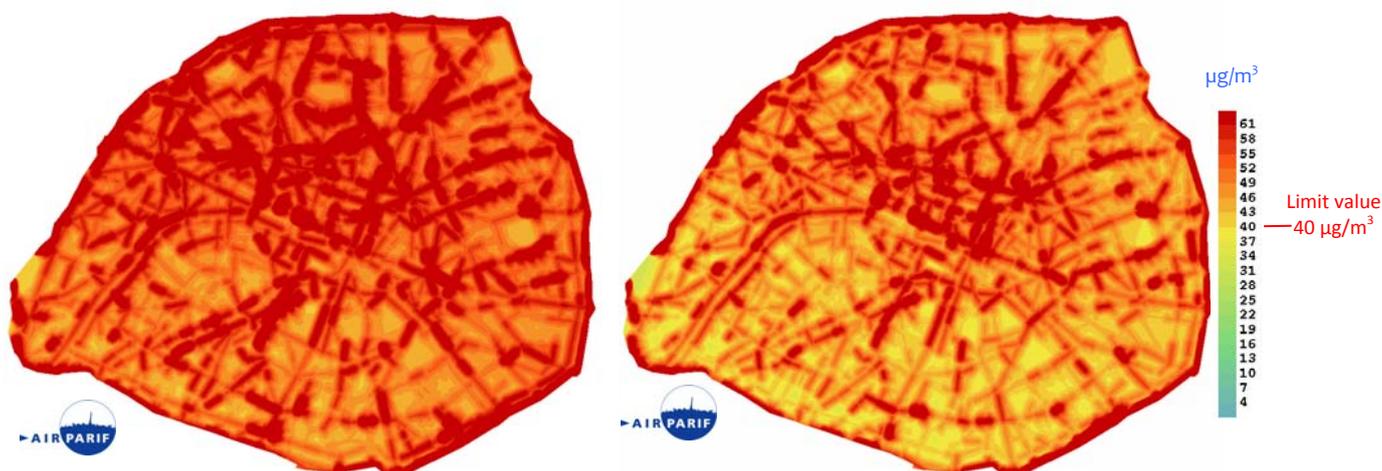


Air quality trend in Paris between 2002 and 2012

As part of its mobility policy, the City of Paris asked Airparif to assess the evolution of the air quality in the capital between 2002 and 2012. This study confirms a general downward trend over 10 years, as throughout the Ile-de-France, however, slowed down by the dieselisation fleet.

The general air quality improves in Paris over 10 years, even if pollution levels remain above the regulations, especially along the traffic. In 2012 for particulate matter and nitrogen dioxide¹, 22% to 97% of Parisians are always exposed to air quality that does not meet the annual standards². Both pollutants are problematic in the Ile-de-France region for 2 to 4 million people each year³.

For nitrogen dioxide, the improvement is not very significant on the average levels (only 3% of Parisians are no longer subject to annual standards exceedances). However it is considerable on the higher levels, which indicates a decrease in the intensity of pollution. Thus, half of Parisians are subject to levels above 50 µg/m³: 80% of the population were affected in 2002, 45% in 2012.



Levels of nitrogen dioxide in 2002

and in 2012

Annual mean levels of nitrogen dioxide in Paris in 2002 and 2012

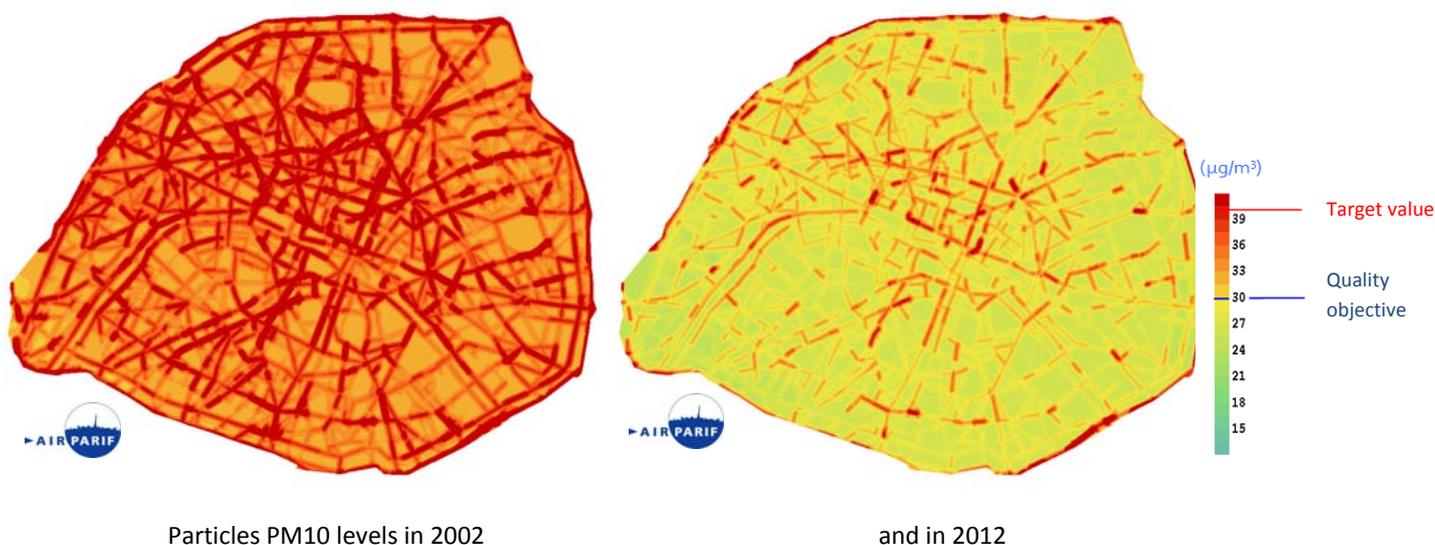
For particles PM₁₀, 78% of Parisians are no longer exposed to quality objective exceedances, whereas they were in 2002. However, to nuance this result, it is important to note that the French quality objective is one and half time above the WHO recommendation. In addition, an assessment in relation to the more stringent daily standard would likely show a less steep decrease since 1.1 million Parisians were subject to such an exceedance of this standard in 2012. But it was not possible in this study to reconstruct the pollution levels on the Parisian axes, day by day, since 2002.

¹ The nitrogen dioxide is mainly emitted by road traffic (66% in Paris) is an irritating gas bronchi. The particulates are also partly emitted by traffic (almost 60% in Paris). They are classified according to their size: PM₁₀ (less than 10 microns) are the size of a cell, PM_{2.5} (less than 2.5 microns) are smaller than bacteria. They can penetrate deeply into the respiratory system and are classified as carcinogenic to humans by the WHO.

² For nitrogen dioxide, 97% of Parisians - so 2.1 million people - are exposed to levels above the annual limit value (40µg/m³), that is to say, the threshold must be respected to avoid, prevent or reduce harmful effects of pollution on health and the environment. For PM₁₀, 22% of Parisians - or 470,000 people - are exposed to levels higher than the annual target value (30 µg/m³) considered as an air quality acceptable or satisfactory.

³ Air quality in Paris region 2012, Airparif, March 2013 – Summary www.airparif.asso.fr/_pdf/publications/bilan-2012-anglais.pdf

Annual mean levels of Particulate matter PM10 in Paris in 2002 and 2012



For these two pollutants, **the decrease was firstly due to the general improvement of air quality in the Ile-de-France** through actions both at national and European level and on all pollution sources: on traffic but also on heating and industry.

This can also be explained by the traffic road implementation done in Paris that led to the overall decline in traffic (-15 to -20%). Nevertheless this has implicated deferrals, mainly on secondary roads, and a general speed reduction of about 2 km/h in Paris (19 km/h to 17 km/h). For Parisians, these measures have managed to expose less people to levels beyond the annual regulations: 24,000 less people for nitrogen dioxide and 170 000 for PM10 (a gain of Parisian of 1 % for nitrogen dioxide and 8% for particles).

The effect of the **modernization of the fleet** with Euro standards is more subtle: it is very positive for PM10 since it has 26% of Parisians no longer exposed beyond the quality objective. However, for nitrogen dioxide, there was a slight deterioration for 1% of Parisians. Euro standards have indeed essentially brought down the nitrogen oxides and particulate matter (see table on trends in emissions below), but not nitrogen dioxide, which is not included in these emission standards and whose share is higher for diesel vehicles.

Dieselisation has indeed offset the improving trends, and explains why the pollution did not decrease further. Especially for nitrogen dioxide: diesel cars emit relatively more than Euro equivalent standard gasoline vehicle. But the diesel fleet of private vehicles has increased from 41% of kilometers traveled in Paris in 2002 to 63% in 2012. And if the number of cars decreased by 10% in ten years, the number of delivery vehicles has increased over the same period, and are mostly diesel. Dieselisation also explains the stability of nitrogen dioxide levels, or the degradation of the air quality with regards to particles, due to changes in the fleet composition.

The impact of various measures on air quality (concentrations) between 2002 and 2012 is summarized in the table below *.

CONCENTRATIONS: Between 2002 et 2012	nitrogen dioxide NO ₂	Particles PM10
Evolution of the number of Parisian exposed to pollution levels beyond annual standards	Beyond the limit value (40 µg/m ³)	Beyond the quality objective (30 µg/m ³)
↻ impact of background pollution (general downward trend in the Ile-de-France)	- 74 000 inhabitants A gain for 3% of the Parisians	-1 703 000 inhabitants A gain for more than 78% of the Parisians
↻ Impact of traffic road implementation : traffic and speed reduction	- 24 000 inhabitants A gain for 1% des Parisians	- 170 000 inhabitants. A gain for 8% of the Parisians
↻ Impact of the modernization of the fleet (evolution of Euro Standards)	+ 22 000 inhabitants. A degradation for 1% des Parisians	-561 000 inhabitants. A gain for 26% of the Parisians
↻ Impact of changes in the composition of the fleet (cars, two wheels, delivery vehicles, Trucks ...)	+ 2 000 inhabitants. A degradation for 0.1% of the Parisians	+ 42 000 inhabitants. A degradation for 2% of the Parisians
↻ Impact of Dieselisation of the fleet	+ 57 000 inhabitants. A degradation for 2.6% of the Parisians	+ 97 000 inhabitants. A degradation for 4.5% of the Parisians

*Note: the different rows of the table are not cumulative

With all these actions, the decrease of pollutant emitted was by thirty percent for nitrogen oxides and for particulate matter in ten years in Paris. But it would have been greater without dieselisation fleet as shown in the table below showing the impact of various factors studied on emissions.

The effect on carbon dioxide emissions (CO₂ greenhouse gas) was less marked than for air pollutants (-13%). It is mainly due to road improvements (10%) and the modernization of vehicles (-5%). As for the effect of the shift to diesel, it is relatively low (-2%), which is surprising. The lower consumption of this engine yet generates lower CO₂ emissions than those of a gasoline vehicle. This is also the reason why a bonus favoured diesel rather than gasoline. But the increasing weight of vehicles with air conditioning had likely offset this positive effect.

EMISSIONS Between 2002 and 2012	Air pollutants		GHG
	Nitrogen oxide NOx	Particles PM10	Carbon dioxide CO ₂
Traffic and speed reduction = traffic road implementation	-11%	-9%	-10%
Modernisation of the fleet: Evolution of Euro standards	-24%	-45%	-5%
Dieselisation of the fleet	+11%	+13%	-2%
Evolution of the fleet composition	+3%	+6%	+4%
TOTAL Evolution of the emissions	-30%	-35%	-13%

With regards to the Airparif 2012 air quality assessment, the air quality improvement was probably more significant between 2002 and 2007 than between 2007 and 2012 when the trends levels were rather stable, especially along the traffic. This has however not been quantified in this study but it is mainly due to the slowdown caused by new technologies, such as the catalytic converters and the dieselisation contribution.