

Prius Environmental Declaration





Although the environmental performance and fuel efficiency are the greatest elements of full hybrid vehicles, I challenged the development team to take the Prius spirit of innovation and vehicle performance to an even higher level.

To achieve this, we carefully re-analysed the balance structure between the engine and motor and improved fuel efficiency and driving performance. We also adopted a new 1.8 litre engine and strived to improve fuel efficiency even further by suppressing the engine speed when driving at high speeds. From there, we meticulously pursued performance aspects that contribute to fuel efficiency such as the aerodynamic design and power saving features of the components.

Akihiko Otsuka
Chief Engineer New Prius
Toyota Motor Corporation



The new Toyota Prius is the most advanced expression of mass sustainable mobility. Prius builds on more than 10 years of history and will remain the undisputed reference point for full hybrid technology. Beyond confirming its environmental leadership, the new Prius sets new standards in terms of status, innovation, design and driving pleasure. The third generation Prius should not be seen as a niche model to be evaluated only against specialised criteria. Continued customer approval is exemplified through the Prius' top ranking in JD Power's German, French and UK customer satisfaction surveys for the last two years.

The new Toyota Prius is a full hybrid, providing full customer satisfaction!

Andrea Formica
Senior Vice President
Toyota Motor Europe

In Latin, Prius means 'to go before'. Fittingly, the car became a symbol of environmental awareness many years before the subject became a mainstream social issue.

Scope. How is the environmental impact of Prius measured and improved? This document follows the complete Life Cycle Thinking for Prius, using the Life Cycle Assessment tool and employing ISO14040-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.

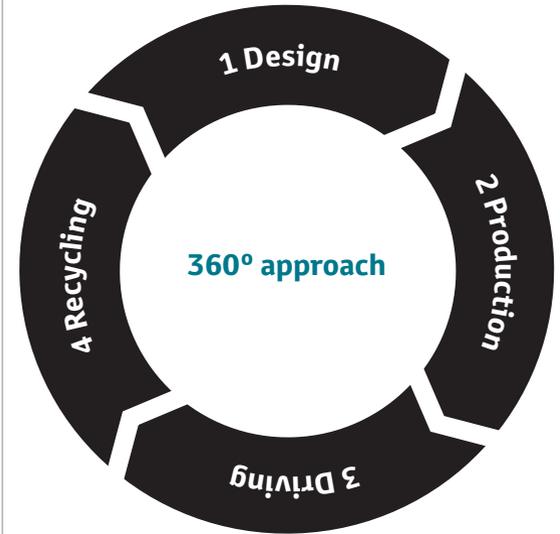
Life Cycle Assessment (LCA) is the methodology used to support Life Cycle Thinking: first by quantifying the data, and secondly by assessing the environmental/health impacts of a product through it's whole life cycle, in order to identify environmental benefits and potential areas for improvement.

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.

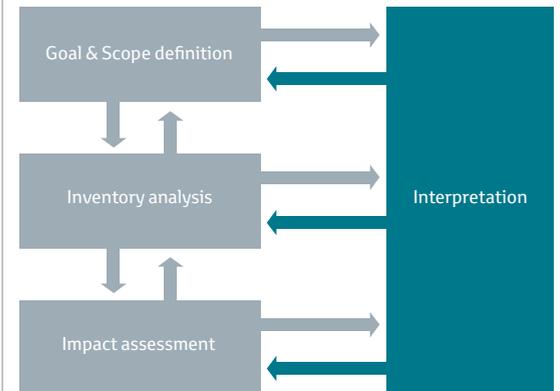
ISO14040-series methodology

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 Prius?

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), recycled material and the use of ecological plastic, which Toyota developed and named from a type of bio-plastic derived from plants.

Conservation of resources

Ecological plastic

Carbon neutral ecological plastic is used on many features to reduce overall life cycle CO₂ emissions. They are developed using a variety of compounding technologies to meet every requirement for vehicle interiors, including heat and shock resistance. Our innovative processes include molecular-level bonding and the homogeneous mixing of plant-derived and petroleum-derived raw materials.

World first

Toyota ecological plastic is the world's first injection-moulded material to be derived from plants.

20% less CO₂

Ecological plastic emits 20% less CO₂ during a product's life cycle. Most of the CO₂ usually emitted at disposal is captured during photosynthesis as the plant grows.

The future

We plan to increase the usage of ecological plastic in future vehicles – yet another revolution that is led by next generation Prius.

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 cooperation with its suppliers, integrated 5.7 kg of recycled plastic materials, including sound proofing products.

Lightweight and compact

As Prius 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.

≥ 95%

recoverable

≥ 85%

recyclable

Energy saving technology at the use phase



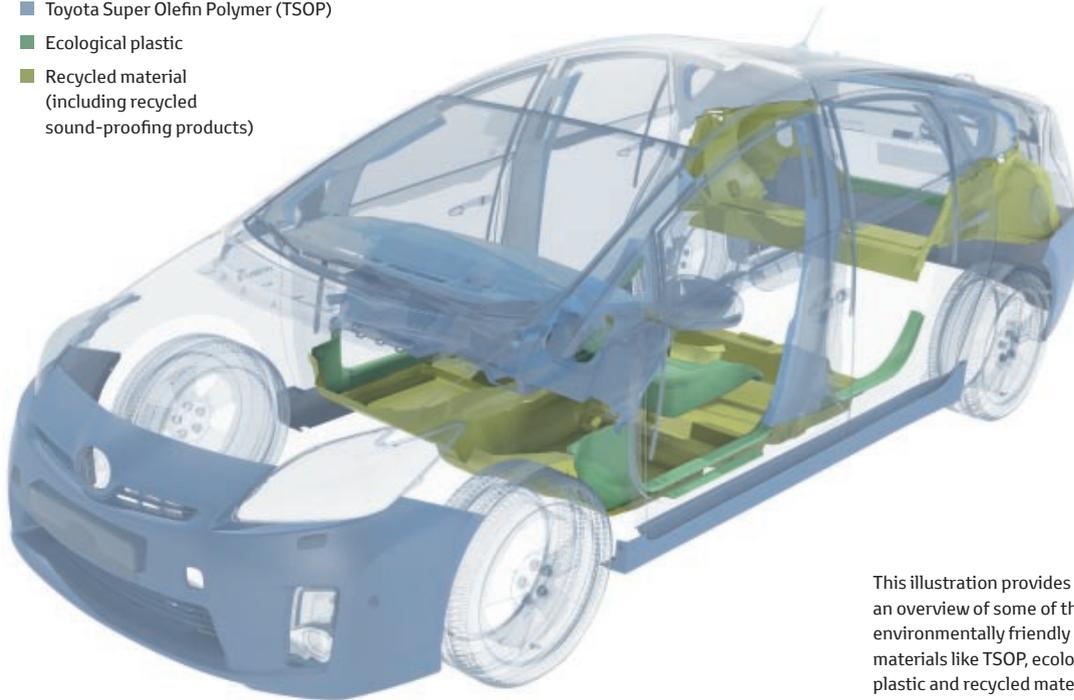
LED headlamps
30% less electricity



Air-conditioning
18% less energy

Conservation of resources

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



This illustration provides an overview of some of the environmentally friendly materials like TSOP, ecological plastic and recycled materials used in the construction of new Prius.

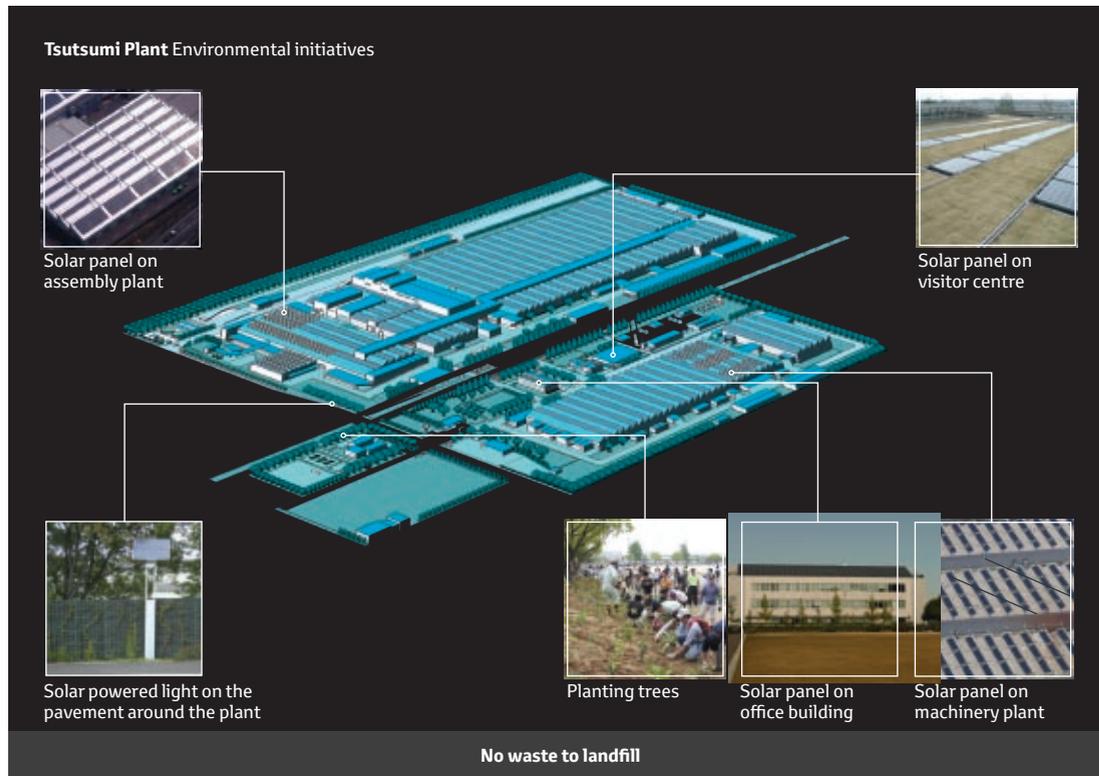
Material composition

Based on vehicle weight.

	Comparable diesel vehicle	Comparable petrol vehicle	New Prius
Steel & iron	65%	65%	61%
Light alloys	9%	9%	10%
Polymers	16%	17%	18%

Aluminium features include engine hood, back door, front bumper reinforcement, engine head, engine block, front knuckle, front stabiliser-link and front/rear brake calliper.

2. Vehicle production. How is environmental efficiency ensured during production? The Tsutsumi Plant, which produces Prius, is striving toward 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 Tsutsumi, the overall CO₂ emissions in the production process were halved by 2006 compared to the level in 1990. Also, in order to conserve the local ecosystem, in May 2008 the employees and community members planted 50,000 trees that are native to the region. The plant qualified for the Environmental Management System ISO 14001 in 1996, a green standard we are extremely proud of.



Eco factory efficiency

Tsutsumi Plant

2003–2007

Waste reduction (since 2004)	21%
Volatile Organic Compound reduction	48%
Water consumption reduction	15%
CO₂ emissions reduction	36%

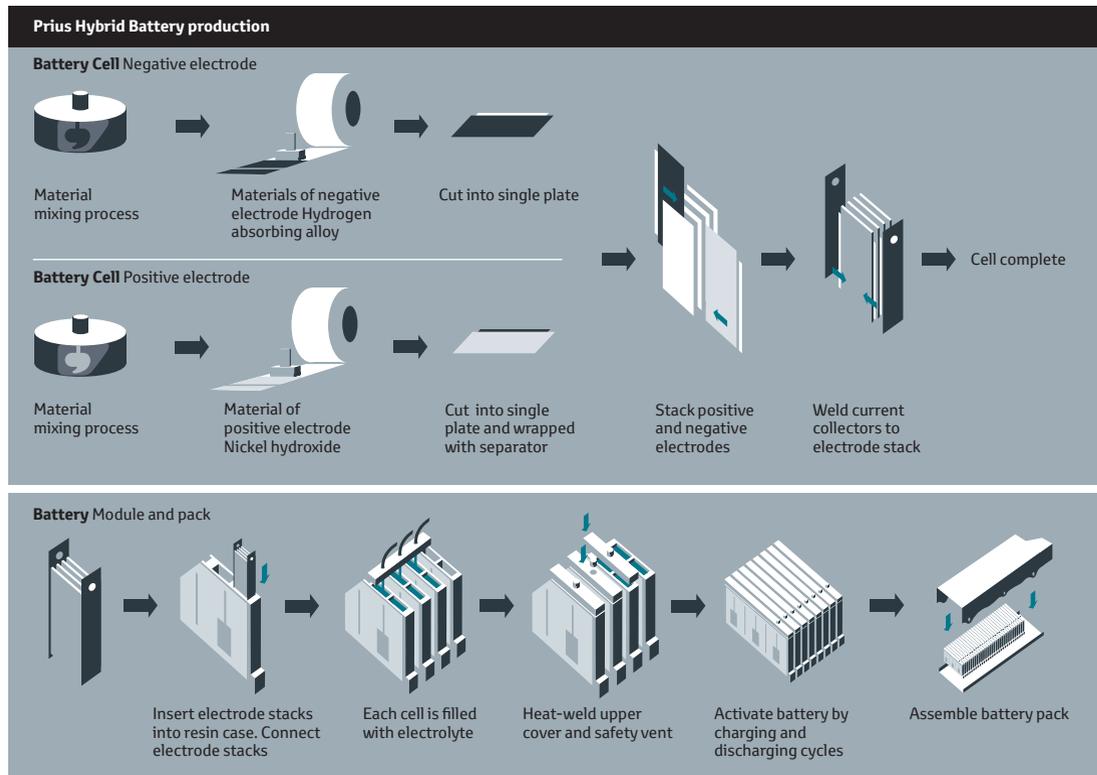
2008

In preparation for new Prius, photovoltaic solar panels with a rated output of 2,000 kW were installed as part of a field test project on new photovoltaic power generation technology within the New Energy and Industrial Technology Development Organisation.

Environmental Management System ISO 14001

Specifies the actual requirements for an environmental management system.

Hybrid battery production. Is the battery produced in a sustainable way? Yes! 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%)

Prius Hybrid Battery specifications
NiMH

Nickel-metal hydride	201.6 V
	27 kW*
28 modules per battery pack	
6 cells per module	
25 plates per cell	

* 2 kW improvement over the previous Prius.

New Prius

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 Prius ECO Drive Monitor even shows you how to maximise the efficiency of your drive.

Hybrid Synergy Drive®

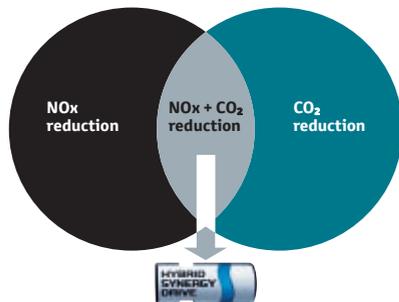
The petrol engine and two electric motors are all separate, which allows Prius to consistently deliver maximum performance and efficiency at every stage of your drive. It also means that you can drive solely on electric power – so no fuel consumption or emissions. Other hybrid vehicles cannot do this, 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 NO_x and CO₂ 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. Example NO_x emission values:

New Prius = 0.006 g/km. Comparable Diesel vehicle 0.081 g/km.



ECO driving

You can play your part too. Drive your Prius in the right way and reduce CO₂ emissions by around 20–30%.

As a supportive tool Prius gives you a chance to monitor and hone your ECO driving skills. The ECO Drive Monitor features a specially devised:

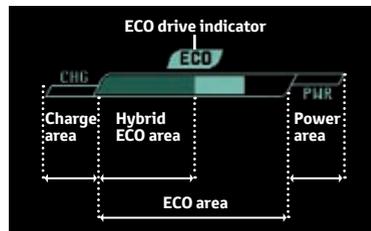
— Energy Monitor

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.

Hybrid System Indicator



Driving efficiency		
	Previous Prius	New Prius
Fuel consumption l/km	4.3/100	3.9/100
CO ₂ level g/km	104	89
Air quality	EURO 4	EURO 5
Drag coefficient C _d	0.26	0.25

Note: Fuel consumption and CO₂ level figures represent respective combined performance.

4. Recycling. How is the recycling process maximised? Toyota thinks it is vital to take a more proactive approach to recycling, geared toward 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 the implementation of 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 achieve these stringent recycling/recovery targets through an intense collaboration with all the partners in the treatment chain.

Hybrid Battery recycling

EU Directive 2006/66/EEC was adopted in 2006 and enforced in EU Member States in 2008. The Final Treatment Company meets the legally required recycling target of an average weight of 50% for industrial batteries, such as the NiMH battery used in Prius.

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

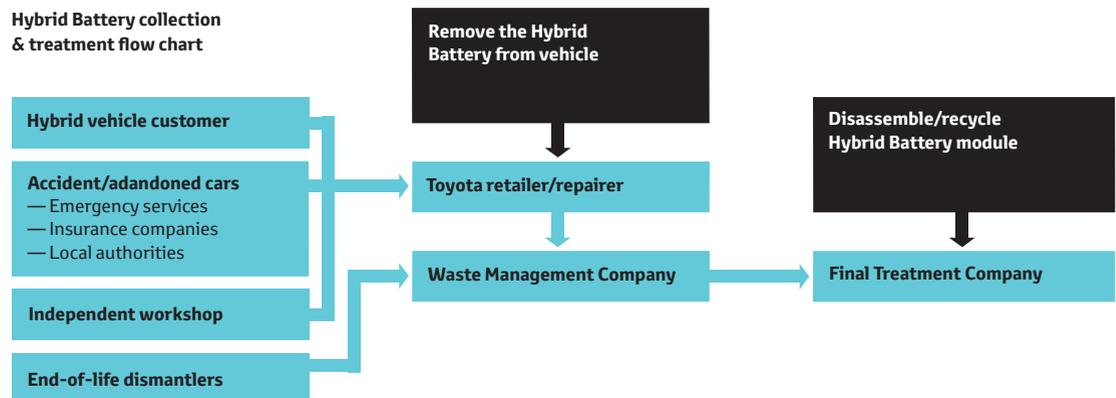
Special metals used, such as nickel (Ni), and cobalt (Co).

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. Its steel, copper (Cu), Ni and Co is 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

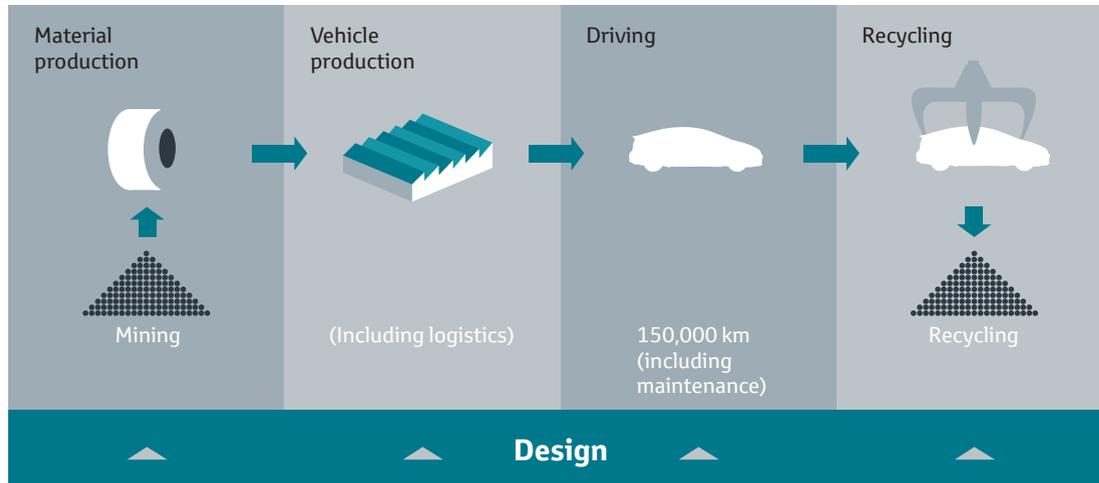


Life Cycle Assessment. How has Life Cycle Assessment influenced the evolution of Prius? Toyota have made a big effort to improve CO₂ emissions from design, through production, driving and recycling. Prius improves fuel economy despite higher power performance.

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)
- As Prius does not exist with a normal conventional engine type (only full hybrid) comparable vehicles are selected from:
 - Conventional petrol (Euro 4) and diesel vehicles (Euro 5)
 - Equivalent power performance

Boundary conditions



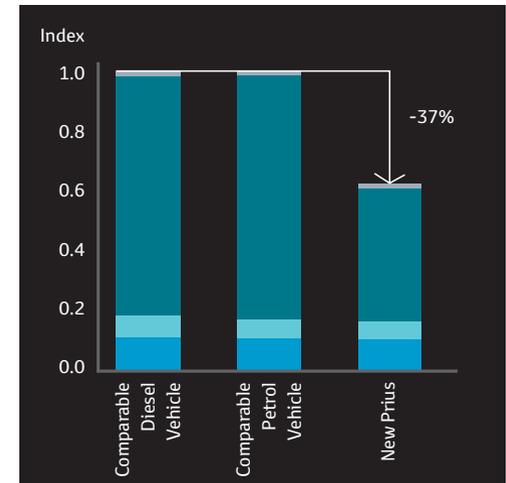
Design takes into account the reduction of environmental impact for each phase.

Comparison of comparable petrol and diesel vehicles:

- The CO₂ emissions of Prius are 37% less
- The CO₂ emissions of Prius related to the production phase are similar

The driving phase of conventional engine types accounts for more than 75% of the life cycle CO₂ emissions.

CO₂ emissions per km

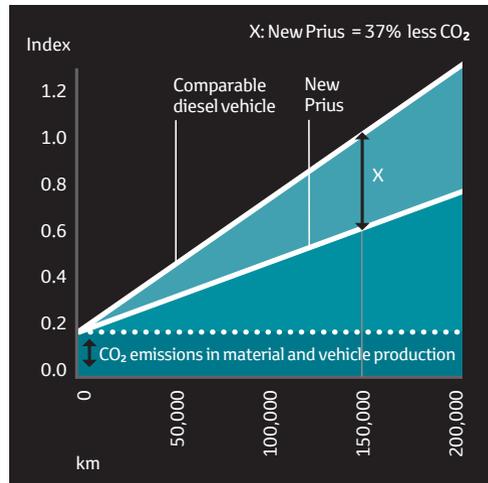


- Recycling
- Vehicle production
- Driving
- Material production

Sensitivity Analysis

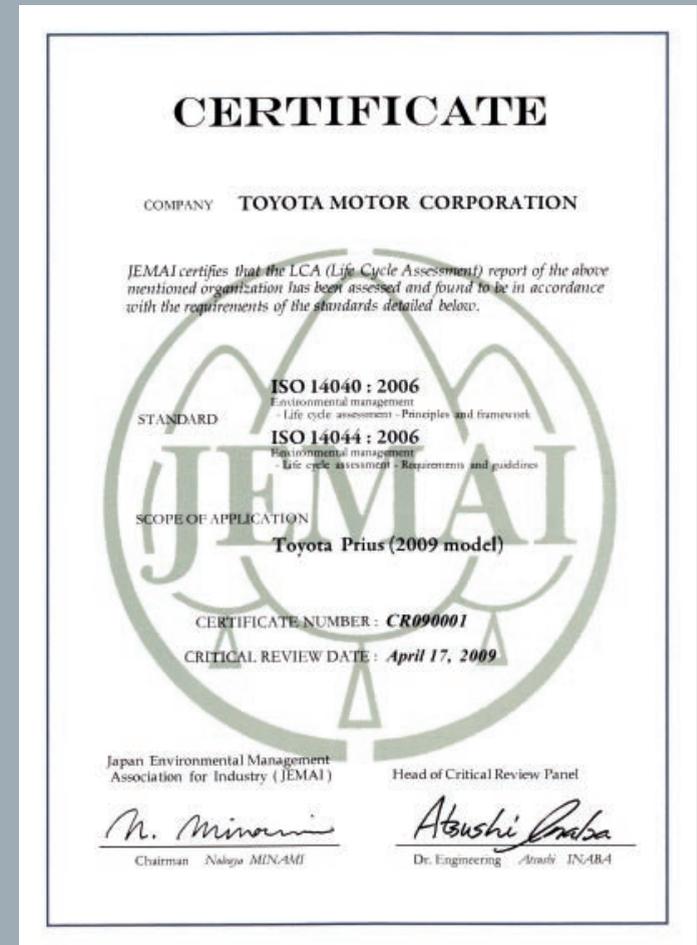
As some people drive more than or less than 150,000 km, we study the ratio between mileage and CO₂. Material and vehicle production of Prius is similar to that of comparable diesel vehicles. The CO₂ advantage begins with the first km of driving. By driving 150,000 km the CO₂ reduction is already 37%. If you drive more, you can save more CO₂ emissions.

Ratio between kilometres and CO₂



Note: Comparable diesel vehicle with 150,000 km = index 1.0

Certificate of Validity The certificate confirms that the Life Cycle Assessment is based on reliable data and methods complying with ISO standards 14040 and 14044.



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

www.toyota-europe.com/prius



An eco car, made in an eco factory, built by people who have eco 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 NOx and PM levels
- CO₂ levels: 89 g/km
- Use of carbon-neutral ecological plastic
- Use of recycled plastic material
- ≥ 95% recoverability and ≥ 85% recyclability



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