PSA PEUGEOT CITROËN

Driving into the Low carbon Economy

Short & Medium Strategy of a European Vehicle Manufacturer

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Climate Change Solutions
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A Major Global Automobile Manufacturer

- 3,286 million vehicles sold worldwide in 2003
  - ➢ + 0,6 % compared to 2004

- Europe's second-largest carmaker
  - ➢ 15.4% of the market in 2003

- 2003 sales of €54.2 billion

- 200,000 employees worldwide

- 2,250 millions € of R&D expenditure (5,2 % of the Automotive sector turnover)

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Bold, Realistic and Effective

Engine Technologies

For today and into the future

- ## Technology programs for 2003-2006

  - ➤ Diesel engines:

    - • Common rail direct injection (HDi)

    - • Particulate filter system

  - ➤ Gearboxes

  - ➤ Hybrids

  - ➤ Natural Compressed Gas for Vehicles

  - ➤ Gasoline engines

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In 1998, we launched large-scale production of the **Common Rail High-Pressure Direct Injection (HDi) engine**

➢ 20% reduction in fuel consumption and CO_2

➢ Pollutant emissions cut in half

➢ Exceptional driving pleasure
(low noise level, torque and availability)

➢ Compatible with the most modern
depollution equipment
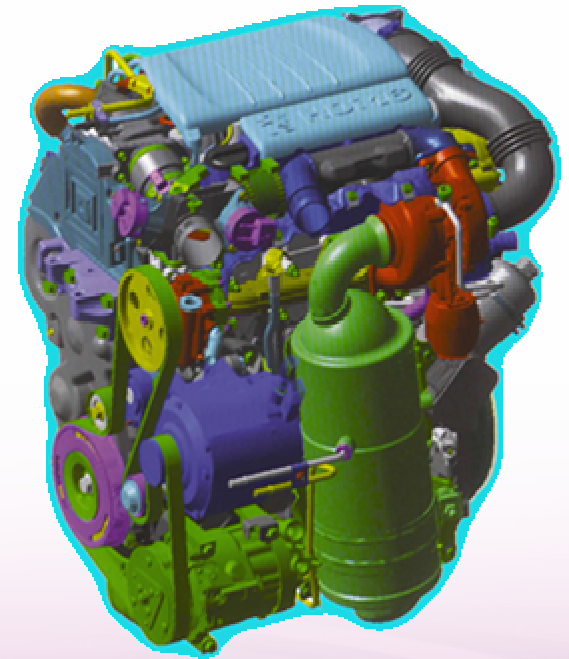
High technology that combines driving pleasure, fuel efficiency and environmental protection

HDi engine

PSA Peugeot Citroën will continue development of the most effective powertrain for abating the greenhouse effect

- New development phase for HDi engines:
  - Even better fuel efficiency
  - Higher injection and combustion pressure

- Continued expansion of HDi diesel engines:
  - 8.5 million diesel-powered vehicles sold by 2006

- Less than 120 g of CO_2 / km driven:
  - Already more than 460,000 vehicles sold to date
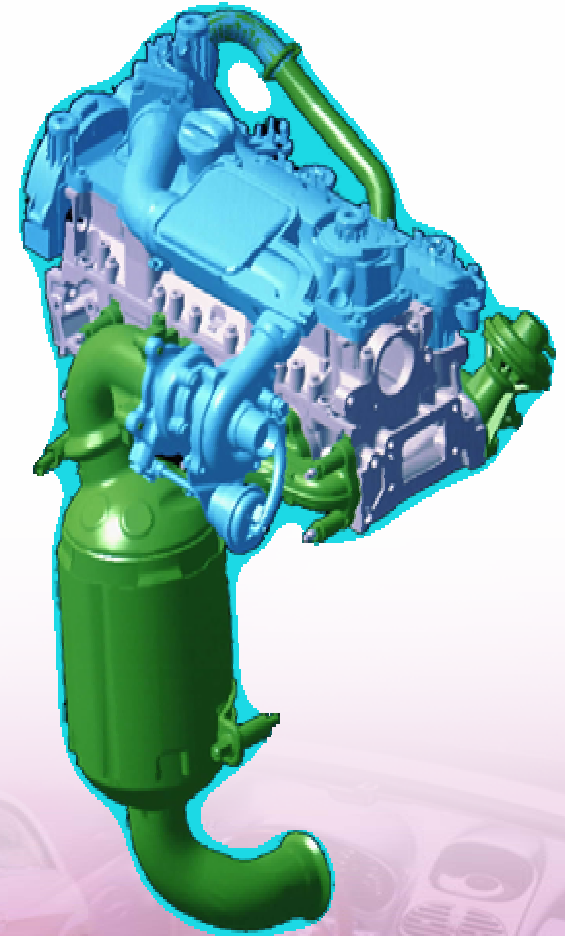 - Cumulated sales of 1.7 million vehicles by 2006

Results

Since 1998:

5 million HDi engines

By 2005:

3 million HDi engines a year

PSA Peugeot Citroën:
The world's leading diesel engine manufacturer

A new generation of Diesel Engines

Two key points
for the next generation
(in cooperation)

➔ Performance
and driving pleasure

➔ Fuel consumption

**HDi 2.0l
136 hp**

Downsizing

**HDi 1.4l
90 hp**

**V6 HDi 2.7l
200 hp**

**HDi 1.6l
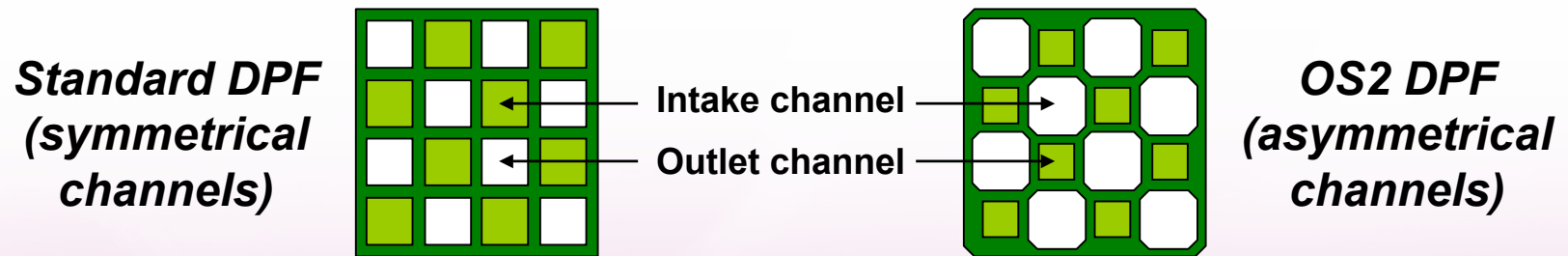110 hp**

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- A technological breakthrough that improves air quality

- Presented in a world first on the Peugeot 607 in 2000

- Applied across the model range
  (Peugeot 407, 307, 807 and Citroën C5 and C8)

- 600,000 vehicles equipped to date

  ➢ A unique world position on the "learning curve"

- Euro 4-compliant technology

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Diesel particulate filter (DPF)

Consolidating our technological leadership

- DPF requiring no servicing for enhanced customer benefits
  - ➢ Additive advances
  - ➢ Octosquare filter medium architecture (developed with Ibiden in partnersh with Ford)

Standard DPF (symmetrical channels)

Intake channel

Outlet channel

OS2 DPF (asymmetrical channels)

- Enhanced environmental effectiveness, deployment across all lines
  - ➢ 1.7 million vehicles equipped in 2006
  - ➢ All vehicles over 100 hp equipped

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- **Useful technology on as many models as possible**

  ➢ Advantages for all customers

  ➢ Maximum environmental leverage for society

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Bringing the comfort of automatic transmissions to more customers

- With two electronically managed manual gearboxes:
  - ➢ SensoDrive, for small and medium-sized engines
  - ➢ The new compact MCP gearbox for mid-range vehicles

- These gearboxes:
  - ➢ Deliver driving pleasure and ergonomics
  - ➢ Offer enhanced fuel efficiency
  - ➢ Cost less than conventional automatic gearboxes

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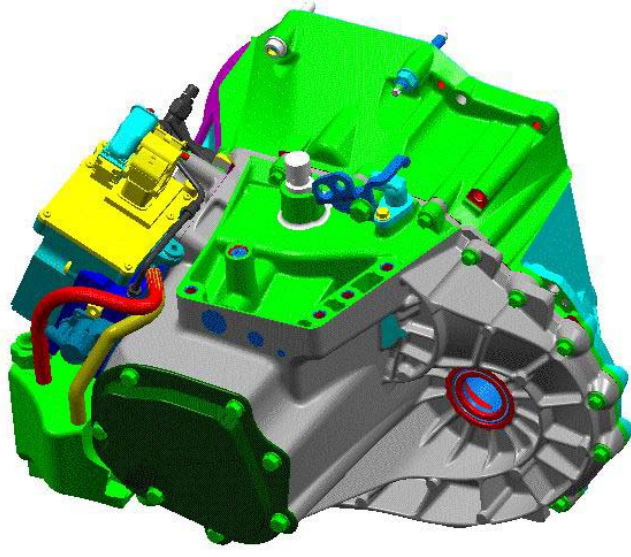## SensoDrive electronically managed gearbox

- Fuel consumption
  - 5% less than with a manual gearbox
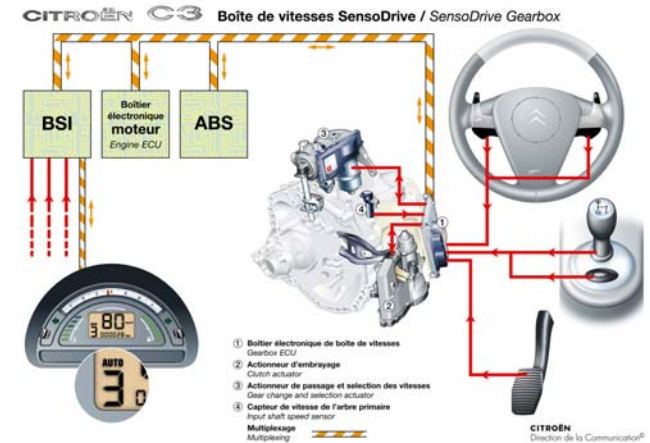
- First introduced on the Citroën C3
  - 650,000 vehicles equipped at end-2006

Electronically assisted compact manual gearbox (MCP)

- Much better driving comfort

- Valenciennes plant in 2005
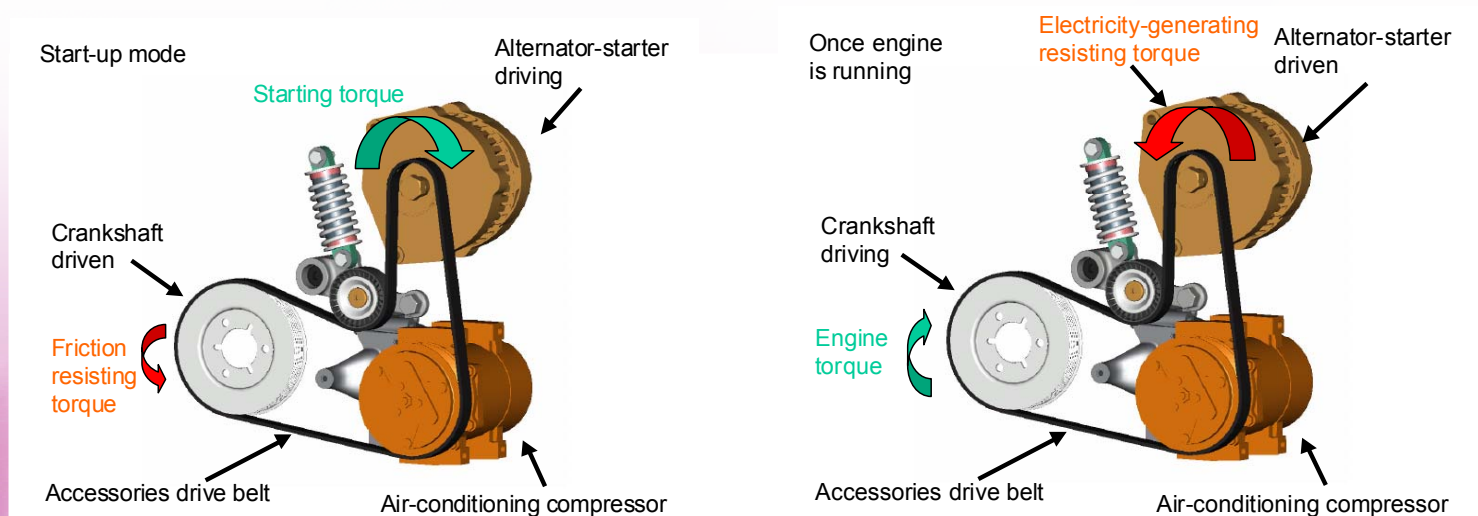
- €430 million investment

- 200 jobs created

5% reduction in fuel consumption on the cycle used for homologation

Stop-and-start: the first level of hybridization available on a large scale

- Operating procedure
  - The powertrain is equipped with an external starter-alternator that can function as either a starter or an alternator
  - Engine can be stopped and restarted when the car is standing still
  - Instant start-up (400 milliseconds) via a dedicated computer

Start-up mode

Alternator-starter driving

Starting torque

Crankshaft driven

Friction resisting torque

Accessories drive belt

Air-conditioning compressor

Once engine is running

Electricity-generating resisting torque

Alternator-starter driven

Crankshaft driving

Engine torque

Accessories drive belt

Air-conditioning compressor

Stop-and-start: the first level of hybridization available on a large scale

- Expected benefits:
  - ➢ Lower fuel consumption and fewer CO_2 emissions (5 to 8%)
  - ➢ Less noise pollution in urban environments

- A technical solution that is well positioned in terms of cost

To be marketed in the second half of 2004, based on the stop-and-start principle

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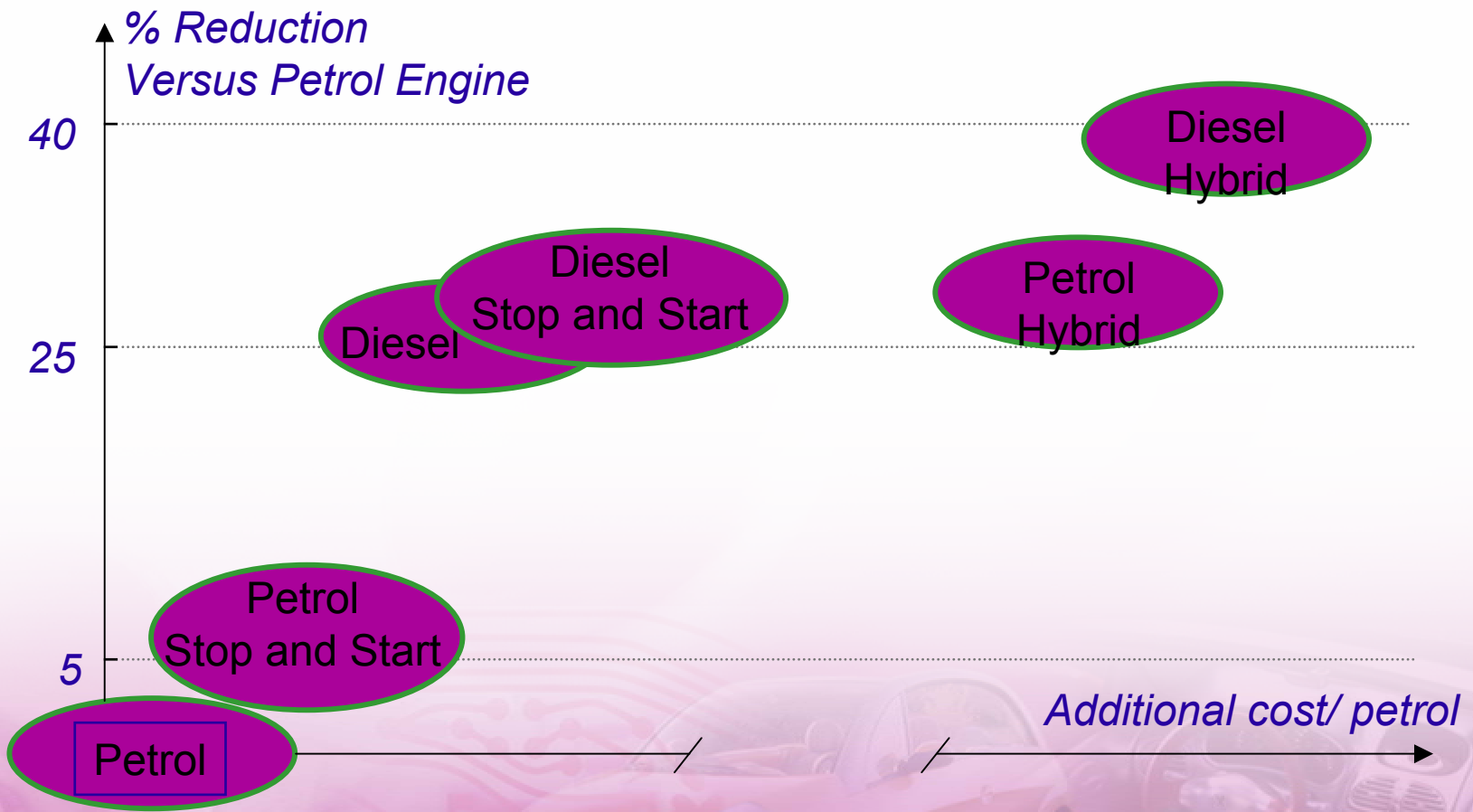
Full Hybrid

- **A research program in the UK**

  ➢ In partnership with Ricardo & QuinetiQ

- **An ambitious goal**

  ➢ Vehicle base : Citroën Berlingo

  ➢ An unique approach : diesel-electric hybrid

  ➢ 100 gr/CO_2/km well to wheel $\leq$ 89 gr/CO_2/km tank to wheel

  ➢ Same performance as an equivalent diesel model

  ➢ A first driving prototype by mid 2005

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Full Hybrid Technology

An economic model to be foun[d]

% Reduction
Versus Petrol Engine

- 40
- 25
- 5

Diesel Hybrid

Diesel Stop and Start

Diesel

Petrol Hybrid

Petrol Stop and Start

Petrol

Additional cost/ petrol

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Cooperation with BMW

Deploy the best gasoline-engine technologies on a large number of vehicles

- **Key technologies**
  - Materials
  - Processes (casting)
  - Direct-injection gasoline engines
  - Turbo compression
  - Electronic management
  - Engine control
  - Intake/exhaust

- **Expected benefits**
  - Lower fuel consumption
  - Fewer emissions
  - Superior pollution control
  - Improved performance

Forecast volumes:
One million units a year

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A natural way to decrease CO_2 emissions

- The best efficiency when blended with fossil fuels

  - Diesel : up to 30 % for FAME (Fatty Acid Methyl Ester) – Diester 30

  - Gasoline : up to 8 to 12 % bio-ethanol from sugar beet or corn

- A highly favourable CO_2 balance sheet

  - CO_2 absorption at source by the plant through photosynthesis

  - FAME = - 2,5 t / CO_2 per ton of diesel replaced

- An interesting application for fleets
  - Caution required with biofuel storage

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Compressed Natural Gas (CNG)
A promising and clean source of energy

- World reserves are of the same order of magnitude as crude oil and geographically complementary to crude

- In some fast emerging markets such as China, an ideal Product-market couple for the future

- Limited to captive fleets due to constraint of distribution

- Already available on commercial vehicles (Boxer and Jumper)

- Will be developed for passenger cars for specific markets (Iran, China) and perhaps later on in Europe (with one dedicated international engine)

A major action of ecological sponsorship

The Peugeot Carbon Sink in Amazonia

- A large scale reforestation programme with three main objectives :

  - Carbon sequestration

  - Reconstitution of the biodiversity

  - Social and economic integration

- A complementary action to our efforts at source on the automotive technology

- A large scale scientific contribution to a better knowledge of the possible relationship between reforestation, carbon sequestration and climate mitigation

Carte de situation
- Parcs nationaux
- Forêt
- Zone de déforestation

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A major action of ecological sponsorship

- A high profile scientific project

- A target of 2 Million tons of CO sequestration (7,3 tons CO_2)

- A long term commitment (100 years)

- A pure sponsorship project

  •No carbon credit claim

  •A tool for the scientific community

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Technological innovation: a growth lever

- Technologies that benefit customers
  - Greater comfort
  - Lower fuel consumption

- Technologies that are beneficial for society
  - Reducing the greenhouse effect
  - Air quality
  - Less noise pollution

- Innovation and series production driven by a passion for the automobile
  - Image
  - Popular products
  - Cost

- A strong commitment towards the environment
  - A major player in the innovation in environmental friendly cars
  - A sponsorship policy focused on forestry carbon sequestration

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