Comune di Milano

FORUM AMBIENTE
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AGENZIA MOBILITÀ AMBIENTE TERRITORIO

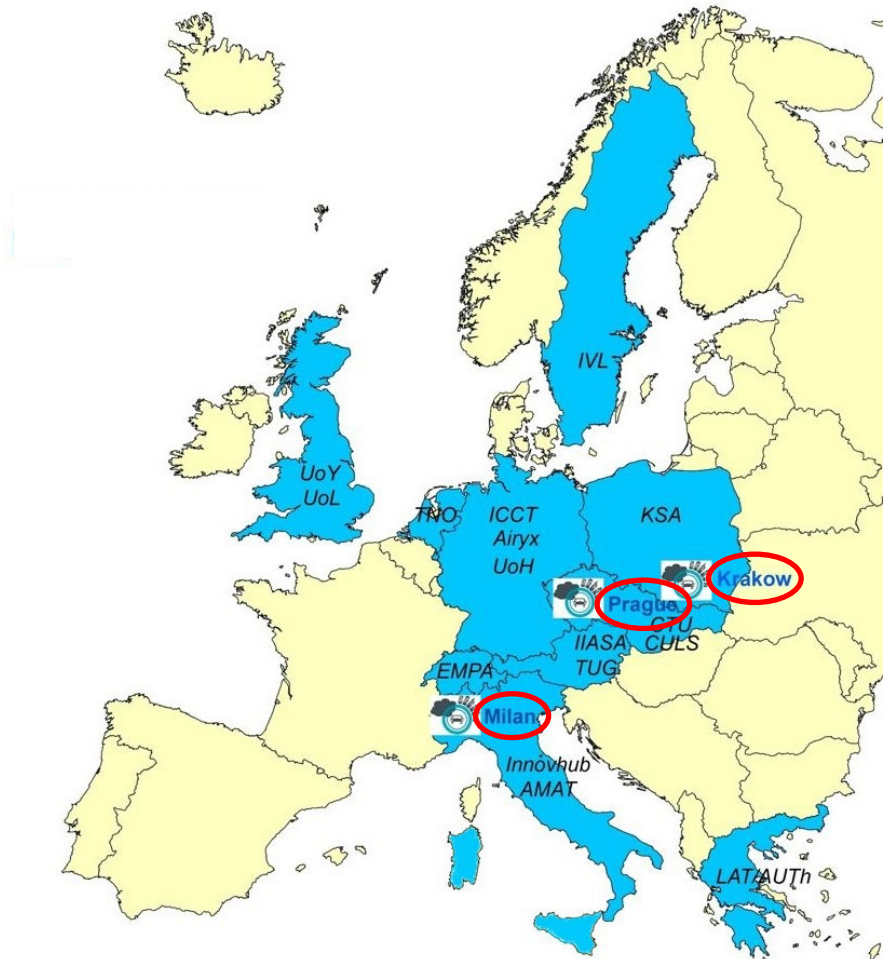
Remote sensing for the reduction of traffic emissions: H2020 CARES project

Ake Sjodin, IVL Swedish Environmental Research Institute

Kaylin Lee, International Council on Clean Transportation

CARES
CITY AIR REMOTE EMISSION SENSING

CARES – a H2020 InCo flagship project bringing together worldwide RES/RDE expertise



Commercial remote sensing service providers:

CARES – a H2020 InCo flagship project bringing together worldwide RES/RDE expertise

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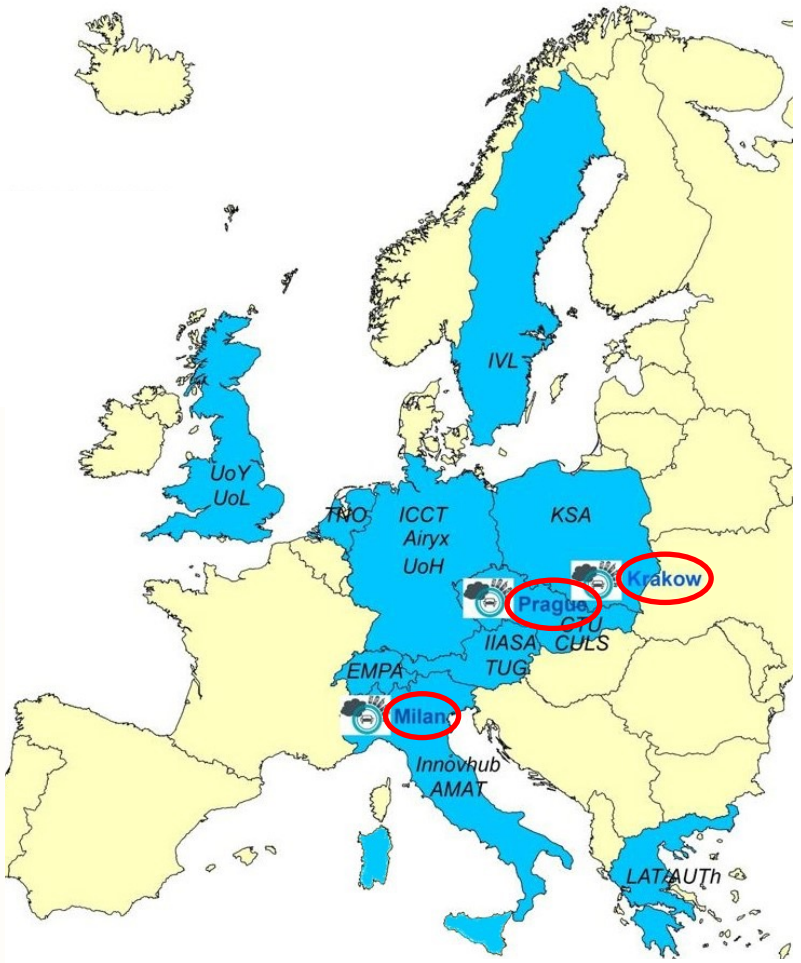
innovation and research



Commercial remote sensing service providers:

OPUS RSE

heat

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CARES overall objectives

"… reduce the hurdles for applications of **remote emission sensing (RES)** to make it a **widespread** means of both **monitoring and enforcement of vehicle emissions**."

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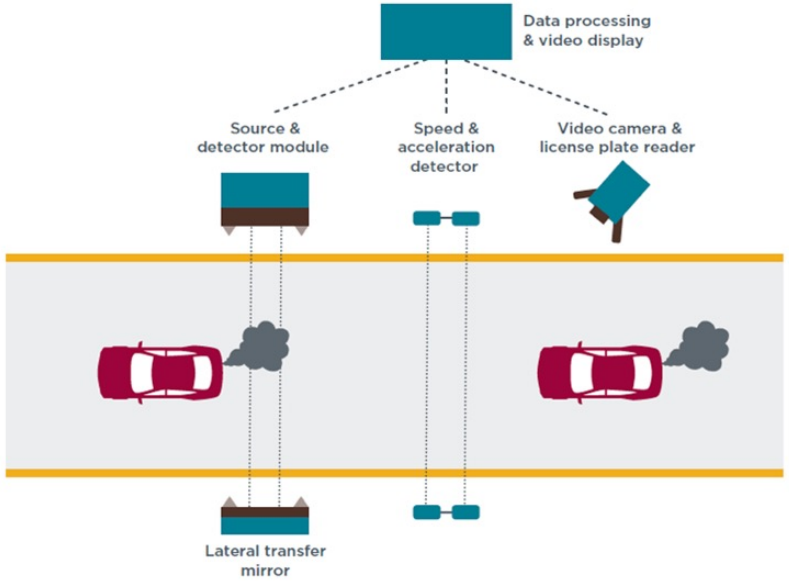
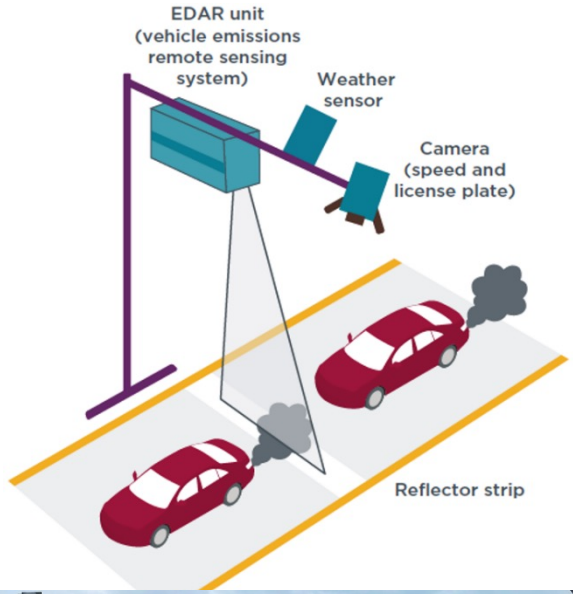
Conventional/commercial remote emission sensing

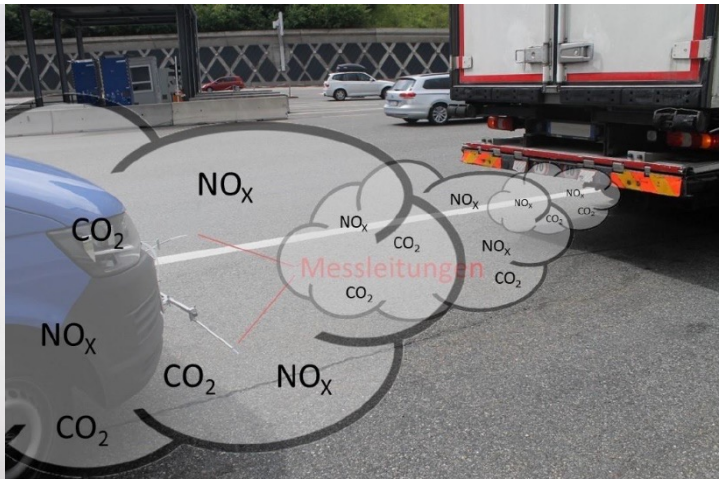




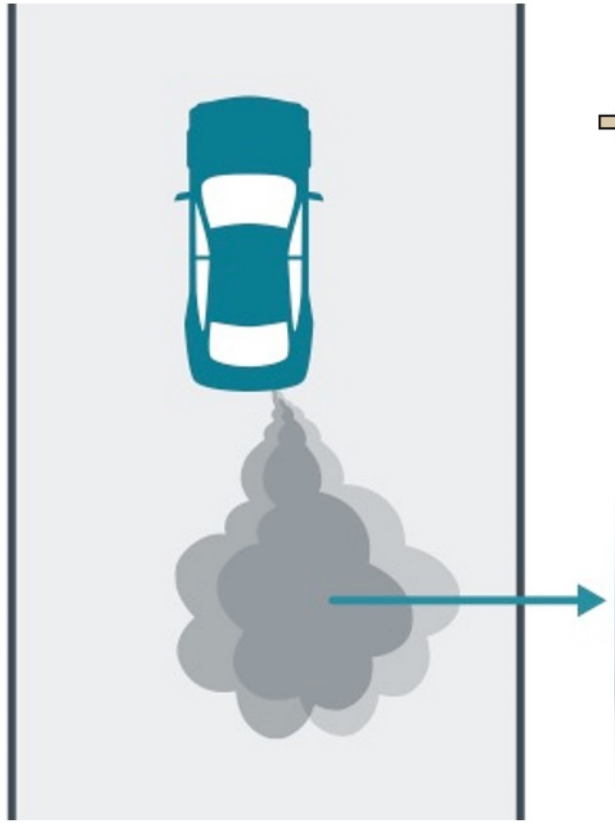
CARES is further developing RES techniques

Plume chasing

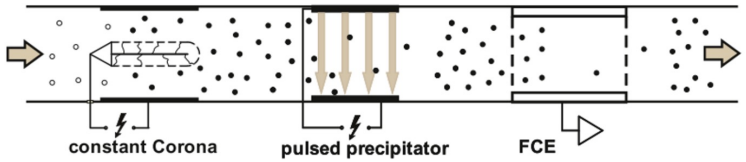
NOx and PN are measured



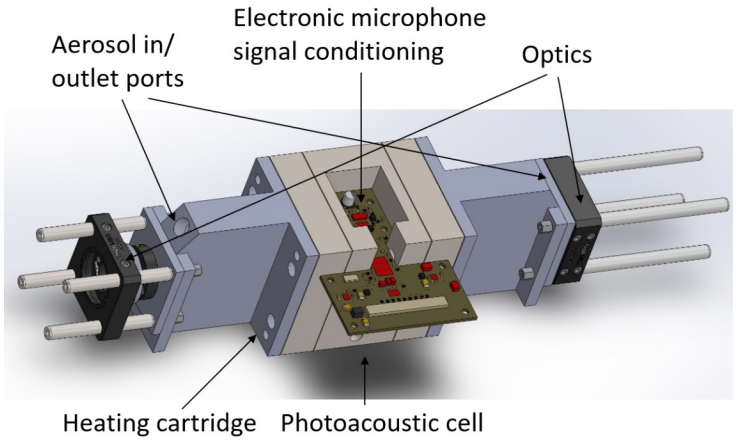
Point sampling



Particle number (PN) sensor



Black Carbon (BC) sensor



CARES challenges

Develop and demonstrate remote emission sensing hard- and software to:

- Improve the accuracy of measurements of **particulate matter**;
- Improve the detection of **high-emitting vehicles**;
- **Lower costs** of remote emission sensing measurements;
- **Facilitate use by unskilled personnel** to achieve a broader deployment potential;
- **Support local air quality plans**;
- Establish a proper **data infrastructure** built around **vehicle registration databases, traffic management** measures and **air quality monitoring** systems.

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Remote sensing testing in Milan

- Testing period: Fall 2021 (Sep – Oct)
- HEAT's EDAR remote sensing systems
  - Deployed in Via Cilea, Via Madre Cabrini (with similar driving conditions)
  - > 35,000 measurements
- Point sampling
  - Via Madre Cabrini, Via Bazzoni
  - Enable real-world measurements of particulate number (PN) and black carbon
- Concurrent portable emissions measurement system (PEMS) testing on certain vehicles
- Air quality monitoring instruments and advanced sensors
- Ambient ammonia concentration and resuspension particle measurements

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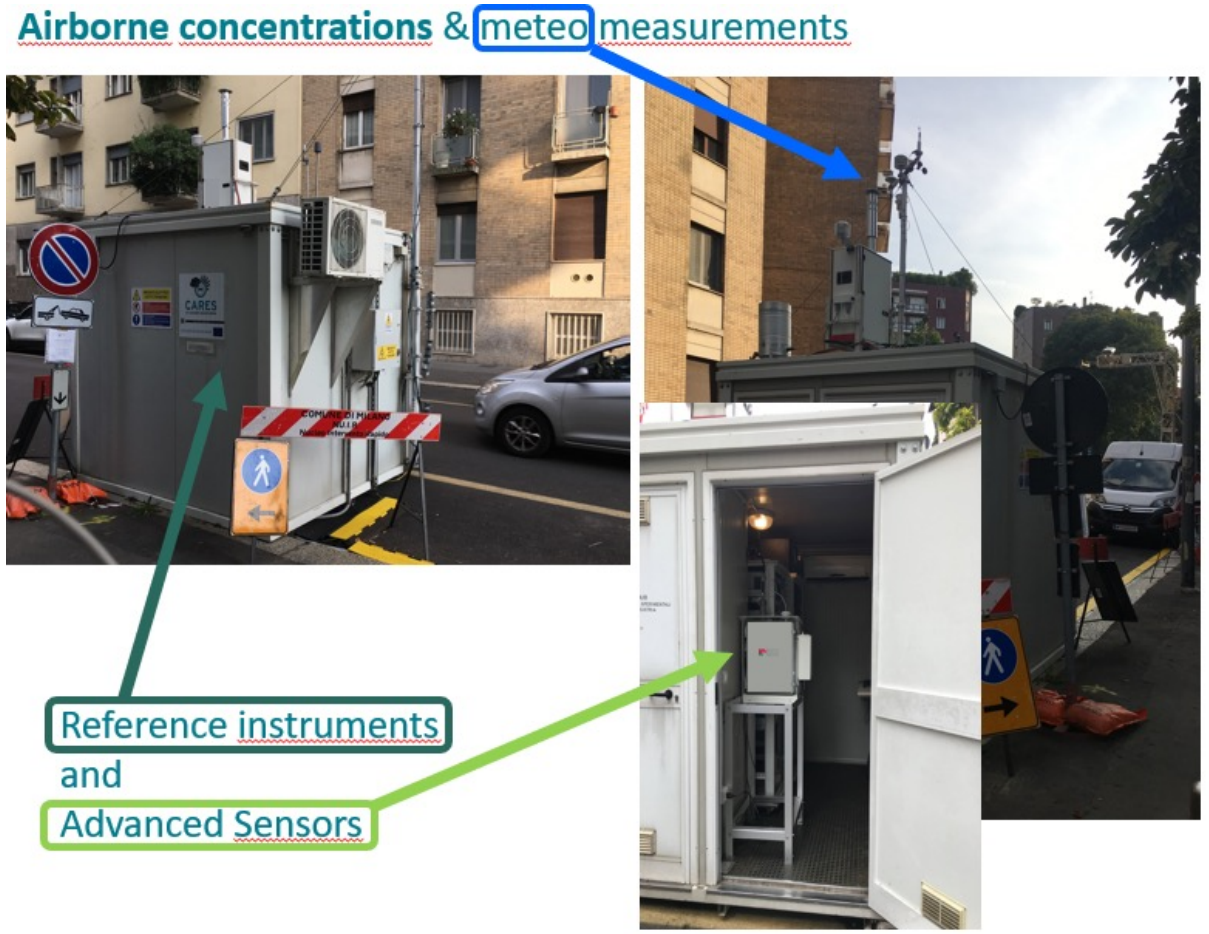

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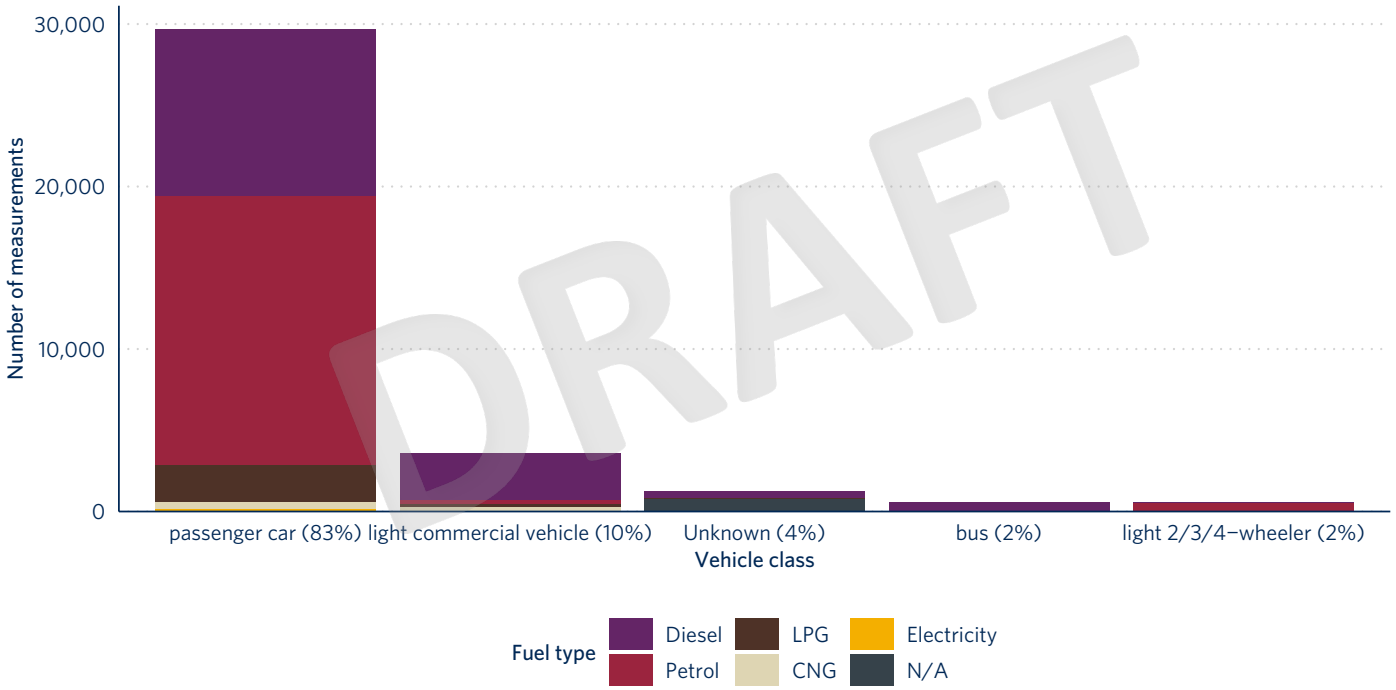
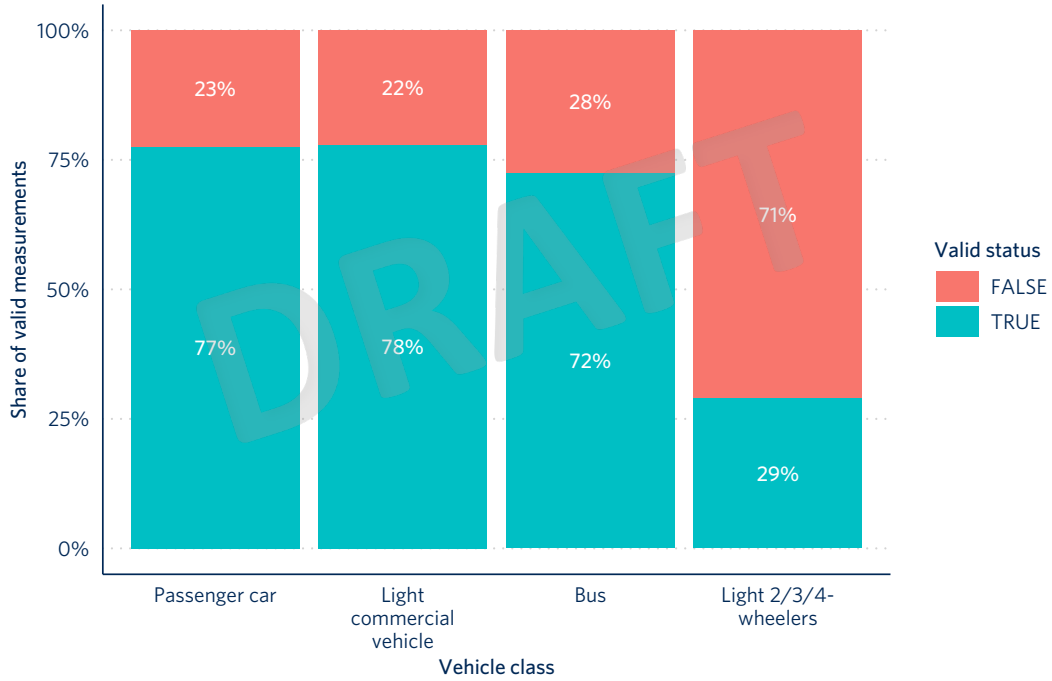
Milan's RS measurements from commercial systems

Fleet measurements

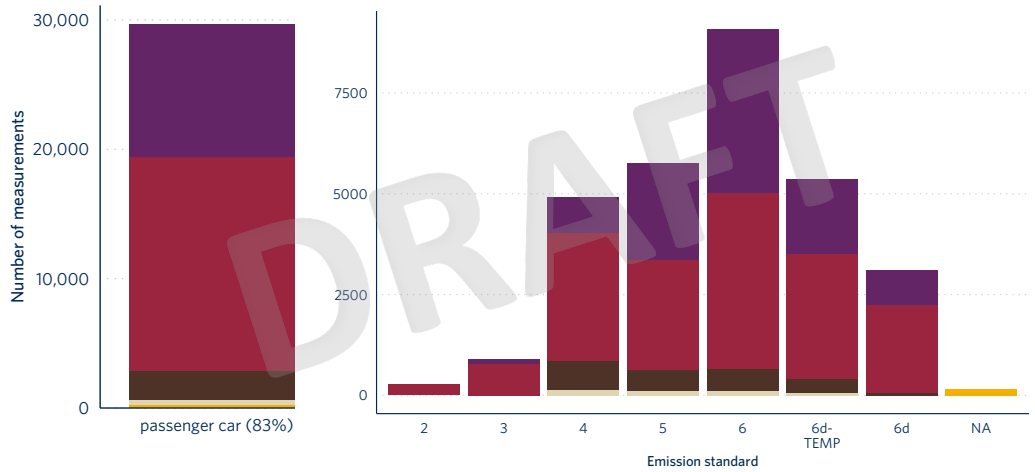


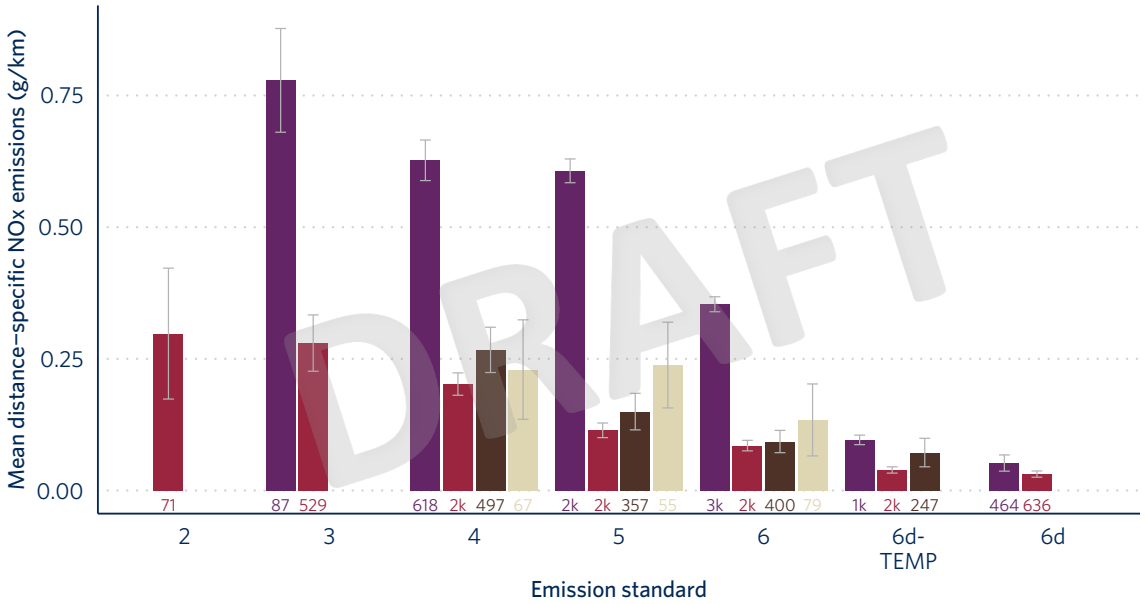
- Passenger car most commonly found
- Significant shares of LPG/CNG vehicles relative to other cities
- Lower share of valid emission measurements of scooters and motorcycles due to driving pattern and small plumes

Emissions measurements



Milan's passenger car emissions





- Fair share of old diesel vehicles (< Euro 6), whose NO_X emissions
  - Multiple times higher than emissions from petrol, LPG, or CNG
  - Do not improve significantly until Euro 6d-TEMP (manufactured after 2019)
- Presence of LPG & CNG vehicles
  - Whose NO_X emissions higher than petrol counterparts
  - Responsible for high CO emissions (LPG) and high HC and CH_4 emissions (CNG)
  - Point sampling results point to the same direction for black carbon and NO_X

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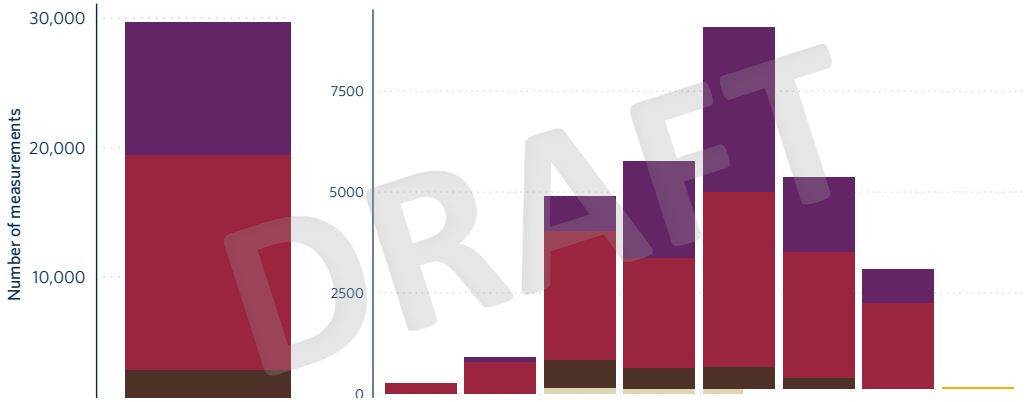

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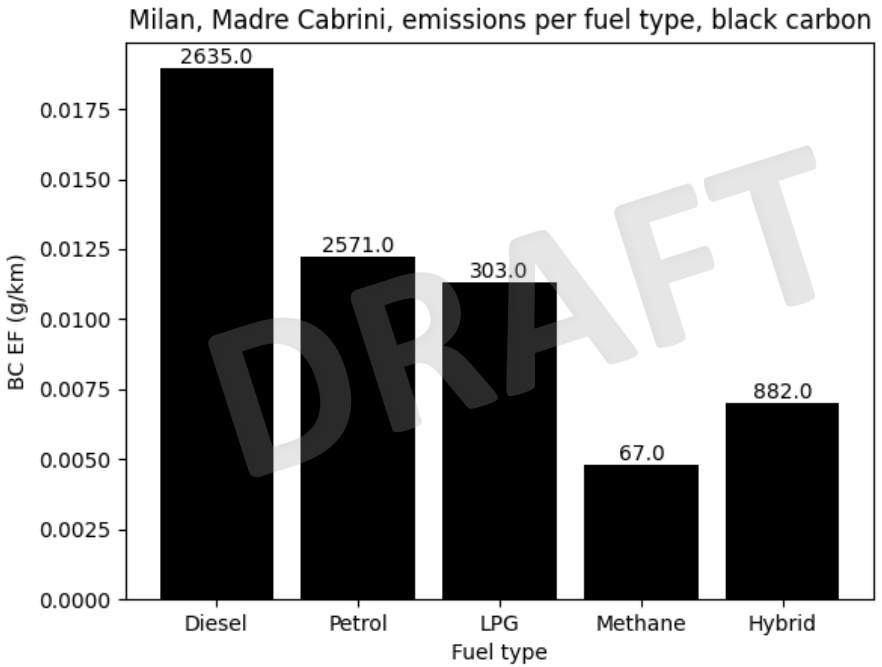

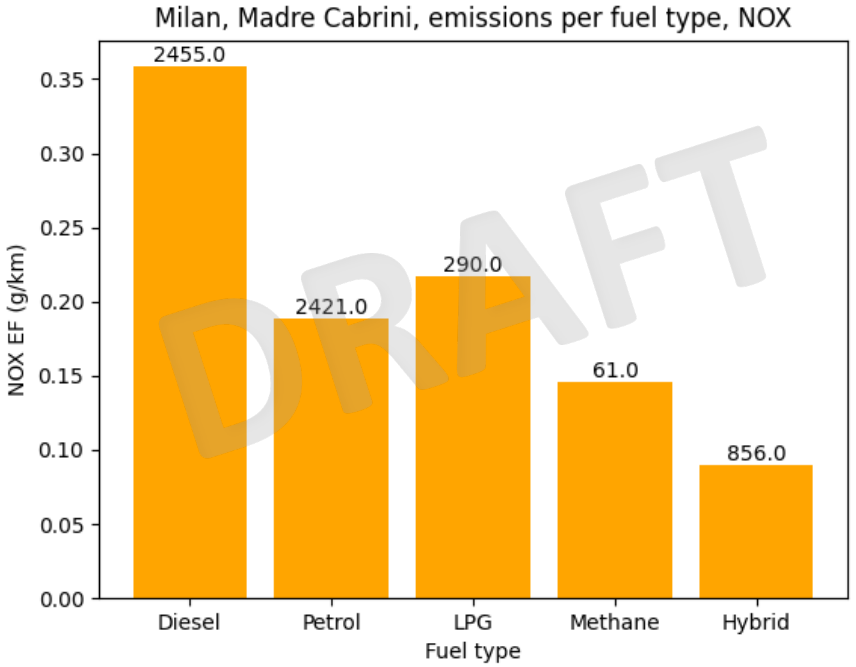

G vehicles

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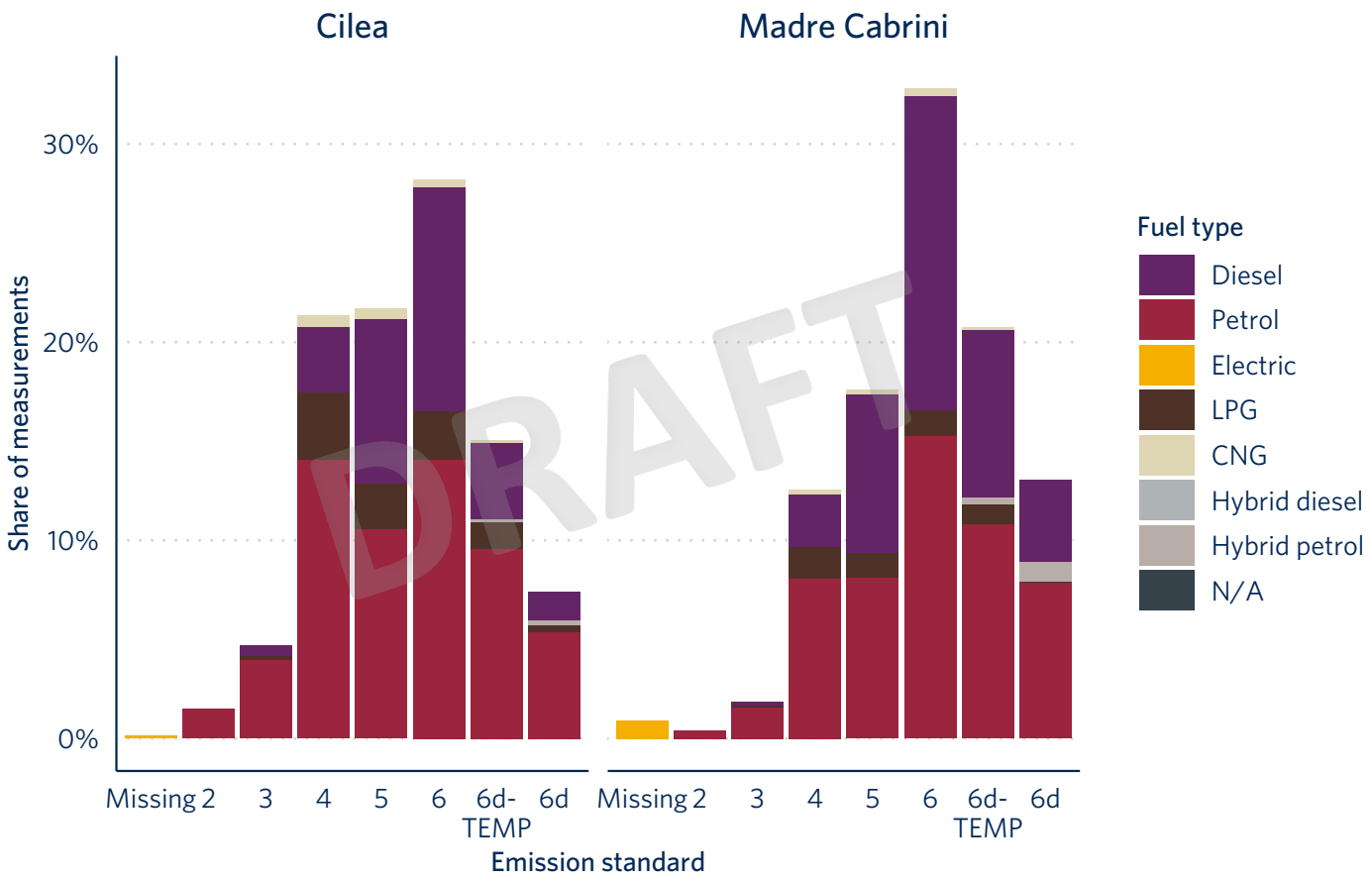
Impact of Milan's low-emission zone (LEZ)



- Restrictions in Area B (Via Cilea)
  - 0.6% vehicles (mostly diesel) detected were not meeting LEZ requirements
- Restrictions in Area C (Via Madre Cabrini)
  - Stricter restrictions of diesel vehicles
  - 2.6% vehicles (mostly diesel) detected were not meeting LEZ requirements
  - 77% Euro 4 equipped with diesel particulate filters
- Milan could benefit from:
  - Further restrictions of successive standards (e.g., diesel Euro 6) or other fuels (e.g., LPG/CNG)
  - Expanding hours and days of low-emission zone

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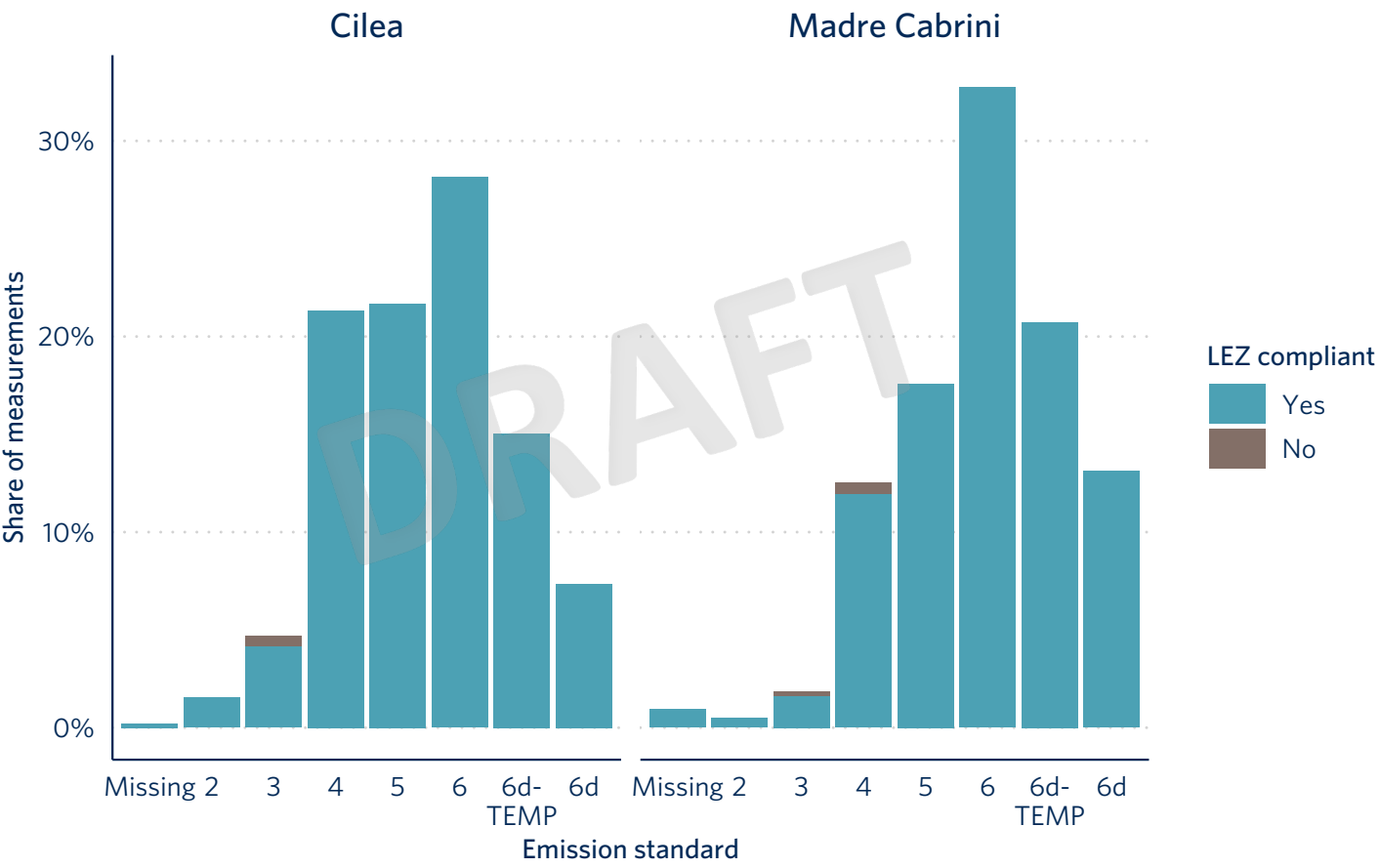

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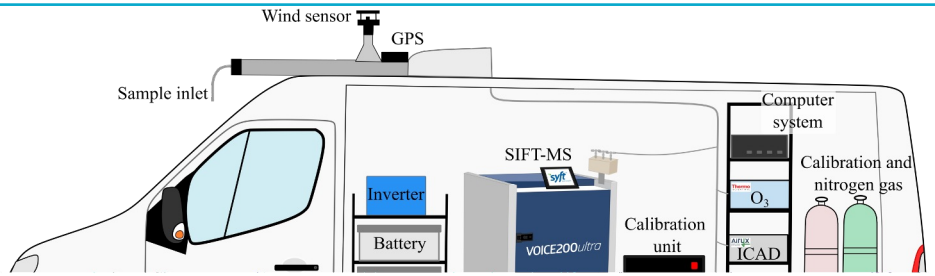
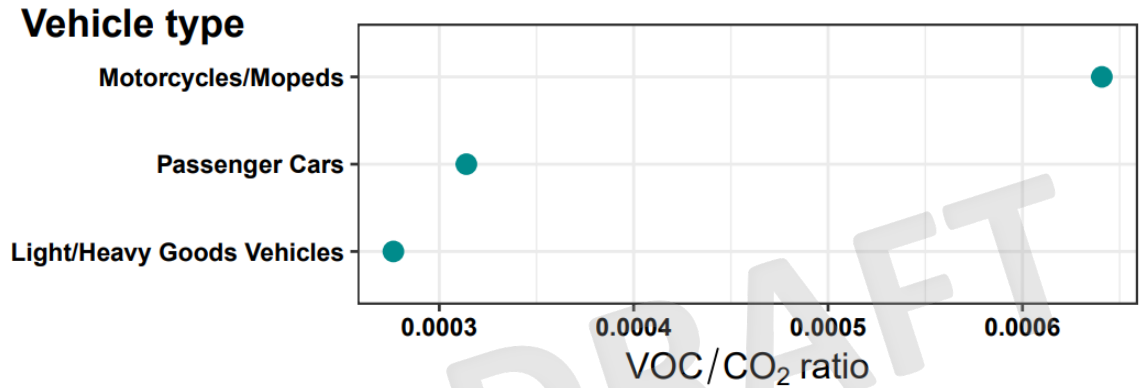
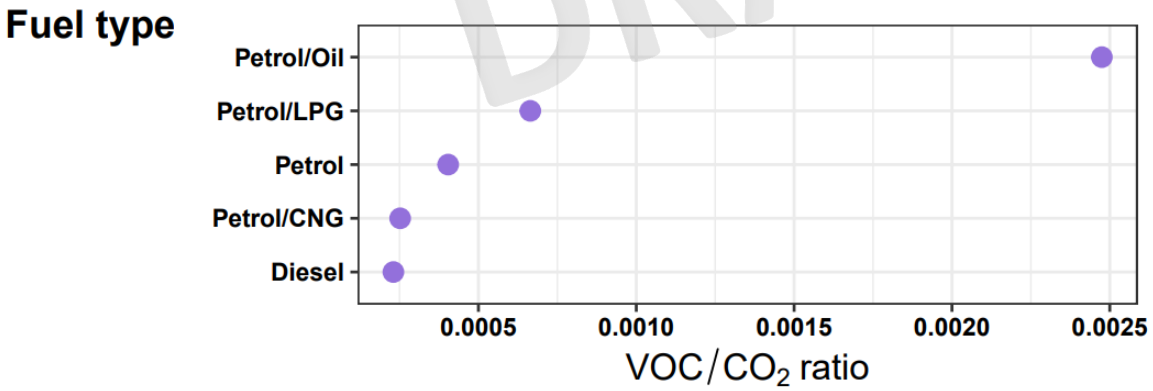
Volatile Organic Compound (VOC) point sampling & mobile measurements

- Mobile laboratory equipped with a Selected-Ion Flow-Tube Mass Spectrometer (SIFT-MS) for sampling of speciated VOCs and other trace gases
- Motorcycles/mopeds and petrol/oil (2 stroke engines) fuel types as important VOC sources in Milan
  - Highest average VOC/CO2 ratios
  - Motorcycles/mopeds not currently regulated by many LEZs
  - LPG and CNG increasingly popular as we try to reduce our carbon emissions
- Mobile measurements to be followed







Summary and conclusions

- Various remote sensing techniques that complement each other were used to collect real-world emissions measurements of the Milan fleet.
- Milan is characterized by relatively high activity of vehicles with alternative fuels (LPG and CNG) and motorcycles and mopeds.
- Diesel vehicles manufactured between 2006 and 2014 (Euro 4-5) contribute a large share of NO_X emissions. The next step of the LEZ would address emissions from these vehicles.
- Vehicles run on LPG and CNG show high real-world emissions of NO_X, CO, HC, and black carbon contrary to conventional beliefs.
- Real-world emissions data can be used to better inform policies to reduce emissions in the city.

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Thank you for your attention!

For further information:

- **Check the website:** https://cares-project.eu
- **Download the project brochure (Also available in Italian)**
- **E-mail contact:** ake.sjodin@ivl.se
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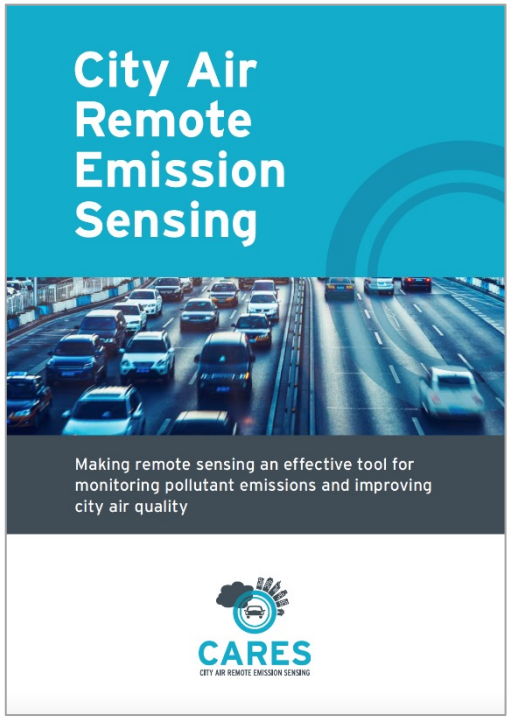

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