

# Auris with Hybrid Synergy Drive<sup>®</sup> and the Environment





The new Auris Hybrid is the first roll-out of full hybrid technology to a core model in the Toyota Europe line-up. I would like to expand full hybrid technology to the many customers who are truly environmentally conscious but do not want to stand out. For this reason, the price is also affordable.

Toyota's full hybrid powertrain will offer the Auris Hybrid customer a smooth and sophisticated, relaxed and stress-free driving experience entirely unique to the C-segment. In addition, the Auris full hybrid boasts class-leading fuel consumption figures of just 3.8 l/100 km in the European homologation combined cycle and CO<sub>2</sub> emissions of only 89 g/km, unmatched by any other C-segment car.

I hope the Auris Hybrid will deliver satisfaction to many customers.

Shinichi Yasui  
Chief Engineer, Auris with Hybrid Synergy Drive®  
Toyota Motor Corporation



Our story is built around Hybrid Synergy Drive®, our core technology which is the most tangible sign of Toyota's commitment to sustainable mobility.

By adding a full hybrid powertrain to Auris, we are making the benefits of our Hybrid technology available to more considerers in the heart of the market – both private and fleet.

Auris Hybrid customers want a high-tech, contemporary family car – one that delivers exceptionally low running costs, emissions and fuel consumption, without looking different.

Leading the way, the new Auris Hybrid is another full hybrid, providing full customer satisfaction.

Andrea Formica  
Senior Vice President  
Toyota Motor Europe



Toyota Manufacturing UK is a model sustainable plant for Toyota in Europe which minimises the use of natural resources and is in harmony with its natural surroundings.

We are very proud to be the first manufacturer to produce a full hybrid vehicle in Europe.

Environment is a pre-requisite to all our operations and is at the heart of everything we do. Through all of our environmental activities we aim to become a truly eco plant, with eco employees building eco cars.

Katsunori Kojima  
Managing Director  
Toyota Motor Manufacturing (UK) Ltd

## Scope. How is the environmental impact of Auris with Hybrid Synergy Drive® (HSD) measured and improved?

This document follows the complete Life Cycle Thinking for Auris Hybrid, using the Life Cycle Assessment tool and employing ISO 14040-series methodology throughout.

**Life Cycle Thinking** is a process which takes into account all resources consumed and the environmental/health pressures associated with the whole life cycle of a product; 360° approach from design through production, driving and finally recycling.

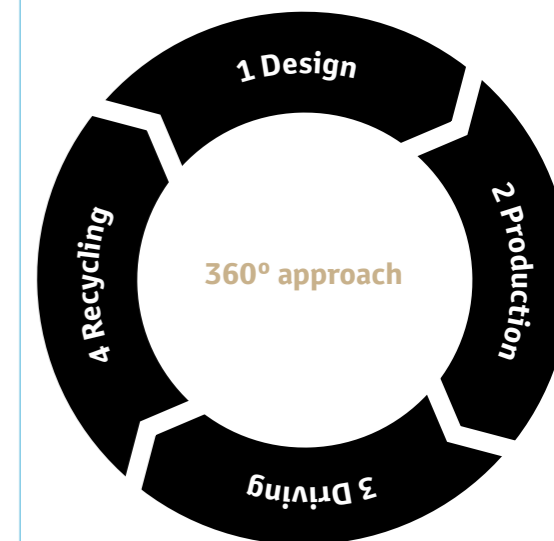
**Life Cycle Assessment (LCA)** is the methodology used to support Life Cycle Thinking: first by quantifying the data, and secondly by assessing the environmental/health impacts of a product through its whole life cycle, in order to identify environmental benefits and potential areas for improvement.

In other words, the objective is to discover how much we have improved the new generation product in comparison to the previous one. We then ensure that all the findings are integrated into new product design and development.

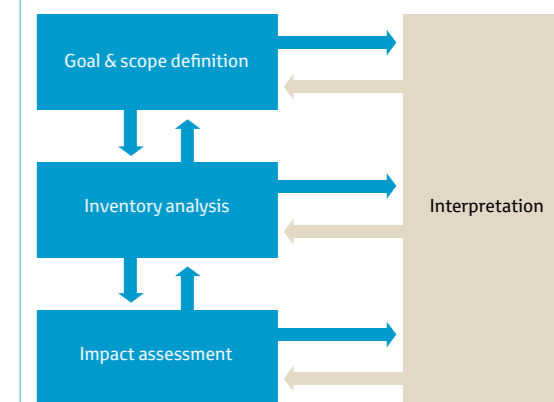
### ISO 14040-series methodology

An International Organisation for Standardisation guideline that describes the principles and framework for Life Cycle Assessment of a vehicle's overall environmental impact.

Life Cycle Thinking



Life Cycle Assessment framework



## 1. Design. What role does design play in the environmental performance of Auris Hybrid?

The findings from our Life Cycle Assessment process are applied at the design development stage. Every design detail is analysed to ensure the lowest possible environmental impact throughout the vehicle's lifespan. This meticulous approach to design has led to an array of innovative features that each contribute to environmental efficiency. These include lightweight design and the conservation of resources, like the application of recyclable plastics (TSOP) and the use of recycled material.

### Conservation of resources

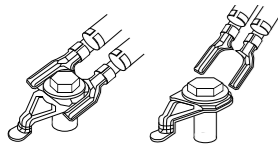
#### Easy-to-dismantle mark

In order to simplify the dismantling process, Toyota designed an easy-to-dismantle mark. This mark is added to vehicle parts clearly indicating certain points that assist in initial dismantling, such as the positions at which large resin parts can be easily separated and the locations at which holes can be drilled for removing fuel.



#### Easy-to-dismantle vehicle structure

A structure has been designed that allows the wire harness to come apart like a pull-tab at the grounding terminal when the wire harness is pulled hard for removal. This structure allows dismantlers to recuperate the wire harness easily, facilitating the recycling of the materials applied.



#### Recyclable plastics (TSOP)

We recycle as many parts of our vehicles as possible. Our own specially developed recyclable plastic called Toyota Super Olefin Polymer is a thermoplastic resin which has better recyclability than any conventional reinforced composite polypropylene.

TSOP is created using our groundbreaking molecular design technology based on new and innovative crystallisation theory.

#### Recycled material

In a market where the price of raw materials is increasing constantly, Toyota, in co-operation with its suppliers, integrated 17.3 kg of recycled plastic materials, including sound-proofing products.

#### Lightweight and compact

As Auris Hybrid includes many additional safety devices, lightweight design was applied in order to reduce the overall vehicle body weight. 90%\* of the full hybrid drive components have been redesigned to create a 20%\* lighter, more compact system. This results in better fuel consumption.

\* Compared to the second-generation Prius.



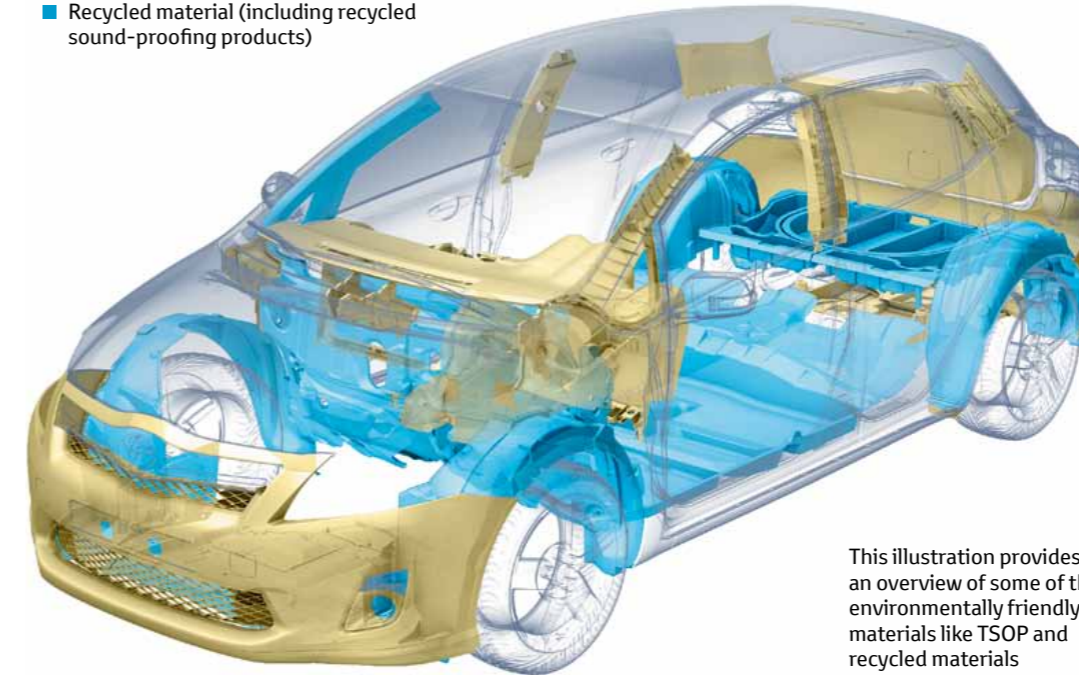
#### Energy-saving technology at the use phase



**Air conditioning**  
18% less energy

#### Conservation of resources

- Toyota Super Olefin Polymer (TSOP)
- Recycled material (including recycled sound-proofing products)



This illustration provides an overview of some of the environmentally friendly materials like TSOP and recycled materials used in the construction of Auris Hybrid.

#### Material composition

Based on vehicle weight.

	Auris petrol	Auris diesel	Auris Hybrid
<b>Steel &amp; iron</b>	64%	65%	62%
<b>Light alloys</b> (aluminium, magnesium, ...)	9%	10%	9%
<b>Non-ferrous</b> (excl. aluminium, magnesium, ...)	2%	2%	5%

**Aluminium features include**  
engine hood, front bumper reinforcement, engine head and engine block.

## 2. Vehicle production. How is environmental efficiency ensured during production?

The Toyota Motor Manufacturing UK (TMUK) plant, which produces Auris Hybrid, is one of the factories striving towards sustainable manufacturing with the concept of a 'plant that fully utilises natural resources while existing in harmony with the natural environment'. By continuously implementing new measures at TMUK, per year over 100,000 m<sup>3</sup> of waste water is reused. Additionally, in 2003 the plant achieved its goal of zero waste to landfill. TMUK was the first UK automotive plant to be awarded the Environmental Management System ISO 14001 for all its operations back in 1996, a green standard we are extremely proud of. From 2004 onwards, TMUK received several awards for its excellent environmental performance.

TMUK plant



Eco factory efficiency TMUK plant	
1993-2008 (reduction percentages per vehicle produced)	
Energy usage reduction	70%
Waste reduction	63%
Water consumption reduction	74%
Volatile organic compound reduction	75%

Two TMUK associates (the first outside Japan) have become certified Energy Saving Team trainers, specialising in the investigation and implementation of energy-saving measures.

One initiative has resulted in a CO<sub>2</sub> saving of 723.3 tonnes per year. This was achieved by modifying the temperature control units of the chillers in the paintshop.

### Environmental Management System ISO 14001

Specifies the actual requirements for an environmental management system.

## Hybrid battery production.

The battery is built in a state-of-the-art plant in Japan, by Panasonic EV Energy Co (PEVE). The battery plant operates according to the Quality Management System ISO/TS16949 and the Environmental Management System ISO 14001.



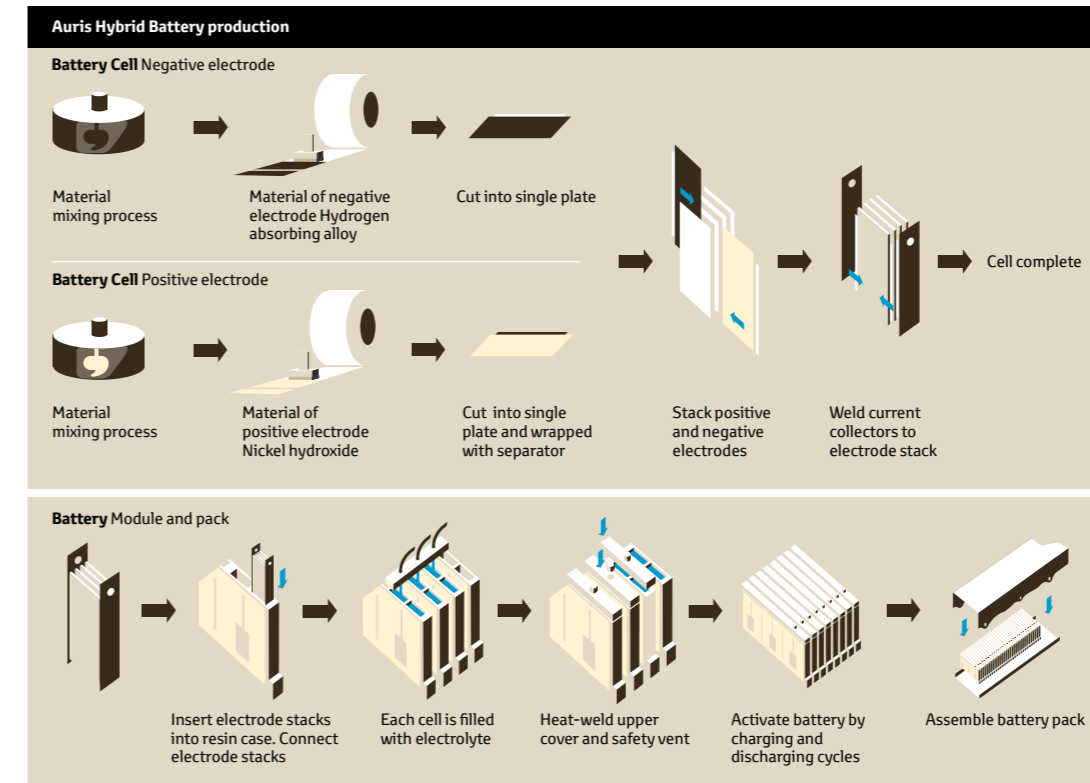
### Panasonic EV Energy Co (PEVE)

— PEVE is a joint-venture company established by Toyota Motor Corporation

— TMC (60%) and Panasonic Corporation (40%)

### Auris Hybrid Battery specifications NiMH

Nickel-metal hydride	Auris Hybrid
201.6 V	
27 kW*	
28 modules per battery pack	
6 cells per module	
25 plates per cell	
* 2 kW improvement over the second-generation Prius battery.	



### Research

Toyota Motor Corporation Battery Research Department is jointly researching materials for next-generation batteries with the Japanese National Institute for Materials Science (NIMS).

### 3. Driving. How does Life Cycle Assessment help create the world's most environmentally friendly drive?

Hybrid Synergy Drive®, lightweight compact components and refined aerodynamics have all been developed to provide groundbreaking environmental performance. The Auris Hybrid, Hybrid System Indicator and ECO Driving Indicator help you to maximise the efficiency of your drive.

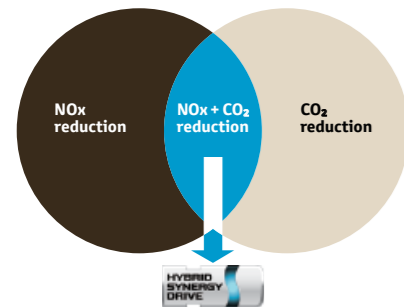
#### Hybrid Synergy Drive®

The petrol engine and two electric motors are all separate, which allows Auris Hybrid to consistently deliver maximum performance and efficiency at every stage of your drive. It also means that you can drive solely on electric power – so no fuel consumption or emissions. Other hybrid vehicles cannot do this, consuming unnecessary fuel in every driving situation. Uniquely, the second electric motor can independently recharge the battery at any time.

A powerful and efficient 1.8 litre engine helps to minimise fuel consumption. The compact lightweight design reduces overall vehicle weight for leaner and fitter performance.

#### Toyota full hybrid technology

Hybrid Synergy Drive® significantly reduces NOx and CO<sub>2</sub> emissions while also improving fuel economy. At present, there are no clean diesels that can offer all three benefits to the same extent as Toyota's full hybrid vehicles. The NOx emissions of the new Auris Hybrid of 0.0067 g/km\* are far lower than the Euro 6 NOx petrol limit level of 0.06 g/km.



#### ECO Driving Indicator

You can play your part too. Drive your Auris Hybrid in the right way and reduce CO<sub>2</sub> emissions by around 20–30%.

As a supportive tool Auris Hybrid gives you the chance to monitor and hone your eco driving skills, with the:

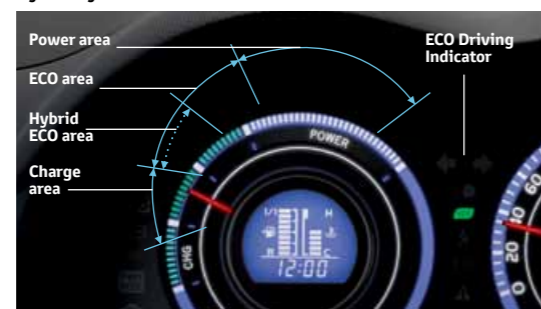
##### — Energy flow display

Displays the current operating conditions of the engine and the flow of the electric power. It allows drivers to understand the basic energy flow of the full hybrid system.

##### — Hybrid System Indicator

Displays information as a guide to support enjoyable eco driving. The bar instantly reflects accelerator operations and allows the driver to visually confirm their pedal operations. It is complemented by the ECO Driving Indicator that illuminates when the vehicle is being driven in an environmentally friendly way.

#### Hybrid System Indicator



Driving efficiency	Auris petrol	Auris diesel	Auris Hybrid <sup>§</sup>
Fuel consumption mpg	42.2	54.3	74.3
CO <sub>2</sub> level g/km	155	138	89
Air quality	Euro 5	Euro 5	Euro 5
Drag coefficient C <sub>d</sub>	0.29	0.29	0.28

Note: Fuel consumption and CO<sub>2</sub> level figures represent respective combined performance.

\* Measured on EU homologation test cycle.

<sup>§</sup> With 15" wheels.

### 4. Recycling. How is the recycling process maximised?

Toyota thinks it is vital to take a more proactive approach to recycling, geared towards the creation of a sustainable and recycling-orientated society. On the basis of such thinking Toyota adopted the Toyota Recycling Vision, which sets forth long-term goals for recycling end-of-life vehicles. And Toyota is proceeding to recycle end-of-life vehicles and components as well as implementing easy-to-recycle design.

#### Complete vehicle recycling

EU Directive 2000/53/EC indicates that as of 1 January 2006, 85% of the car by weight should be re-used or recovered. By 2015 this percentage will rise to as high as 95%, of which only 10% can be used for thermal recovery. Toyota is committed to achieving these stringent recycling/recovery targets through an intense collaboration with all the partners in the treatment chain.

#### Hybrid Battery recycling

As Toyota is highly concerned about the environment we believe there is a solid business case for recycling Hybrid Batteries:

- Conservation of virgin materials
- Decrease in energy consumption
- Reduction of greenhouse emissions
- Minimisation of hazardous materials disposed of in nature

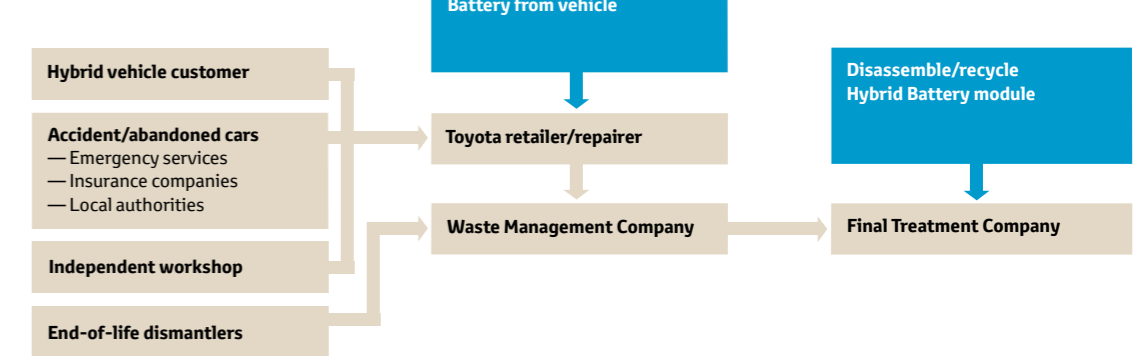
#### Special metals used, such as nickel (Ni) and cobalt (Co)

According to the World Nickel Institute, about 60–65% of global Ni production is used for the making of stainless steel. Another large portion goes into engine alloys such as pistons and rings. About 2.5% of Ni goes into the production of all types of batteries, mainly portable rechargeable battery devices, such as mobile phones and laptop PCs.

Batteries represent a secondary ore with high valuable metal content. Their steel, copper (Cu), Ni and Co are recycled, sold back into the market and re-used for different types of applications, such as the production of stainless steel. Established pathways exist for collection, disassembly, sorting and recycling of these metals – this is similar to the recycling flow of catalytic converters.

According to EU Commission information, using recycled Ni requires 75% less primary energy than the extraction and refining of virgin materials.

#### Hybrid Battery collection & treatment flow chart



## Life Cycle Assessment. How has Life Cycle Assessment influenced the evolution of Auris Hybrid?

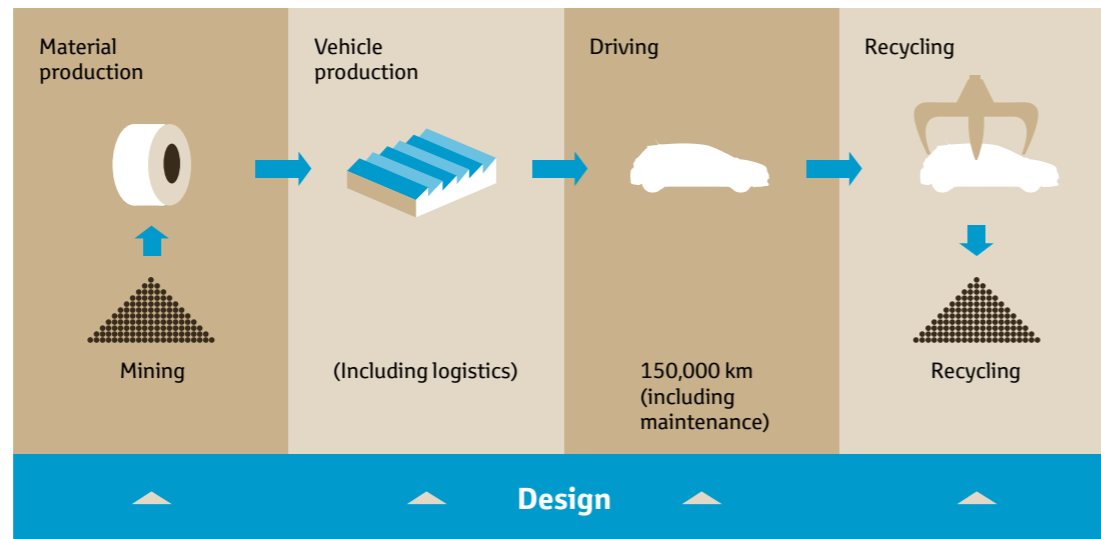
Toyota have made a big effort to improve CO<sub>2</sub> emissions from design, through production, driving and recycling. Auris Hybrid improves fuel economy without compromising on performance.

### Boundary conditions and assumptions

- From production, to driving, to recycling (including mining and transportation)
- Assumed driving distance 150,000 km (New EU Drive Cycle – NEDC)

### Boundary conditions

TMUK			
Fuel type	Petrol	Diesel	Hybrid
Engine type	2ZR	1AD	2ZR-FXE
Transmission type	6 M/T	6 M/T	Electronically controlled continuously variable
Vehicle weight	1275 kg	1405 kg	1380 kg
Fuel consumption	42.2 mpg	54.3 mpg	74.3 mpg
Production plant	TMUK	TMUK	TMUK

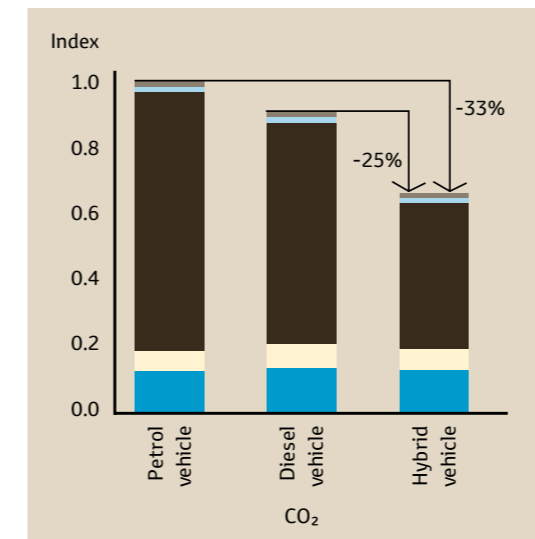


Design takes into account the reduction of environmental impact for each phase.

An eco car, made in an eco factory, built by people who have the environment on their mind.

- Full hybrid
- A big contributor to the reduction of emissions throughout the complete vehicle life cycle
- High air quality standards: Euro 5 – hardly any NO<sub>x</sub> and PM emissions (better than Euro 6 petrol requirements as presently [May 2010] known)
- CO<sub>2</sub> levels: 89 g/km
- Use of recycled plastic material
- ≥ 95% recoverability and ≥ 85% recyclability

### CO<sub>2</sub> emissions per km

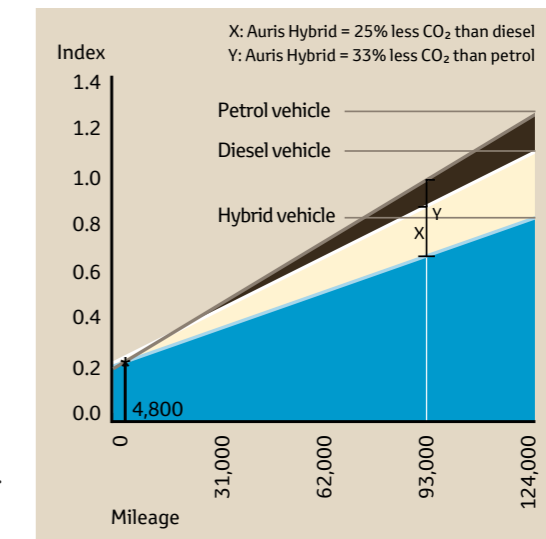


■ Disposal ■ Maintenance ■ Driving  
■ Vehicle production ■ Material production

### Conclusions:

- The CO<sub>2</sub> emissions of Auris Hybrid are 33% less than the Auris petrol.
- The CO<sub>2</sub> emissions of Auris Hybrid are 25% less than the Auris diesel.
- The CO<sub>2</sub> emissions of Auris Hybrid related to the production phase are similar.
- The driving phase of conventional engine types accounts for more than 75% of the life cycle CO<sub>2</sub> emissions.

### Ratio between kilometres and CO<sub>2</sub>



Note: Comparable petrol vehicle with 93,000 miles = index 1.0.  
\* Represents 'petrol vehicle index' = 'hybrid vehicle index' (4,800 km). 'Hybrid vehicle index' is smaller than 'diesel vehicle index' regardless of the mileage.

### Sensitivity analysis

Emissions from material and vehicle production of Auris Hybrid are similar to those of the Auris petrol and diesel vehicles. By driving 93,000 miles the CO<sub>2</sub> reduction varies between 25 and 33%. If your mileage is higher, the relative CO<sub>2</sub> emission savings will be even greater.

To learn more about Toyota and the environment please visit our website

[www.toyota.co.uk](http://www.toyota.co.uk)

Whilst every effort is made to reproduce accurate information, we reserve the right to change specifications, equipment and availability without prior notice. This brochure cannot be regarded as infallible (some of the vehicles shown may not be to exact UK specification), and as such does not constitute an offer for sale of any particular vehicle or specification. Fuel consumption values quoted throughout this brochure are determined according to EC Directive 1999/100/EC. The results do not express or imply any guarantee of actual fuel consumption. For the latest specification and availability we ask that you contact your local Toyota Centre.

GBNGV-510AU-EN May 2010

# help

## Using the navigation bar

A navigation bar is provided at the bottom of each page of this e-brochure to make browsing it easy. Please follow the simple instructions on the right to navigate through this e-brochure.



Takes the document back to the beginning.



This will take the document to the previous page.



This will take the document to the next page.



This will allow the Acrobat toolbar to be visible if pressed once and it will also make it disappear if already visible.



This will zoom in on the document so smaller text etc will be easier to read. To zoom in further, click the icon again. If the menu bar is not visible then use your mouse by clicking the left hand button and moving it.



This will zoom out of the document. To zoom out further, click the icon again. If the menu bar is not visible then use your mouse by clicking the left hand button and moving it.



This will print out the full brochure to your printer. Please note that if you have a colour printer this document will print in full colour.



This will save the whole document to your computer.

To close this document press esc and then close the document normally.

Whilst every effort is made to reproduce accurate information, we reserve the right to change specifications, equipment and availability without prior notice. This e-brochure can not be regarded as infallible, (some of the vehicles shown may not be to exact UK specification), and as such does not constitute an offer for sale of any particular vehicle of specification. For the latest specification and availability we ask that you contact your local Toyota Centre.