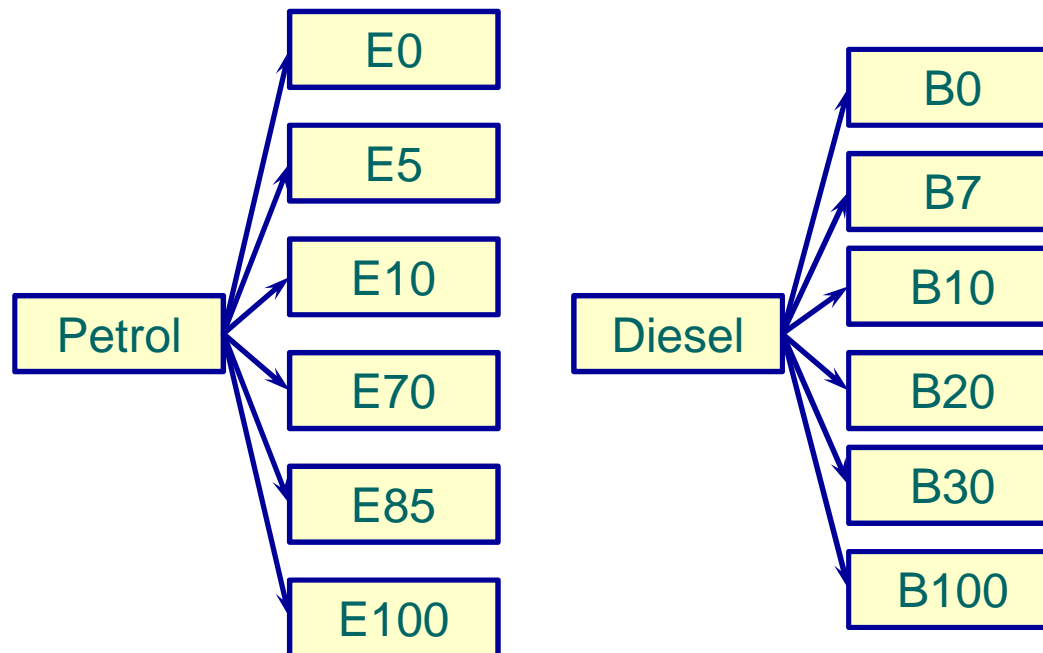


Primary Fuel	Total Fuel sales [TJ]
Petrol Grade 1	0
Petrol Grade 2	0
Diesel Grade 1	0
Diesel Grade 2	0
LPG Grade 1	0
LPG Grade 2	0
CNG	0
Biodiesel	0
Bioethanol	0
H2	0
Electricity	0

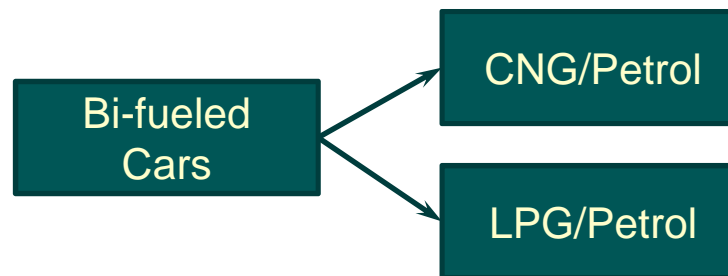
Distinction between primary and end (blends) fuels (2/2)

- End fuels: User may define different fuel blends per vehicle type, e.g. EX blends, difference between winter-summer, etc.
- Example: Petrol passenger car, Small, EURO 1
 - Blends energy share: First order estimate by the user, e.g. 70% E5 and 30% E10 (up to two blends per vehicle type)
 - E5 consisting of
 - 5% vol. Bioethanol
 - 95% vol Petrol (Grade 1 and/or Grade2)
 - E10 consisting of
 - 10% vol Bioethanol
 - 90% vol Petrol (Grade 1 and/or Grade2)

Available Blends



Bi-fueled vehicles



May be shown as two vehicles to present the different parameters used for the calculation of emissions

New vehicle types

- Fuel/energy consumption and emission factors still under development



Emission control technology level

Category	Fuel	Euro	Tech 1	Tech 2	Tech 3
Passenger Cars	Petrol	4, 5, 6	PFI	GDI	
Passenger Cars	Diesel	6	DPF	DPF+SCR	DPF+LNT
Heavy Duty Trucks	Diesel	V	EGR	SCR	

- Emission control technology layer to distinguish between concepts with distinct emission behavior in same Euro class
- Initial values proposed, can be modified by the user

Updated methodological elements

- Fuel
 - Advanced fuel specifications
- Vehicle Types
 - Updated vehicle category naming
- Emission factors
 - Consolidated hot emission factor function
 - Possibility to distinguish between peak/off-peak urban
 - Hybrid cold emission factors
 - NO_x Diesel PCs (Euro 6 and on) and LDVs (Euro 5 and on)

Advanced fuel specifications

Fuel Specifications

Undo Redo Import Export

Primary Fuel	Specifications				Content In Species									
	Energy Content [MJ/kg]	H:C Ratio [-]	O:C Ratio [-]	Density [kg/m3]	S [ppm wt]	Pb [ppm wt]	Cd [ppm wt]	Cu [ppm wt]	Cr [ppm wt]	Ni [ppm wt]	Se [ppm wt]	Zn [ppm wt]	Hg [ppm wt]	As [ppm wt]
Petrol Grade 1	43.774	1.89	0.016	750	0	0.0016	0.0002	0.0045	0.0063	0.0023	0.0002	0.033	0.0087	0.0003
Petrol Grade 2	43.774	1.89	0.016	750	0	0.0016	0.0002	0.0045	0.0063	0.0023	0.0002	0.033	0.0087	0.0003
Diesel Grade 1	42.695	1.86	0.005	840	0	0.0005	0.00005	0.0057	0.0085	0.0002	0.0001	0.018	0.0053	0.0001
Diesel Grade 2	42.695	1.86	0.005	840	0	0.0005	0.00005	0.0057	0.0085	0.0002	0.0001	0.018	0.0053	0.0001
LPG Grade 1	46.564	2.525	0	835	0	0	0	0	0	0	0	0	0	0
LPG Grade 2	46.564	2.525	0	835	0	0	0	0	0	0	0	0	0	0
CNG	48	3.9	0	775	0	0	0	0	0	0	0	0	0	0
Biodiesel	37.3	1.94	0.11	750	0	0.0005	0.00005	0.0057	0.0085	0.0002	0.0001	0.018	0.0053	0.0001
Bioethanol	28.8	3	0.5	710	0	0.0016	0.0002	0.0045	0.0063	0.0023	0.0002	0.033	0.0087	0.0003
H2	43.774	0	0	0	0	0	0	0	0	0	0	0	0	0
Electricity	1,000	0	0	0	0	0	0	0	0	0	0	0	0	0

OK Apply Cancel

Similar to COPERT 4, each fuel has its own set of properties (example: HM content)

Updated vehicle category naming (1/2)

Passenger Cars

COPERT 4	COPERT 5
<0.8 l	Mini
0.8 – 1.4 l	Small
1.4 – 2.0 l	Medium
>2.0 l	Large-SUV-Executive

- Engine capacity as such little relevant for consumption
- Segmentation may be found by ACEA or vehicle dealers



Light Commercial Vehicles

COPERT 4	COPERT 5
Gasoline	Petrol N1-I
	Petrol N1-II
	Petrol N1-III
Diesel	Diesel N1-I
	Diesel N1-II
	Diesel N1-III

- Categories relevant to fuel consumption calculation
 - N1-I: $RW \leq 1305$ kg
 - N1-II: $1305 \text{ kg} < RW \leq 1760$ kg
 - N1-III: $1760 \text{ kg} < RW$

Updated vehicle category naming (2/2)

L-category vehicles

COPERT 4	COPERT 5	
Mopeds and Motorcycles	L-category vehicles	
-	Quads and ATVs	
-	Micro-cars	

- Two categories completely missing from COPERT 4:
- Quads and ATVs: Petrol powered
- Micro-cars: 500 cc diesel powered

Consolidated hot emission factor function

$$EF(v) = \frac{a \cdot v^2 + b \cdot v + c + \frac{d}{v}}{e \cdot v^2 + f \cdot v + g} (1 - RF_{EURO})(1 - RF_{FUEL}) \quad [\text{g/km}]$$

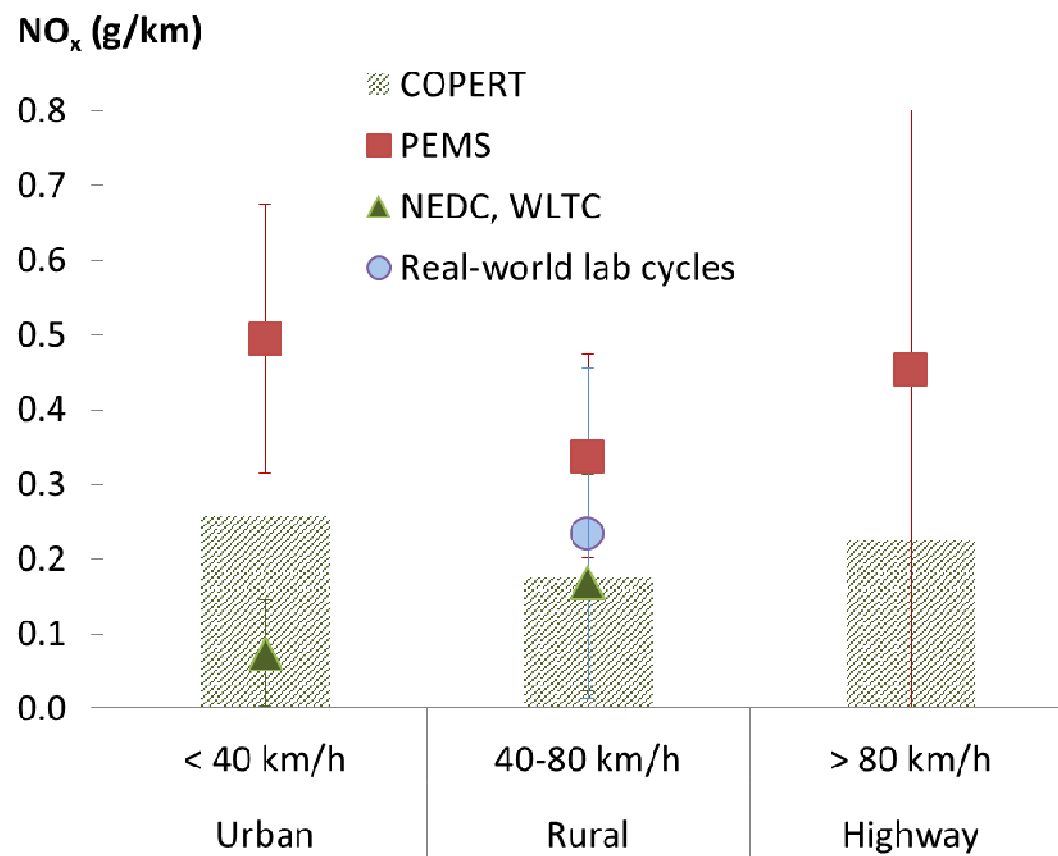
- Pollutants covered NO_x , PM, CO, VOC and fuel consumption
- New function adds flexibility
- Can accommodate fuel effects

New emission factors

- First 'official' version of COPERT 5 not expected to introduce substantially new EFs to COPERT 4
 - Emission factors for new vehicle types
- Peak/off-peak distinction
 - Software feature for the time being, methodology being developed

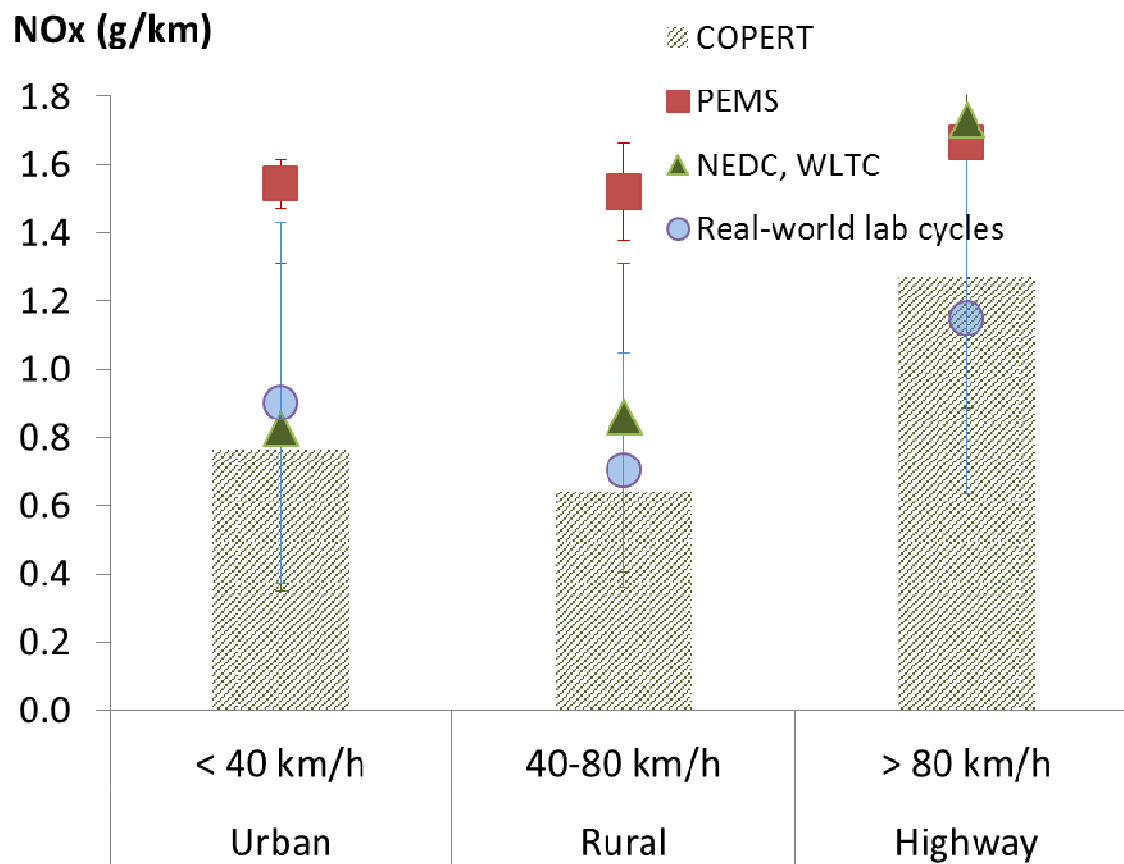
NO_x Diesel PCs (Euro 6 and on) and LDVs (Euro 5 and on)

Euro 6 DPC NO_x



NOx Diesel PCs (Euro 6 and on) and LDVs (Euro 5 and on)

Euro 6 DLCVC NO_x



New measurements available for NO_x (1/2)

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TNO report

TNO 2016 R10383

NO_x emissions of Euro 5 and Euro 6 diesel passenger cars – test results in the lab and on the road

Date 09 March 2016
Author(s) Gerrit Kadijk
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Project name -
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TNO report

TNO 2016 R10356

NO_x emissions of Euro 5 diesel vans – test results in the lab and on the road

Date 17 May 2016
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New measurements available for NO_x (2/2)



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Final Report
WLTP-NEDC correlation exercise
M1 Vehicles



Materials Science & Technology

Factsheet - 5214004257/LD5-2013

Emissions of Euro 5 light duty diesel vehicles

Swiss emission inventory project, measurement program 2013

By orders of the Swiss Federal Office for the Environment (FOEN)

Example of Germany data 2014 (1/2)

- Data inserted to COPERT 4
- COPERT 4 file imported to COPERT 5
 - adjust fuel specifications to match COPERT 4
 - adjust Blends in COPERT 5
 - adjust Blends share in COPERT 5
 - adjust Diesel fuel density in both versions

Example of Germany data 2014 (2/2)

COPERT 4 name	COPERT 5 name	Difference	Reasoning
Total_CO2_Emiss_t	CO2_TOTAL	0.07%	Hybrid vehicles cold emissions
Total_Cadmium_Emiss_kg	CD_TOTAL	0.06%	Hybrid vehicles cold emissions
Total_Chromium_Emiss_kg	CR_TOTAL	0.02%	Hybrid vehicles cold emissions
Total_Copper_Emiss_kg	CU_TOTAL	0.03%	Hybrid vehicles cold emissions
Total_Nickel_Emiss_kg	NI_TOTAL	0.05%	Hybrid vehicles cold emissions
Total_Selenium_Emiss_kg	SE_TOTAL	0.05%	Hybrid vehicles cold emissions
Total_Zinc_Emiss_kg	ZN_TOTAL	0.03%	Hybrid vehicles cold emissions
Total_CO_Emiss_t	CO_TOTAL	0.48%	CO emission factor equation consolidation (mainly pre Euro 1 vehicles)
Total_OM_Emiss_t	OM_TOTAL	0.00%	No difference
Total_PM10_Emiss_t	PM_10_TOTAL	0.00%	No difference
Total_PM2.5_Emiss_t	PM_2.5_TOTAL	0.00%	No difference
Total_SO2_Emiss_t	SO2_TOTAL	0.00%	No difference
Total_VOC_Emiss_t	VOC_TOTAL	1.97%	Evaporation calculation speed improvement
Total_VOC_Evap_Emiss_t	VOC_EVAP	8.95%	Evaporation calculation speed improvement
Total_NMVOC_Emiss_t	NMVOC_TOTAL	2.08%	Evaporation calculation speed improvement
Total_NMVOC_Evap_Emiss_t	NMVOC_EVAP	8.95%	Evaporation calculation speed improvement
Total_CH4_Emiss_t	CH4_TOTAL	0.00%	No difference
Total_NOx_Emiss_t	NOx_TOTAL	0.06%	NOx emission factor equation consolidation + Hybrid vehicles cold emissions
Total_NO2_Emiss_t	NO2_TOTAL	0.01%	NOx emission factor equation consolidation + Hybrid vehicles cold emissions
Total_NO_Emiss_t	NO_TOTAL	0.08%	NOx emission factor equation consolidation + Hybrid vehicles cold emissions
Total_N2O_Emiss_t	N2O_TOTAL	0.14%	Hybrid vehicles cold emissions
Total_NH3_Emiss_t	NH3_TOTAL	0.07%	Hybrid vehicles cold emissions

Thank you for your attention!

