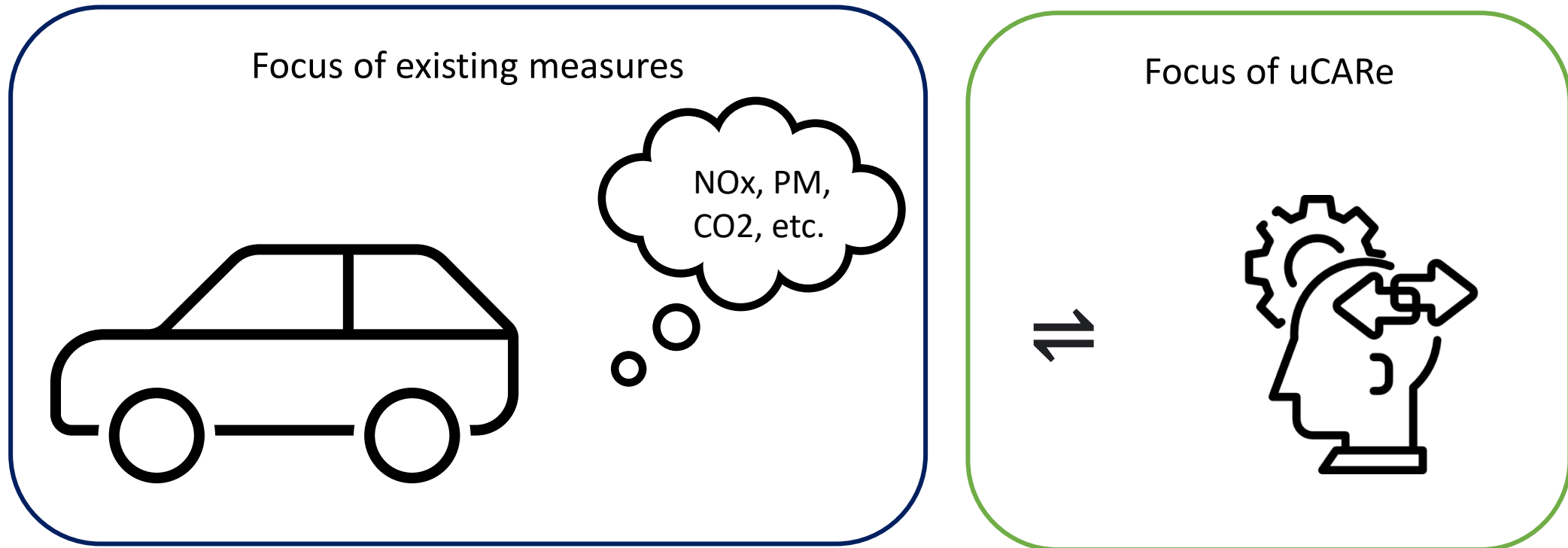


uCARe: Pollutant reduction for existing and future vehicles

DIAS Dissemination Event, 25th October 2022

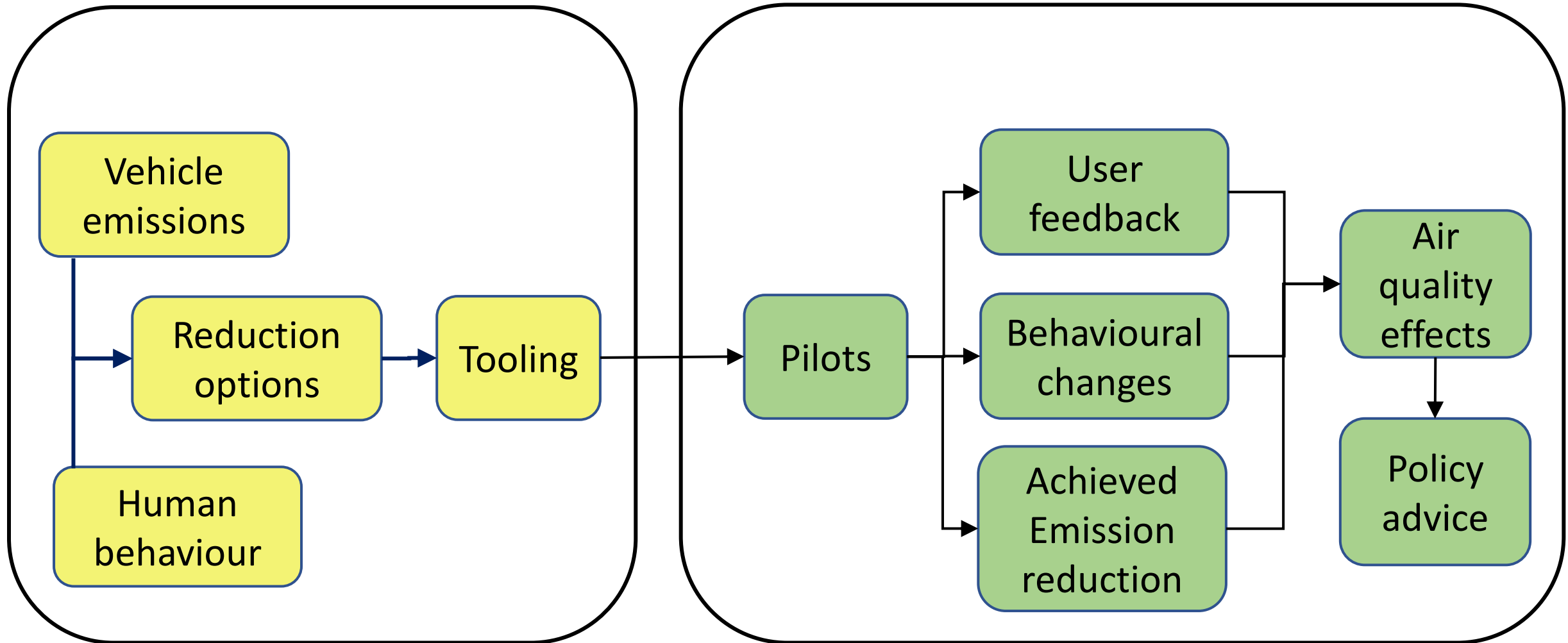
The uCARe Horizon 2020 project



To reduce the **overall pollutant emissions** of the **existing vehicle fleet (euro 3 -6)** by:

1. Providing **vehicle users** with **simple, insightful, and effective tools** to decrease their individual emissions *and*
2. Supporting **stakeholders** in selecting feasible **intervention strategies** that lead to the desired user behaviour.

Structure of the project



Overview of uCARe toolbox elements

Item	Details	User expertise required	
		Normal	Advanced
Surveys	Before/after training or participation in pilots, tailored to needs of specific interest groups, collect data in terms of baseline behaviour , perception of uCARe concepts , willingness and effectiveness in adopting uCARe concepts etc.	YES	YES
Training material	Full text and easy to perceive visual material (videos with DIY tests, infographics etc.) tailored to specific interest groups, based either language neutral or easy to translate to local language	YES	YES
Measurement equipment	NOx direct feedback device , smoke detector based particle sensor , mini-PEMS for two-wheelers and mobile machinery, portable FTIR	YES	YES
Logging equipment	Miniature OBD dongle (invisible to user after installation, install-and-forget) to collect and store vehicle operation data and GPS signal to uCARe server via mobile data connection	YES	YES
uCARe DriveStyle mobile app	Driving style response, grading and advice feedback during driving , option to record app data, GPS signal and driving dynamics, mobile phone should only be fixed on a normal phone holder at any orientation	YES	YES
Augmented emission maps, other methodologies	uCARe emission maps database and methodologies (e.g. cold start) open to the public	NO	YES (app and software developers, emission experts)
uCARe tool	Implementation of the uCARe augmented emission maps and emission methodologies in an advanced emission model	NO	YES (internal to uCARe only)
uCARe web tool	the uCARe emission tool implemented as an easy-to-use web application (runs on any web browser/device), multiple layers for different levels of user expertise and data availability, calculates emissions and fuel consumption (https://ucaretool.eu/)	YES	YES

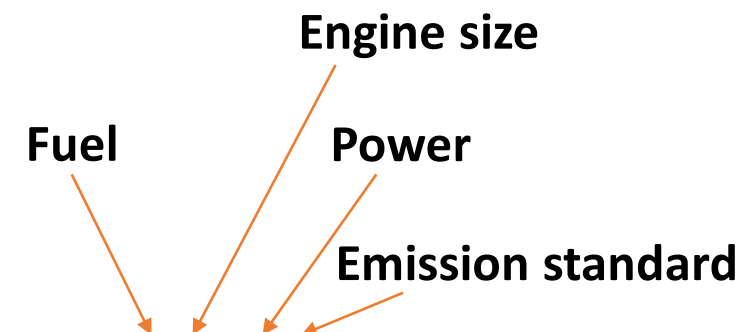
What vehicle, comparable with?

- Taxonomy and alliance code:
 - Grouping vehicles together by the engine make
 - Unique naming scheme

Engine block disambiguation

Specs are the same, but the engines are physically different.

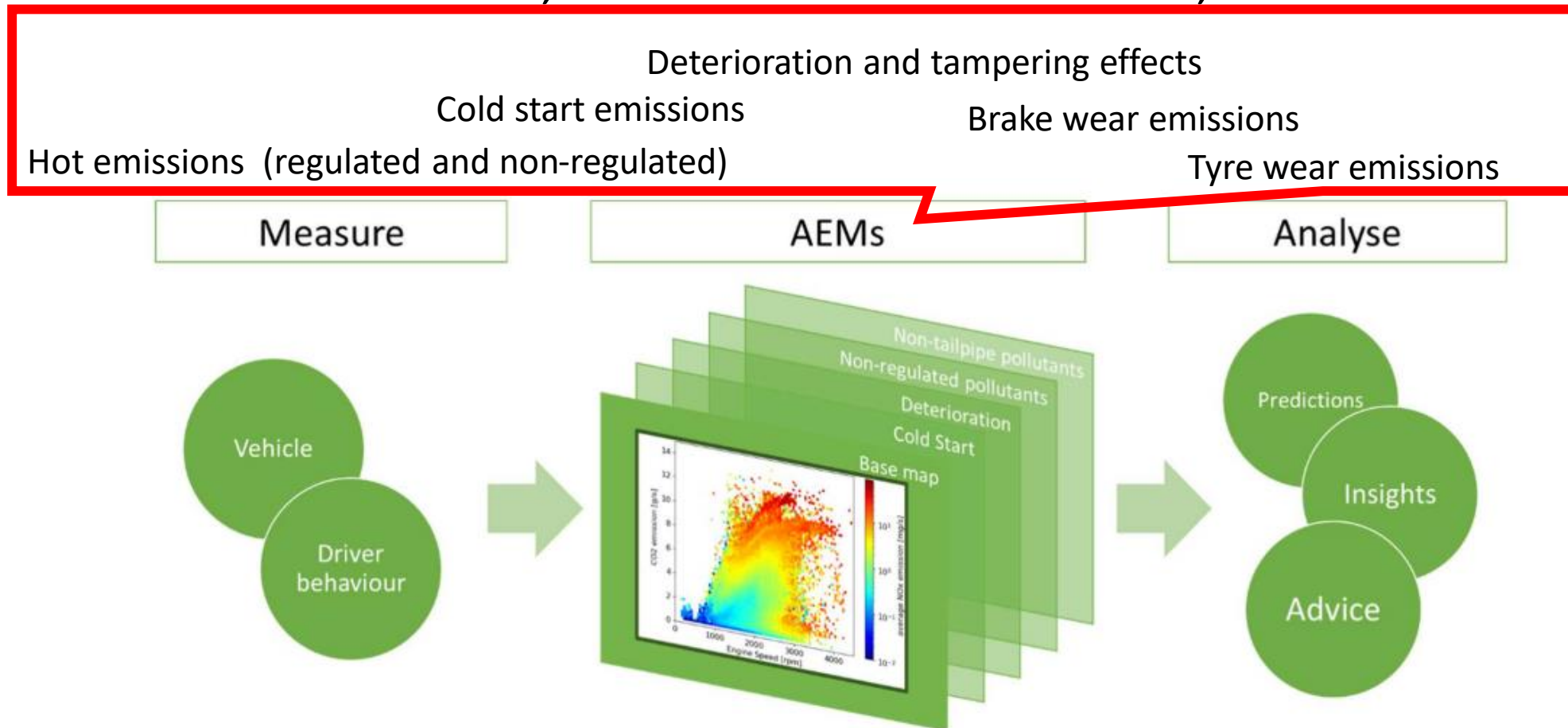
P_1598_77_E4	P_1390_55_E4	P_998_51_E5	P_1598_85_E4	D_1598_77_E5	P_1598_81_E4	P_1997_100_E3	D_1598_88_E6	P_1587_80_E3
FCA	RNM	HYUN	TRIT	FCA	RNM	PSA	VAG	VOLV
VAG	VAG	DAIH	VAG	VAG	TOYO	MIT	FCA	PSA
GM			GM		VAG			
RNM								
MAZD								



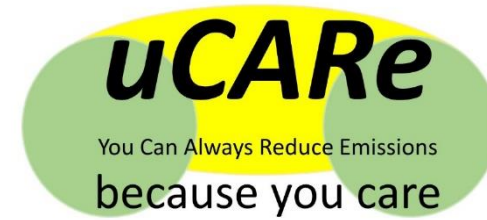
P_1598_74_E4	P_1598_88_E4	P_999_55_E6	P_999_66_E6	P_999_85_E6	D_1598_81_E6	P_998_48_E6	P_998_48_E5
RNM	PSA4	VAG	VAG	VAG	VAG	FORD	FORD
GM	ALFA	GM	GM	GM	GM	HYUN	HYUN
							GM

uCARE Augmented emission maps

- All emission data, combined and normalized, to be use in emission models



uCARe tool (software PHEM from HBEFA used as basis)



uCARe version:

PHEM Basis:

Vehicle longitudinal dyna

Vehicle specifications
Selection of map (AEM)

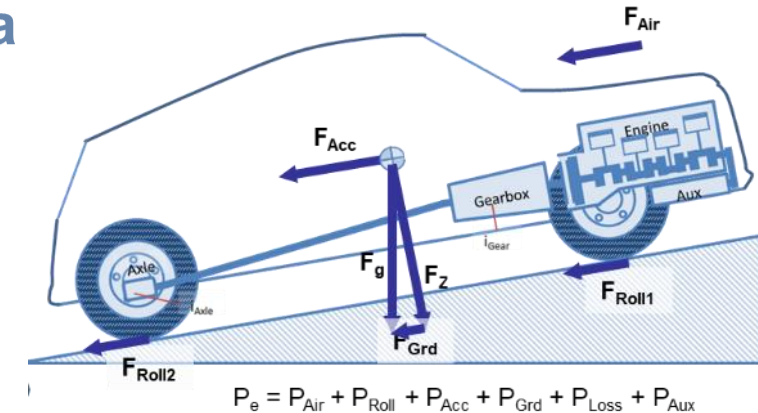
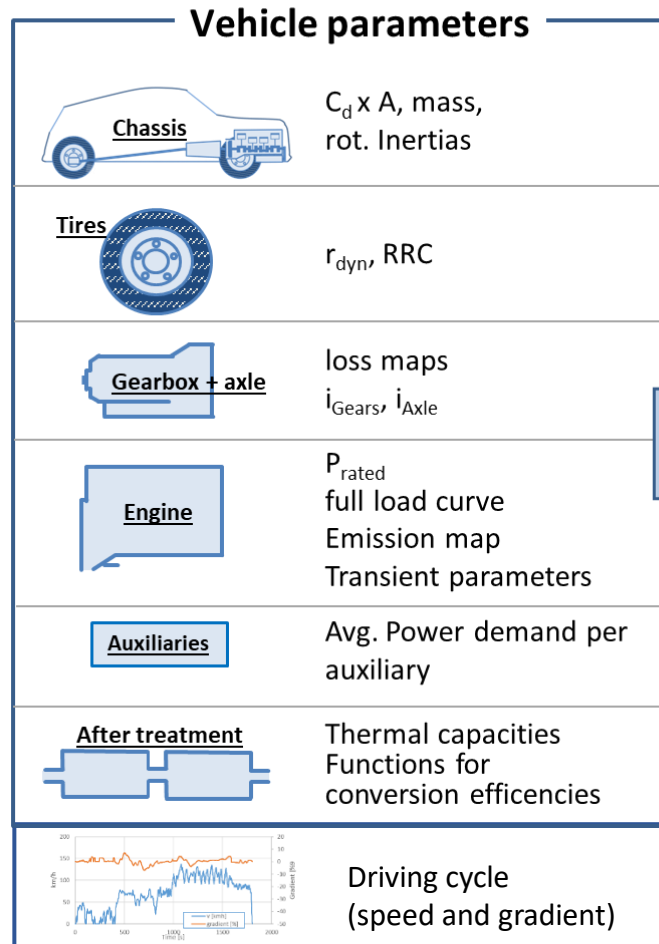
OBD Dongle

Driving cycle (v, grad)
Gear shift behaviour
measured

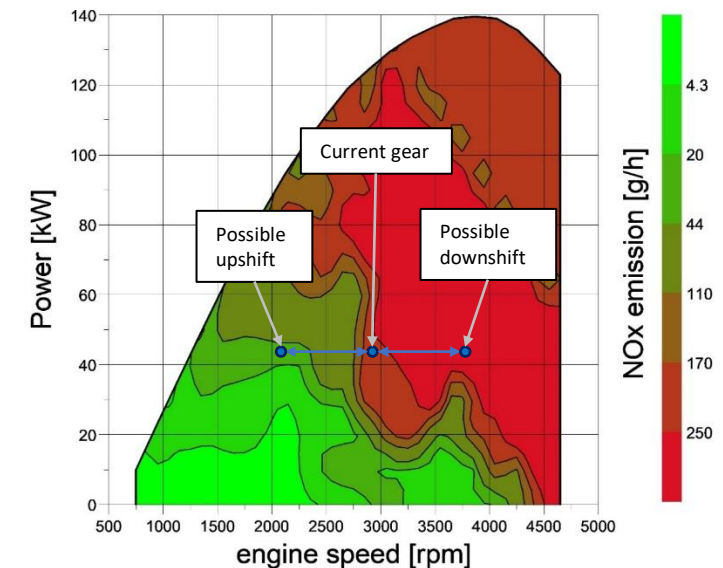
Add-on routines (Eco-
driver, driver rating,..)

Off-Line Expert version

Measured cycles from
any source

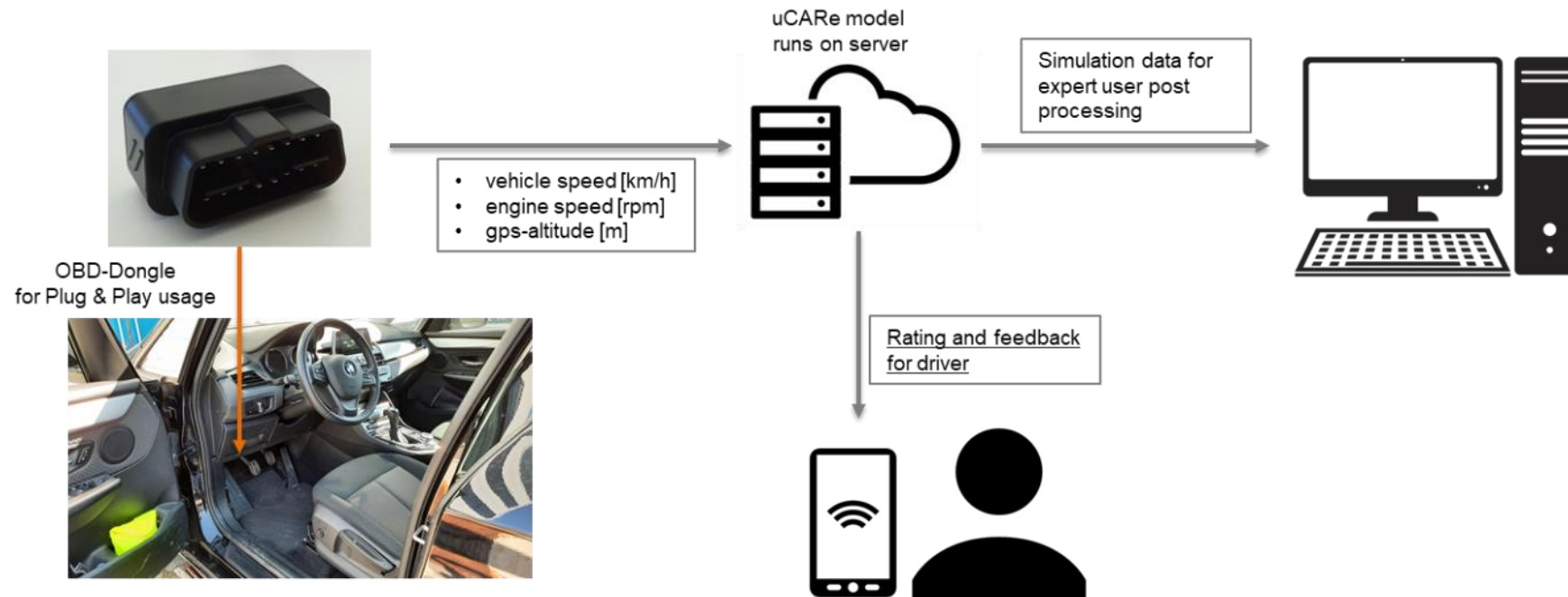


Interpolation of fuel flow from engine map, $F(rpm, P)$
Interpolation of emissions from WP 1 maps, $F(rpm, CO_2)$



uCARe hardware/software architecture

- OBD-Dongle is simple Plug & Play solution
- Measured trip data is sent to server
- Simulation and driver rating done on server
- Rating and improvement proposals available for user via GUI



uCARE web tool

(emission and fuel consumption calculation tool - web application)

<https://ucaretool.eu/>

uCARE

You Can Always Reduce Emissions
because you care

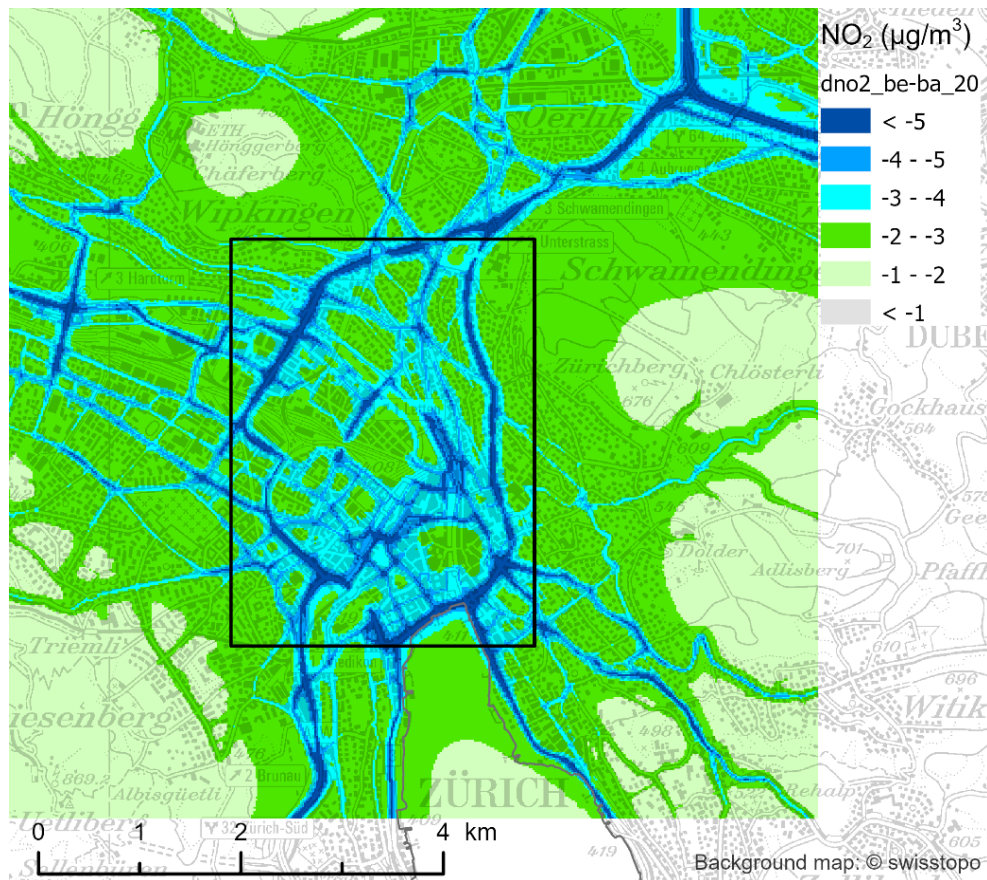
The image shows two overlapping screenshots of the uCARE web application. The background screenshot is the homepage, which includes a navigation bar with 'uCARE Emissions Tool', 'Home', 'My Vehicles', 'My Trips', and 'Privacy'. It also has 'Register' and 'Login' links. The main heading is 'Welcome to the uCARE Emissions Tool!' with the tagline 'You Can Always Reduce Emissions because uCARE.' Below this, there's a section titled 'Listen to your car and adapt your driving style!' and a prompt to 'Have you already installed the uCARE app?'. The foreground screenshot is the 'My Trips' page, which shows a table of trips with columns for 'Vehicle', 'Start Time', 'Distance [km]', and 'Rating'. It also includes two bar charts: 'Your Last 10 CO2 Ratings' and 'Your Last 10 NOx Ratings'. A 'Show My Trips' button is at the bottom.

Vehicle	Start Time	Distance [km]	Rating
		11.61	★★
		20.43	★★
		21.59	★★
		20.49	★★

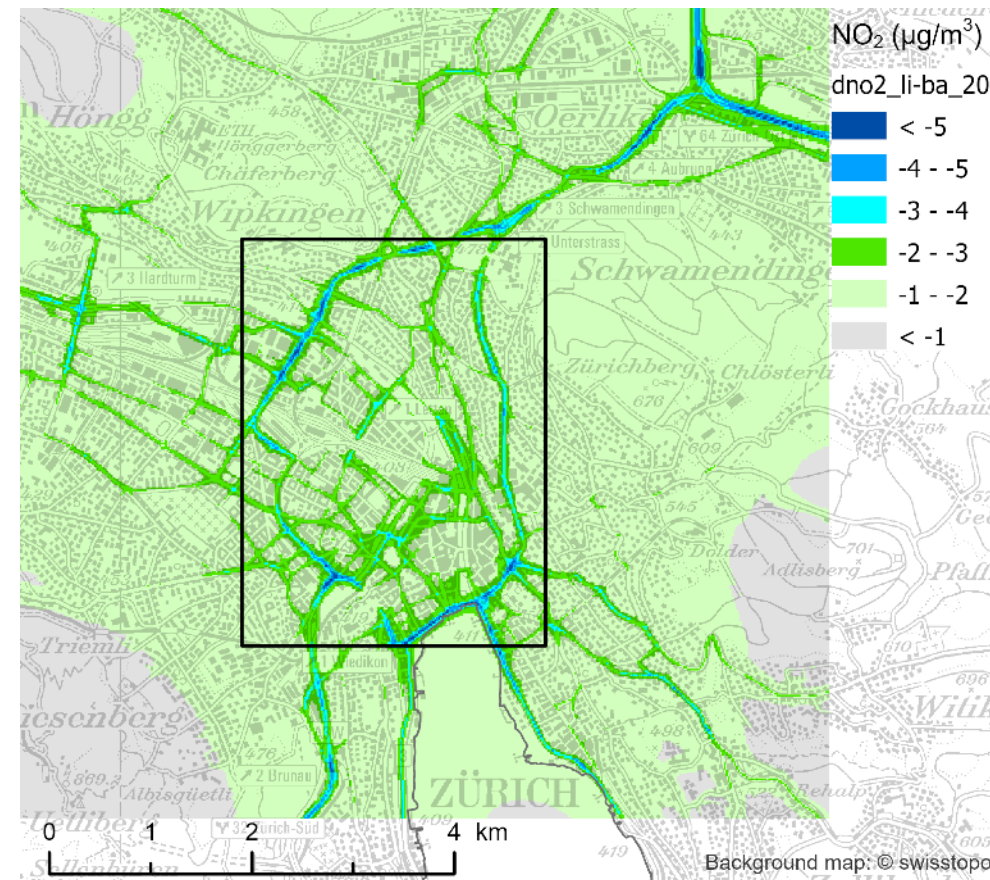
The image shows the results page of the uCARE web application. It features a map at the top left. The main content is divided into several sections: 'Rating CO2' and 'Rating NOx' with star ratings; a summary of potential savings ('You could save 231€ per year...'); a list of driving tips ('You are too often using low gears...'); a 'Stats' section with various metrics like 'Duration: 00:26:26' and 'Average speed: 30 km/h'; a section on 'Your optimum gear shift behaviour'; and a final section on 'How to improve your acceleration behaviour'.

Results – Zurich: Maps of differences NO₂

NO₂ best-case minus baseline scenario 2020

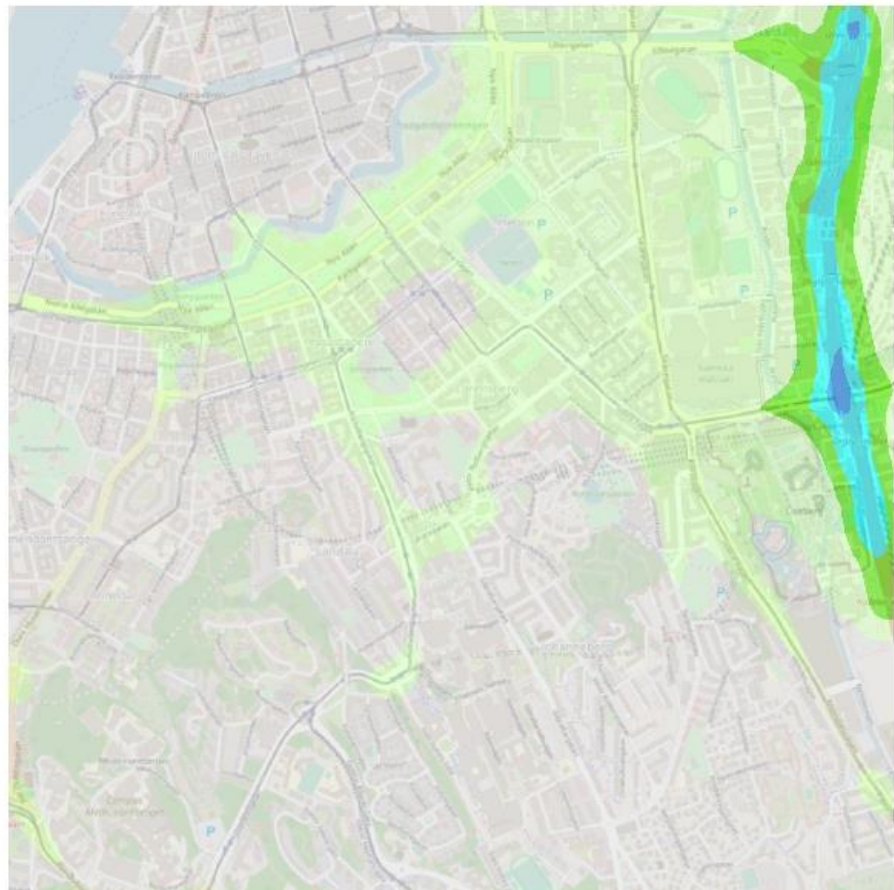


NO₂ most-likely minus baseline scenario 2020

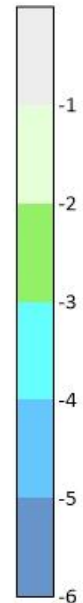


Results – Gothenburg: Maps of differences NO₂

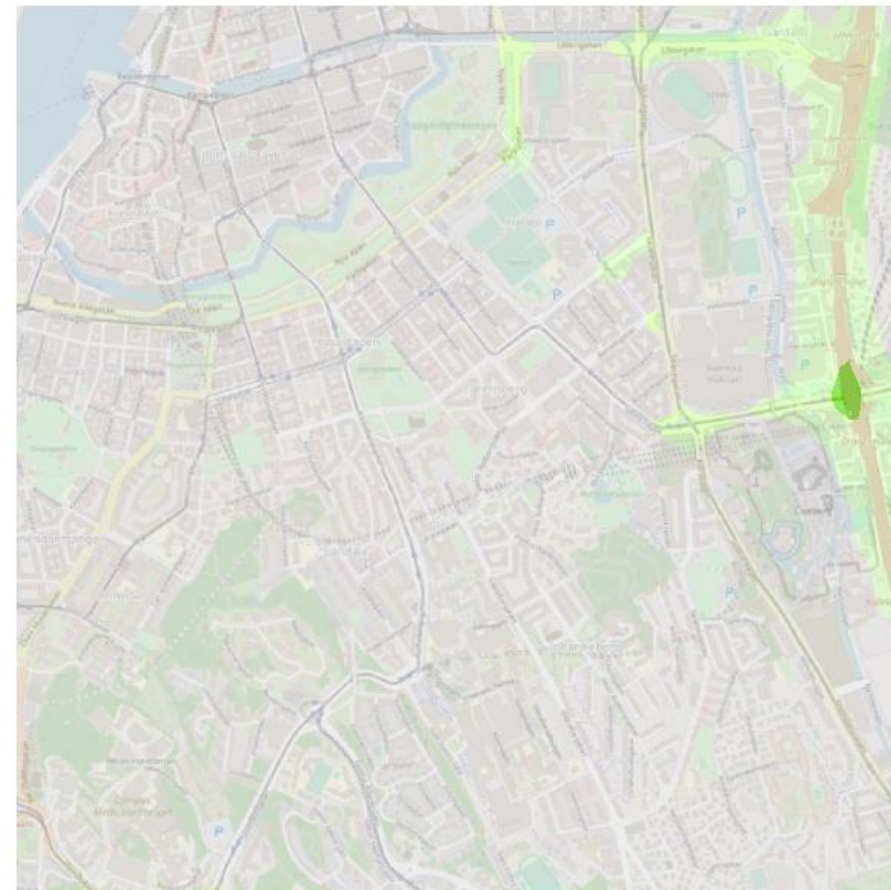
Scenario best 2019 - base 2019 for NO₂ [μg/m³]



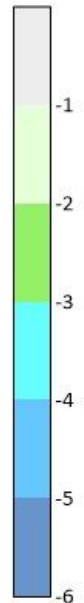
NO₂ [μg/m³]



Scenario most-likely 2019 - base 2019 for NO₂ [μg/m³]



NO₂ [μg/m³]



What can we do with all these tools in current and future vehicles?



Changing your driving style to reduce driving emissions

— How it can be done

Avoid harsh braking

Use the foot brake gently and in good time. Try to avoid approaching a stop, or another car, at a high speed and then stopping hard.

If you can't stop a safe amount of time to simply release the accelerator pedal and reduce speed slowly and gently until it's safe to turn green. A car that is using its engine to brake consumes too fuel.

Emissions from aggressive driving

Compared with eco-driving, aggressive driving uses more fuel and emits more emissions of CO2 and NOx. For NOx it can be more than a 40% increase.

Welcome to the uCARe Emissions Tool!

You Can Always Reduce Emissions because uCARe.

Listen to your car and adapt your driving style!

Have you already installed the OBD device? [Login](#) or [Register](#).

— The uCARe Team

[Check the uCARe Project site](#)

GA 815002

Before study: How easy or hard is it for you to drive in the following way?

Keep a constant speed in various road conditions?
Very hard 1 2 3 4 5 6 7 8 9 10 Very easy

Anticipate traffic flow and signals to avoid hard braking?
Very hard 1 2 3 4 5 6 7 8 9 10 Very easy

Examples of application of uCARe toolbox in current and future vehicles

Current vehicles

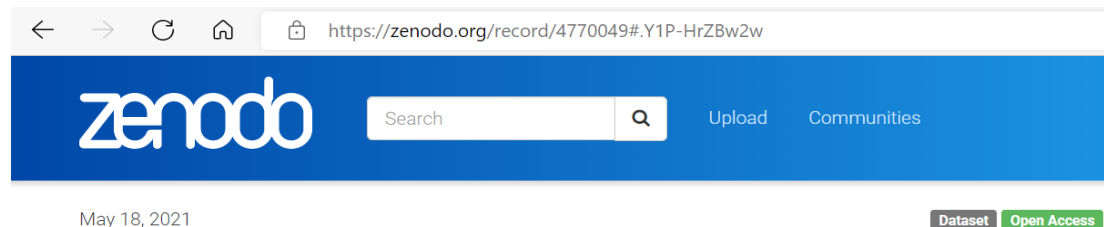
- Integrate uCARe training material to mandatory (or optional training)
- Retrofit OBD equipment for operation logging to be used in combination with uCARe web tool
- Use of uCARe emission modelling tools and data (Augmented Emission Maps, AEM) in:
 - navigation software
 - traffic management systems

Future vehicles

- Use of uCARe emission modelling tools and Augmented Emission Maps (AEM) in (cloud-based) vehicle emission performance monitoring platforms (AEMs can also be compiled by OEMs for specific new vehicle models), use in Pay-as-you-pollute schemes
- Integrate uCARe tool in OEM systems
 - in-car driver information systems for eco driving guidance (similar to GSI)
 - in-car navigation software
 - in-car ADAS

Resources

- Zenodo:
<https://zenodo.org/communities/ucare>
 - All augmented emission maps, taxonomy



Augmented emission maps: several petrol (Euro 3 - 6) and diesel (Euro 5 - 6d-Temp) vehicle-specific maps

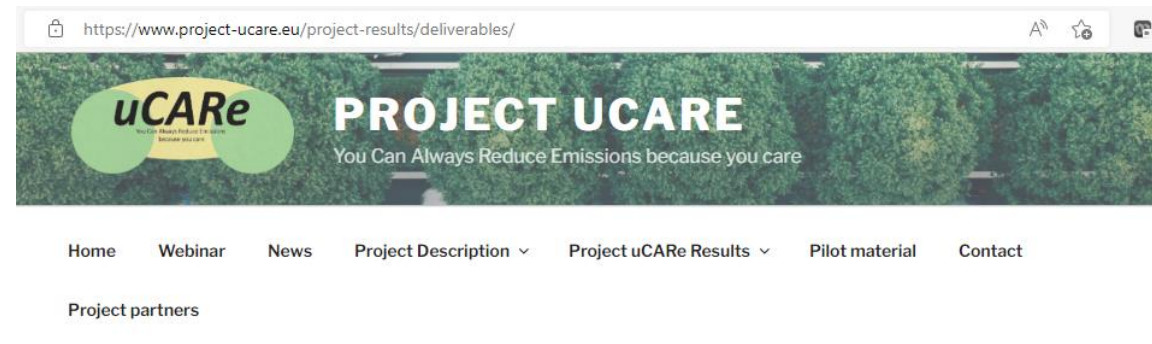
Elstgeest, M.; Indrajana, A.P.; Ligterink, N.E.

In order to enable the sharing of data the emission data for vehicles is standardized. The data exchange format contains all data that is applicable for a specific engine taxonomy code.

The standardized emission map has a ".map.txt" extension and is also human readable. The files starts with metadata which contains information about:

- the engine taxonomy code,
- total driven kilometers over which the data was gathered,
- total time in hours over which the data was gathered,
- the number of vehicles which were tested to create the emission map,
- the DOI (Digital Object Identifier) reference,
- Which emission maps are available in the file.

- The uCARE website:
<https://www.project-ucare.eu/>
 - All deliverables



DELIVERABLES, REPORTS AND PUBLICATIONS OF UCARE

Deliverables

D1.1 – Taxonomy

Download

D1.1 – Alliance_code_v1.5

Download

D1.1 – domains

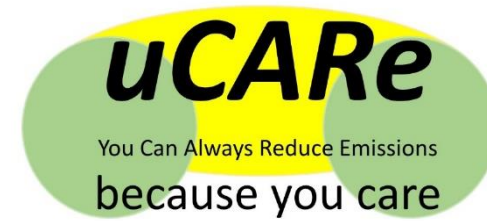
Download



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For more information please visit the uCARe website: <https://www.project-ucare.eu/>

Thank you for your attention, questions, discussion



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