



Toyotas 100mpg Car Of The Near Future

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The ES3 is a four-seat, lightweight vehicle that combines many of Toyota's innovative environmental technologies, aimed at achieving low emissions, easy recycling and an ultra-high-fuel efficiency of 104.6mpg (2.7l/100km) in the EC test cycle.

To achieve optimum fuel economy, Toyota kept the ES3's kerb weight down to 700kg by adopting a body made largely of aluminium and resin, and employed an exterior design with outstanding aerodynamic characteristics that allow for a Cd value of 0.23.

The powertrain comprises a turbocharged 1.4-litre direct-injection diesel engine combined with a continuously variable transmission (CVT). An "idling stop" mode, which automatically shuts off the engine when the vehicle is stopped, and regenerative braking technology – both honed through Toyota's development of hybrid vehicles – have been included to achieve higher efficiency.

For cleaner emissions, the ES3 is equipped with the Diesel Particulate-NOx Reduction System (DPNR), a new catalytic converter technology. DPNR will feature on regular production cars from Toyota in the near future.

The car's high recyclability comes from the use of improved Toyota Super Olefin Polymer (TSOP) and biodegradable plastic, among other advanced materials and processes, greatly reducing the amount of substances of environmental concern.

TOYOTA ES3 IN DETAIL

City street, country road or open highway – ES3 takes being fun to drive to new environmental horizons.

- Advanced prototype concept
- Key technologies for the future
- Reduced fuel consumption, clean exhaust emissions & reduced weight
- Stop & Go powertrain management
- Future recycling technologies

Toyota today reveals first details of its new multi-scene car concept, ES3, designed to transport four adults along the city streets, country roads and highways of the 21st century in comfort with greatly reduced effect on the environment. ES3 stands for Eco Spirit cubic. Its purpose is to reflect Toyota's multidirectional approach to creating sporty and fun-to-drive environment-friendly vehicles.

ES3 is a showcase of key technologies for the near future - all of which are achievable now through the application of intelligent engineering.

Specific targets for ES3 are:

- fuel consumption of 104.6mpg (2.7 litres/100km) within EC mode
- kerb weight reduction to 700kg
- emission levels equivalent to Euro Step IV emissions standards for petrol-powered vehicles
- implementation of future recycling technologies

Although still an advanced prototype, ES3 represents a practical solution to caring for the environment, while keeping driving fun. By size, it is similar to vehicles found in today's European sub-B (city compact) segment. But by performance...well, get ready for a totally exhilarating small-car experience.

Economical Powertrain

- 1.4-litre common rail diesel
- CVT (continuously variable transmission)
- Stop & Go powertrain management
- Regenerative braking system

The key to ES3's outstanding fuel economy is a highly efficient powertrain, combined with a light and aerodynamic body. ES3 uses a 1.4-litre, direct-injection, common-rail diesel engine with turbocharger and charge-air intercooler, mated to a continuously variable transmission. The common-rail system is electronically controlled to deliver reduced emissions and lower noise and vibration levels. Further reduction of friction loss and the adoption of a variable geometry turbocharger also make for better fuel efficiency and excellent driving performance.

The newly developed CVT, with a torque converter, contributes to ES3's class-leading fuel efficiency. It also helps keep emissions low and adds to the enjoyable driving performance. This is made possible through a highly integrated electronic control system that links the CVT to the ES3's high-efficiency diesel engine. The torque converter is equipped with a lock-up torsional damper that has a wide effective range of angles.

It delivers superior torsional characteristics and makes it possible to minimise the torsional resonance frequency of the vehicle. It also allows lock-up at lower vehicle speeds, contributing to further improvement in fuel efficiency.

A Stop & Go powertrain management system turns the engine off when the vehicle is stationary in traffic and provides instant restart. When in "idling stop" mode, the brakes are controlled by a function that prevents the vehicle from rolling back when stopped facing up a slope.

A braking energy regenerating system, one of Toyota's key hybrid technologies, is used to convert vehicle deceleration energy to electric energy for storage in a capacitor. The stored electric energy is used for auxiliary electric loads and for restarting the engine. This system allows for reduced engine workload in generating the required volume of electricity, thus, providing further reduction in fuel consumption.

The ES3 has a fuel consumption rate of 104.6mpg (2.7 litres/100km) and CO₂ emissions of 71g/km. The vehicle is equipped with the Toyota Diesel Particulate-NO_x Reduction System (DPNR)

for further reduction of harmful emissions. DPNR and the use of fuel containing less than 10ppm of sulphur puts ES3's emissions at levels equivalent to those needed to meet Euro Step IV standards for petrol-powered vehicles.

Light, aerodynamic body

- Aluminium body and plastic panels
- Reduced weight components and seats
- Drag coefficient 0.23

The kerb weight of 700 kg is achieved through the use of a strong, but light aluminium body with plastic outer panels. These plastic panels include the back door window, rear floor, radiator supports, side panels of the front and rear wings, bumpers and fuel tank.

Further weight reduction is achieved by intelligent design of interior components, such as the instrument panel and heater modules. Front seat frames are made from magnesium alloy and seat cushion weight has been reduced.

Weight has been taken out of a wide range of components including items such as brake callipers, suspension parts, wheels and brakes. The front suspension adopts a fourth-generation lightweight bearing structure and an aluminium lower arm with an integrated ball-joint structure that does not require machining. The rear suspension is of the torsion beam type, with an integrated structure made of thin stainless steel plates. Front brakes use aluminium callipers and cast iron-aluminium hybrid disc rotors, while rear brakes employ aluminium wheel cylinders and Metal Matrix Composite (MMC) drums.

Narrow, large-diameter 145/70R15 tyres, incorporating low rolling resistance technology, are also used

ES3 is very aerodynamic with a target drag coefficient of Cd0.23, even with a compact vehicle length of only 3.52 metres. The front features an optimised cooling intake and a special bumper configuration that flows smoothly to the body side and bottom. The roofline flows gently downward to the rear, while the rear sides narrow, forming a sheer back.

The floor height is raised to increase the amount of airflow under the car and the underfloor surfaces have been smoothed to increase airflow speed. An optimally raised rear floor provides great improvement of airflow convergence at the rear end of body. In addition, an optimally shaped rear under spoiler, bracket type door mirrors, flat wheel covers and the shape of the rocker covers all contribute to outstanding aerodynamics and exceptional stability at high speeds.

Recycling

In developing ES3, all aspects of recycling were taken into full consideration. Special emphasis was placed on the development of materials that are acceptable to a variety of recycling methods. Materials with even greater recyclability than highly recyclable Toyota Super Olefin Polymer (TSOP) have been used in the bumpers and outer panels.

As a new type of material for interior use, Toyota developed a biodegradable plastic made from starch extracted from sweet potatoes and other plants. This plastic was combined with natural fibres for use in the ES3's pillar garnish and other interior parts.

The ES3 is free of polyvinyl chloride (PVC), even in its wire harness covers. Also the usage of

substances that place a burden on the environment have been kept to the absolute minimum level, for example, by reducing the amount of lead used in light bulbs, paint and other items, the result is a significant decrease in the amount of lead used for the vehicle.

ES3 Specifications

- Length x width x height (mm) - 3,520 x 1,630 x 1,460
- Engine - In-line 4-cylinder direct-injection 1.4-litre diesel turbo
- Transmission - CVT (continuously variable transmission)
- Powertrain - 2WD (FF)
- Seating capacity - 4

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