



Aaqui & Aaqui  
STRATEGIC MARKET & BUSINESS DEVELOPMENT  
PARIS, BRUXELLES

# French perspective on diesel engines & emissions

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*DEER 2002 - San Diego*

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***Strategic Market & Business Development***

# Aknowledgements

## ■ OEM's :

- > Audi, BMW, PSA Peugeot-Citroën, Ford Europe, VW, Renault-Nissan, GM-Opel, Daimler-chrysler, Fiat

## ■ Project Team :

- > Project Director / VP Business Development Aaqius & Aaqius Paris:  
Dr Ing. Marc Lagarrigue
- > Senior Project Manager Paris : Ing. Baudouin de Chassey
- > Strategic market senior Project Manager Frankfurt :  
Franck Botzem

## ■ Aaqius Network representatives in :

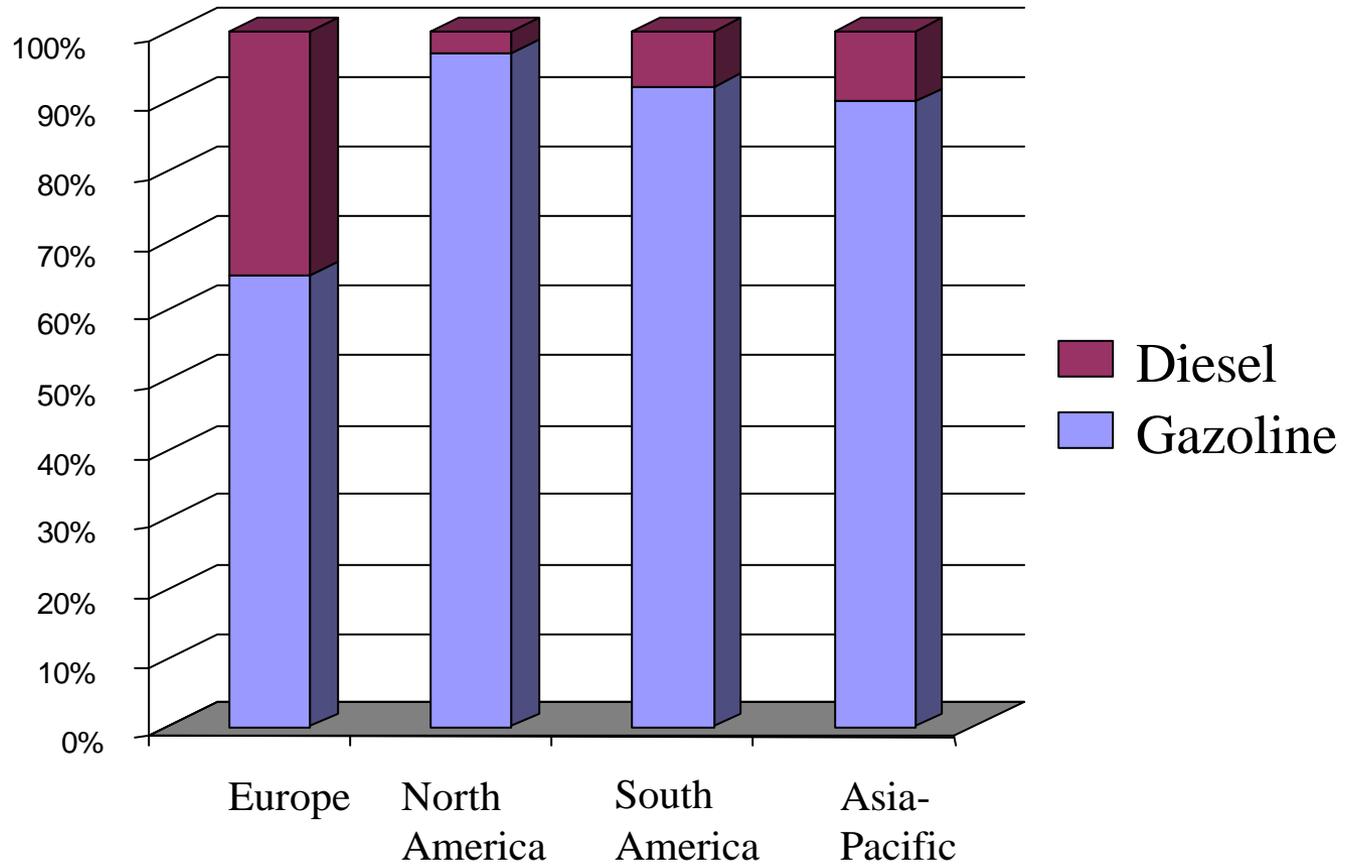
- > Beijing, Bruxelles, Detroit, Frankfurt, Paris, San Francisco, Tokyo.

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# Diesel emission control : a strong concern for Europe

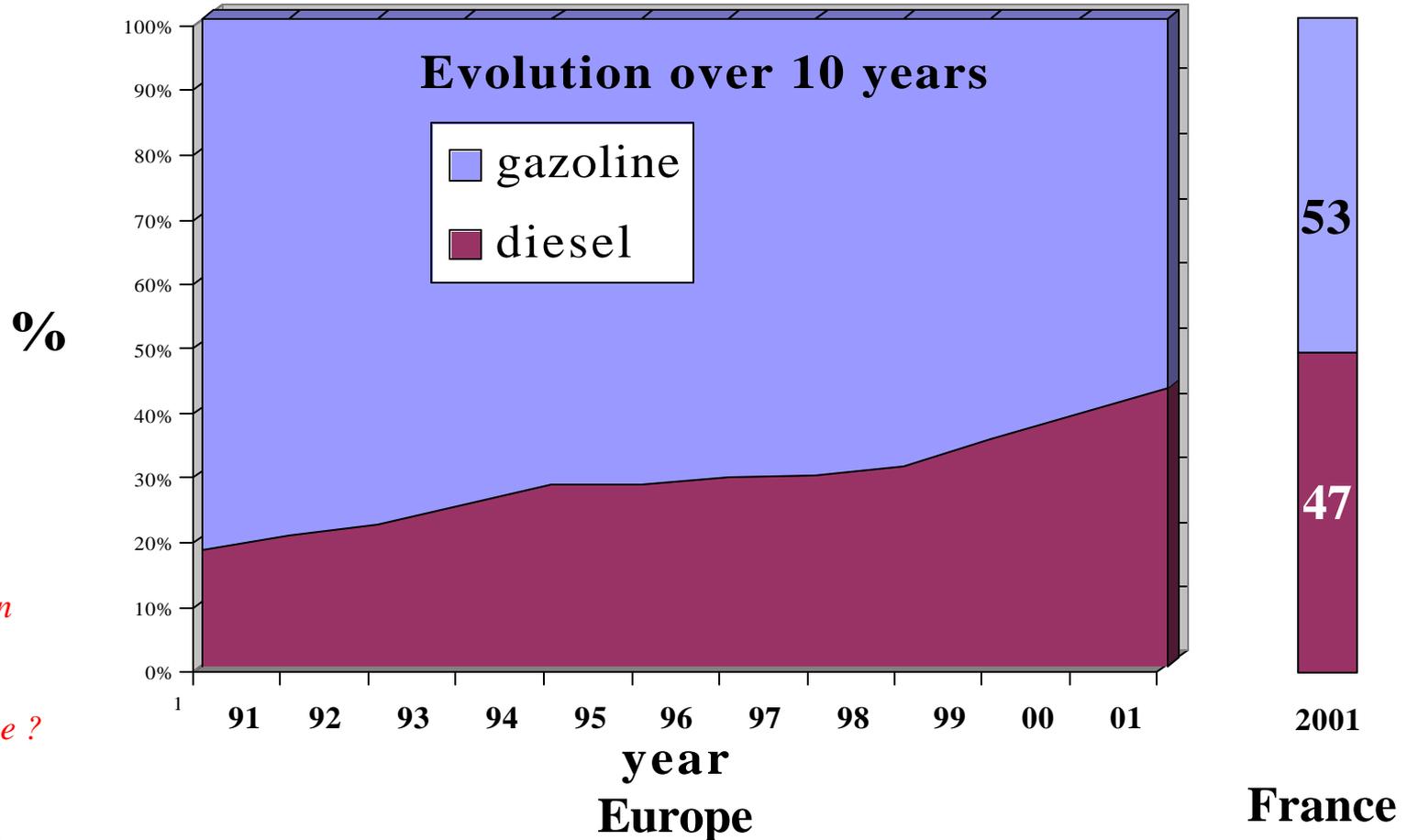
## ■ Market volume : total vehicles in use 2001



*Regulations have a strong impact on European countries but the problem has to be solved worldwide*

# Diesel will continue to grow if PM & NOx are controlled

- Sales of new passenger car and light commercial vehicle (< 3,5t)



*With an advantage on CO2 emissions, can diesel challenge the leadership of gasoline ?*

# Why final users buy diesel ?

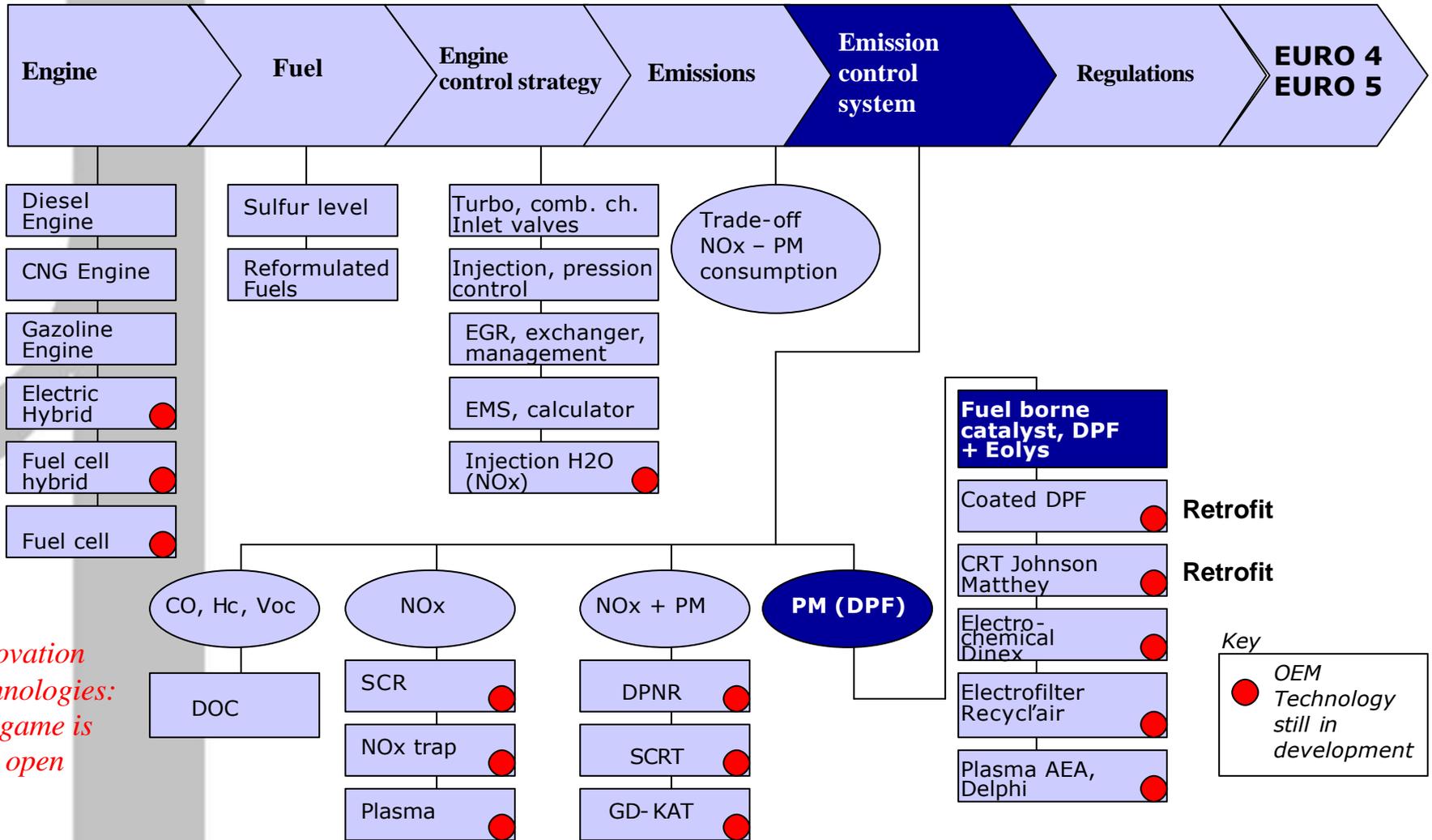
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<b>Pros</b>	<b>Cons</b>
Fuel price Consumption Better resell Durability  Comfort of driving (better torque at low regime)	More expensive (12 %)  Noise

CO2	PM and Nox
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*Final buyers are strongly attached to the advantages of driving a diesel car*

# A complex technology map to control emissions issues



*Innovation technologies: the game is still open*

# European regulations

## ■ Agenda

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
<b>Dir 99/96/EC-HD Emissions</b>	Commission		Parliament and Council	Finalization & Publication		OBD		OBD	N	A	
<b>Fuels guidelines 98/70/EC</b>	Commission		Parliament and Council	Finalization & Publication		?		?			
<b>PMP GRPE - Mes. particules</b>		Preliminary datas			Finalization & Publication						
	Commission		Parliament and Council		Preliminary datas	Finalization & Publication		Enforcement of new guidelines		N = New models A = All new cars	

*EURO 5 still on discussion for measuring PM by mass or by number*

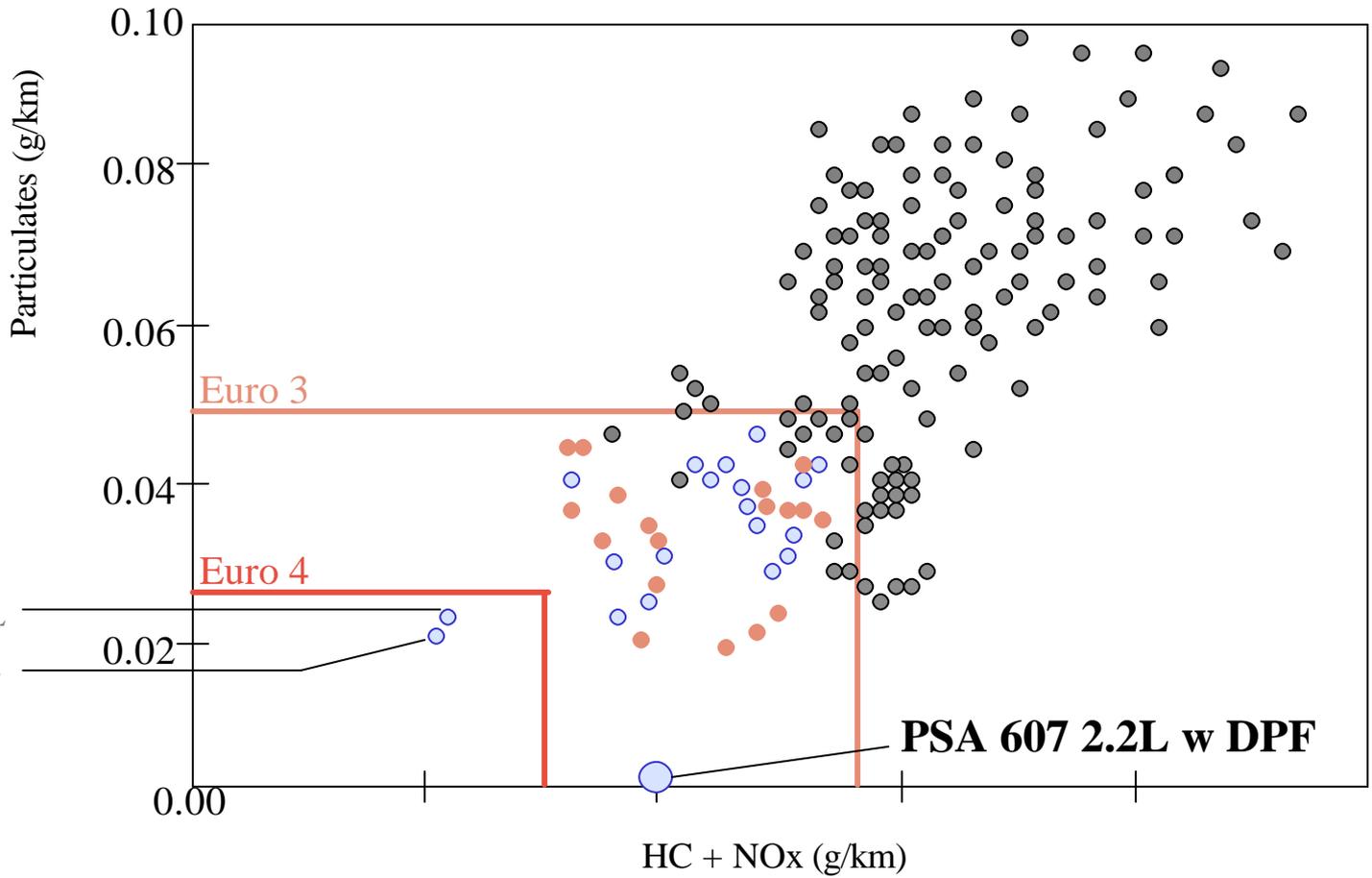
## ■ Sulfur levels

	2000	2005
<b>Sulfur ppm</b>	350 ppm	50 ppm

# Emission levels of cars MY 1997-2000

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- Model year 2000
- Model year 1998
- Model year 1997



*A breakthrough has occurred on PM. What about NO<sub>x</sub> control ?*

# Car maker strategies to meet future european standards

Vehicles size	Euro 4	Euro 5
Small & medium	<b>DOC + DPF(1)</b>	<b>DOC + DPF(1)</b>
Large	<b>DOC + DPF(1) or NOx trap</b>	<b>DOC + DPF and NOx Trap</b>

(1) Some will have a DPF for marketing strategy

DOC : Diesel Oxydation Catalyst

DPF : Diesel Particulate Filter

*The growing marketing impact of DPF could make the volumes of production even bigger*

# Only one DPF regeneration strategy fully industrialized

■ DPF with Fuel borne catalyst → Winner

- > Equiped since 2 years
- > Efficient & durable
- > No failure

■ Coated DPF → ???

- > Still in development

# The European initiative

Peugeot 607



## ■ Achievement

- ◆ Regeneration every 500-1000 Km
- ◆ Soot burning  $t^{\circ}450- 500^{\circ}C$  w additive.
- ◆ Regeneration time lowered to 3 mn.

## ■ Proven experience

- ◆ No dependance on sulfur level
- ◆ Cleaning at 80,000 km (50,000 miles)
- ◆ System mounted on various models :
  - > Peugeot : 607 + 406 + 307 + 807
  - > Citroën : C5 + C8
  - > Lancia : Phedra
  - > Fiat : Ulysse



Fiat Ulysse

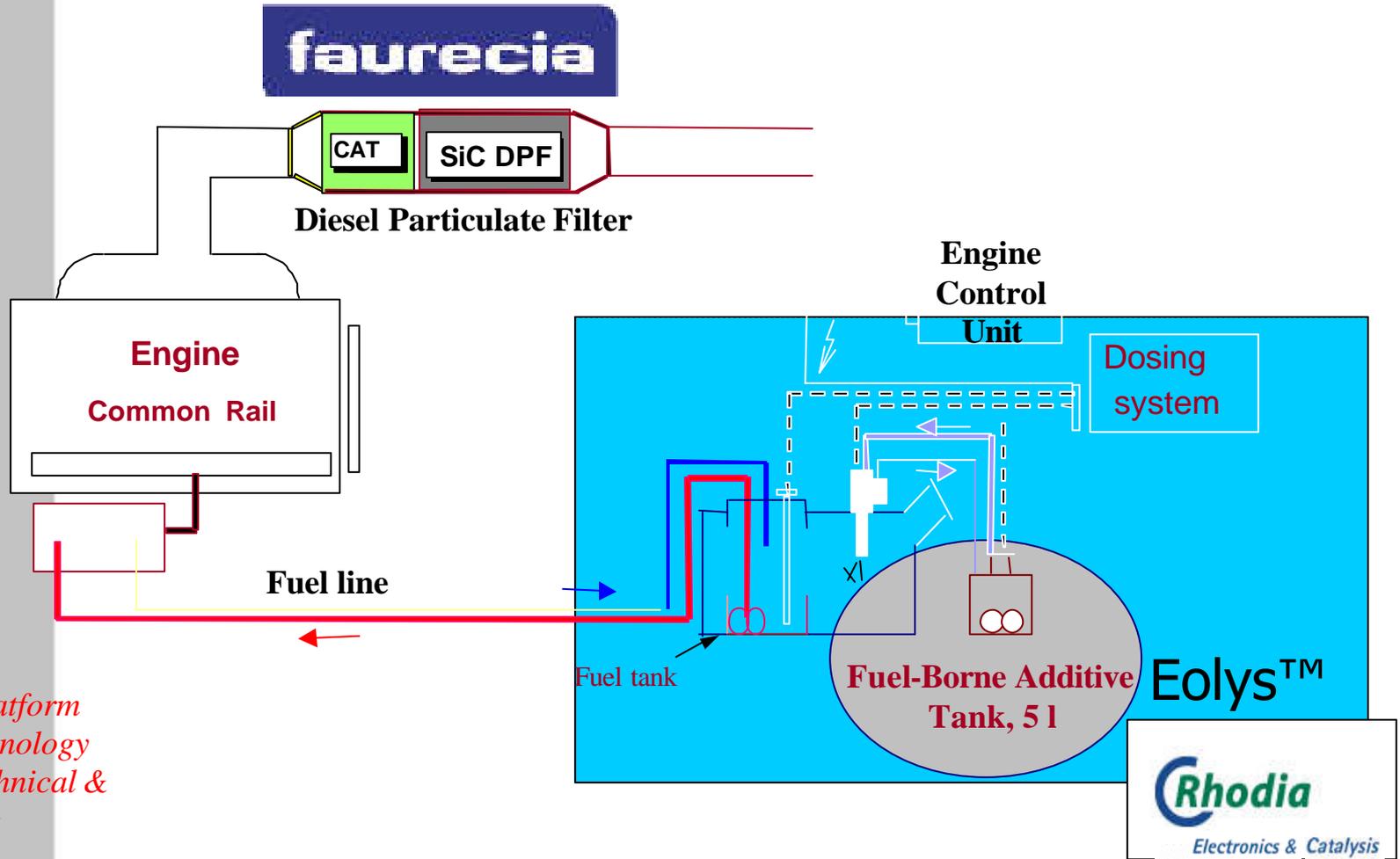
## ■ Next step

- > Lowering system price
- > Lowering back-pressure
- > Lowering weight



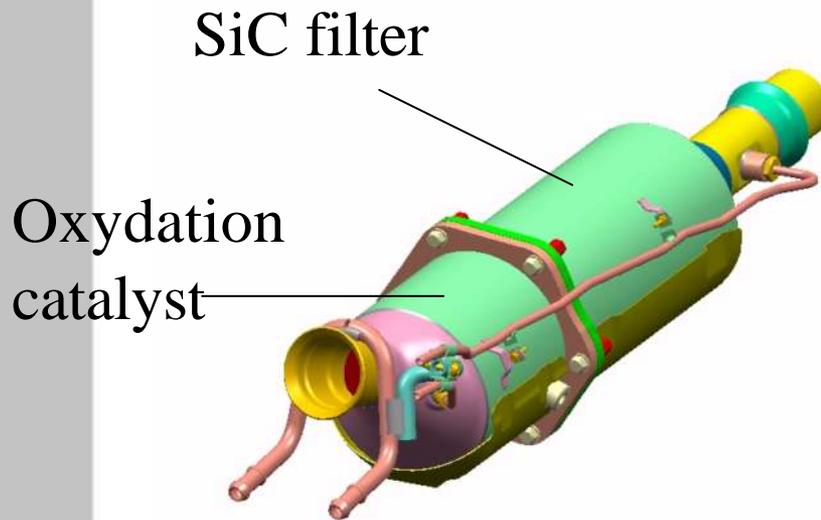
Citroën C5

# DPF PSA Peugeot 607 : on the road in Europe since Dec. 1999

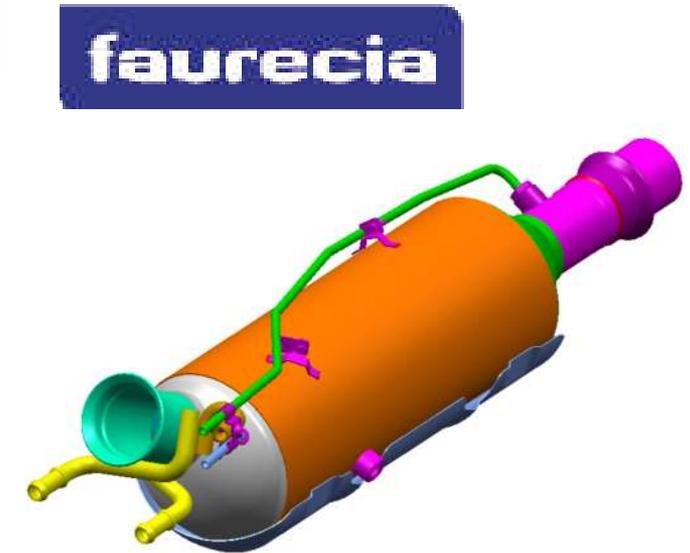


*A performing collaborative platform allowed the technology to meet both technical & customers needs*

## The state-of-the-art particulate filter



Peugeot 607 : SOP Dec. 1999



Peugeot 307: SOP June 2001

- 400.000 units on the road at the end of 2002

# Market survey on 180 retrofit programs

## Public transportation

### Options evaluated

	Much better than EURO 2
	Better than EURO 2
	EURO 2
	Less than EURO 2
	Much less than EURO 2

	Pollutants				Greenhouse effect	Maintenance	Investment	extra costs	Users' point of view	
	CO	HC	Nox	PM					Noise, smell, smoke	Image
CNG		(CH4)								
Hybrid										
Diesel + DPF										
Electric										

Source : ADEME

### EURO 3 and after

	Progresses awaited
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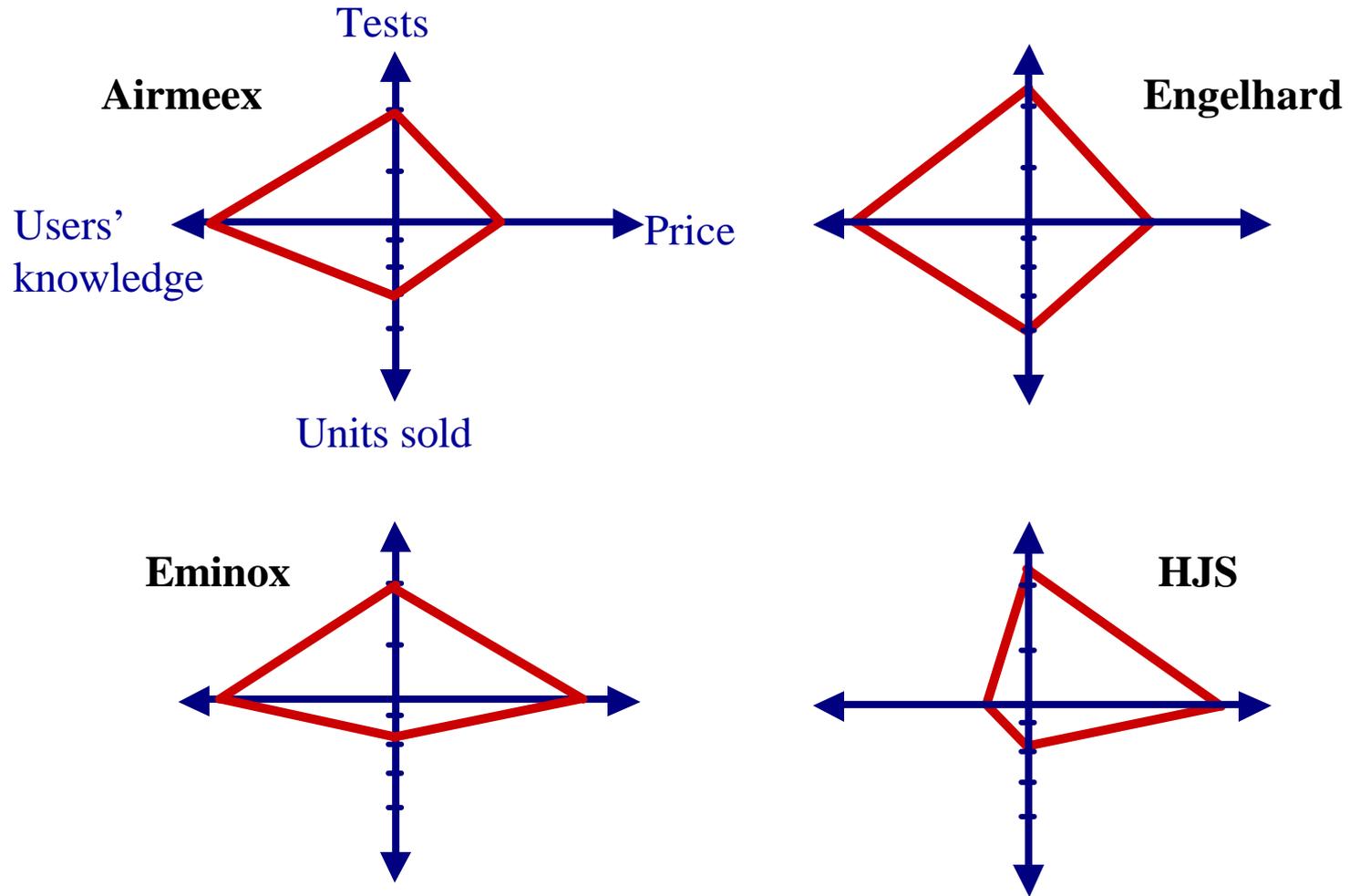
	Pollutants			Greenhouse effect	Maintenance	Investment	extra costs	
	CO + HC	Nox	PM					
CNG								CNG
Hybrid								Hybrid
Diesel + DPF + DeNOx								DPF

Source : ADEME

*Emissions controlled  
diesel is efficient*

**Fuel cell** : partnership between Paris, Madrid and Turino and private companies for exploitation of hybrid buses in 2003.

# Competitors on the retrofit market : the game is still open



# Facts & prospective : the key to success

## ■ Facts :

- ◆ Only 1 OEM solution fully industrialized with Fuel borne catalyst proven solution
- ◆ Durability & performance (2 years experience - 400.000 systems on road)
- ◆ Alternative solutions to treat both NO<sub>x</sub> & PM are emerging but are still under development

## ■ Prospective :

- ◆ Major Tiers 1 not yet active on the retrofit market
- ◆ Global solutions will come out from technology platform partnerships involving :
  - ◆ System integrator
  - ◆ Technologies
  - ◆ Retrofit suppliers network

## Conclusion

In the future, Aaqius & Aaqius, will continue to :

- ◆ evaluate technologies
- ◆ study the strategical markets needs in collaboration with governemental agencies
- ◆ build the collaborative platform to develop and market emission control solutions for the retrofit market.



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**Thank you for your attention**

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