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RENAULT'S POWERTRAIN RANGE: A CLEAN BREAK IN TERMS OF CO₂ EMISSIONS

Renault knows that radically curbing fuel consumption and CO₂ emissions is vital in today's world. The brand already figures among Europe's three best-performing carmakers when it comes to average CO₂ emissions, and **its sights are now set on moving to the top of the order**. To achieve this objective, Renault is currently working on the development of low-emission and zero-CO₂ emissions vehicles in a determined bid **to introduce as many effective technologies as possible at an affordable price**. Its work on **powertrains** focuses on **two main areas**:

- **An unprecedented commitment to the development of electric motors:** **all-electric vehicles** do not produce any CO₂ emissions resulting from their use on the road. Renault is aiming to become the industry leader in the realm of **mass-market electric vehicles**. The Renault-Nissan Alliance is consequently developing a **comprehensive range of all-electric powertrains**, with power outputs ranging from 50 to 100kW (70 to 140hp).
- **New technologies for conventional engines.** Renault is working on a new generation of turbocharged internal combustion engines, as well as on new automatic transmissions.

- **'Modular' TCe engines, with power outputs ranging from 90 to 115hp**

With the imminent switch to Euro 5 and Euro 6 legislation, petrol engines are poised to become an increasingly attractive proposition, a trend anticipated by Renault's new **TCe** powerplant family. Scheduled for launch in 2012, it is expected to account for 85 per cent of Renault's petrol engine sales in 2015. These 'modular' engines will have a cubic capacity of between 0.9 and 1.2 litres and will be available in three- and four-cylinder form with power outputs ranging from 65 to 85kW (90 to 115hp). A number of vehicles equipped with these engines will emit less than 100g of CO₂/km.

- **The future 1.6 dCi 130 engine**

The forthcoming 1.6-litre engine will boast a power output of 96kW (130hp) from launch. It is being co-developed within the framework of the Renault-Nissan Alliance and is scheduled for release in 2011. Its CO₂ emissions will be 25g/km lower than those of a current 1.9-litre diesel.

- **Twin-clutch transmission**

Renault will be in a position to release a twin-clutch transmission on the market in the course of the next year. Twin-clutch transmissions combine exemplary gearshift quality with lower CO₂ emissions for the same fuel consumption as that of a manual gearbox.

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RENAULT'S POWERTRAIN STRATEGY

CO₂ emissions: targeting a number one ranking in Europe

In Renault's view, respecting the environment stands out as the key challenge to which the automobile industry needs to rise if it intends to survive in the long term. It is today vital to radically curb the fuel consumption of vehicles, while at the same time endeavouring to obtain zero CO₂ emissions within the shortest timeframe possible. Renault believes it is essential to ensure that as many customers as possible have access to the most efficient technologies at an affordable price.

In 2008, Renault figured among Europe's three best-performing carmakers with regard to average CO₂ emissions. Compared with 1995, Renault's average CO₂ emissions have come down by 25 per cent, while in the same 14-year period its vehicles have also become safer and quieter. Renault's intention today is to become Europe's number one carmaker in the realm of CO₂ emissions. To achieve this, the group is focusing on two main areas:

- **An unprecedented commitment to the development of electric motors** as a breakaway technology. All-electric vehicles produce zero CO₂ emissions on the road.
- **New technologies for conventional engines and transmissions** targeting a significant reduction in CO₂ emissions.

AN UNPRECEDENTED COMMITMENT TO THE DEVELOPMENT OF ELECTRIC MOTORS

A technological clean break

Renault is working actively on mobility solutions aimed at marking a clean break in terms of CO₂ emissions compared with solutions that propose CO₂ reductions of 10, 20 or 30g/km,. This major project involves the development of all-electric vehicles, a form of transport which produces no CO₂, no polluting emissions and no noise. Renault's target is to become the leading producer of mass-market electric vehicles.

All-electric vehicles: an inevitable answer

Renault's commitment to the development of electric vehicles is due to a number of factors:

- **Awareness of the role CO₂ emissions play in global warming,**
- **Toughening legislation aimed at curbing CO₂ emissions,**
- **Oil price increases,**
- **A growing need for urban mobility** and the potentially significant market in Europe, due notably to motorists who primarily use their vehicle on a daily basis to get to and back from work; in other words urban commuters for whom electric vehicles are a workable solution,

- **A grasp of lithium-ion battery technology** within the Renault-Nissan Alliance thanks to Automotive Electric Supply Corp (AESC), a joint venture involving Nissan and NEC. Significant progress has been made concerning lithium-ion batteries in terms of energy density, safety, durability and cost reductions. This work has led to the possibility of developing attractive, pleasant-to-drive electric vehicles with sufficient range,
- **The development of new consumer patterns** (monthly subscriptions, pay as you go schemes, etc.) which already operate in numerous sectors and which can be carried over to the automobile.

The development of a comprehensive range of all-electric powertrains

The Renault-Nissan Alliance is developing a comprehensive range of all-electric powertrains which **will cover a power range of between 50 and 100kW (70 and 140hp)**. These powertrains are intended for a wide range of vehicle categories, from city cars and family saloons, to small and large vans. The first vehicles to feature all-electric powertrains will be a three-box saloon and a Kangoo-type van as early as 2011.

That said, electric vehicles are not destined to replace all vehicles on the road. Thanks to their versatility and to advances due to be introduced over the coming years, internal combustion engines will continue to stand out as a valid solution for many customers.

NEW TECHNOLOGIES FOR CONVENTIONAL ENGINES AND TRANSMISSIONS

In its bid to achieve significant reductions in CO₂ emissions, Renault is working concurrently on:

- **Fundamental vehicle design parameters:** mass, aerodynamics (CdA), rolling resistance,
- **Efficient management** of electrical energy (battery recharging under braking and when decelerating) and thermal energy (to speed up the climb in engine temperature),
- **Transverse technologies**, including 'stop & start' which automatically cuts the engine when the vehicle is at a standstill,
- **Widespread downsizing of internal combustion engines** (smaller turbocharged engines are more efficient). This work covers both petrol and diesel powerplants, although the greatest scope for reducing CO₂ emissions concerns petrol engines.
- **More efficient manual and automatic transmissions.**

The latter two points in greater detail...

The future 'modular' TCe engine range

Renault is speeding up its work on downsized petrol engines

The challenge faced by petrol engines is to deliver significantly enhanced energetic efficiency, in particular when motoring in built-up areas. Downsizing and turbocharging are two very effective solutions, as illustrated by the TCe 100 which was launched two years ago and which has emerged

as a pioneer in its class (1.2 litres). Powered by this engine, Renault Clio boasts the lowest CO₂ emissions of its class (i.e. 100hp petrol engines), namely 137g/km, equivalent to combined cycle fuel consumption of 5.8 litres/100km.

To maintain the competitive edge its petrol engine range enjoys, and to achieve further significant reductions in CO₂ emissions, Renault is developing a family of 'modular' TCe engines.

The future 'modular' TCe family (90 to 115hp)

With the imminent switch to Euro 5 and Euro 6 legislation, petrol engines are expected to become an increasingly attractive proposition, a trend anticipated by the new family of three- and four-cylinder TCe engines. Based on a range of cubic capacities extending from 0.9 to 1.2 litres, they will replace the current normally-aspirated engines in the 1.2- to 1.6-litre bracket. These new engines, which will feature a low inertia turbocharger, will focus on power outputs of between 65 and 85kW (90 and 115hp). Renault will go on to develop more powerful versions. The basic design of these engines will permit the use of direct fuel injection and will enable even higher specific power outputs. CO₂ emissions will be cut by between 30 and 40g/km compared with the engines they replace, and certain vehicles will be able to claim CO₂ emissions of less than 100g/km.

The first of these engines will be launched within the next two-and-a-half years, and Renault estimates that these powerplants will go on to account for some 85 per cent of the petrol engines it markets in Europe.

This family of modular engines is being developed within the framework of the Renault-Nissan Alliance, an approach which permits capital outlay to be shared and economies of scale to be achieved, while also allowing the development of powertrains that meet the specific needs of different regions. Renault are bringing its understanding of the European market and experience of turbocharging to the table.

The future dCi range: an all-new engine

The advantages of dCi engines

Turbocharged four-stroke diesel engines equipped with common rail direct fuel injection currently stand out as the most energy-efficient solution for use in passenger cars. On average, diesel engines consume between 20 and 30 per cent less fuel than a petrol engine of an equivalent level of performance.

The range of dCi engines currently boasts first class results with regard to CO₂ emissions. For example:

- Renault Twingo dCi 85 claims 104g of CO₂/km (equivalent to combined cycle fuel consumption of 4.0 litres/100km).
- New Renault Mégane Hatchback emits 118g of CO₂/km (equivalent to combined cycle fuel consumption of 4.5 litres/100km).
- Laguna dCi 110: 130g of CO₂/km (combined cycle fuel consumption of 4.9 litres/100km).

Renault's engineers intend to maximize the benefits of dCi technology thanks to evolutions aimed at enabling them to comply with upcoming emissions standards and making them even more fuel efficient. Numerous vehicles powered by these new-generation dCi engines will be able to claim CO₂ emissions of less than 100g/km.

New generation 1.5 dCi engines

The 1.5 dCi (Type K9K) has a special place within the diesel range, since it is the most commonly sold Renault engine, with sales in 2008 of almost 900,000 units manufactured at Valladolid (Spain) and Bursa (Turkey). Available in several versions delivering different power outputs which currently extend from 65 to 110hp, the 1.5 dCi equips several Renault models (from Twingo to Laguna) and Dacia models. Its simple design and low friction make it a **particularly attractive engine in terms of the performance it delivers for its price.**

Renault plans to develop in-depth modifications to this 1.5-litre, four-cylinder powerplant which is expected to emit approximately 20g/km less CO₂ when introduced from 2012.

The future 1.6 dCi 130 engine

This all-new 1.6 litre engine will boast peak power of 96kW (130hp) from launch. This represents a 16 per cent reduction in cubic capacity compared with a current 1.9 litre diesel engine of the same power output. Renault will go on to develop more powerful versions. CO₂ emissions will be reduced by 25g/km compared with an equivalent engine, independent of improvements made to the vehicles it equips in fields such as aerodynamic performance, rolling resistance, mass, etc. It will be Euro 6-ready and is covered by 15 Renault patents. This engine will form the core of the brand's C-segment line-up and will also play key roles in its D-segment and van ranges. Its launch is scheduled for 2011. This project, codenamed R9M, is a Renault-Nissan Alliance joint development.

2.0 dCi engines and beyond

The new-generation 2.0 dCi engine (Type M9R) is due to be released in 2012. In the meantime, Renault will carry over its downsizing policy to cover utility vehicles with the replacement of its current 2.5-litre engines by a 2.3 dCi unit featuring the same genetic make-up as the 2.0 dCi.

The V6 dCi (Type V9X) will continue to equip the group's upper-range models.

Automatic transmissions

Twin-clutch transmission

Conventional automatic transmissions tend to place the emphasis on gearshift quality rather than fuel consumption. The development of new automatic transmissions sees Renault pursue two objectives:

- Improved mechanical efficiency compared to that of a conventional automatic transmission (with hydraulic coupling) thanks to technologies carried over from manual gearboxes.

- profit from the ability of automatic transmissions to permit an engine to run at the most energy-efficient revs with a view to obtaining fuel consumption performance on a par with that of manual gearboxes.

Renault is poised to release a twin-clutch transmission within the next year. Twin clutch transmissions enable gears to be changed without interrupting the transmission of torque. Twin-clutch transmissions also combine ride comfort (no jarring during gearshifts, no loss of traction) with CO₂ emissions identical to those of a manual gearbox (a reduction of 15 per cent compared with conventional automatic transmissions).

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