



**Sales & Marketing**  
**Natural Gas Business Development & Product Unit**

# **CNG for cleaner cities and road transport**

Alfredo Martín, January 2005

# Fuel evolution in city / road transportation

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Due to environmental and/or economic issues, the shift from liquid oil to gaseous fuels has begun in many countries.

- Low oil reserves
  - Large gas reserves
  - Population concentration in bigger cities
  - Heavier needs of transport vs emission levels
  - Poor city ventilation,
- have made this growing shift quicker and wider**

# Advantages of CNG for city / road transportation

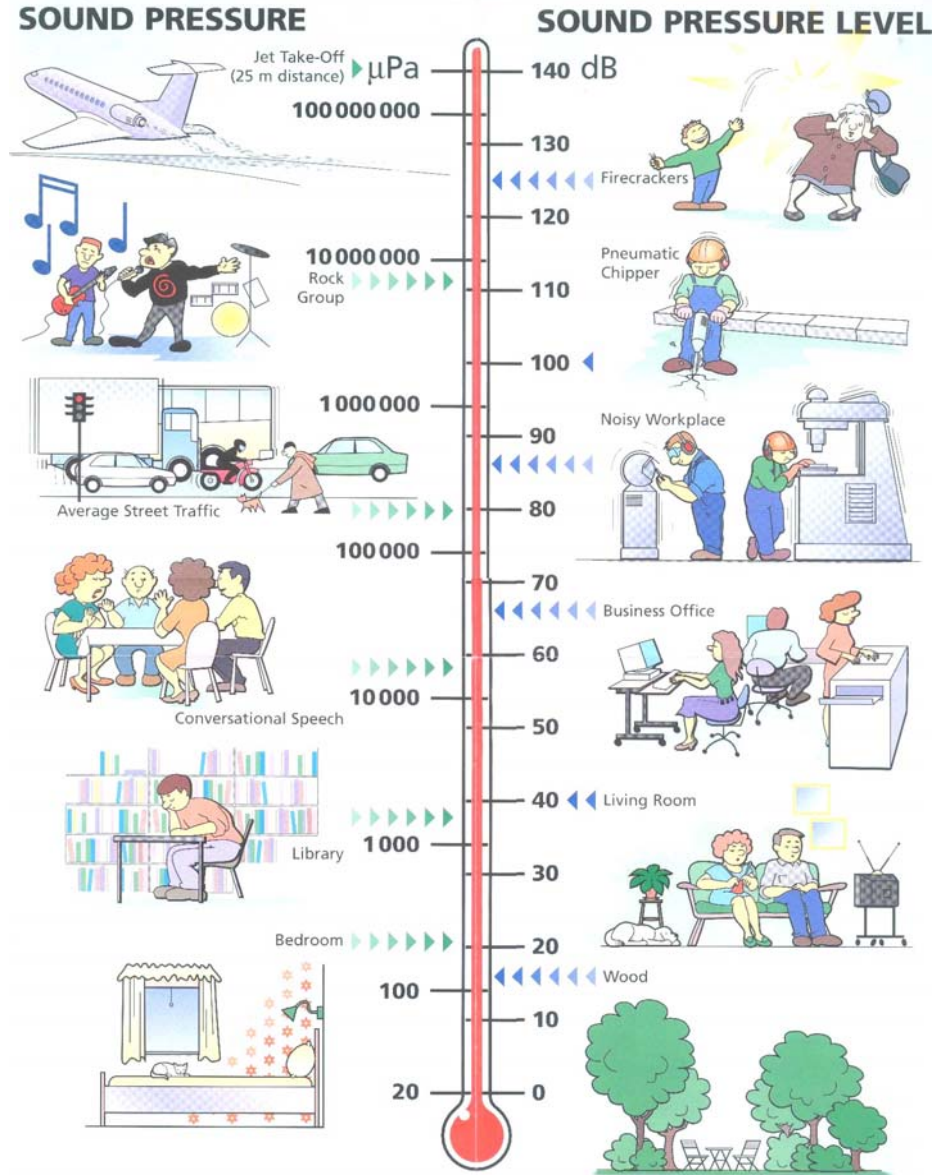
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CNG fuel used in trucks and buses offers very significant advantages:

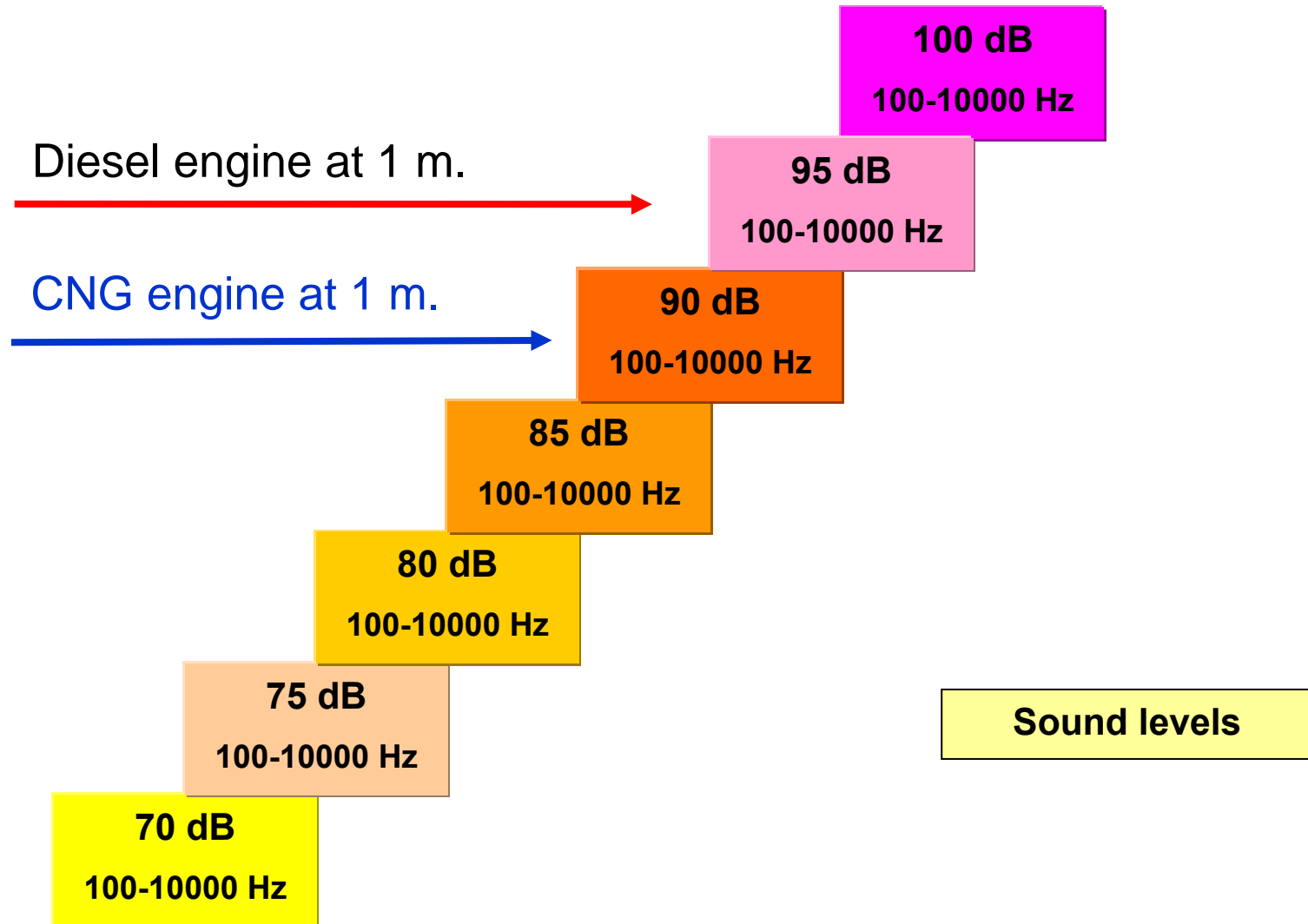
- Much lower gaseous emissions
- Much lower noise

**In the case of stoichiometric mixture combustion (Iveco choice), exhaust pollutants are well below the levels of the EEV (Enhanced Environmental Vehicle), very near the fuel cell level**

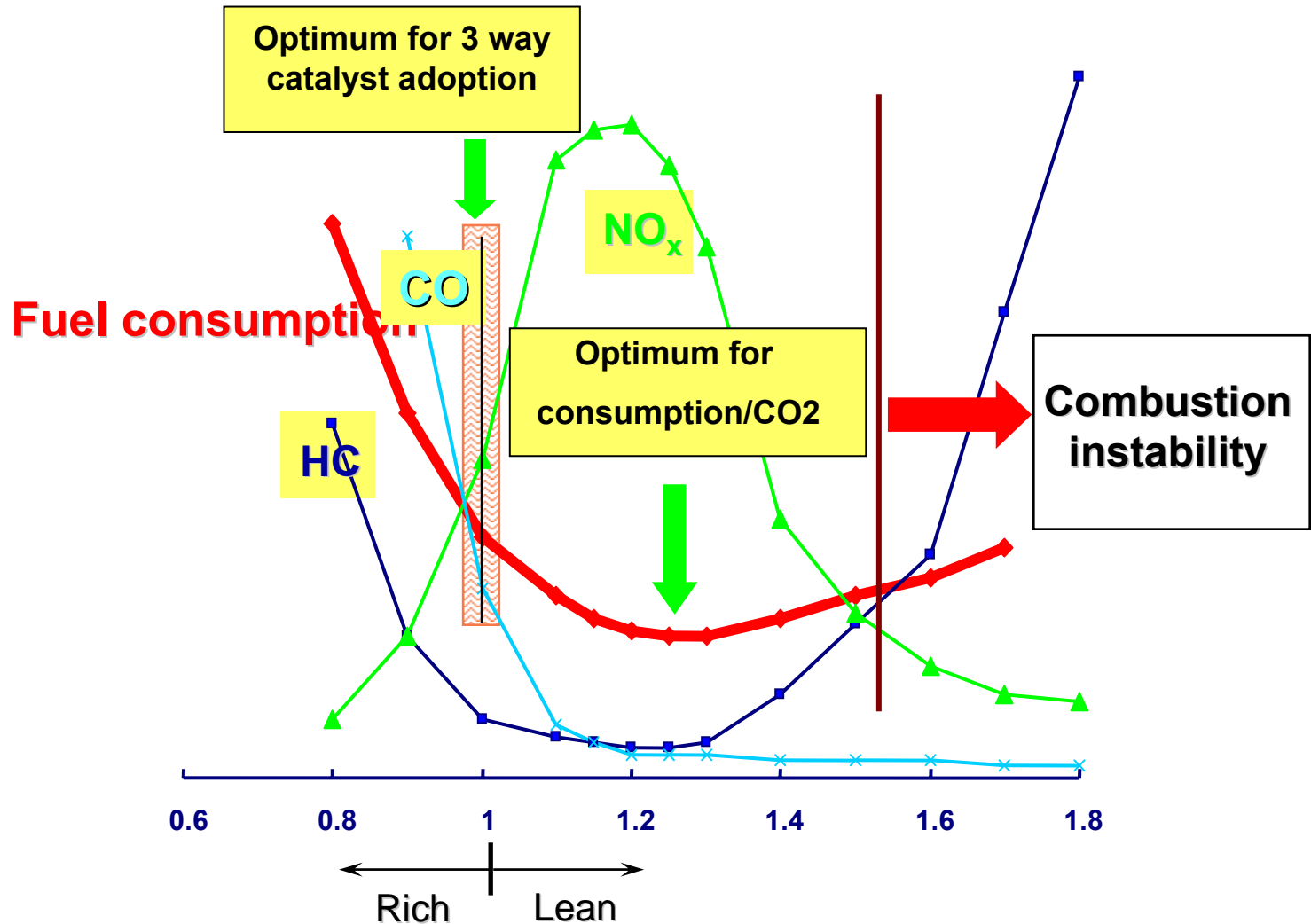
# CNG – EMISSIONS. NOISE REFERENCE LEVELS



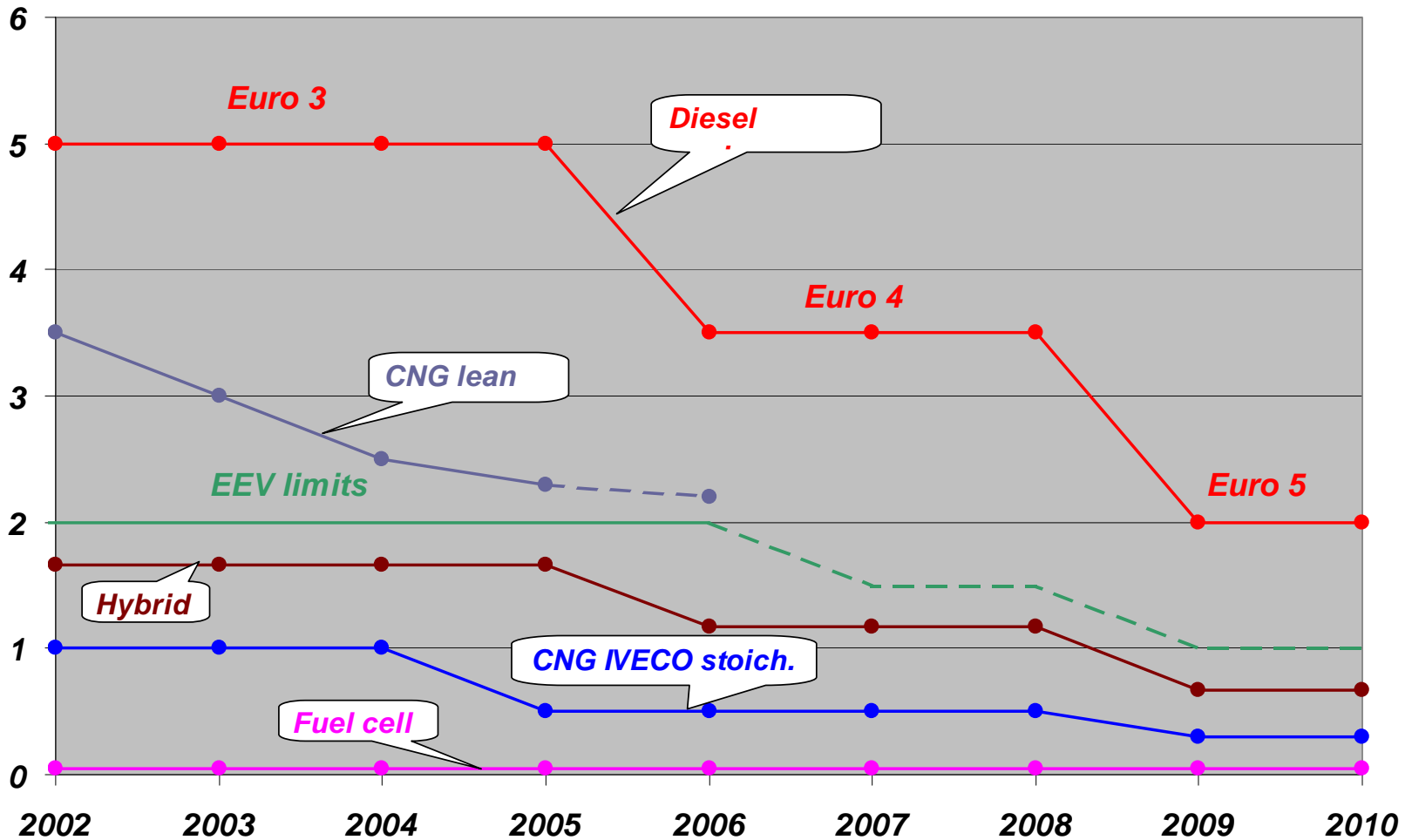
# NOISE EMISSION. Diesel vs CNG vehicles



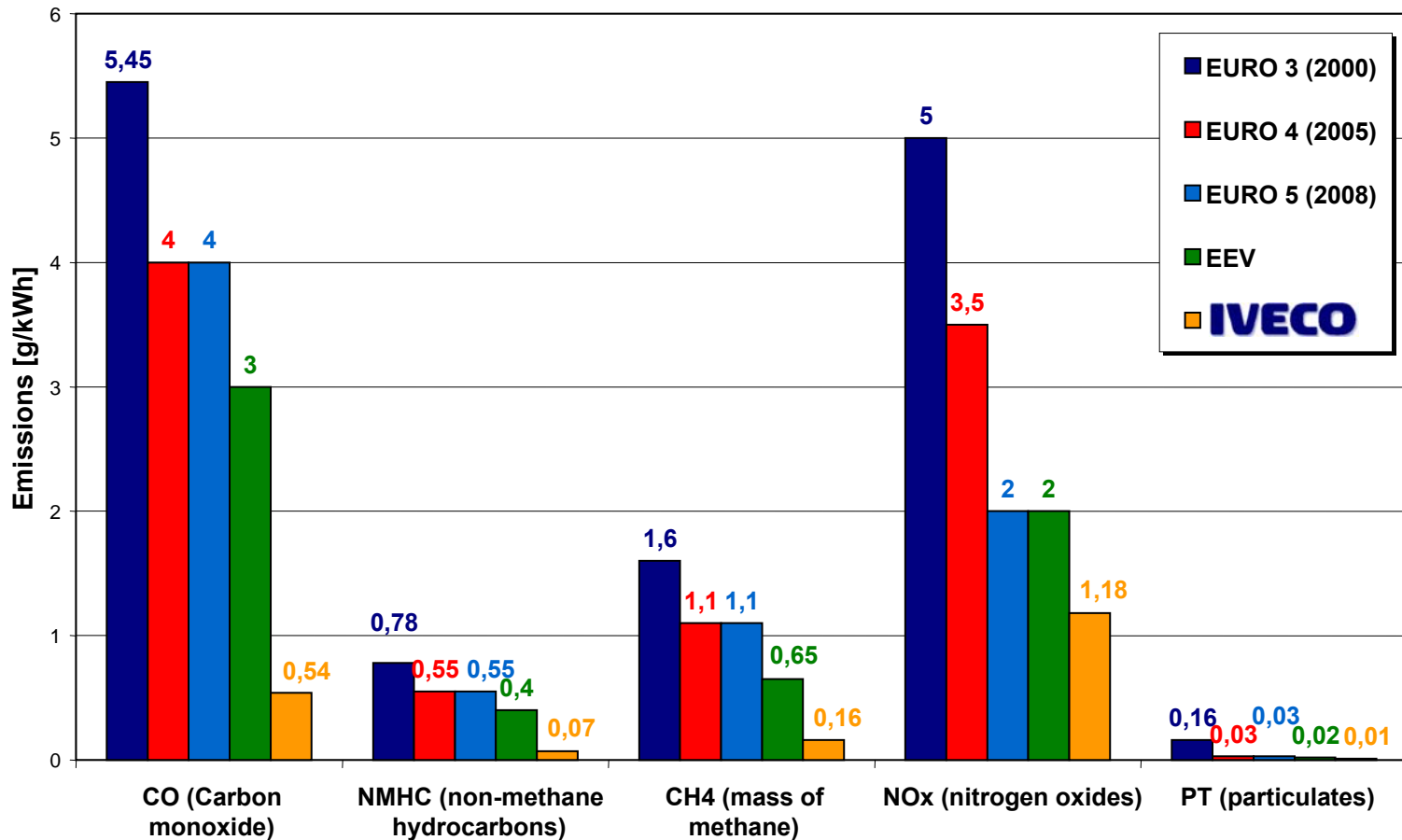
# EMISSION AND FUEL CONSUMPTION VS AIR/FUEL RATIO



## COMPARED NO<sub>x</sub> EMISSIONS DIESEL vs ALTERNATIVE TECHNOLOGIES

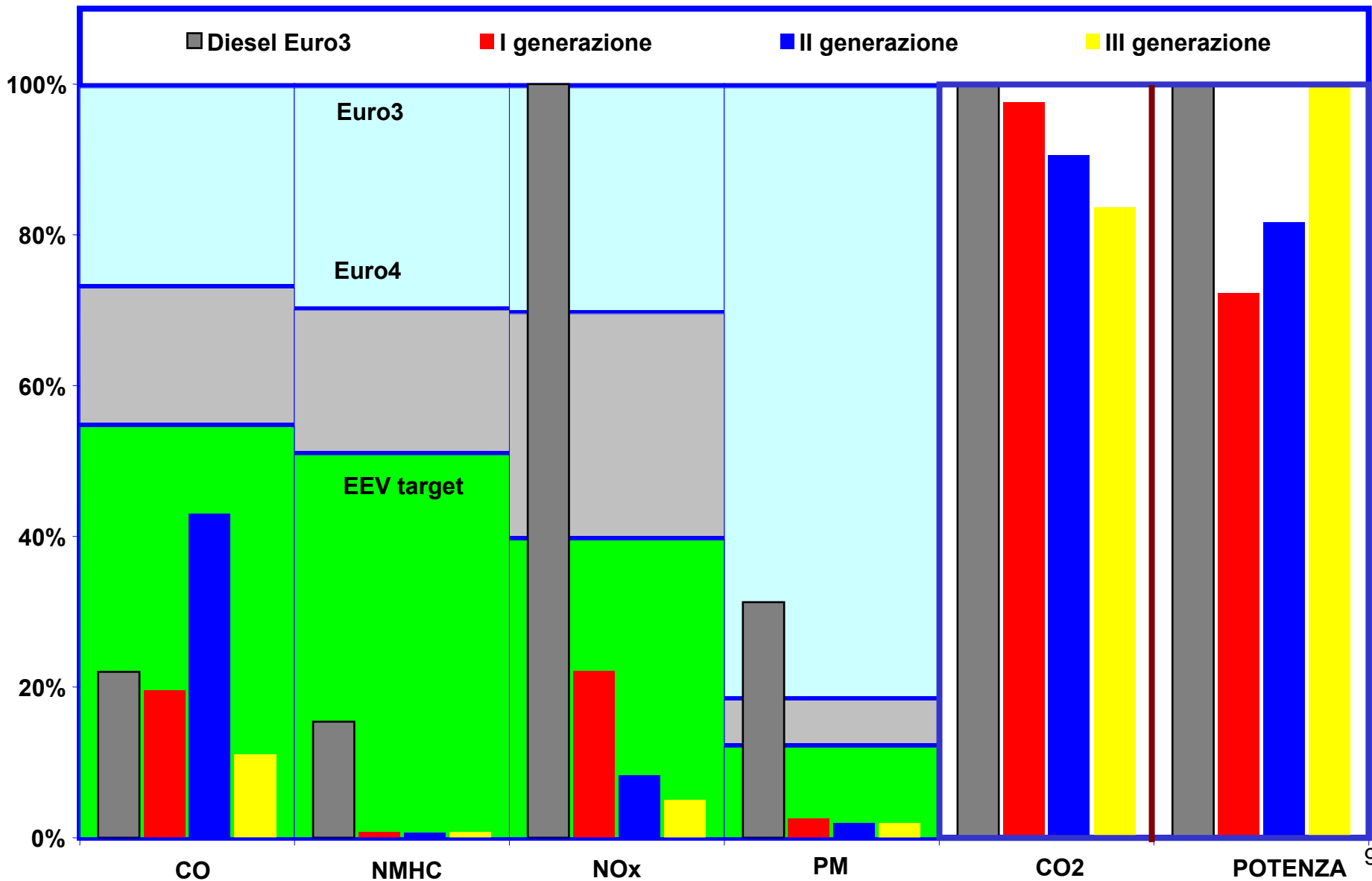


## GASEOUS EMISSIONS IVECO 8469 ENGINE vs PRESENT AND FUTURE EUROPEAN LIMITS





# IVECO CNG ENGINES



CNG for cleaner cities and road transport

# CNG EXHAUST EMISSION COMPARISON (1)

## REGULATED POLLUTANT EMISSION. VEHICLE IN OPERATION

(source: VTT Processes\* report, 2004, E.E.V. certified engines \*\*)

	<u>COMBUSTION MIXTURE TYPE</u>		
	<u>STOICHIOMETRIC</u>	<u>LEAN-BURN</u>	<u>IMPROV.</u>
HC, g/km	1.17	1.92	39 %
NOx, g/km	2.17	4.50	52 %
PM, g/km	0.008	0.016	50 %

**Stoichiometric Iveco engines,  $\lambda=1$ , don't emit NO<sub>2</sub>, the pollutant that doesn't seem to be decreasing in Europe, on the contrary to NO that has a decreasing trend.**

\* VTT, Technical Research Centre of Finland, Transient Bus Emission Study

\*\* Braunschweig driving cycle

# CNG EXHAUST EMISSION COMPARISON (2)

## CO2 EMISSION, GREENHOUSE EFFECT GAS (GHG) VEHICLE IN OPERATION

(source: VTT Processes\* report, 2004, E.E.V. certified engines \*\*)

	<u>COMBUSTION MIXTURE TYPE</u>		
	<u>STOICHIOMETRIC</u>	<u>LEAN-BURN</u>	<u>IMPROV.</u>
CO <sub>2</sub> , g/km	1046	1447	28 %
(Diesel Euro 3,	1150 g/km		9 %)
(Diesel Euro 3 + CRT,	1240 g/km		16 %)

## CO<sub>2</sub> EMISSION COMPARISON (% to DIESEL Euro3)

<u>D. E 3</u>	<u>D. E 3+CRT</u>	<u>Lean-burn CNG</u>	<u>Stoich. GNC</u>
100	108	126	91

\* VTT, Technical Research Centre of Finland, Transient Bus Emission Study

\*\* Braunschweig driving cycle

# CNG Iveco sales and running park (Europe)

	1999-2001	2002	2003	2004	TOTAL
DAILY - TRUCK & VAN	111	81	185	82	459
DAILY - IRISBUS		18	64	15	97
EUROTECH					1000
AUTOBUS IRISBUS	961	313	314	160	1827
				Final total	<b>3383</b>

The 1000 units of trucks are in:

**Spain: 550; France: 300; Italy: 150**

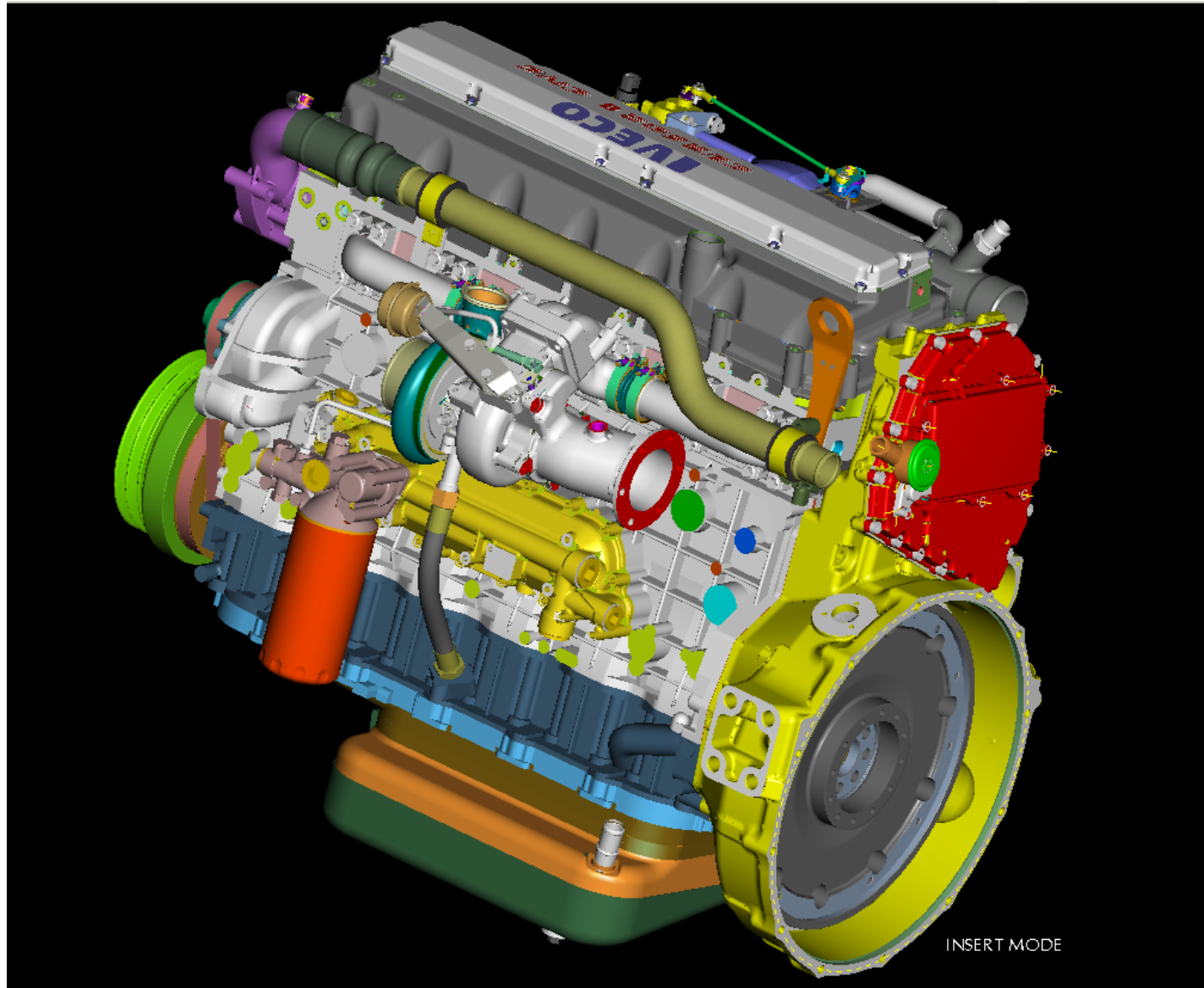
**IVECO is the major player of CNG in Europe, and the clear leader in buses**

# IVECO CNG ENGINES LINE UP

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<b>SOFIM</b>	<b>2,8 l.</b>	<b>NA</b>	<b>106 CV</b>
<b>8460</b>	<b>9,5 l.</b>	<b>TC/TCA</b>	<b>218 to 310 CV</b>
<b>TECTOR</b>	<b>5,9 l.</b>	<b>TCA</b>	<b>200 CV</b>
<b>CURSOR</b>	<b>7,8 l.</b>	<b>TCA</b>	<b>270 / 310 CV</b>

# CURSOR F2G CNG ENGINE



# IVECO DAILY CNG





# EUROCARGO CNG





# IVECO EUROTECH CNG

Modello - Model	Cabina - Cab	Passo - Wheelbase mm	Potenza - Power HP / rpm	Coppia - Torque Nm / rpm	Cambio - Gearbox
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## C.N.G. 4 x 2

Sospensione Pneumatica / Air suspension

MP190E26/P-CNG	MPC	3800 / 4200 / 4500 / 4800 / 5100	260 / 2100	1050 / 1100	D - Q
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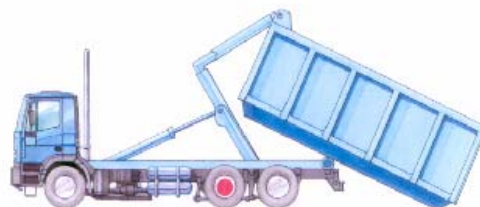


## C.N.G. 6 x 2

Asse Posteriore Sollevabile Sterzante / Steering and lifting third axle

Sospensione Pneumatica / Air suspension

MP240E26/PS-CNG	MPC	3100 / 3800 / 4200 / 4500 / 4800 / 5100	260 / 2100	1050 / 1100	D - Q
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## C.N.G. 6 x 2

Asse Posteriore Sollevabile Sterzante / Steering and lifting third axle

Sospensione Pneumatica Integrale / Full air suspension

MP240E26/FS-CNG	MPC	4200	260 / 2100	1050 / 1100	Q
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## C.N.G. 6 x 2

Asse Centrale Sterzante / Central steering axle

Sospensione Pneumatica Integrale / Full air suspension

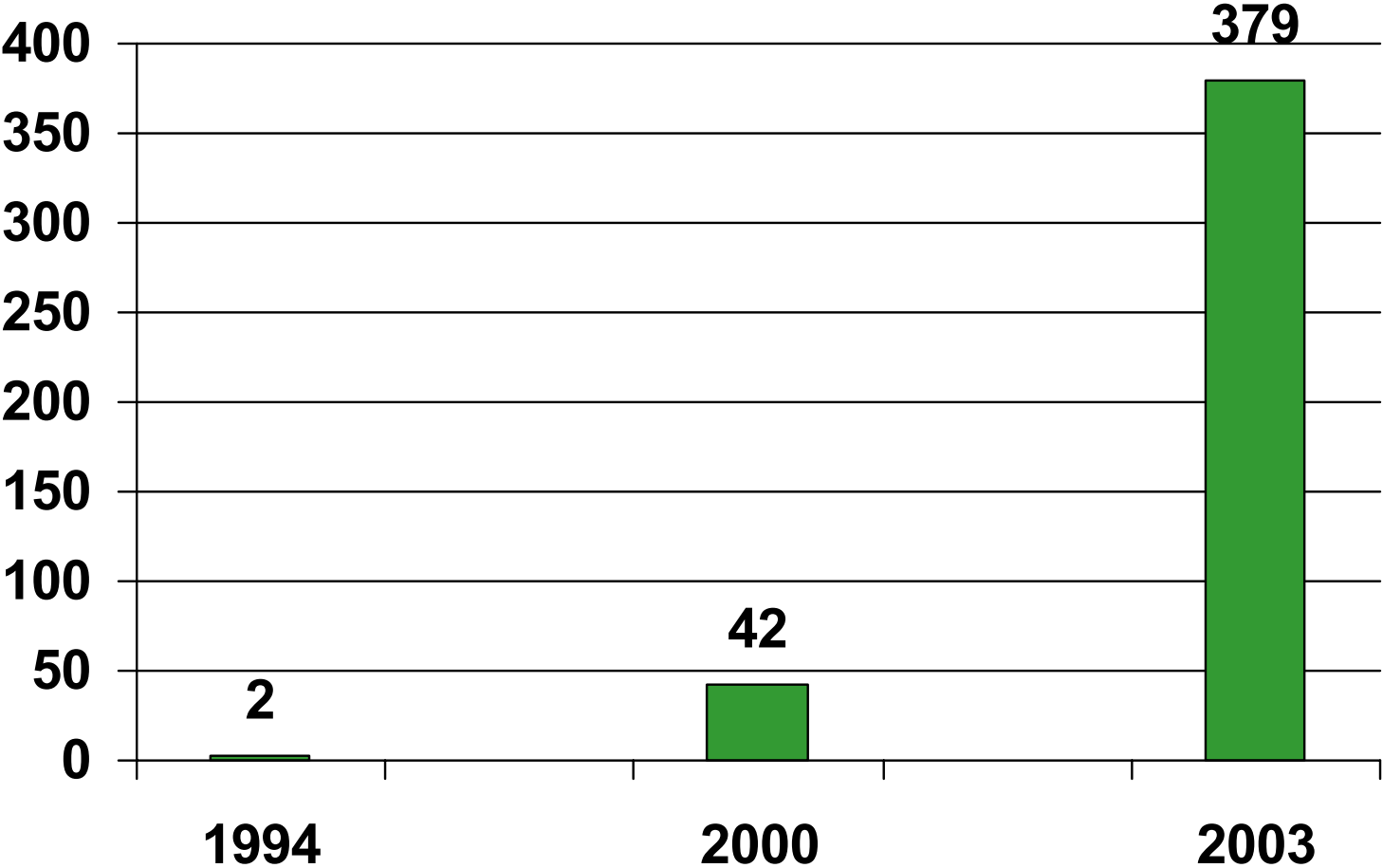
MP240E26X/FP-CNG	MPC	2840	260 / 2100	1050 / 1100	Q
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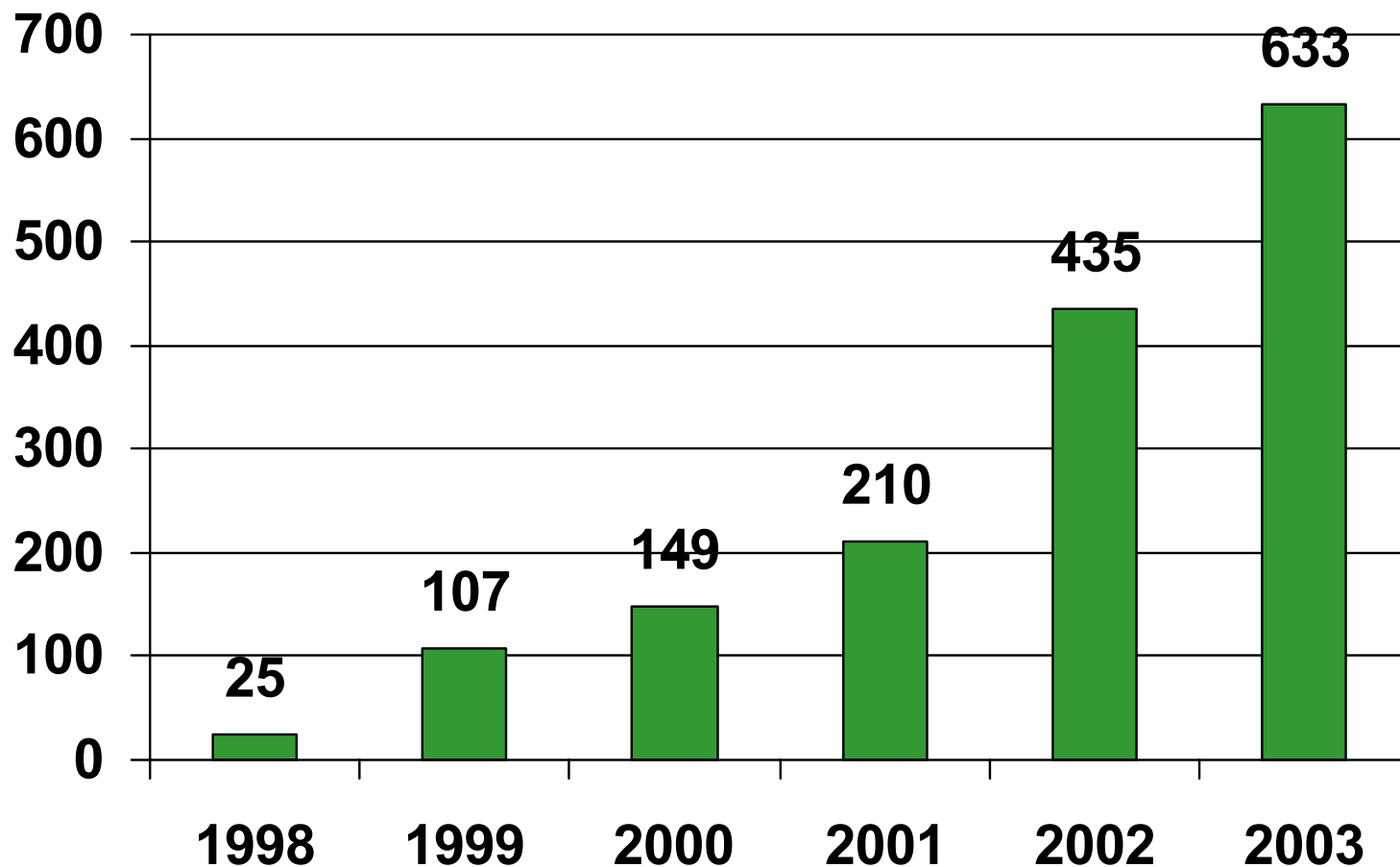
# CNG Refuse collection fleet



# IVECO CNG trucks for refuse collection in Madrid



# IVECO CNG heavy trucks for refuse collection in Europe





# IRISBUS – AUTOBUS CNG



EUROPOLIS CNG



ZAMYAD BUS A60.11  
(MOTORE 8149)

CITY CLASS CNG 12 and 18 m

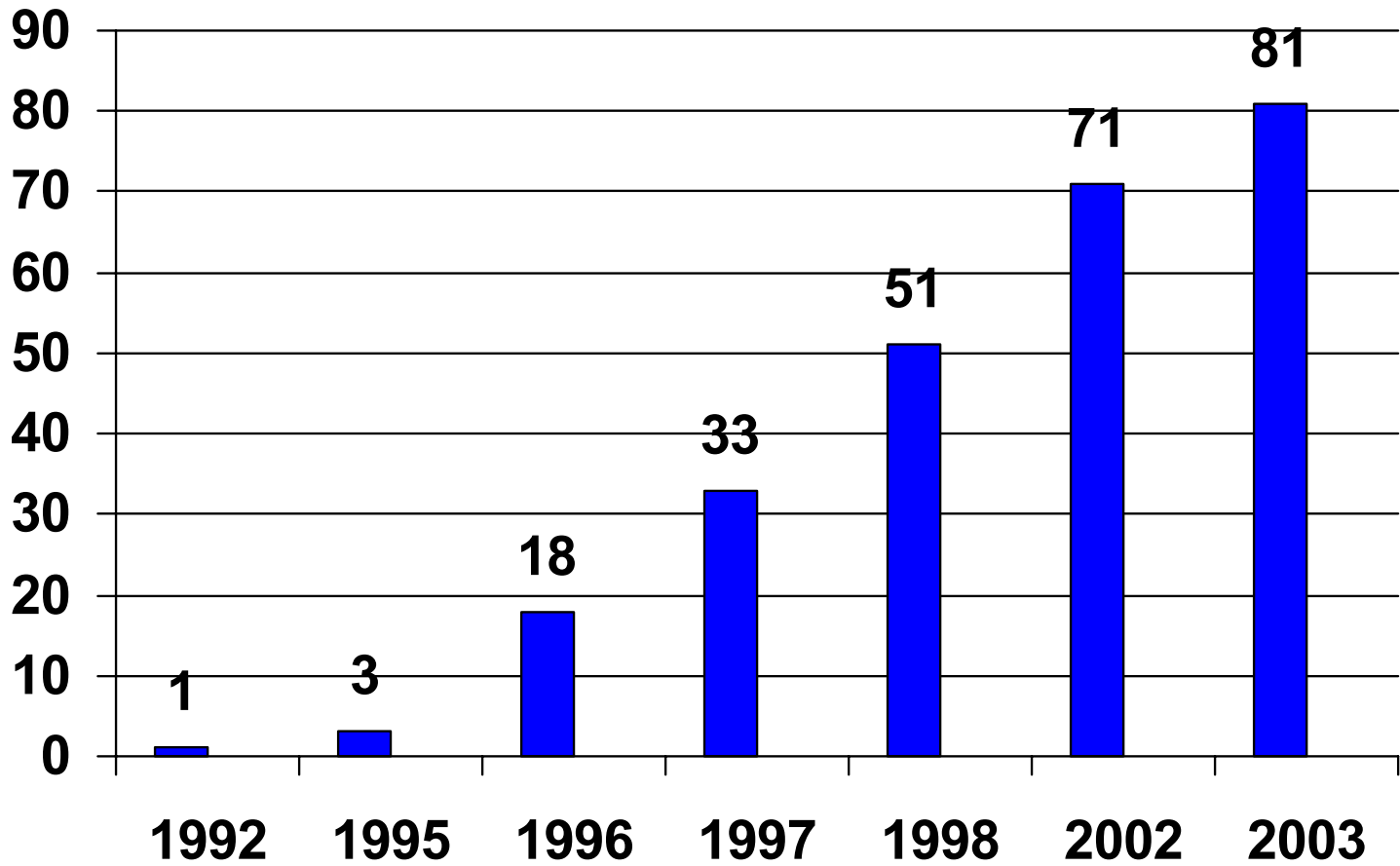


BEIJING BUS TECTOR CNG

# CNG BUS FLEET IN MADRID



# IVECO CNG urban buses in Madrid





# RELIABILITY

The refuse collection company FCC S.A., operating basically in Madrid but with other locations world wide, has acquired about 320 CNG units since 1999 with a yearly average mileage of 55,000 km.

In the public transport sector there are other companies such as EMT Madrid, TMB Barcelona, ATAF Florence and ATM Ravenna, with 114, 105, 91 and 8 CNG buses respectively with a yearly average mileage between 45,000 and 60,000 km.

In each of these companies there are vehicles that have already shown a good performance in the long term:

TOWN	MISSION	YEAR	TOTAL KM/UNIT
MADRID	BUS	1998	320.000
MADRID	REFUSE COLLECTION	1999	241.000
BARCELONA	BUS	2001	130.000
FLORENCE	BUS	1998	280.000
RAVENNA	BUS	1998	350.000

**TOTAL HEAVY CNG FLEET MILEAGE, >353,000,000 KM**



# IVECO-OTOYOL CNG BUS FOR IRAN



**3.000 UNITS FORESEEN FOR THE NEXT 3 YEARS**

**IVECO PORTFOLIO OF ORDERS  
FOR CNG VEHICLES AND ENGINES:**

**MORE THAN 2.800 UNITS**

# CONCLUSIONS

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- **CNG VEHICLES CONSTITUTE AN ECONOMIC, UP-TO-DATE AND DEPENDABLE ALTERNATIVE TO DIESEL VEHICLES, TO IMPROVE ACOUSTIC AND GASEOUS EMISSIONS SIMULTANEOUSLY**
- **ADDITIONALLY, CNG IVECO VEHICLES, WITH STOICHIOMETRIC COMBUSTION, PROVIDE EVEN BETTER POLLUTION AND CO<sub>2</sub> EMISSION LEVELS.**

- **TODAY IVECO OFFERS A RANGE OF CNG VEHICLES COMPLYING WITH THE E.E.V. STANDARD AND CONTINUES DEVELOPING STATE-OF-THE-ART CNG VEHICLES TO SATISFY GLOBAL MARKET NEEDS**