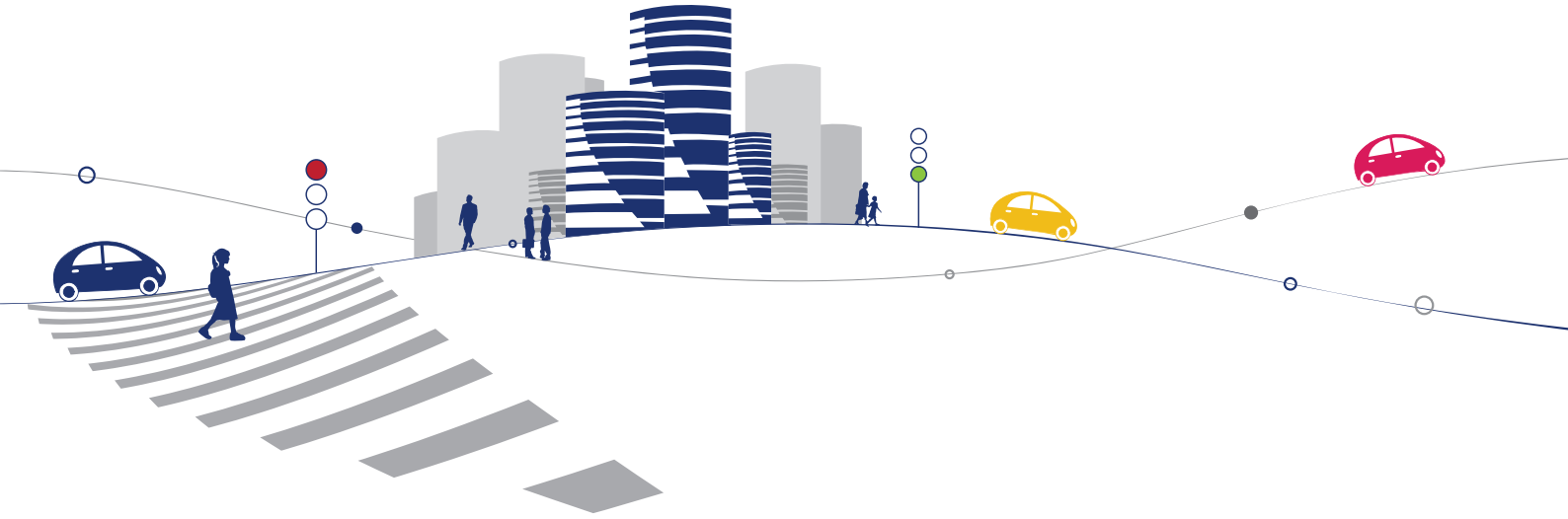
PSA PEUGEOT CITROËN

PRESS
INFORMATION

e HDI



SUMMARY

e-HDi: KEY DATES, FACTS AND FIGURES 01

- KEY DATES
- FACTS & FIGURES

e-HDi: DEFINING CHARACTERISTICS 02

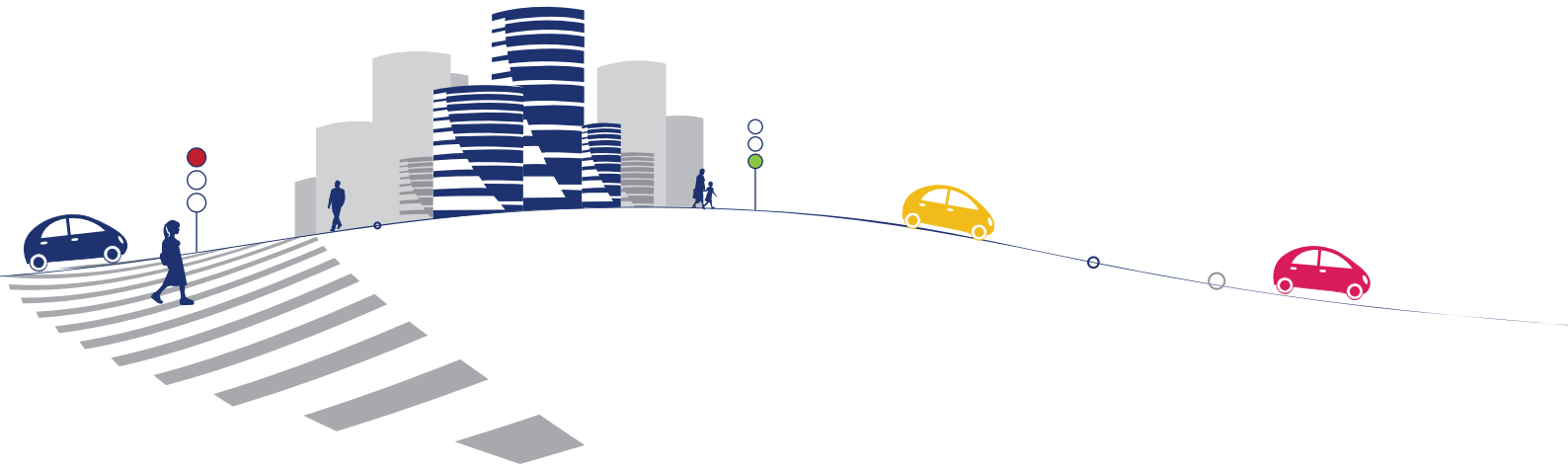
- Fuel efficiency
- Customer benefits

e-HDi: GENERIC SYSTEM ARCHITECTURE 03

- Euro 5 compliant engines: 1.6-litre HDi 68kW/92ch & 82kW/112ch and 1.4-litre HDi 50 kW/70ch
- Valeo second-generation 2.2 kW starter-alternator reversible system (i-StARS).
- Volt Control alternator management system to regenerate energy as the vehicle slows.
- Hybrid battery system

VALEO SECOND-GENERATION **STARTER-ALTERNATOR REVERSIBLE SYSTEM (StARS)** 04

- FACTS AND FIGURES
- BENEFITS FOR THE DRIVER
- OPERATING PRINCIPLE



e-HDi: KEY DATES, FACTS AND FIGURES

KEY DATES

2004

PSA Peugeot Citroën pioneers micro-hybrid stop & start starter-alternator technology on the petrol version of the Citroën C3, followed by the C2.

2010

In a world first, PSA Peugeot Citroën introduces an improved version of the technology on the Euro V-compliant 1.6-litre HDi, the Group's most popular diesel engine.

2010-2013

The e-HDi is deployed in the Peugeot and Citroën line-ups and the 1.4-litre e-HDi engine is introduced.

- Compact, lower and upper mid-range models will be fitted with e-HDi technology.

FACTS & FIGURES

- More than **30 patents** filed for the e-HDi system.
- Total investment: **€300 million.**
- Nearly **500** PSA Peugeot Citroën **engineers and technicians** involved in the project.
- Project lasted **36 months.**
- Objective: **1 million e-HDi vehicles** sold by 2013.
- In 2012, **30 %of HDi engines** will be e-HDi's.
- More than **95 %** of the innovation's value chain is based in France, where both the HDi engine and starter-alternator were designed and are being built.

  - 1.6 HDi Engine (Tremery, Lorraine)
  - 1.4 HDi Engine (Française de Mécanique Douvrain – Pas de Calais)
  - Production sites: i-StARS (machine and electronics) are produced at Valeo's production sites of Etaples and Sablé (France)

e-HDi : DEFINING CHARACTERISTICS

Fuel efficiency

- Fuel efficiency improved by up to **15 %** in city driving.
- CO_2 emissions reduced by around **5 g/km** in the EU test cycle.

Customer benefits

- Engine restarts in just 400ms.
  - Twice as fast as a manual key restart.
  - 30 % faster than with a reinforced starter.

- Completely transparent for the driver, with quiet operation – no noise or vibrations.

- Broad operating range, with engine shut-off and restart while still moving at between 8 and 20 kph depending on the gearbox. System availability guaranteed between -5° and 30° C, with operation possible outside this range.

- Regenerative braking engaged when the foot is lifted from the accelerator, thanks to the Volt Control alternator management system.

- A distinct engine shut-off strategy for each type of gearbox (20 kph for straight manual and 8 kph for an electronic manual, in response to different customer expectations:
  - Drivers who actively manage their fuel efficiency: straight manual gearbox proactively turns off the engine at 20 kph, to maximise carbon gains.
  - Drivers who prefer automatic operation: electronic manual gearbox automatically manages engine shut-off at 8 kph.

- Safe, secure operation
  - Engine-driven assistance and comfort systems remain operative even in shut-off mode.
  - Possibility of overriding the system with a dashboard pushbutton.

e-HDi : GENERIC SYSTEM ARCHITECTURE

Euro 5 compliant engines: 1.6-litre HDi 68kW/92ch & 82kW/112ch and 1.4-litre HDi 50 kW/70ch

- Features specific to the e-HDi: turbo lubrication system, reinforced injection pump and crankshaft bearings, sealed air distributor, reinforced dual mass flywheel (DMF).

Valeo second-generation 2.2 kW starter-alternator reversible system (i-StARS).

- Durability: 600,000 restarts.
- Delivers 70 % more torque than the previous generation.
- Integrated power electronics.

Volt Control alternator management system to regenerate energy as the vehicle slows.

Hybrid battery system:

- L3 70 AH type sealed 12V battery.
- E-Booster system with 5 volts of stored super capacity power and power electronics, to:
  - Boosts the battery to drive the reversible alternator at start.
  - Support vehicle electrical voltage at start.

VALEO SECOND-GENERATION STARTER-ALTERNATOR REVERSIBLE SYSTEM (StARS)

FACTS AND FIGURES

- Machine length (from pulley 1st groove to cover): **156 mm**
- Weight: **7,5 kg**
- Torque at **50 rgm** in N.m (6mW battery, 25°): **53N.m.**
- Electrical output: **180 Amps**
- Durability: **600 000** restarts during lifetime
- Protected inventions: **124**
- Production sites: i-StARS (machine and electronics) are produced at Valeo's production sites of Etaples and Sablé (France)

BENEFITS FOR THE DRIVER

- Up to **15 % fuels** savings in crowded cities for the client
- The engine **stops and restarts automatically**, in 400 milliseconds.
- The engine restarts **completely silently**,
- High availability of the stop-start function (from -5°C till +30°C) and longer stop phases thanks to the "mind change" function: the engine can be restarted in the process of stopping, if for example, the driver unexpectedly changes his or her mind

OPERATING PRINCIPLE

The StARS solution combines the alternator and starter functions. As a starter, it starts the engine instantly and silently using the alternator belt. This allows the machine to start the engine silently and without vibrations in less than 0.4 seconds, before immediately switching to alternator mode.

The StARS starter alternator is a synchronous machine using three-phase current. The rectification of the alternator current to battery current (AC/DC) is realized with so-called field-effect transistors instead of diodes, which gives an excellent efficiency at >77% (VDA measurement), or 10 points higher than a traditional alternator and thus allows additional fuel savings, independently from the engine stop phases.

The starter-alternator is driven by the front-end accessory belt. A reversible tensioner allows power to be transmitted in both directions, depending on whether the StARS starter alternator is working as a starter or an alternator.