

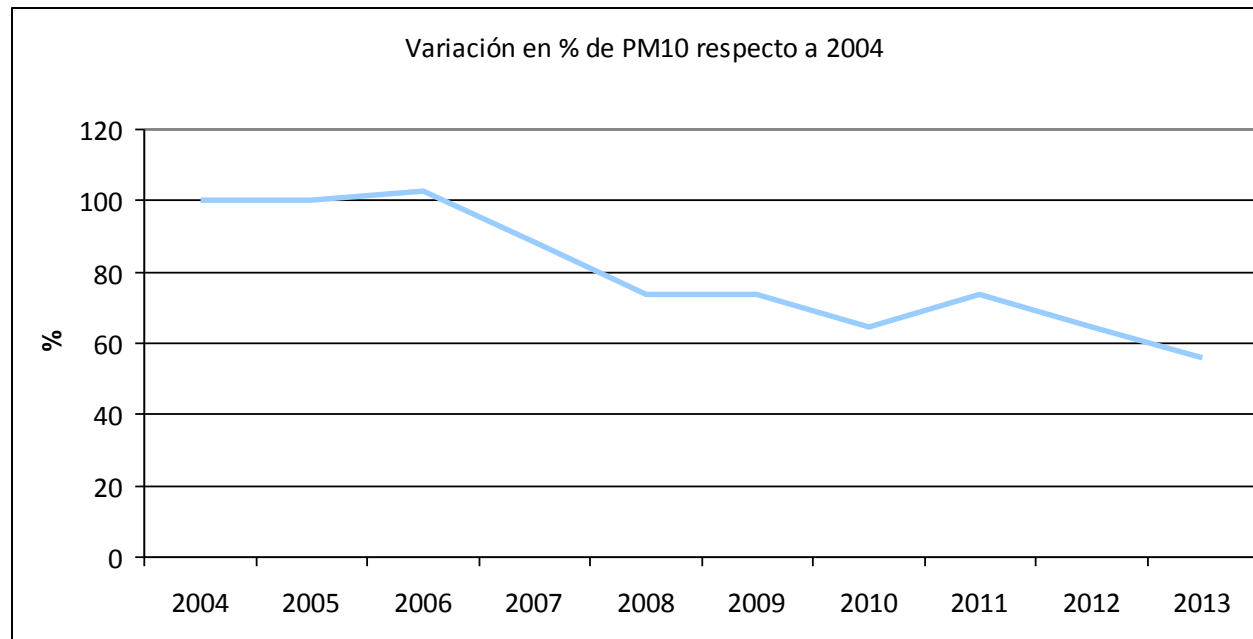
Abatement of NO₂ and PM pollution in the city of Madrid



Air quality in the city of Madrid **has significantly improved at every pollutant level** during the last decade. This shows an improving tendency along the years. The only exception would be **ozone**, which exceeded pollutant levels in 2013.

PM10 Particles

Last decade's annual evolution

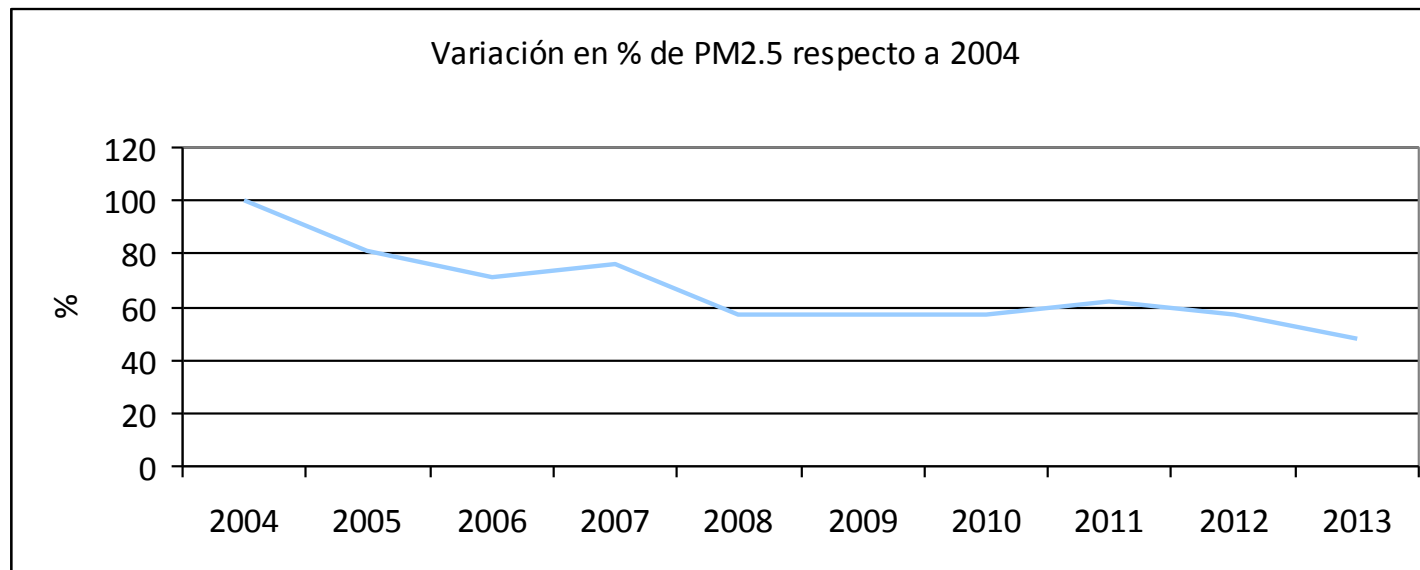


Over a **40%** reduction of average concentration

PM2.5 Particles

Last decade's annual evolution

Annual average figures during 2013 per measuring station



50% reduction of average concentration

Nitrogen Dioxide

The number of measuring stations that had exceeded the annual limit and the hourly limit value **has been reduced** as opposed to previous years.

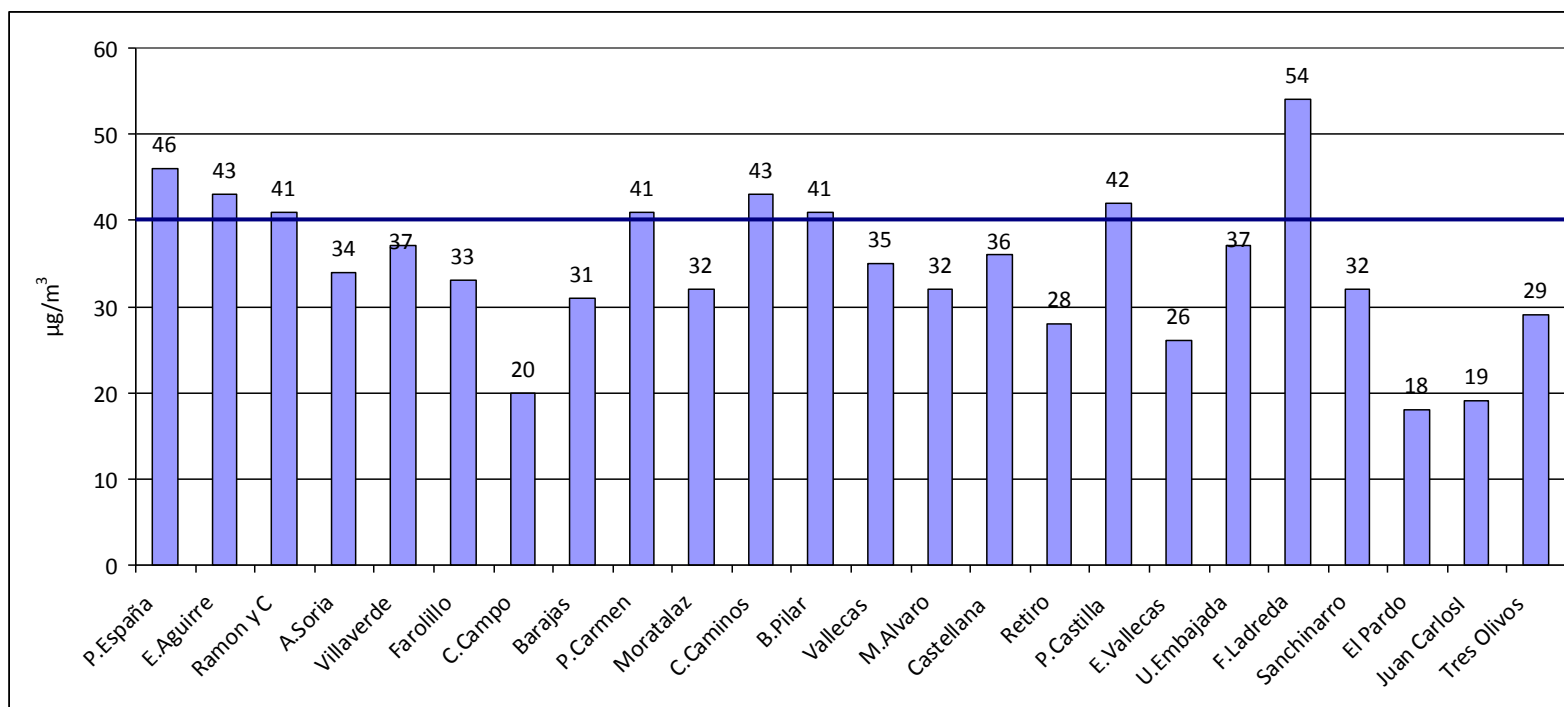
Concentration levels have decreased in all of the network's measuring stations.

Nitrogen dioxide (NO₂)

Year	2010	2011	2012	2013
Nº of stations exceeding the annual average value	16	15	9	5

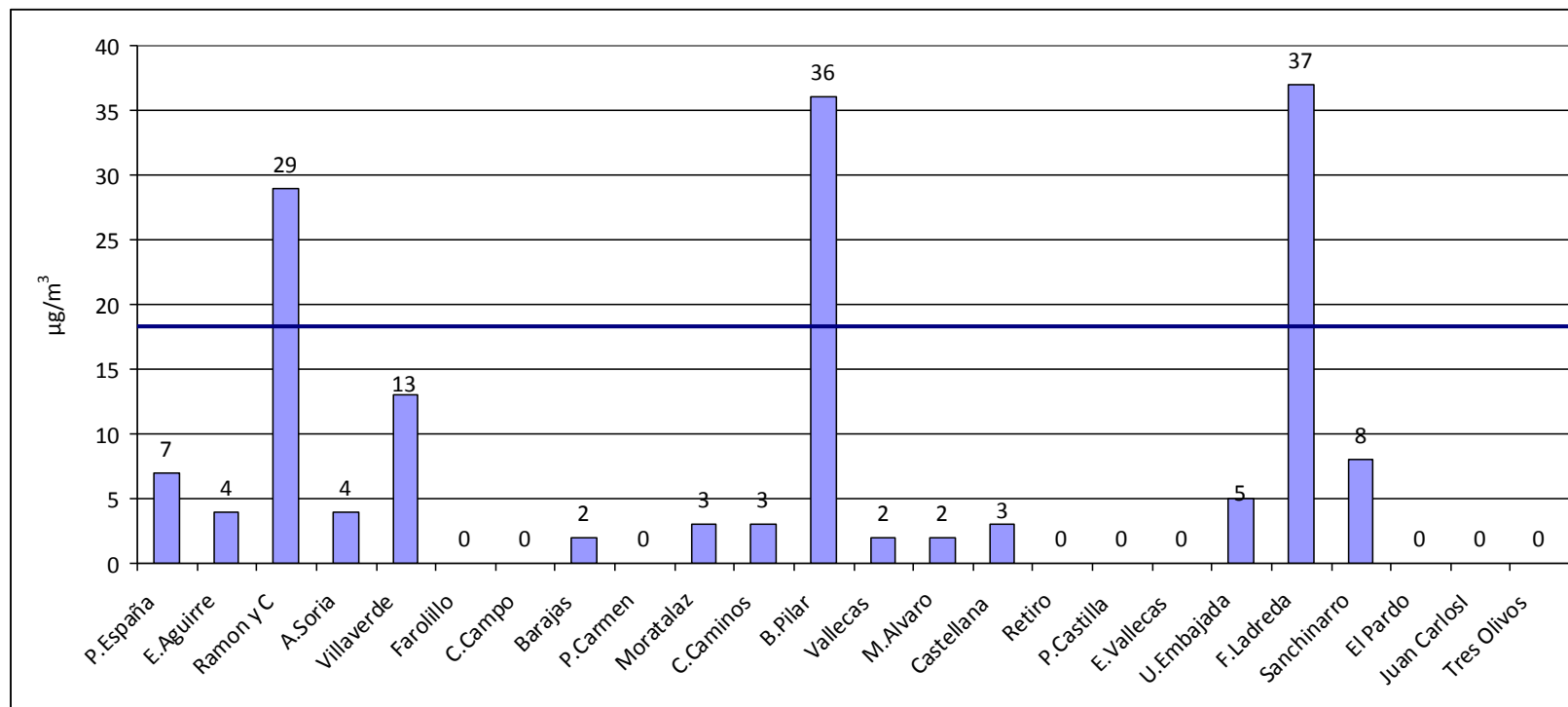
Year	2010	2011	2012	2013
Nº of stations exceeding the hourly value	6	8	3	2

Nitrogen dioxide (NO₂)



Exceedings of the 2013 yearly average value

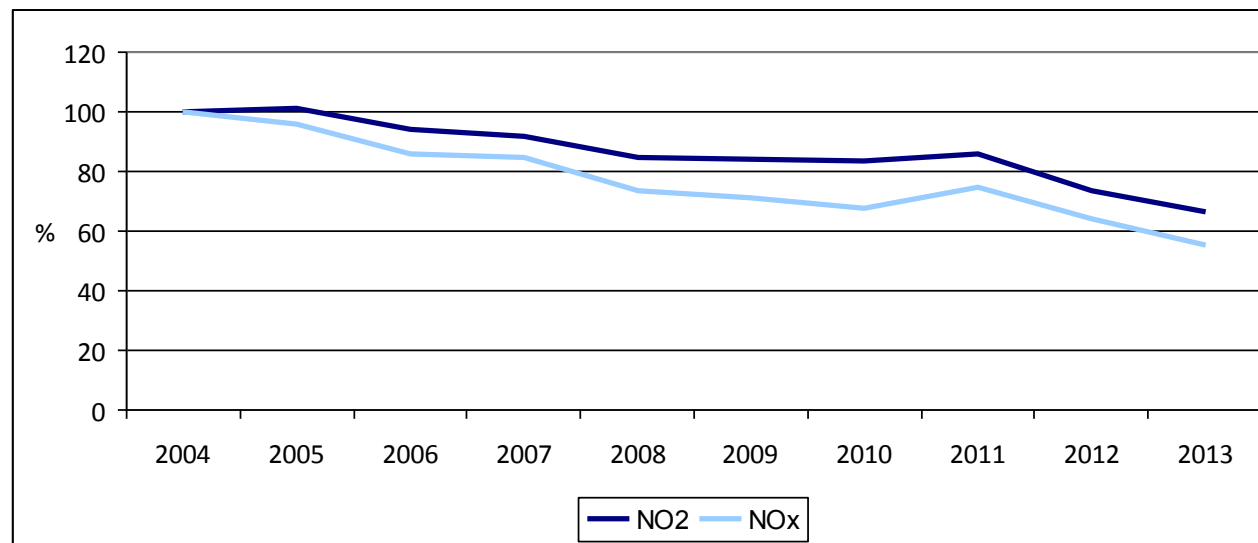
Nitrogen dioxide (NO₂)



Exceedings of the 2013 yearly average value

Nitrogen Dioxide (NO₂) and NOX

Last decade's annual evolution



25 % reduction of the NO₂ average concentration as opposed to **40%** NO_x reduction from 2004 to 2013.

Background

- **Ordinance against air pollution (1968)**
- **Madrid's Local Air Quality Strategy (2006-2010): special effort for reduction on stationary emission sources (domestic boilers, industries,...)**



Background

Additional complementary measures:

- **Ring motorway undergrounding (M-30)**
- **New intermodal hubs (13)**



		▼ 1990-2009	▼ 2006-2009
NOx		39,24%	20,80%
Particulate matter	PM 2,5	48,06%	24,34%
	PM 10	56,84%	23,02%
	PST	59,27%	22,40%
COVNM		40,99%	18,87%

Madrid's vehicle fleet characterization study

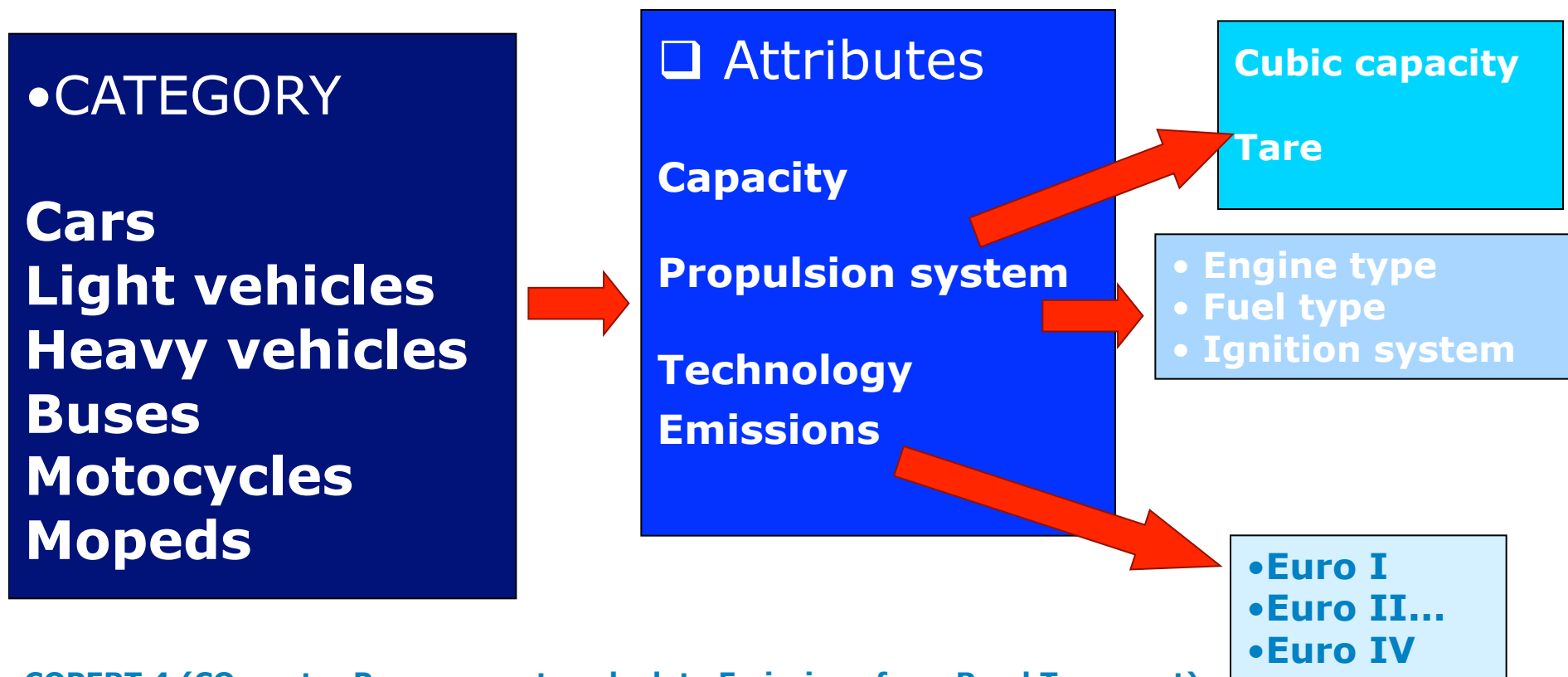
Objective: identify Madrid's vehicle fleet to obtain an accurate estimate of **traffic emissions**

Scope: within Ring motorway Calle 30

Timeframe: 2008-2009



Vehicles characterization according to **COPERT 4**



COPERT 4 (COmputer Programme to calculate Emissions from Road Transport)

- **Sampling points :**

- **30 points**
- **3 and 4 lane streets**
- **Monday-Friday sampling**



Madrid vehicle fleet characterization study: Results

There is a structural problem caused by the large dieselization of the vehicles in the city.

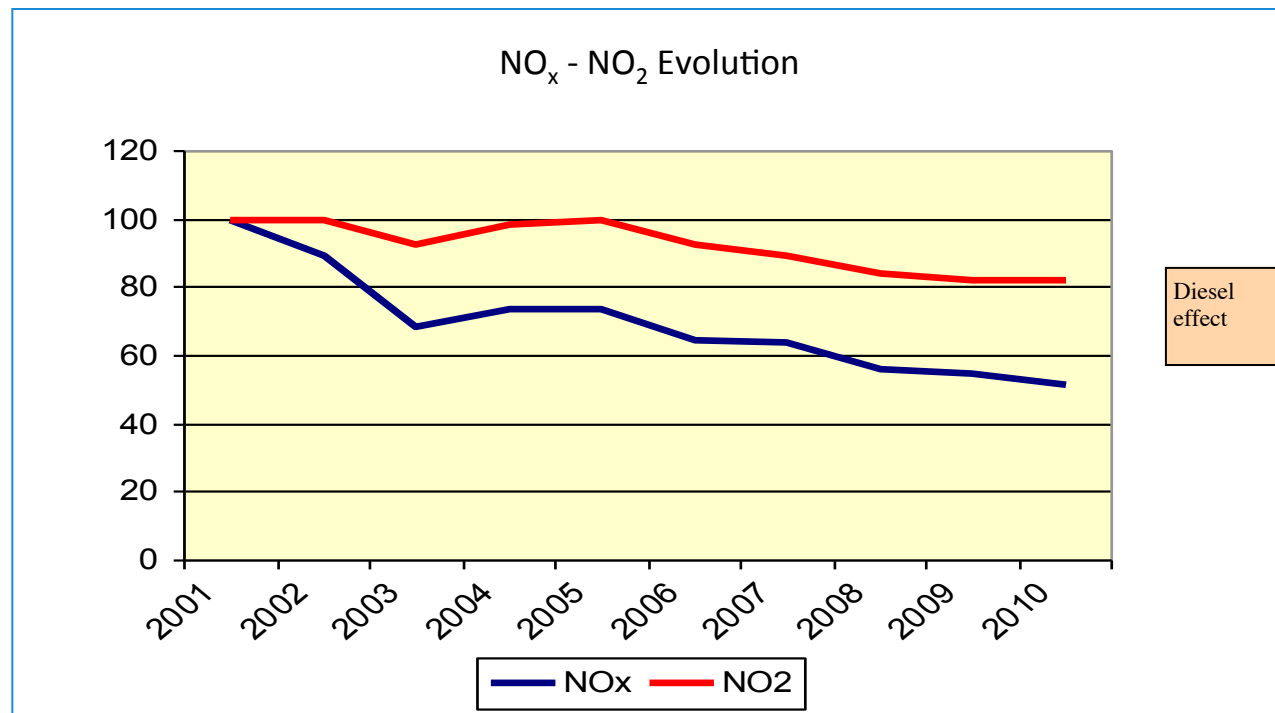
- **Diesel vehicles, even if equipped with the newest technology, still release more nitrogen oxides per kilometer** than gasoline vehicles
- Of the 56% of NO₂ emissions caused by car traffic in the City, 98% are a result of cars (excluding taxis) that use diesel fuel.
- 63% of traffic is made of privately owned diesel-cars and 96% of them where less than 10 years old. Technological improvements introduced in recent years to reduce Nox emissions from diesel-powered cars have entailed a substantial increase in the portion of primary NO₂ emitted.

This explains why, despite having substantially reduce Nox emissions from traffic, as well as NOx concentrations in the ambient air, there has not been a proportional drop in NO2 concentrations.

NOx and NO2 concentrations evolution at urban stations of traffic pollution measurement

Source: Madrid Air quality monitoring network urban stations of traffic pollution measurement

**Percentage
% respect
2011**



MADRID'S AIR QUALITY PLAN 2011 – 2015

Objectives:

To consolidate what has already been achieved in **improving the city's air quality** by driving its ongoing improvement comprehensively.

To ensure fulfilment of all established objectives under current law within the legally planned time frame, and in particular, **nitrogen dioxide** limit values

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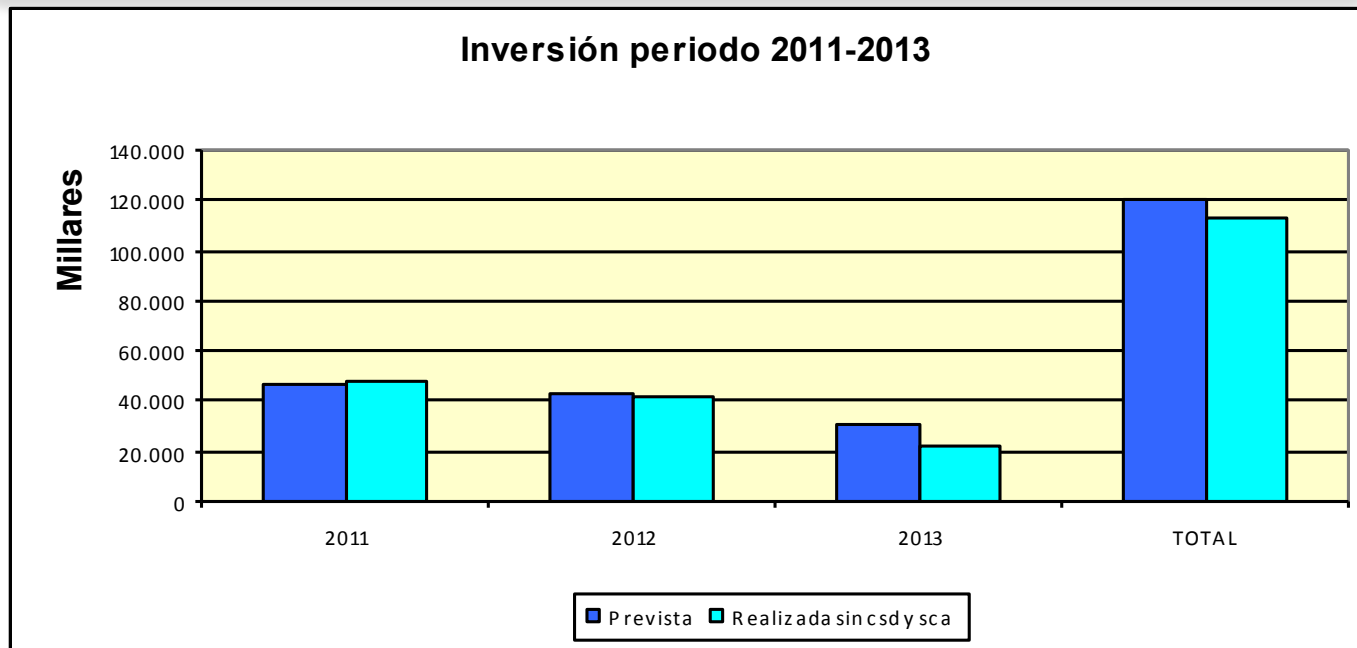
The Plan contains **70** measures in **9** sectors

Table 1 New measures 2011-2015		
SECTORS		MEASURES
1	TRANSPORT AND MOBILITY SECTOR	42
2	RESIDENTIAL, COMMERCIAL AND INSTITUTIONAL SECTOR	4
3	CONSTRUCTION AND DEMOLITION WORK	2
4	CLEANING AND WASTE MANAGEMENT	4
5	URBAN PLANNING	4
6	NATURAL HERITAGE	2
7	STRENGTHENING INTEGRATION OF CONSIDERATIONS RELATIVE TO AIR QUALITY IN MUNICIPAL POLICIES	4
8	MONITORING, FORECASTING AND INFORMATION SYSTEMS	3
9	TRAINING, INFORMATION AND AWARENESS	5
TOTAL		70

COMPLIANCE

Ongoing measures: **91,4%** (64 out of the 70 in the Plan).
In **7 out of the 9** sectors all measures are ongoing.

Investment executed: **93,6%** of the budget (**112,5 M€**)



Some of the **main achievements** in transport and mobility:

- Low Emission Zone (LEZ)
- Implementation of a separate Regulated Parking System rate within LEZ (+10% of the fee)
- Consolidation and strengthening the renewal of the municipal fleet of vehicles to cleaner technology. **704 buses** (82 M€).
- Increase of pedestrian areas in **2.875 m²** (2 M€)
- New taxi regulation: new emission limits from 2020 on (160g/km of CO₂ and Euro 6 for NO_x and PMs)
- **Electric vehicle** promotion :
 - 438 charge points

Some of the **main achievements** in transport and mobility:

- **Tax incentives** for cleaner vehicles.
- **Subsidies** for taxi renewals
- Consolidation and expansion of the supply points for alternative fuels: 15 LPG, 2 bioethanol and 5 CNG
- Promotion of **alternative means of mobility** :
 - Carpooling and carsharing
 - Promotion of the use of motorcycles (increase from 12% to 16%).
 - Promotion of the use of bicycles (22% within M30).
 - Cyclist mobility infrastructure : 283 Km.
 - New electric bicycle public service system



Some of the **main achievements** in transport and mobility:

- Agreements with private entities. Foro ProClima: **18** big companies signed a voluntary agreement to elaborate Corporate Mobility Plans
- **New Regulated Parking System:**
 - based on vehicle technology and occupancy



Actions for 2014 and 2015:

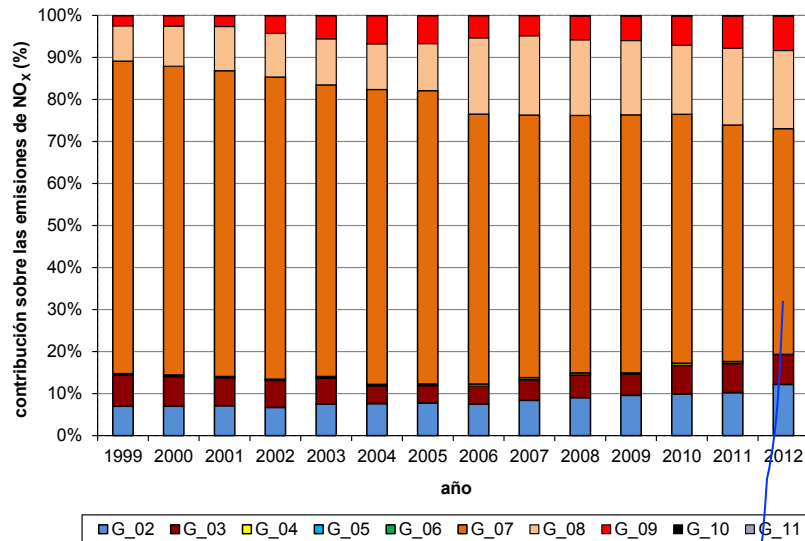
- **3 new Residential Priority Areas** in the city center (Opera in 2014, Justicia and Universidad in 2015)
- **Madrid's Sustainable Urban Mobility Plan**
- **New pedestrianisations**
- **Renewal of the Air Quality Monitoring Network in 2014 (1M €)**



New Madrid's vehicle fleet characterization study results 2013:

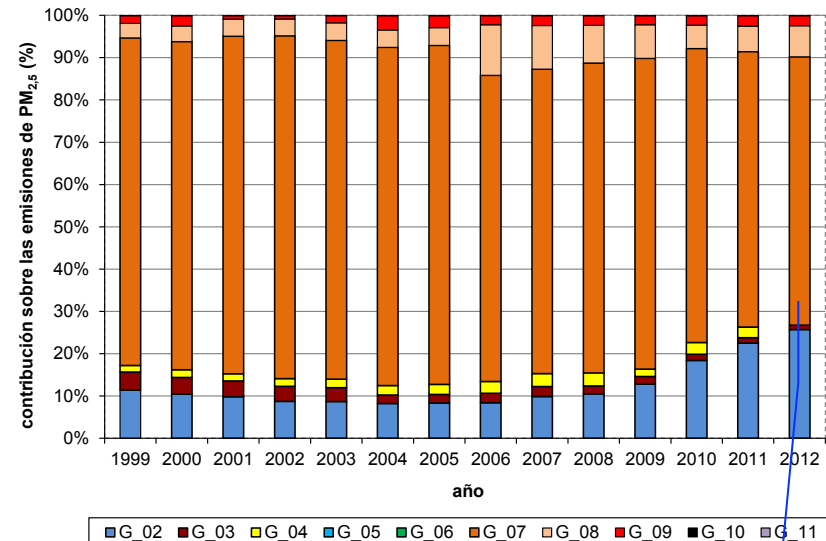
ROAD TRANSPORT CONTRIBUTION TO NO_x EMISSIONS IN MADRID

NO_x



53.7%

PM 2.5

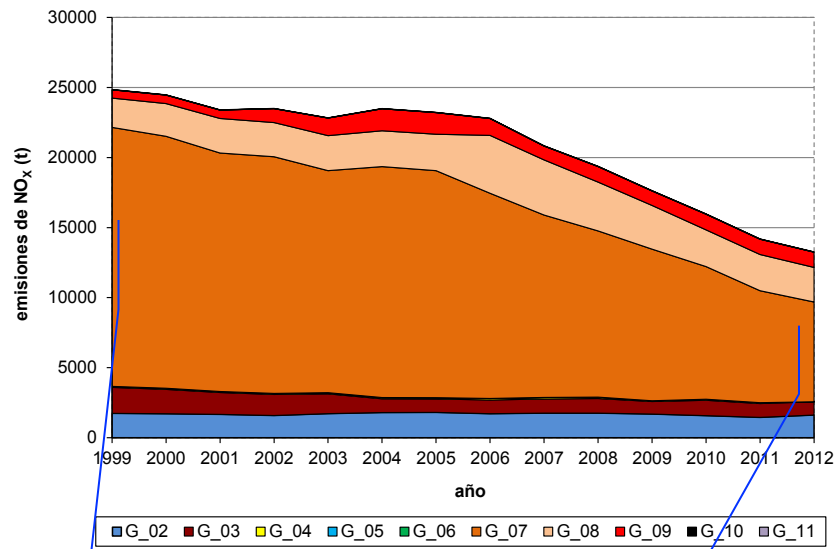


63.5%

(based on the emissions inventory Madrid 2012)

NOx AND PM 2.5 TREND IN ROAD TRANSPORT EMISSIONS (based on the emissions inventory Madrid 2012)

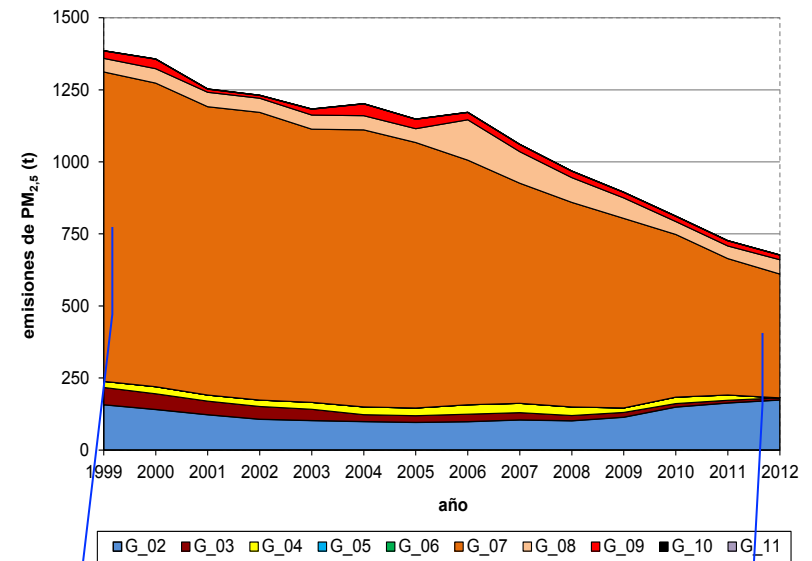
NOx
- 159 % (1999 – 2012)



18.486 t

7.122 t

PM 2.5
- 149 % (1999 – 2012)



1.074 t

430 t

CONTRIBUTION OF PUBLIC AND PRIVATE TRANSPORT TO NO_x AND NO₂ EMISSIONS

Sector	NO _x		NO ₂	
	PC-2009	PC-2013 ZONA A	PC-2009	PC-2013 ZONA A
Turismos	43,8%	60,1%	56,1%	69,8%
Gasolina	7,1%	6,6%	1,1%	0,7%
Diésel	36,6%	53,5%	55,0%	69,1%
Híbridos	0,0%	0,0%	0,0%	0,0%
Otros (GLP, GNC)	0,0%	0,0%	0,0%	0,0%
Vehículos ligeros	7,1%	6,9%	9,0%	8,6%
Vehículos pesados	6,7%	4,1%	3,5%	1,5%
Autobuses	31,6%	17,6%	16,4%	6,0%
EMT	23,5%	15,8%	12,2%	5,3%
No EMT	8,1%	1,9%	4,2%	0,7%
Ciclomotores	0,2%	0,1%	0,0%	0,0%
Motocicletas	0,9%	1,9%	0,1%	0,2%
Taxis	9,7%	9,3%	14,8%	13,8%
TOTAL	100%	100%	100%	100%

Conclusions :

- Road transport contribution to NOx emissions have decreased substantially from 2009 to 2013
- Diesel-vehicles have increased their contribution to NOx emissions and NO2 showing that the “diesel effect” is a real problem
- Investment made in public buses fleet has been very effective:

CLEAN TECHNOLOGY INTRODUCTION IN MADRID PUBLIC BUS FLEET

3 examples:

- 700 CNG Buses
- 20 Electric Buses
- 500 Electric Buses refitted with Selective Catalytic Reduction systems (SCR)

➔ Its contribution to NO_x (emitted by the road transport sector) has been **REDUCED by a 32% since 2009** (from a 23.5% in 2008 to 15.8% in 2013).

VEHICLE CLASSIFICATION – NEW ON-STREET PARKING REGULATION

The vehicles with lowest NOx emissions will benefit from a reduction in the parking fee while the most polluting vehicles are penalized with a higher fee, according to the 'polluter pays' principle

CLASS A (20% BONUS): Non-plug-in Hybrids, LPG, CNG

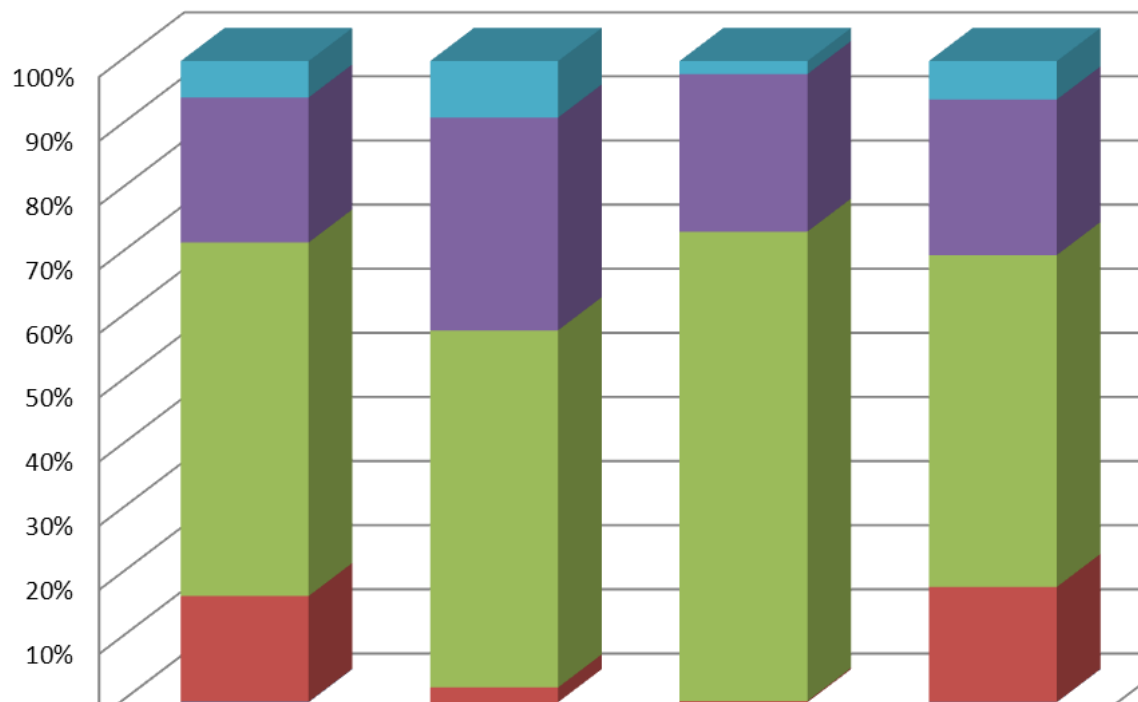
CLASS B (10% BONUS): Gas. (EURO 4 and +) Diesel (EURO 6)

CLASS C (Same rate): Gas. (EURO 3) Diesel (EURO 4, 5)

CLASS D (10 % SURCHARGE): Gas. (EURO 2) Diesel (EURO 3)

CLASS E (20 % SURCHARGE): Gas. (EURO 1 AND PRE EURO)
Diesel (EURO 1, 2)

EMISSIONS BREAKOUT BY VEHICLE CLASSIFICATION



	Recorridos	NOx	NO2	CO2
■ E	6%	9%	2%	6%
■ D	23%	33%	25%	24%
■ C	55%	56%	73%	52%
■ B	17%	2%	0%	18%
■ A	0%	0%	0%	0%

Clase	Vehículos considerados en cada clase		
	Sector	Combustible	Tecnología
A	Turismos	Híbridos no enchufables, GLPs y GNG	
B	Turismos	Gasolina	EURO 4-5-6
	Turismos	Diesel	EURO 6
	Ligeros	Gasolina	EURO 4-5-6
	Ligeros	Diesel	EURO 6
	Pesados	Diesel	EURO 6
C	Turismos	Gasolina	EURO 3
	Turismos	Diesel	EURO 4-5
	Ligeros	Diesel	EURO 5
	Pesados	Diesel	EURO 5
D	Turismos	Gasolina	EURO 2
	Turismos	Diesel	EURO 3
	Ligeros	Gasolina	EURO 3 y anteriores
	Ligeros	Diesel	EURO 3-4
	Pesados	Diesel	EURO 3-4
E	Turismos	Gasolina	EURO 1 y anteriores
	Turismos	Diesel	EURO 2 y anteriores
	Ligeros	Diesel	EURO 2 y anteriores
	Pesados	Diesel	EURO 2 y anteriores