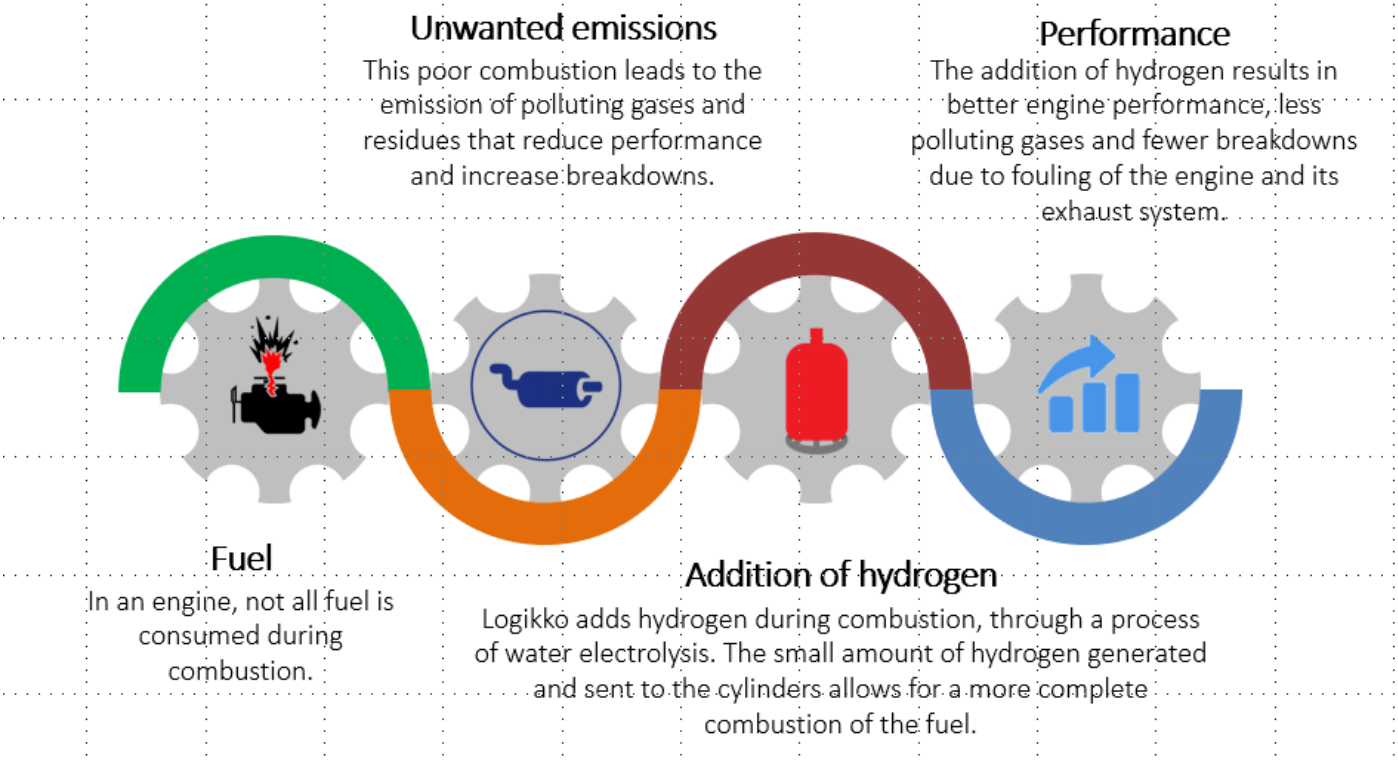
Concerning the Logikko system tests

The Logikko system is the only on-board system, miniaturized, easy to install, which allows to lower the consumption and pollution of any thermal vehicle. First of all, the Logikko system has a curative effect on engine fouling. Then, it will have a preventive effect, keeping pollution and consumption at a level equal to or lower than the theoretical values.

Logikko markets the first product in a range for cars, vans and trucks. Logikko's technology is unique in that it is based on a physical principle that has been demonstrated (the addition of hydrogen in small quantities improves combustion) by renowned laboratories (Jet Propulsion Laboratory).



Based on this principle and 25 man-years of R&D, Logikko has resulted in the unique innovation of an on-board electrolysis system that is miniaturized (e.g., even on a motorcycle), with low water consumption (one liter of water every 10,000 km), does not consume energy (consumption less than 9 Amperes), is easy to install and can be easily industrialized.

Also, as part of a rigorous strategy, Logikko has relied on experiments and tests in real life situations to see the actual performance of its systems in "real life". These tests made it possible to verify the positive role of hydrogen and to demonstrate that the Logikko system was a solution adapted to the rolling stock.

The way to the electric vehicle is open, but while waiting for it to become widespread, Logikko is positioning itself as a precursor of the on-board fuel cell (by inverse electrochemical effect), insofar as it also uses hydrogen as a fuel...

Test strategy and choice of vehicles tested

Logikko has chosen different vehicles (mileage, year/euro, fuel, type of journey) to highlight the technical-economic benefits of its system considering the link between consumption, pollution, fouling and maintenance linked to the related breakdowns (see below).

For the record :

- The average vehicle in the French car fleet has 106,000 km on the odometer.
- The average age of the French fleet is 8.9 years (Source: CCFA), with 7.6 years for diesels and 10.3 years for diesel (Source: Sofres).
- Current drivers keep their vehicles for an average of 5.3 years (compared to 3.7 in 1990 and 4.4 in 2000). On average, a vehicle that lasts 8.9 years and travels 13270 km/year, i.e. 106 000 km for a "diesel" and 166 000 km for a "petrol".

From 150,000 km, on the vast majority of older vehicles, it is necessary to start changing certain equipment on the exhaust line, often the intake (sometimes for the second time). In addition, the engine begins to be vulnerable (cylinder head gasket, piston liners, timing, etc.). On newer vehicles, it is sometimes the anti-pollution and intake equipment that are more vulnerable because they are subjected to greater stress.

So our testing strategy is threefold:

1° Demonstrate the safety of the system

Both for the tests and for the marketed products, we had to be insured.

GAN agreed to assure us from the moment the company was convinced that the Logikko System was safe for the vehicles simply because we did not need to modify the engine specifications (no changes to engine or fuel characteristics).

To confirm our first results, we have chosen real-life tests for which we have chosen vehicles of all ages, but with a lot of mileage, which are obviously more vulnerable.

These "tired" engines that could have "failed" allowed us to validate that the Logikko system did not have a negative impact on the engine.

2° Validate reductions in consumption and pollution, whatever the age of the engine.

In terms of soiling, a vehicle that has been driven 200,000 to 300,000 km has had to replace some equipment that has also had time to become re-clogged. In terms of soiling, such a vehicle is equivalent to a vehicle that has travelled 100,000 km. This makes it possible to study the influence of engine age on pollution and consumption levels.

In fact, we find in our tests the same variations in pollution and consumption regardless of these fouling cycles because what determines our results are the criteria of :

- Type of trip,
- Type of driving,
- Engine technology,
- Level of fouling when the system is activated.

3° Demonstrate that the Logikko system brings longevity to the engine and repels breakdowns.

Moreover, by using older engines we also demonstrated that the Logikko system preserves the engine block which -on none of the tested vehicles- had been changed before our tests.

We have not damaged any of these engine blocks, while achieving the reductions indicated in our pollution and consumption tests. In addition, we have not observed any failure on any of the aforementioned components.

Demonstrating the reliability of the system and its safety explains why some tests lasted so long and covered so many kilometers because the demonstration also had to be done over time in order to show that the Logikko system promotes engine longevity.

The tests carried out by Logikko

As part of its development, Logikko has experimented with hydrogen injection on nearly 200 vehicles in total. Among this group, 50 vehicles provided more precise information by travelling 500,000 km. Finally, around 15 vehicles were subjected to much more detailed tests, some of which lasted more than a year.

These tests were carried out on different types of engines and vehicles. They show that the Logikko system lowers consumption (up to 25%, on older vehicles) which reduces CO_2 by the same amount (global pollution). The Logikko system also has an impact on toxic discharges (local pollution), reducing them by up to 70%.

The best results were obtained on vehicles that had been driven mostly in the city and with more than 50,000 km on the odometer. Pollution reductions are related to the clogging of anti-pollution systems and vary according to use, model and year. Finally, a test was carried out in August 2017 by UTAC, in accordance with current standards on a new Dacia.

Brand	Model	Year of Production	Mileage before test	Test duration in Km	Age engine when tested	Energy	Norm	Cylinder Volume	Consumption		Gain in %	
									Before Test	After Logikko installation	Consumption	Pollution
Dacia	Sandero	2016	15 000	1 300	0	Gazoline	Euro 6	1,8 l	6,3	6,3	0%	33%
Smart	For Two Cdi	2003	80 000	2 000	5	Diesel	Euro 3	0,8 l	4,2	3,4	19%	71%
Yamaha	Onboard F150	2010	700 h	2h15	5	Gazoline	Euro 5	2,7 l	9,2	7,2	22%	Not mesured
Volkswagen	Passat Tdi 105	2006	171 000	7 000	8	Diesel	Euro 4	1,9 l	5,6	4,9	12%	38%
Renault	Espace DCI 150	2006	185 000	8 500	8	Diesel	Euro 4	2,2 l	7,5	7,1	5%	68%
Ford	Mondeo Tdci	2003	271 000	18 000	9	Diesel	Euro 3	2 l	7	6	14%	14%
Mercedes	Vito dCi	1999	284 000	100 000	13	Diesel	Euro 2	2,2 l	10,5	7,9	25%	58%
Renault	19 Turbo	1995	178 000	1 500	16	Diesel	Euro 1	1,9 l	7,2	5,5	24%	41%
Renault	Twingo	1998	150 000	30 000	17	Gazoline	Euro 2	1,2 l	8	6	25%	40%
Renault	Twingo	1996	215 000	4 300	18	Gazoline	Euro 2	1,2 l	6,4	5,6	13%	30%
Renault	4L	1983	100 000	2 000	30	Gazoline	-	1 l	6,5	5,5	15%	40%

Of the total documented tests, 250,000 km have been run, including 180,000 km on the tests of this extract.
It is estimated that the mileage of the other 35 equipped vehicles represents at least an additional 250,000 km.

During these tests, it appeared that the performance of engines equipped with a Logikko system varies according to several criteria:

- The level of fouling in the vehicle: the higher the level of fouling, the more the system reduces consumption and pollution,
- The level of sophistication of the engine technology linked to the Euro standard: the older the engine, the better the system improves combustion. On newer engines, it particularly preserves the emission control systems.
- The driver's driving style: the system acts all the more as the driving is classic (not sporty)
- The type of trip: Logikko gives better results on city type trips with stop & go.

The UTAC test

A test was carried out by UTAC on a new Euro 6 vehicle, using the NEDC test cycle, which has since been discontinued. It should be recalled that this NEDC cycle did not reproduce real traffic conditions.

Measurements have shown that even on a new vehicle, the Logikko system significantly reduces local pollution. On the other hand, since the engine is not dirty, the system does not reduce fuel consumption.

This test, carried out by the official body retained by the French government, shows that even in the case of an almost new engine, the NOx level drops from 91 to 60.75 mg/km, i.e. a drop of 33.2%, whereas the Euro 6b Standard is 60 mg/k. In addition, the rate of CO goes from 713 to 468 mg/km, a decrease of 34.4% compared to the Euro 6b Standard of 1000 mg/km.

CERAM
UTAC CERAM

Rapport d'essais / *Test report*
Reference : 17/05900

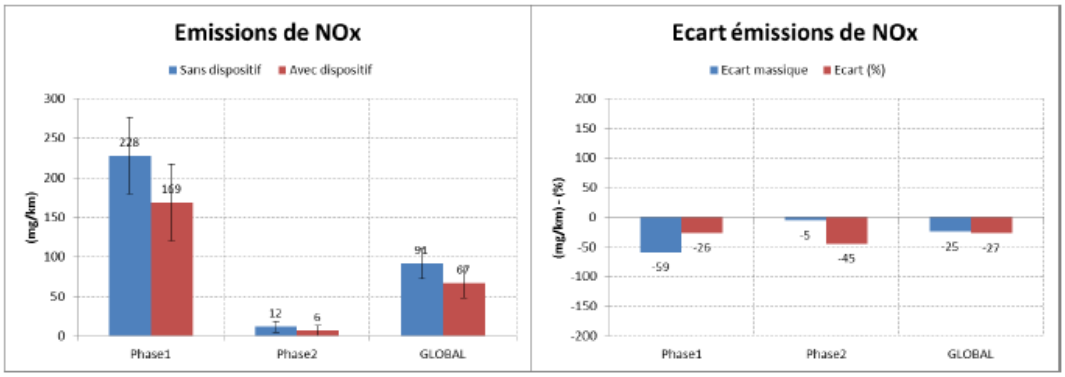


Figure 3 : Emissions de NOx

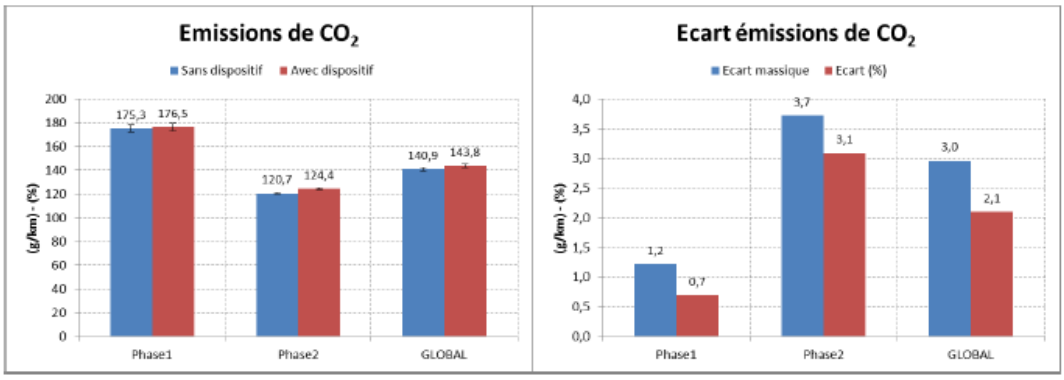


Figure 4 : Emissions de CO_2

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Validity of the Logikko system tests on vehicles

The empirical data from the tests were mathematically translated into "pollution reduction" and "consumption reduction" interpolation curves as a function of engine year (see graph below).

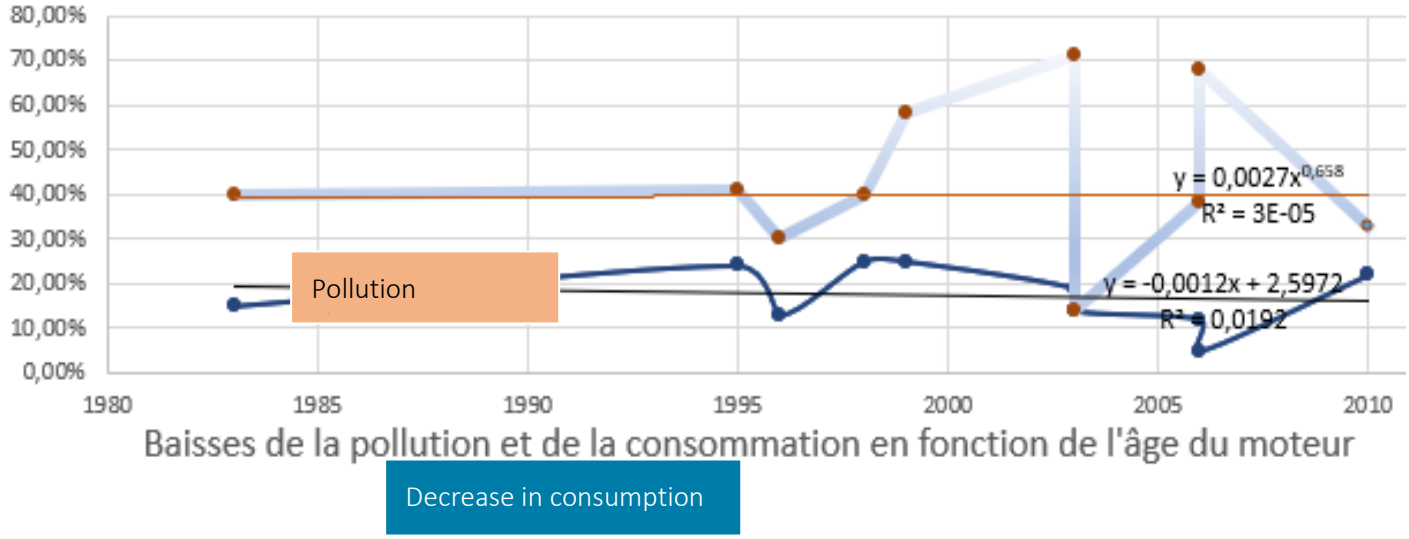
The results show that the Logikko system has an almost constant reducing effect on local pollution (toxic emissions such as NOx, CO, unburned) and that the reduction in consumption will depend on how dirty the vehicle and engine technology are.

1° The "pollution reduction" interpolation curve shows that the pollution reduction is stable, whatever the year of the vehicle. It should be noted that :

- Above the average (40% decrease), the vehicles are mainly used for short journeys and therefore get dirtier.
- And below the average (40%), vehicles drive more on motorways and therefore clog up less.

2° The interpolation curve "reduction in consumption" and therefore in $_{CO2}$, shows that the older the vehicle, the more the reduction will be characterized, going from 15 to 20%. It should be noted that :

- The decrease also depends on the engine technology,
- The savings between 10% and 15% correspond to maintained vehicles, therefore with less clogging.
- Savings above 20% correspond to heavily soiled vehicles.



CONCLUSIONS

It is thus confirmed that the Logikko system has an almost constant effect on local pollution on any used vehicle on which the Logikko system is professionally installed.

Fuel consumption will decrease depending on how dirty the vehicle and engine technology are.