

Introduction

I would first like to say that **I** of course **support sustainable development from personal, ethical, political grounds**, but **I also support it because I feel it is a precondition for the future of my company Renault**. We have been in the car business for slightly over 100 years, and we hope to stay in this business for at least as long and we are thriving for profitable growth. Now **if you want to have growth in this business, it does mean it has to be sustainable**

Mr. Louis Schweitzer, Renault Chairman and CEO

Customer requirements

Society environment

CO2 & ACEA self-commitment

Candidate technologies

Cars

Engines

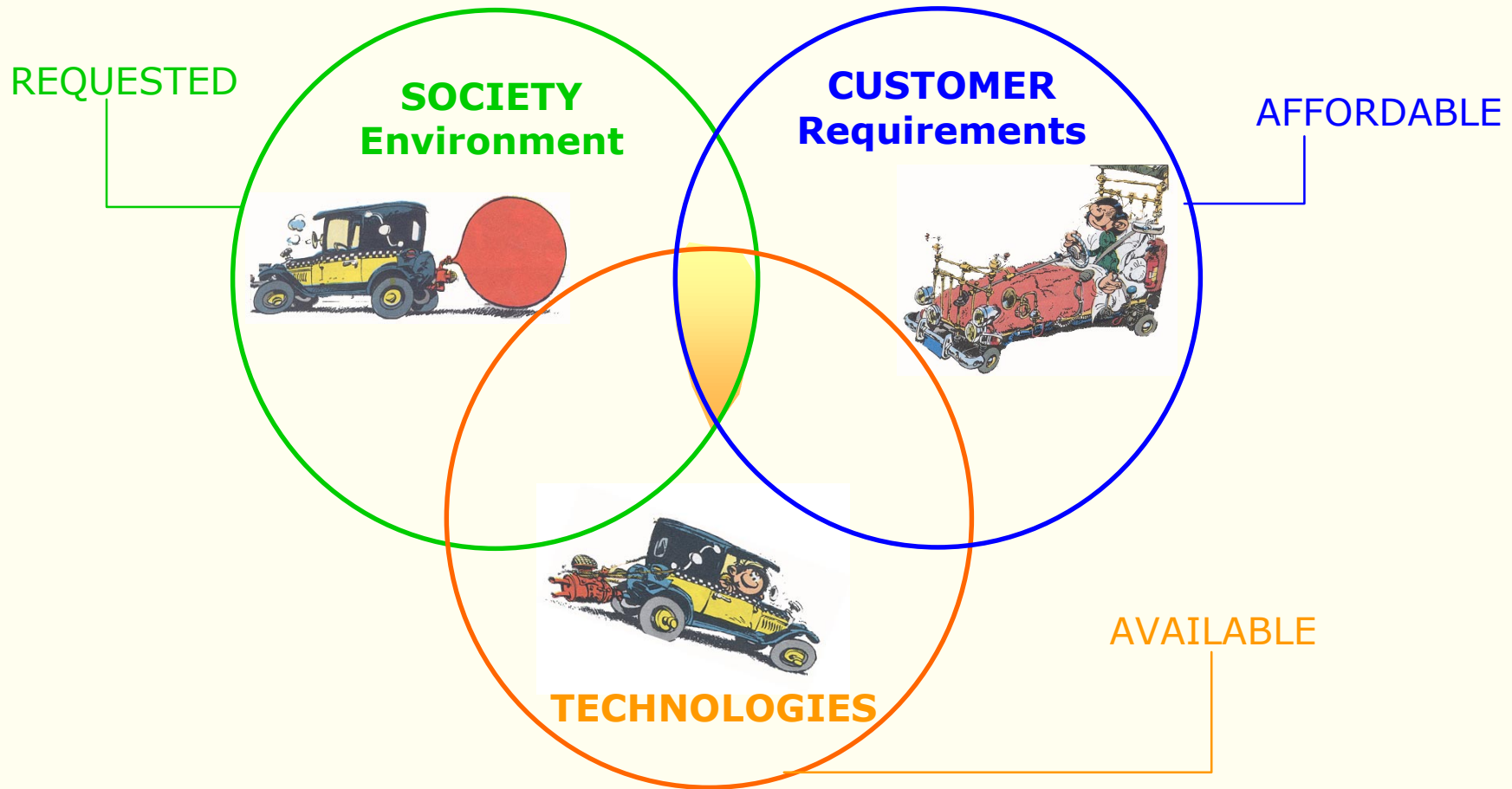
Transmissions

Hybrids

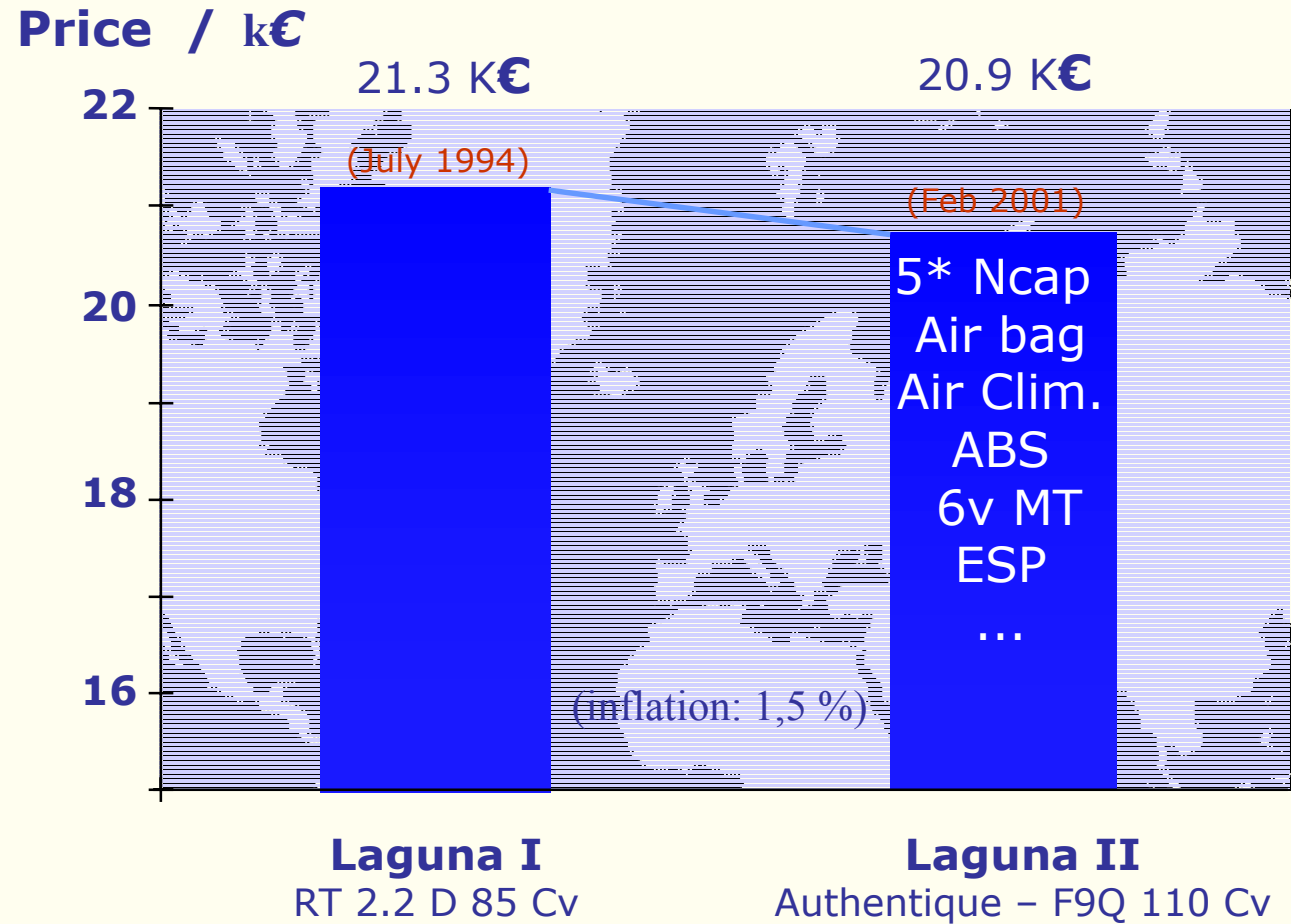
New fuels & technologies

Conclusions

Carmakers context



Customer requirements



Euro III emis. level
Fuel Cons. : - 15%
Noise : - 3dBA

Society environment

Local effect

- Air pollution
- Safety
- Noise

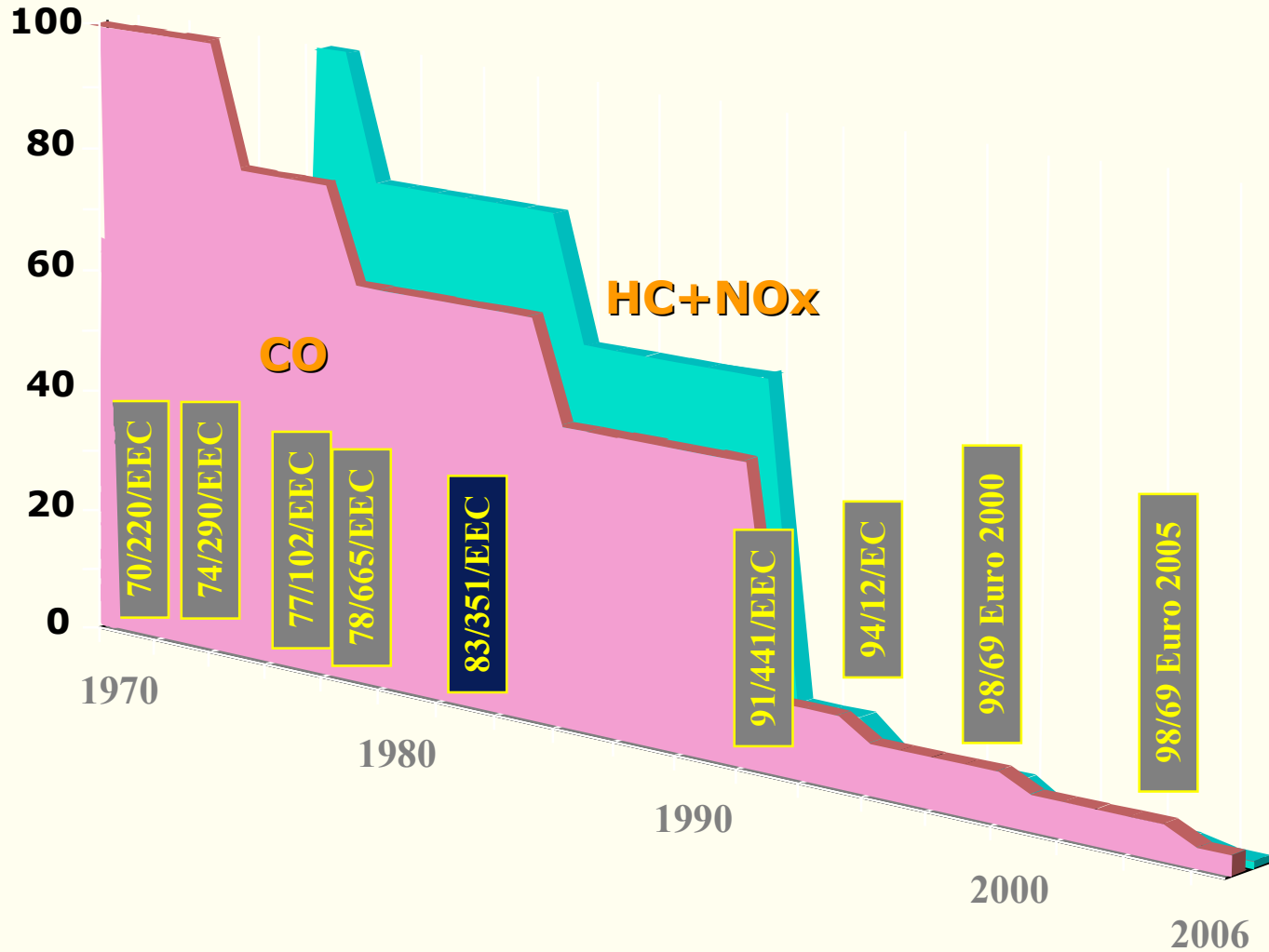
Global effect

- Green House Effect Gas emission

Society environment : conventional emissions

Gasoline engines

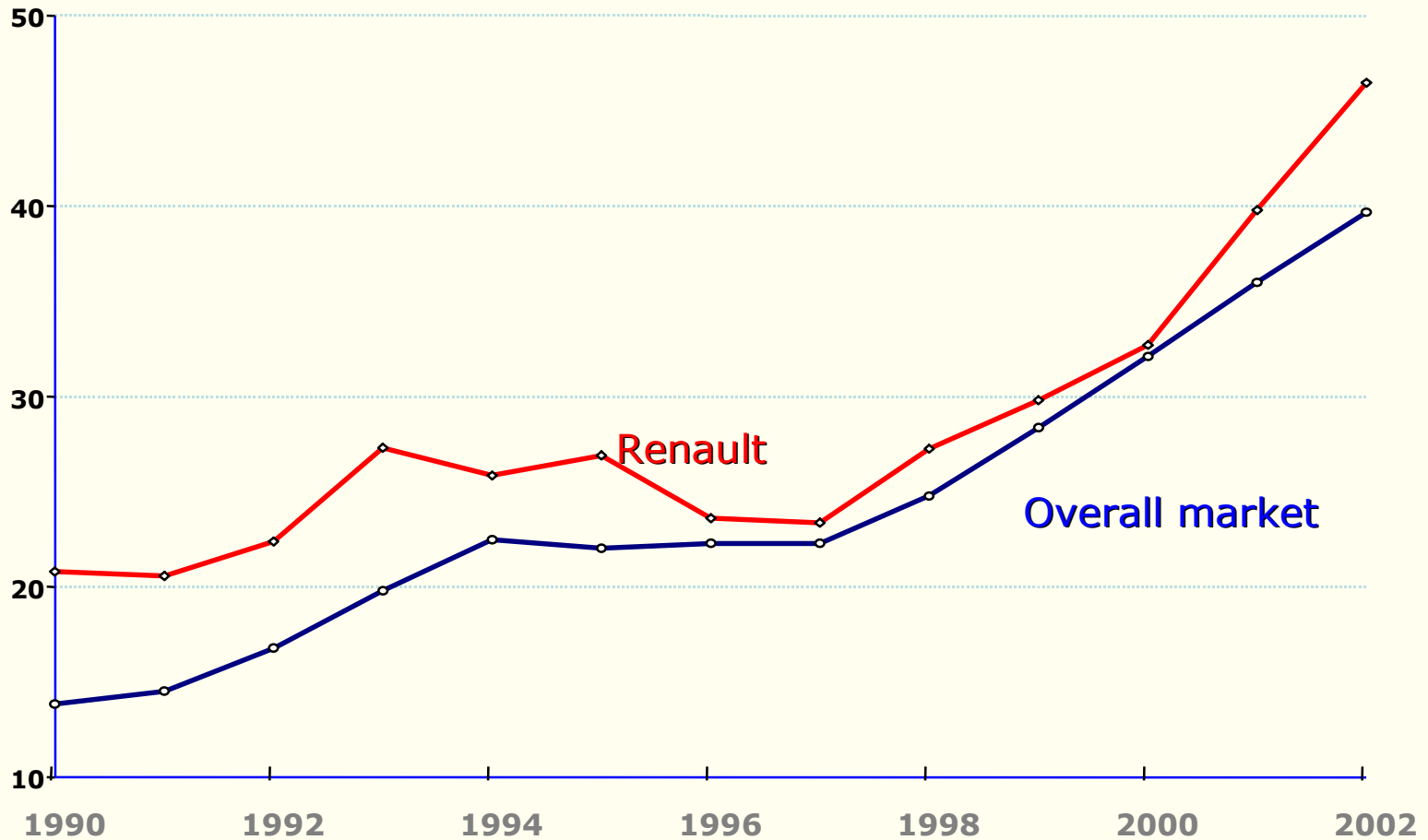
Emission index



Society environment : conventional emissions

Diesel marketshare in Western Europe

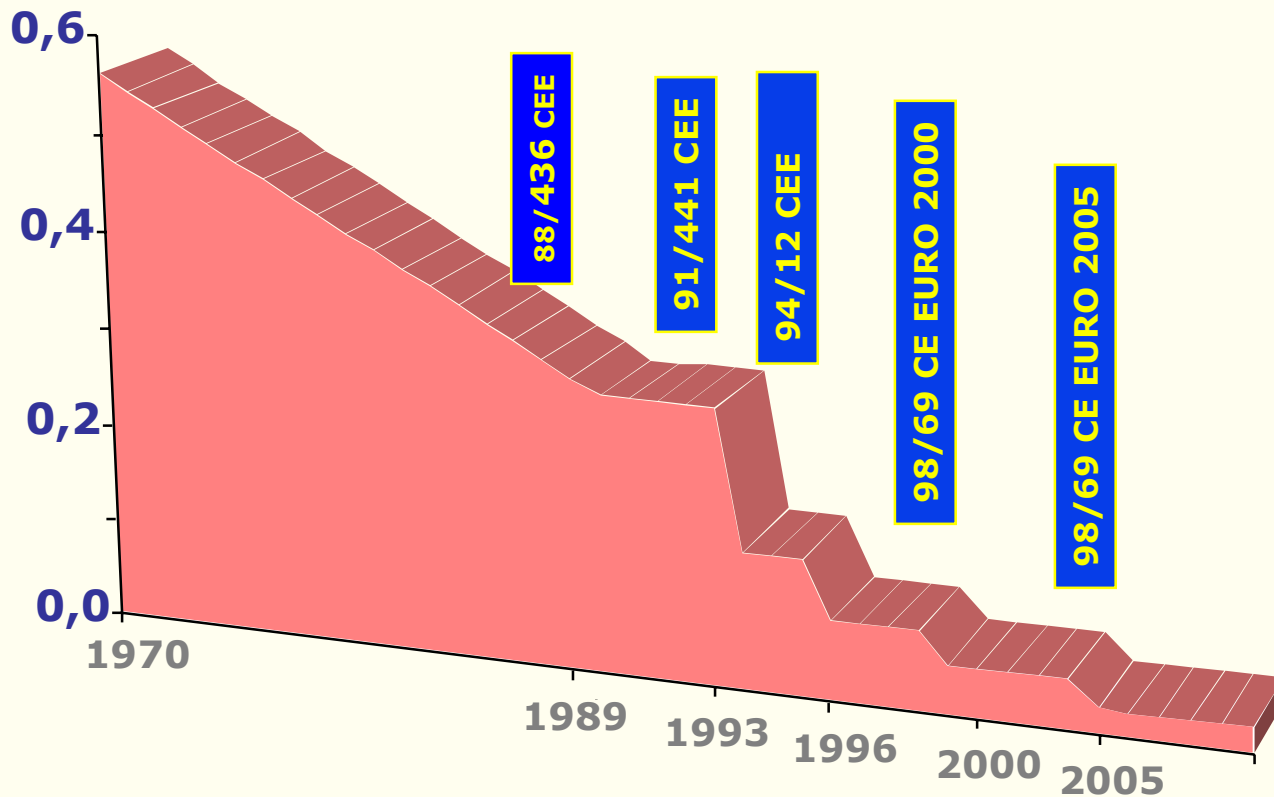
Marketshare %



Society environment : conventional emissions

Diesel engines

Particles emission g/km



Society environment

Local effect

- Air pollution
- Safety
- Noise

Global effect

- Green House Effect Gas emission

Society environment : Green House Effect Gas

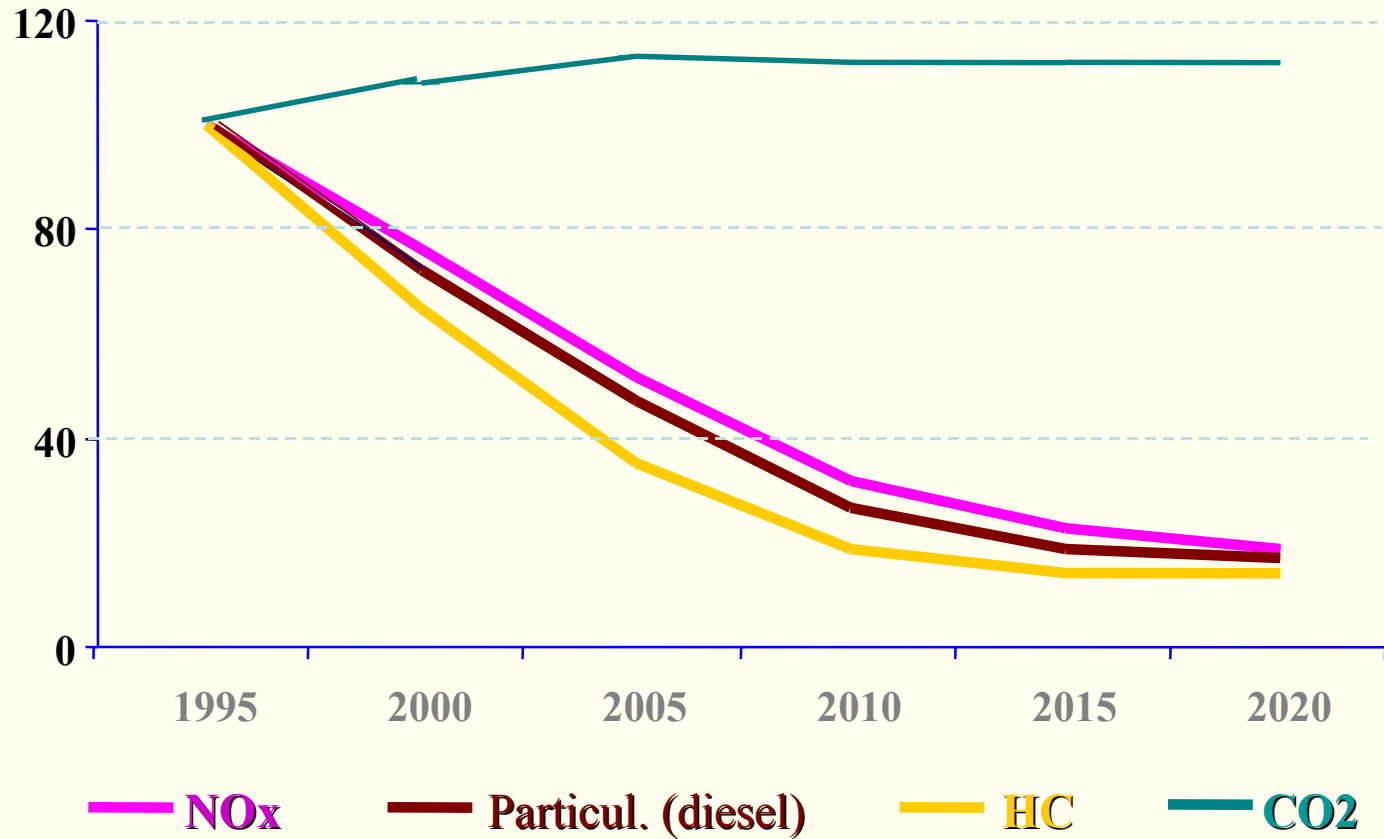
Gas	Greenhouse effect
Carbon dioxide CO₂	~ 55 %
Methane CH₄	~ 15 %
Chlorofluorocarbons CFCs	~ 15 %
Nitrous oxide N₂O	~ 5 %
Ozone O₃	traces
Water vapour H₂O	"

CO₂ is the most important Greenhouse Effect Gas

CO₂ emission is directly proportional to fossil fuel consumption

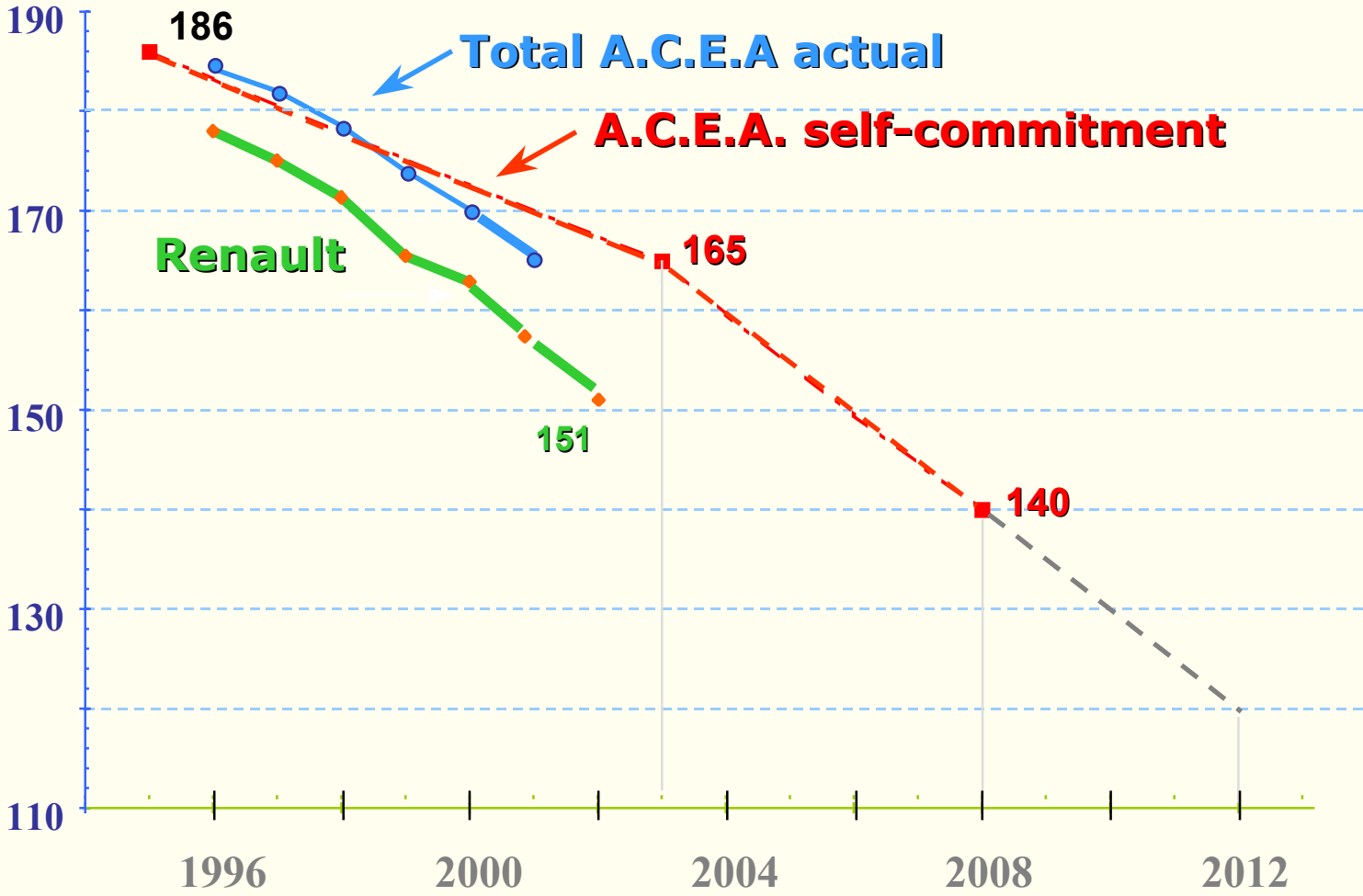
Society environment : Green House Effect Gas

Emission index



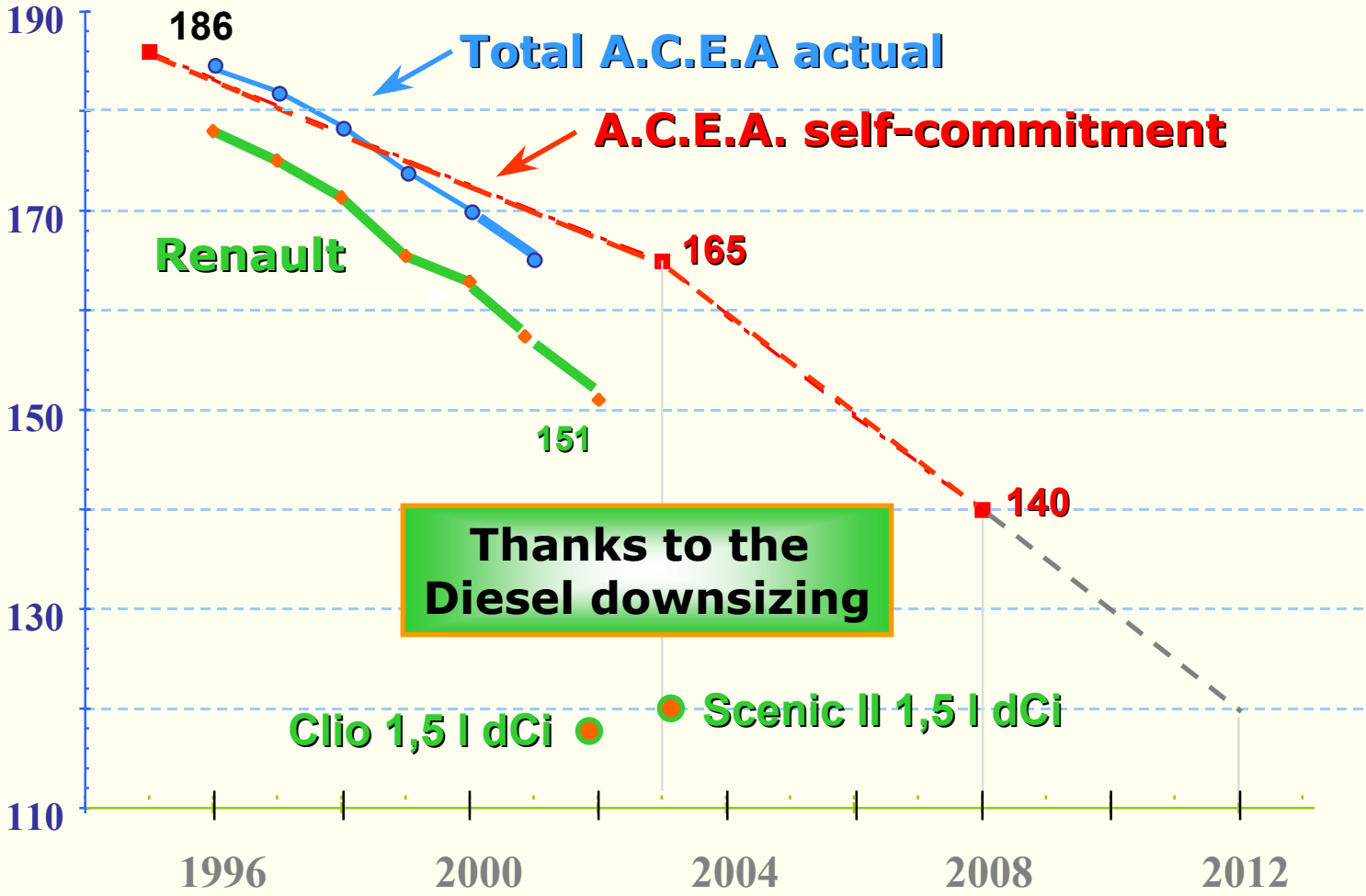
CO2 : ACEA self-commitment

CO2 (g/km)



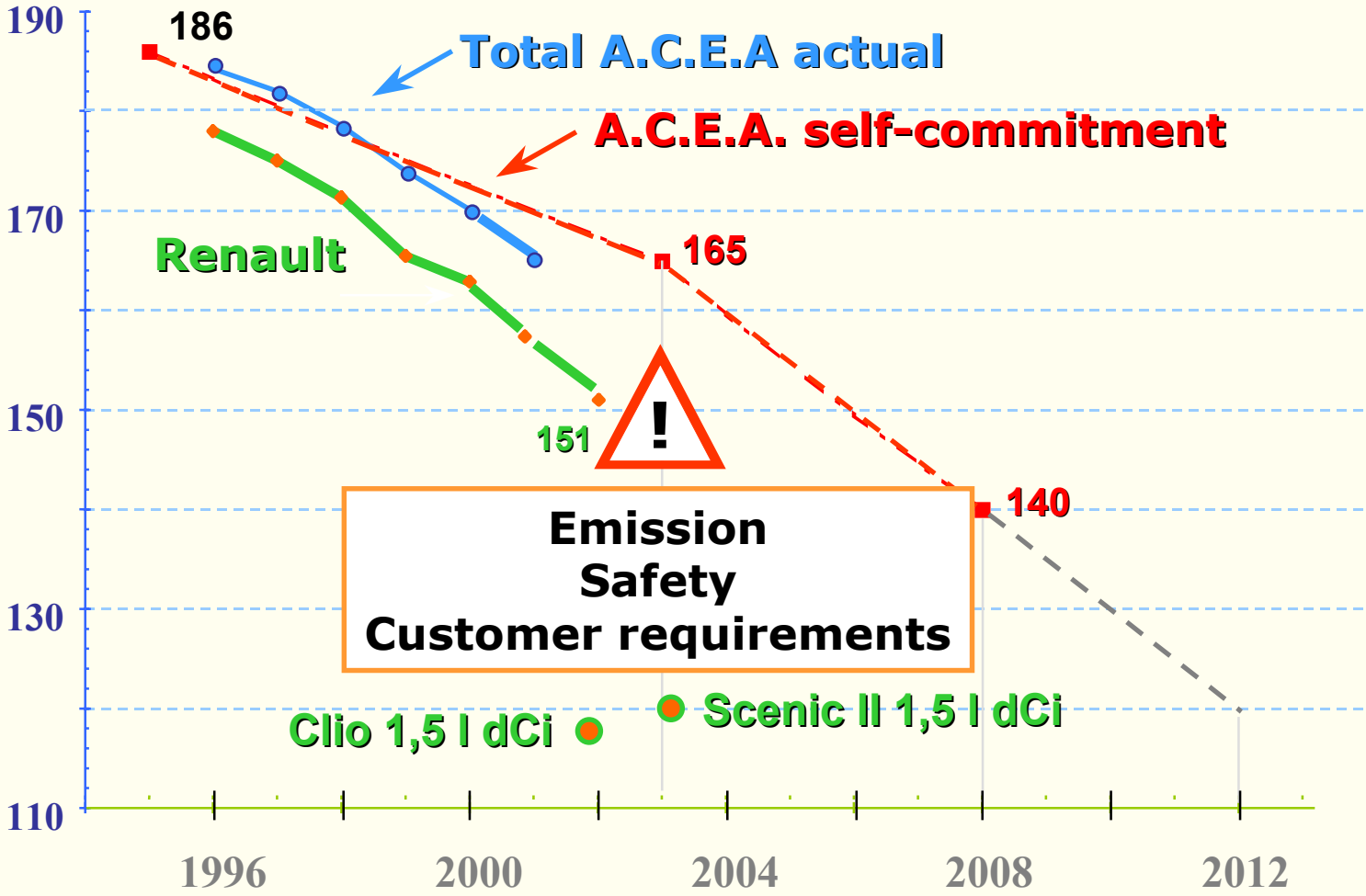
CO2 : ACEA self-commitment

CO2 (g/km)



CO2 : ACEA self-commitment

CO2 (g/km)



To reduce the car energy requisites

- Weight reduction
- Air drag reduction
- Rolling friction
- Accessories consumption
(power steering, air-conditioning, ...)

Candidate technologies

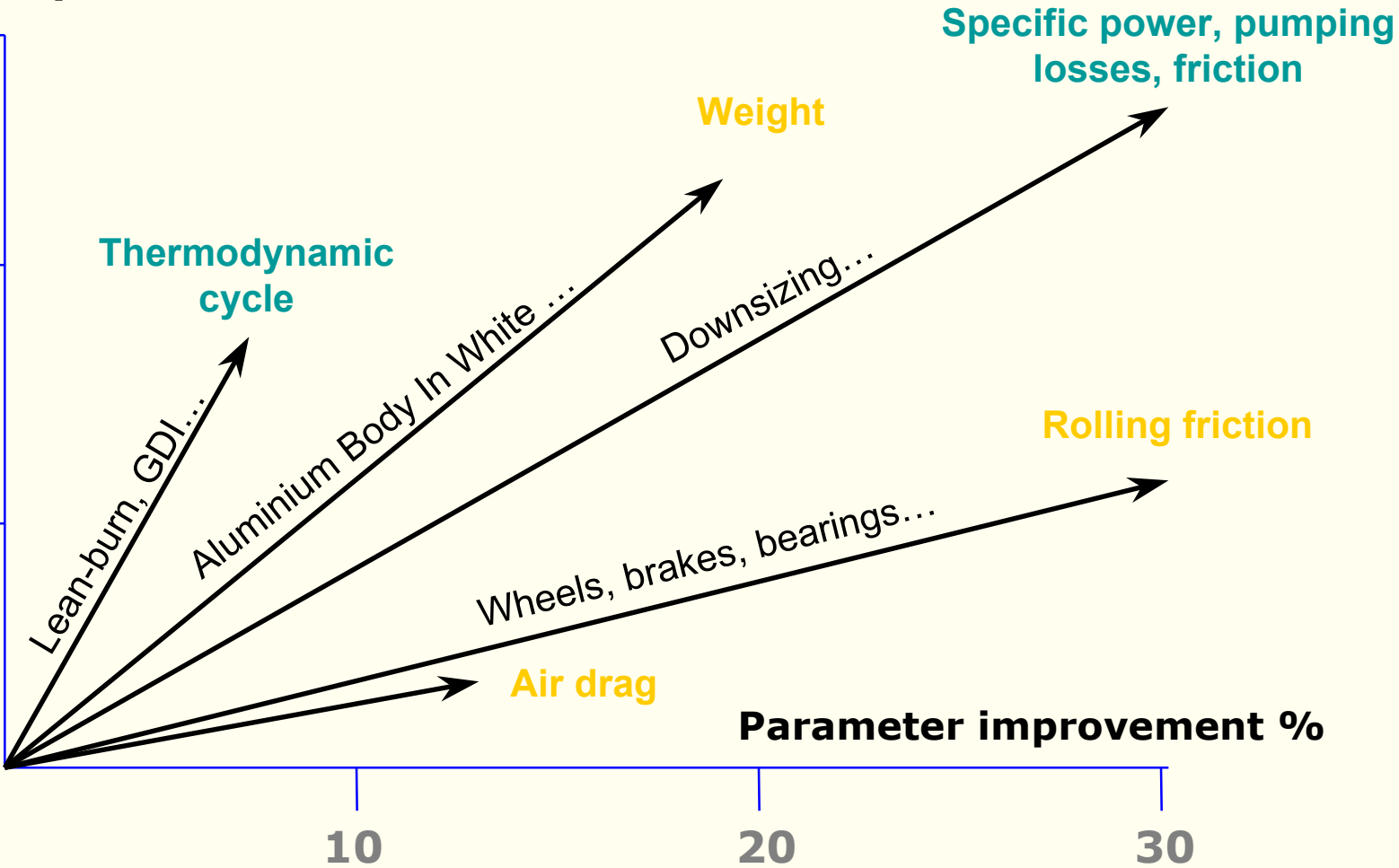
Car improvement versus engine improvement

Fuel economy %

15

10

5



Thermodynamic cycle

Weight

Specific power, pumping losses, friction

Rolling friction

Air drag

Parameter improvement %

Lean-burn, GDI...

Aluminium Body In White ...

Downsizing...

Wheels, brakes, bearings...

10

20

30

Candidate technologies : engines

- **Diesel engines : today the most CO2 efficient**
 - After-treatment
 - Noise reduction
- **Gasoline engines : the challenger**
 - GDI
 - Downsizing
 - Variable valve actuation

We can expect that in 10-20 years, gasoline and diesel engine will converge (combustion process, variable valve actuation and compression ratio ...)

Candidate technologies : engines

Diesel

IDI N/A

IDI T/C

DI T/C

Gasoline

MPI N/A

GDI N/A

MPI T/C
high perf

GDI N/A
lean burn

MPI T/C
"eco"

Today

DI T/C downsized

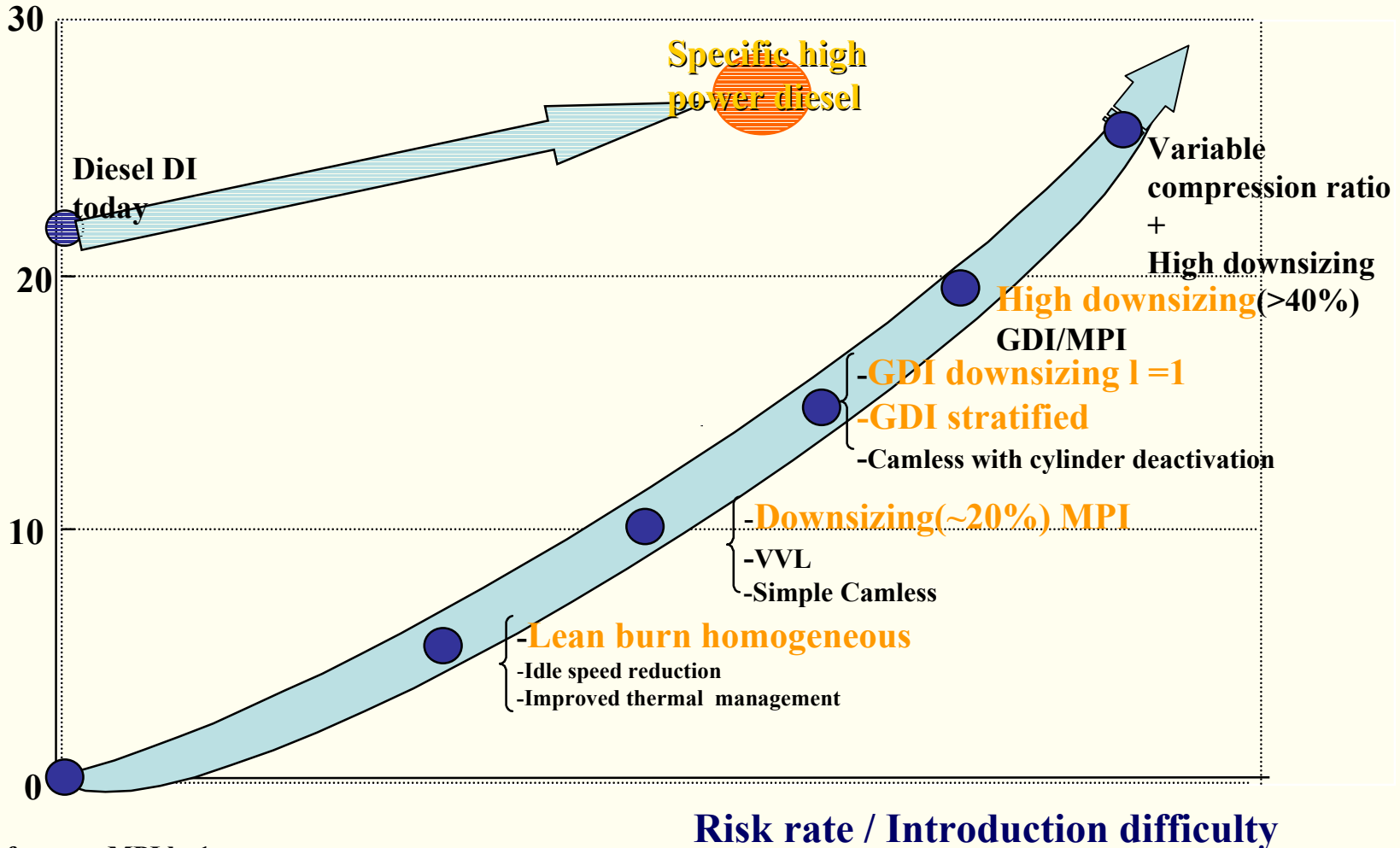
- Higher injection & in-cylinder pressure
- Multi injection

GDI T/C downsized

Time

Candidate technologies : engines

CO₂ reduction(%)



Reference: MPI $\lambda = 1$

Candidate technologies : transmissions

- Increased gearset spread ratio
 - 6 speed Manual & Automatic Transmission
 - Continuously Variable Transmission
- Powertrain adjustment
 - Adaptive control transmission ("Pro active")
 - Infinitely Variable Transmission
- Efficiency improvement
 - The automatic "manual" transmission
from the today add-on module to the twin clutch

Candidate technologies : hybrids

Function	NMVEG	Japan 10-15 mode	Customer Cycle (INRETS)
Stop & Start	3 %	10 %	1%
Stop & Start + Brake & Boost	12* %	22* %	8* %
Stop & Start + Brake & Boost + Electric drive	18* %	34* %	13* %

* With downsizing

Hybrids challenges :

- Electrotechnics components cost including batteries
- Batteries durability

Candidate technologies

- **Non conventional fuels**

LPG, CNG, Fischer-Tropsch, ...

- **Non-conventional powertrains**

Fuel cell

We have to apply the well to wheel assessment to
CO₂ emission

Conclusions

- GHG =global effect -> worldwide agreement
- 80% cars = 20 % people -> CO2 will increase
- No technical miracle -> combination of actions

Car transportation ~ 15 % CO2

But to fight against the greenhouse effect is, for the car industry a duty of precaution and a political and ethical necessity even if we don't really know the real long-term effects