



LIFE Platform meeting on Air-Quality, Barcelona 26-27/08/2017

# “Global system for Sustainable TRAffic management”

- *LIFE GySTRA* -  
*LIFE16 ENV/ES/000082*

M<sup>a</sup> Dolores Hidalgo Barrio



**RSLab**  
Remote Sensing Lab.

**Ciemat**  
Centro de Investigaciones  
Energéticas, Medioambientales  
y Tecnológicas

**DGT**  
Dirección General  
de Tráfico

STADT  
**GRAZ**

# «Global system for Sustainable TRAffic emissions management»

## LIFE GySTRA - LIFE 16 ENV/ES/000082

### BUDGET INFO:

Total amount: 1,567,625 Euro

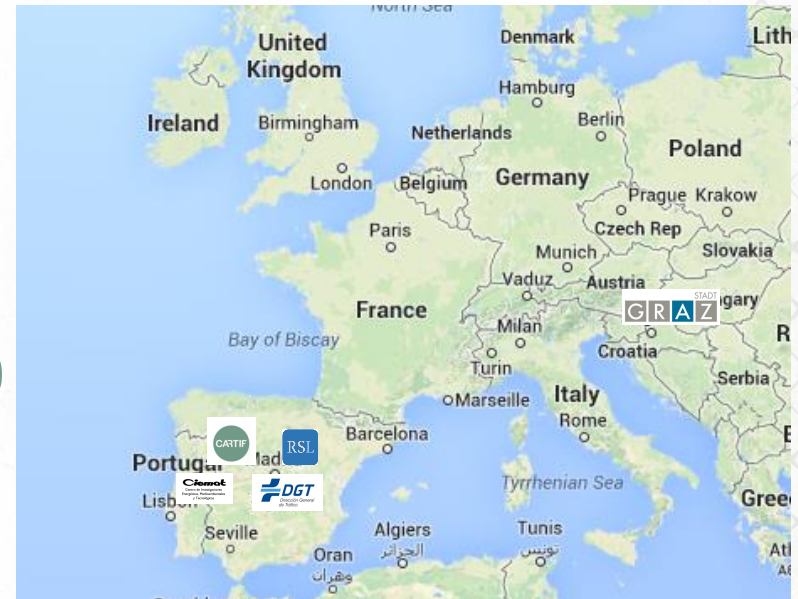
EC Co-funding: 52.16 %

DURATION: Start: 01/09/2017 - End: 30/11/2020

### PROJECT'S IMPLEMENTORS:

Coordinating Beneficiary: CARTIF

Associated Beneficiary(ies): RSLAB (now OPUS-RSE), CIEMAT, DGT, Stadt Graz

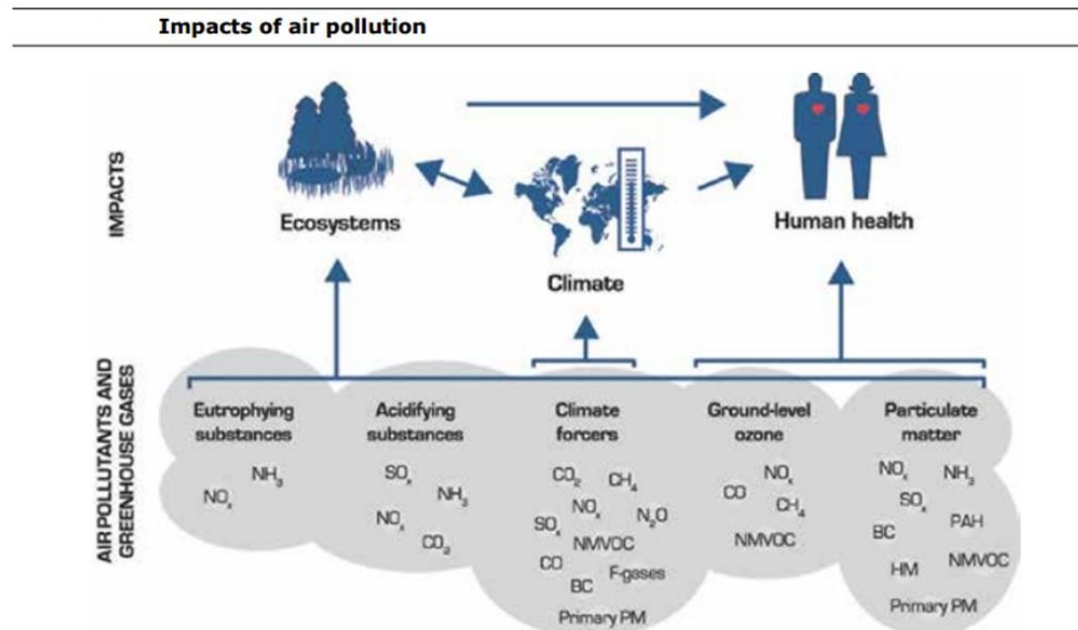


# PROJECT BACKGROUND



# Environmental problem targeted

- Nowadays, air pollution is one of the main environmental challenges in Europe.
- Air pollution causes significant environmental impacts on natural ecosystems.



Source: EEA.

# Environmental problem targeted

- (Road) Traffic is a very important source of air pollution.



# Environmental problem targeted

As for environment traffic contributes with up to 60% of the total  $\text{NO}_x$  emissions in European Cities.

$\text{NO}_x$  is one of the most dangerous pollutants because it generates the tropospheric ozone.

$\text{NO}_x$  and  $\text{SO}_2$  emissions cause acid rain.

Incomplete combustion of hydrocarbons results in CO pollution, a leading cause of global climate change.

Fine particles reduce visibility and, when settling on land or water, affect local ecosystems.



# Environmental problem targeted

As for health, CO directly affects the cardiovascular system in case of chronic exposure to this gas.

NOx are highly toxic and responsible for a rise of cases of asthma, strokes, heart attacks or cancer.



The PM, are related to DNA degradation, cancer, cardiovascular and respiratory problems, neurodegenerative lesions, etc.

In figures, these pollution problems cause annually up to 1.3 million of premature deaths in the whole world.

# Environmental problem targeted

As for the economy, the breach of air quality standards of the European Union involves the payment of a fine, to which the economic costs related to health and public maintenance are added, since air pollution is directly related to diseases and deterioration of buildings.

In total, air pollution is an environmental problem which in economic terms represents costs of 100,000 M€ per year in the EU.







## Environmental problem targeted

Pollutant emissions from motor vehicles are initially **controlled from their manufacture** before bring them onto the market.

However, the reality is that these tests are performed on "bench" without circuit tests and within specific driving cycles. Therefore, real driving emissions from vehicles in urban areas differ from the official data.

Once in circulation, the vehicle must overcome **Periodic Vehicle Technical Inspection (PVTI)**.

PVTI is not made in real driving conditions, the vehicles are stopped and accelerated and not all relevant pollutants are measured (only CO and opacity to visible light).

## Environmental problem targeted

Pollutant emissions from motor vehicles are initially **controlled from their manufacture** before bring them onto the market.

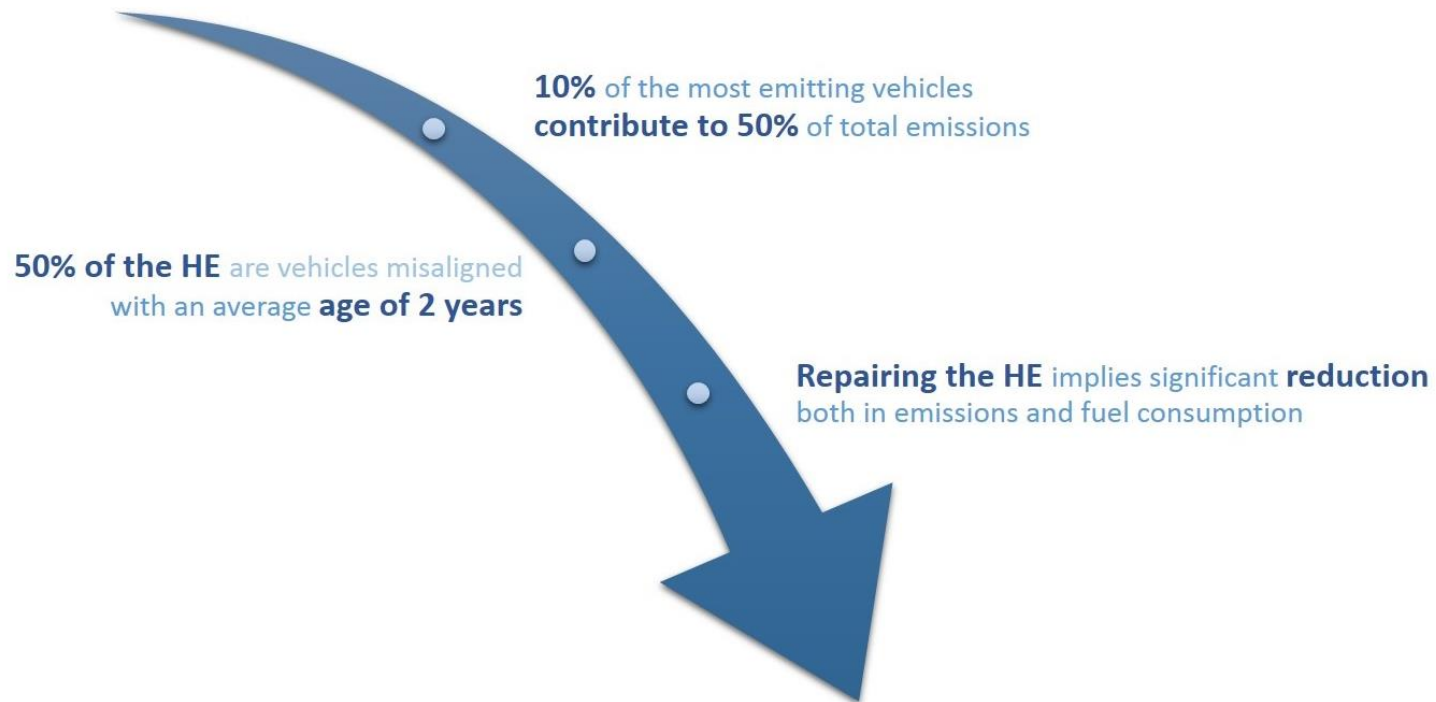
However, the reality is that these tests are performed on "bench" without circuit tests and within specific driving cycles. Therefore, **real driving emissions** from vehicles in urban areas differ from the official data.

Once in circulation, the vehicle must overcome **Periodic Vehicle Technical Inspection (PVTI)**.

PVTI is not made in **real driving conditions** the vehicles are stopped and accelerated and not all relevant pollutants are measured (only CO and opacity to visible light).

# Environmental problem solution?

Identifying High Emitters is not intuitive at all



# How can we identify HE?

- (1) PTI: Idle test / acceleration test carried out with intrusive analyser in the Periodical Technical Inspections.
- (2) CVS: Laboratory test carried out with CVS analyser and dynamometers in order to simulate the engine load.
- (3) OBS-PEMS: On-Board Systems or Portable Emissions Measurement Systems are devices installed in the vehicle to measure their emission levels.
- (4) RSD: Remote Sensing Devices, traditionally not suitable to be used in high capacity roads.





# LIFE GySTRA PROJECT



# Main Objectives

- To establish a real and effective policy for sustainable mobility, both for city traffic as for public transport fleets.
- To implement actions that achieve the reparation of the vehicles that are polluting beyond the defined thresholds (High Emitters).



# Main Objectives

- To establish a real and effective policy for sustainable mobility, both for city traffic as for public transport fleets.
- To implement actions that achieve the reparation of the vehicles that are polluting beyond the defined thresholds (High Emitters).

## HOW?

With the creation of a global emission management system using a newly developed RSD adapted to the EU requirements by including NO<sub>2</sub>.



# Main Objectives

- To establish a real and effective policy for sustainable mobility, both for city traffic as for public transport fleets.
- To implement actions that achieve the reparation of the vehicles that are polluting beyond the defined thresholds (High Emitters).

## HOW?

With the creation of a global emission management system using a newly developed RSD adapted to the EU requirements by including NO<sub>2</sub>.

**RSD+**



# RSD+ technology

- The RSD+ will measure CO, HC, CO<sub>2</sub>, NO and NO<sub>2</sub> via nondispersive infrared spectroscopy (for the carbon species) and dispersive ultraviolet spectroscopy (for nitrogen species) in less than 0.5 seconds via the exhaust of vehicles.
- RSD+ software determines the ratios of CO/CO<sub>2</sub>, HC/CO<sub>2</sub>, NO/CO<sub>2</sub> and NO<sub>2</sub>/CO<sub>2</sub> in the diluted and dispersed exhaust plumes and applies the mathematics of chemical mass balance of internal combustion to calculate tailpipe concentrations that are corrected for water and excess air.
- RSD+ also calculates a total obscuration factor (termed a “smoke factor”) that is a fuel specific exhaust opacity measurement.
- RSD+ technology is prepared to measure in the European roads in fixed locations, similar to speed radars.



# How can we identify HE?

	Static Test		On Board	Remote	
	(1) PTI	(2) CVS	(3) OBS-PEMS	(4) RSD	(5) RSD+
Scope	CO and Oppacity	HC, CO, NO <sub>x</sub> and PM	HC, CO, NO <sub>x</sub> and PM	HC, CO, NO and PM	HC, CO, NO <sub>2</sub> and PM
Real driving emissions?	NO	NO	YES	YES	YES
Accuracy? Regulated use?	Low 2009/40/EC ISO 17020	High 2007/46/EC	High CE-marking	High ISO 17025	High ISO 17025
Number of vehicles analyzed per hour?	10	3	1 per PEMS	< 1,000	< 3,000
Data automation and integration?	None	None	Limited	Limited	Full
Deployment	Indoor	Indoor	On board	Single lane roads	Multiple lanes roads
Costs by vehicle analyzed	50 €	2,000 €	1,500 €	1 €	0,1 €

# RSD+ prototype

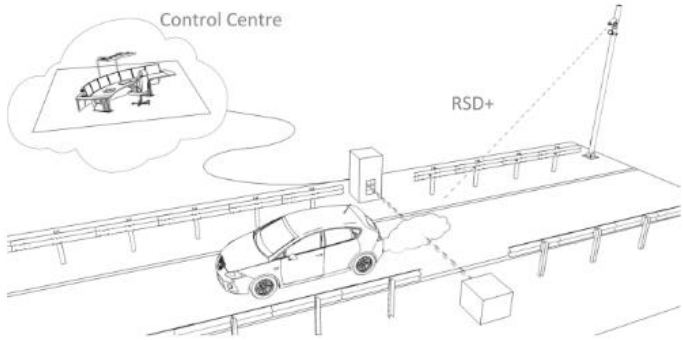
**RSD**  
Available in the market



**RSD+**  
NOT commercially available



- NO2 included
- Fixed design
- DGT Control Centre Integration (Estrada System)
- Design according to European Standards
- Lower cost manufacturing
- Increase the daily vehicles collected
- Designed in Europe



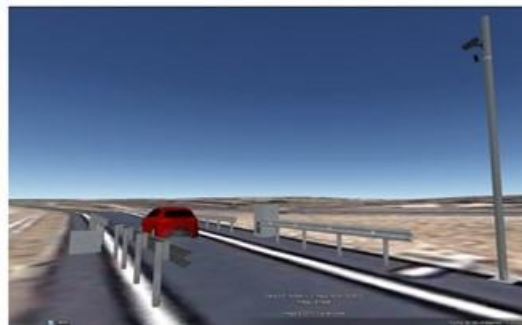
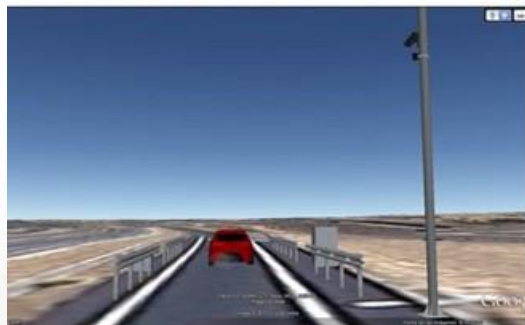
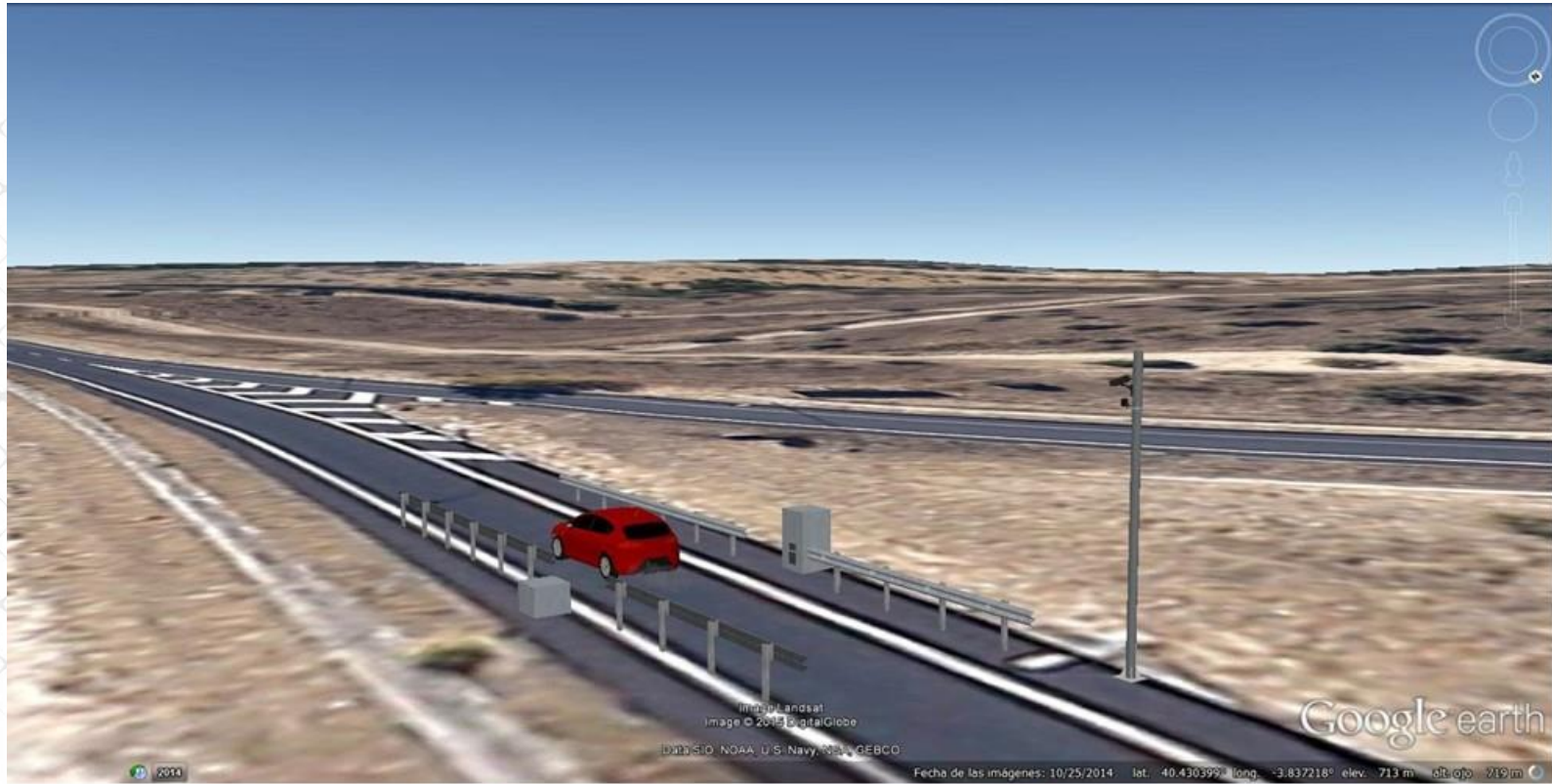
# RSD+ technology

The innovation, in terms of instrumental matter, lies in that this is the first device that measures remotely all emissions included  $\text{NO}_2$  in a fixed manner with a cutting-edge software that allows, in less than 0.5 seconds, controlling:

- Emissions ( $\text{NO}_2$  added).
- License plate.
- Conditions that have influence in the measurements such us kinetics (speed and acceleration).
- Environmental conditions (temperature, pressure, humidity, direction and speed of the wind).



# RSD+ prototype (TRL7)





# Specific Objectives (1)

- Demonstration of RSD+ technology at TRL7.
- Implementation of a solid sustainable mobility policy with the following aims:
  - Control and quantification of real driving traffic emissions.
  - Creation of a global emission management system for two types of users.
    - Public model: directed to public entities with legislative power to reduce up to 20% of traffic emissions through the identification of high emitters, notification and repair, to avoid penalty payments.
    - Fleet model: directed to private or controlled fleets to reduce up to 20% of vehicles emissions and 3-5% of fuel consumption.

## Specific Objectives (2)

- Demonstration that the application of the emissions management system has a long trajectory since it will not only be implemented by Spanish or Austrian administrations.
- Publication and dissemination of the results to different interest groups: scientific circles, public administrations, private companies, consumers and automobile associations, etc., in order to replicate the model in further EU member states.





## Actions (2)

- Creation of the **public model** - actions in Madrid.
  - Installation of RSD+ in roads and massive data collection campaign (RSLAB).
    - Integration with national database of vehicles (DGT).
    - Validation of the measurements by comparison test with known gas concentrations (CIEMAT).
  - Notification to drivers who exceed a certain emission threshold. In case of not repairing the vehicle identified as high emitter, they will be fined (DGT).
  - Quantification: evaluation of the environmental, socio-economic and technical-economic impact of the project (CARTIF).





## Actions (4)

- Sustainable mobility reference model. Transference and replication:
  - Barcelona
  - Lille
  - Göteborg
  - Valladolid
  - Graz (full implementation)
  - Madrid (full implementation)
- Active dissemination of the project and its results.



## Expected results (1)

- Sustainable mobility policy based on a legal frame to identify high emitter vehicles (HE) and reduce traffic emissions.
- Develop RSD+ prototypes which complies with EU standards, small and versatile, able to be installed in fixed locations, with uncertainty less than 15% applied to all the emissions: NO, CO, HC and PM, and NO<sub>2</sub>.
- Model replicable, with two different approaches:
  - a public model based on a policy deployed through a legal framework for the control of emissions from city traffic and,
  - a private fleet model for control and regulation of traffic emissions from the vehicle fleet.
- Dissemination of the results to more than 50,000 people from all sectors.



## Expected results (2)

### ■ Public model:

- In the Spanish pilot (Madrid), **700,000 vehicles per year** will be monitored with 2 RSD+ devices (30% of fleet in Madrid).
- Circa 5% will be identified as HE.
- With the repair of HE it is expected to achieve reductions of CO, HC and NOx emissions of 617 t/y, 89 t/y and 518 t/y, respectively, in Madrid.
- The projection for all the country would be 17,779 t/y, 2,463 t/y and 15,320 t/y, respectively, this is an estimated emission savings of 14.8% (CO), 2.8% (HC) and 22.7% (NOx, NO and NO<sub>2</sub>) of the total volume of emissions according to the numbers of the Inventory of the Emissions to the Atmosphere in Spain (MAGRAMA).



## Expected results (3)

### ■ Fleet model:

- In the Austrian pilot (Graz) a controlled fleet of **150 buses** will be continuously monitored.
- Identifying 6% of HE and repairing them their emissions will be reduced by up to 84%, contributing with a saving of up to 17% and an average of 9% of the total bus fleet.
- Fuel savings are expected to be 3-5% of HE.



# Thank you for your attention

More information:

[CENTRO  
TECNOLÓGICO] **CARTIF** / [www.cartif.es](http://www.cartif.es)

[dolhid@cartif.es](mailto:dolhid@cartif.es)

[www.lifegystra.eu](http://www.lifegystra.eu) (coming soon)



**RSLab**  
Remote Sensing Lab.

**Ciemat**  
Centro de Investigaciones  
Energéticas, Medioambientales  
y Tecnológicas

**DGT**  
Dirección General  
de Tráfico

STADT  
**GRAZ**