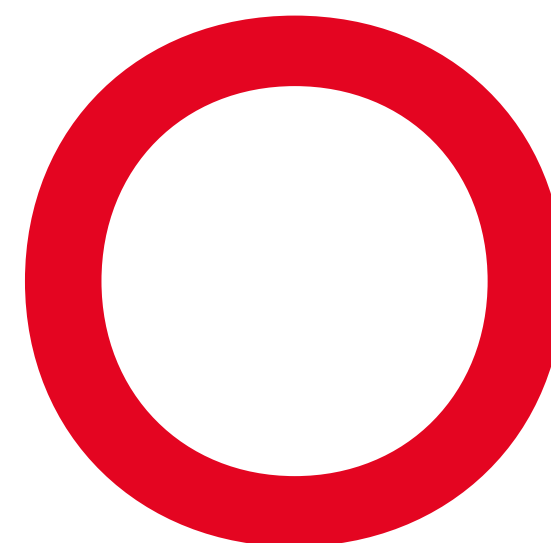




BEYOND  
Z E R O

TOYOTA

BEYOND



**Z E R O**

# INTRODUCTION

The automotive industry is facing the most profound transformation in its history. Toyota is ready to take up the challenges of the future that have in the acronym CASE the 4 main change factors: Connected for connectivity and digitalization, Autonomy for autonomous and automated driving, Shared for all the new forms of car sharing alternatives to ownership, and finally Electrification for the progressive electrification of propulsion systems starting from Full Hybrid, through Plug-in Hybrid, battery electric and hydrogen fuel cell. Faced with a revolution of such magnitude, Toyota has decided to transform itself from an automotive company to a mobility company with the aim of providing everyone with the tools to move freely, safely and in an environmentally friendly way, for the good of the planet and society. To the 4 technological factors of change, Toyota adds the H factor: the human being, who is and must remain the central element of any transformation. The key word is sustainability, to be achieved by changing the business model, but maintaining a solid link with the values, principles and methods that have always been the basis of Toyota's actions around the world, such as the Toyota Production System with its two pillars: Just-in-Time and Jidōka. In the mobility of the future, Just-in-Time means providing everyone with the right vehicle, at the right time and in the right place, at the right price. Jidōka means "automation with a human touch", a concept that will be extended from the production lines to the mobility system that Toyota is already building with the KINTO mobility brand, revolutionizing itself and starting from itself. Toyota has already done this once, transforming itself from a textile machinery industry to an automotive industry. It wants to do it again becoming a mobility company capable of producing happiness, kindness and inclusion by giving everyone the right way to move and its customers a memorable experience. Toyota believes that, when mobility is for all and without barriers, anything is possible. Human centricity for Toyota is not simply putting its customer at the center, but trusting in its employees, partners and all those who want to undertake this journey of transformation. To make this journey into the future together, we need to look at what has always made us human and allowed us to expand our humanity. Zero-emission, zero-accident and zero-barrier mobility is possible, and for Toyota it is possible to go even further by looking at mankind, its deepest needs and aspirations. For Toyota, this means being a mobility company, this means Beyond Zero.

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# 01.

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## CONTEXT AND CHALLENGES

### THE CHALLENGE OF CHANGING MOBILITY

WHAT IS MOBILITY?

### CHALLENGES FOR INDUSTRY

OBJECTIVES FOR EUROPE

SUSTAINABILITY

MAIN OBJECTIVES



# THE CONTEXT AND THE CHALLENGES

## THE CHALLENGE OF CHANGING MOBILITY

All people must have the possibility to move in the safest and most responsible way. Mobility, therefore, must continue to be an accessible asset in the future while respecting the environment and the planet, in order to give society a prospect of prosperity and sustainability. To achieve these goals, the automotive industry is called upon to make a major transformation process, the most difficult and radical since its inception.

### WHAT IS MOBILITY

Mobility is the set of tools, tangible and intangible, through which people can move freely. The car, especially that in personal ownership, has for decades been the main means of individual mobility, becoming its symbol. Today people have more ways of getting around and have discovered mobility as a useful means and not only as a possession, while new technologies have generated new services and new behaviors. At the same time, cars have improved both their safety levels and their efficiency, considerably reducing their impact on the environment and society, and still remain the most widely used means to give people the freedom to move around.

### CHALLENGES FOR THE INDUSTRY

Stricter environmental and safety regulations pose enormous challenges to the industry in creating CASE mobility, which stands for Connected, Autonomous, Shared and Electric, meaning connected, self-driving, shared (as in car sharing, rental and ride-hailing) and electrified. Manufacturers are re-defining their industrial scope, while simultaneously advancing technological progress to ensure safe and environmentally friendly mobility for all.

### TARGETS FOR EUROPE

The European Commission has set ambitious targets for both reducing emissions and improving road safety. By the end of 2020, the limit for CO<sub>2</sub> emissions from cars has been set at 95 g/km. A further reduction of 15% is planned for 2025 and 37.5% for 2030. The new Euro 7 standards for pollutant emissions are in the process of being finalized and are expected to be approved by the end of 2021. By 2020, road fatalities were expected to halve compared to 2010. Up to 2019 the decrease was 23% with 22,800 victims while 120,000 people suffered serious injuries. The European Commissioner, Ursula von der Leyen has relaunched these goals for 2030 by extending them to include serious injuries. The European Parliament is working on guidelines for autonomous driving and the connected car and their definition is expected by 2023. It is estimated that 95% of accidents are due to human error. The EU aims to have zero accidents and CO<sub>2</sub> neutrality by 2050.





SUSTAINABILITY

The European Union estimates that pollutant emissions related to land transport create a social cost of 100 billion euros and 83 billion for CO<sub>2</sub> emissions. The social cost of road accidents is 280 billion, or 2% of GDP. It is also estimated that the connected car and autonomous driving sectors will generate a turnover of 620 billion and 180 billion respectively. Thus, the objectives for the environment and safety have multiple values: health and quality of life alongside technological and economic progress.

THE MAIN OBJECTIVES

**Drastically reducing emissions of climate-altering gases** (mainly CO<sub>2</sub>), which are responsible for global warming and climate change, and improving air quality by reducing health-damaging pollutants (HC, CO, PM and NOx).

**Improving energy efficiency and decarbonisation**, to reduce dependence on fossil fuels and encourage the large-scale deployment of energy from renewable sources, including through the use of energy carriers such as hydrogen.

**Increased safety, reduced travel times and lower emissions and fuel consumption** through cars equipped with devices that can communicate with each other and with infrastructure to avoid dangerous situations, reduce traffic jams and improve traffic flow.

**Implementation of increasingly advanced safety and driver assistance systems** to prevent the risk of accidents with other vehicles and to protect pedestrians and cyclists by avoiding dangerous situations and distractions in advance.

**Reducing the consumption of resources** (water and raw materials) and providing products that can be recovered by recycling the materials from which they are made, so as to reduce the impact of industry on the environment and avoid geopolitical tensions.





Toyoda Model AA.

# 02.

## TOYOTA HISTORY AND VALUES

### TOYOTA VISION

#### THE TREE METAPHOR

TOYOTA GLOBAL VISION

THE 12 FRUITS  
OF THE TOYOTA TREE

THE MEANING OF THE THREE ELLIPSES

LEXUS, THE PREMIUM BRAND  
OF TOYOTA MOTOR CORPORATION

#### THE VALUES OF THE TOYOTA WAY

THE FUNDAMENTAL RULES

SUSTAINABILITY

TOYOTA PRODUCTION SYSTEM

KAIZEN AND KAIKAKU



# TOYOTA HISTORY AND VALUES

## TOYOTA'S VISION

Toyota wants to play a leading role in the mobility of the future, providing the tools and services so that everyone can move freely in the safest and most responsible way, exceeding customers' expectations in order to get a smile from them. The aim is to be a mobility company in which the drivers of change towards CASE mobility put the H factor, i.e. people, at the centre. Technology must amplify the potentialities and faculties of human beings without replacing them by creating a society that protects the planet and gives freedom to move so that everyone can cultivate and establish social relationships, prosper and improve, to enrich their lives. To accomplish this mission of change, Toyota relies on the philosophy, values, guiding principles and precepts it has cultivated since its foundation.

## THE TREE METAPHOR

The tree is a metaphorical representation of Toyota as a mobility company. Its 12 fruits can be traced back to two main objectives: producing ever better cars and enriching the lives of the communities in which Toyota is present. The deep roots are made up of the ideal heritage (values, Toyota Way, precepts, principles, philosophy) that has always firmly supported the company's solid trunk, with all its branches, and is the basis of all its actions. A tree is an organism made up of several functional parts, such as branches and leaves, which are indispensable for its life and growth, as well as for the planet and the living beings that populate it. In the same way, for Toyota, each employee is a fundamental functional unit that must express itself in the best possible way to allow the company to develop and interact in harmony with the environment that surrounds it.

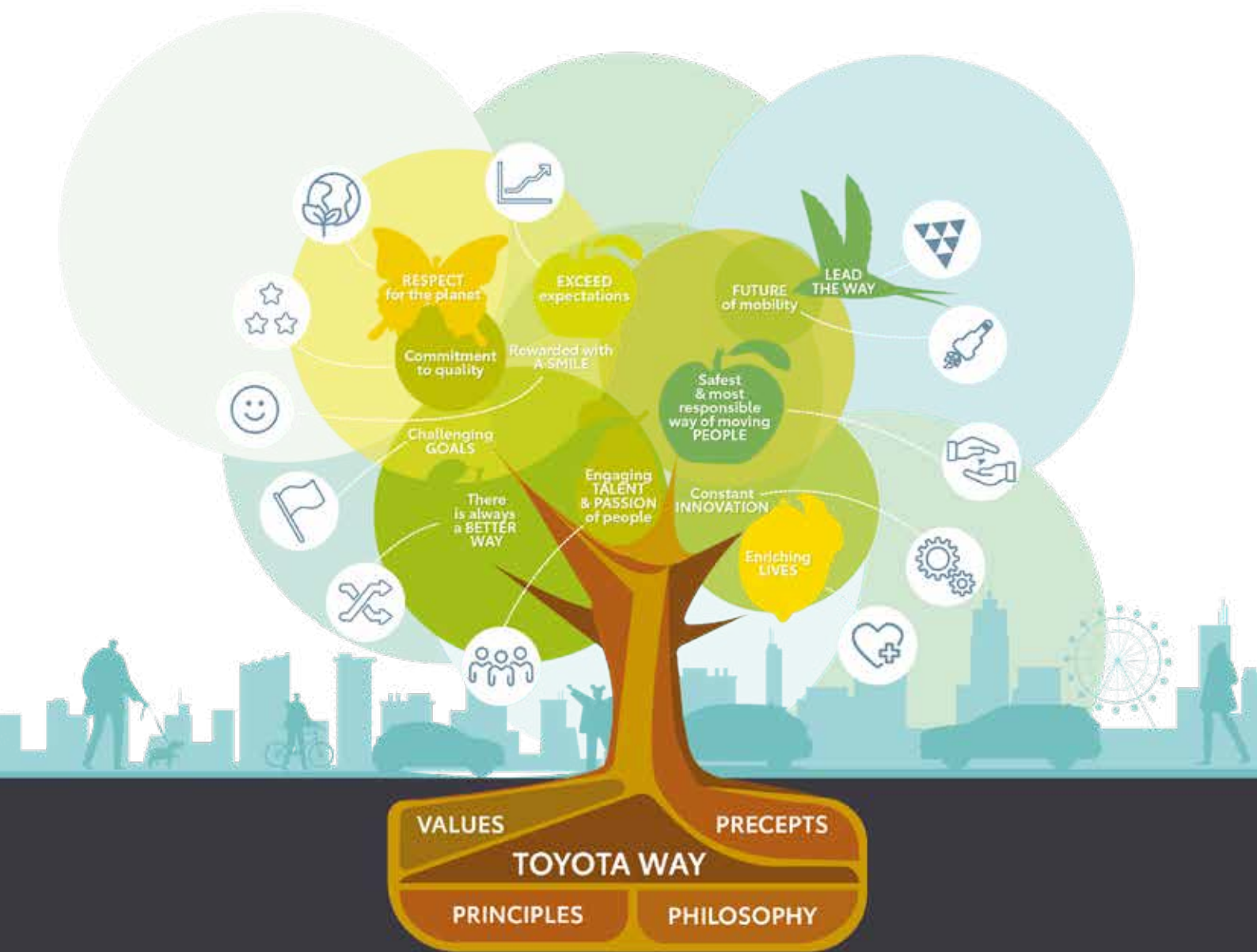
### TOYOTA'S GLOBAL VISION

***Toyota will lead the future mobility society, enriching lives around the world with the safest and most responsible ways of moving people.***

***Through our commitment to quality, ceaseless innovation, and respect for the planet, we strive to exceed expectations and be rewarded with a smile.***

***We will meet challenging goals by engaging the talent and passion of people who believe there is always a better way.***





THE 12 FRUITS OF THE TOYOTA TREE

**ENGAGING TALENT AND PASSION OF PEOPLE**

The strength of an organisation lies in the ability of its employees and partners. Diversity helps solve problems and stimulates new ideas.

**THERE IS ALWAYS A BETTER WAY**

Kaizen (continuous improvement) is the spirit that drives every activity and strives to overcome any existing compromise.

**CHALLENGING GOALS**

Goals must have a high horizon involving the ambitions of many people working together as a team.

**REWARDED WITH A SMILE**

A customer's smile is an expression of satisfaction and creates a feeling of gratitude, which goes beyond loyalty.

**COMMITMENT TO QUALITY**

Quality is the key to customer relations and satisfaction, it is the result of a way of working.

**RESPECT FOR THE PLANET**

Every action, product or service must have the conservation of the planet and environmental sustainability at its heart.

**EXCEED EXPECTATIONS**

Constantly improving standards to anticipate and exceed expectations is the key to customer satisfaction.

**LEAD THE WAY**

To have the ambition to reinvent one's mission and find new areas to progress and prosper together with society.

**FUTURE OF MOBILITY**

The commitment to develop new forms of transport and new technologies that enable all people to keep moving.

**SAFEST AND MOST RESPONSIBLE WAY OF MOVING PEOPLE**

A commitment to creating tools that allow everyone to work and move freely, safely and in an environmentally friendly way.

**CEASELESS INNOVATION**

Creating ever better cars and services through technology and research, including through competition.

**ENRICHING LIVES**

Valuing people and their abilities, doing things with love and dedication to contribute to the good of society.



### THE MEANING OF THE THREE ELLIPSES

The Three Ellipses have been Toyota's trademark since 1989. The ellipse is the natural form of movement and expansion. Recently, the brand identity has undergone an evolution: the logo has become two-dimensional, is dark grey and is no longer accompanied by the name Toyota so that it can be flexed in more ways with the expansion of mobility products and services. The two internal ellipses perpendicular to each other are the T of Toyota and represent the customer with his expectations and the company with its ideal heritage. The outer ellipse represents the world around them both. The overlapping of the three ellipses therefore represents the integration of these three elements and the empty spaces are the margins for improvement to make their coexistence ever more harmonious. The Three Ellipses brand thus fully represents Toyota's new mission as a mobility company and, at the same time, the indissoluble link with its fundamental historical values.

### LEXUS, THE PREMIUM BRAND OF TOYOTA MOTOR CORPORATION

1989 was also the year that Lexus, the premium brand of the Toyota group, was launched. The external design of the logo expresses the lineage and link with Toyota, while the internal part, rather than two geometric figures, is a stylised L. Lexus is fully involved in the Group's vision and its mission is to be the highest expression of the Toyota Motor Corporation in terms of technology, style, customer proximity and social responsibility, sharing its values, resources and strategic objective of transformation from an automotive company to a mobility company.

## THE TOYOTA WAY VALUES

The Toyota Way was defined in 2001 and sets out the core values and working methods that guide the behaviour and aspirations of the people who work at Toyota, at every level of the company, throughout the world. It is based on two pillars: continuous improvement and respect for people. The first pillar is based on the ideal of Kaizen, on overcoming existing standards and obstacles by drawing on technological evolution and creativity, and finally on Genchi Genbutsu, i.e. experience gained in the field, listening and direct observation, in order to get to the root of facts and problems and make the right decisions. The second pillar emphasises the centrality of people and the importance of their interaction. Mutual understanding, diversity and teamwork are essential to identify opportunities and achieve the best results while promoting the personal and professional growth of individuals. Ultimately, the Toyota Way is the engine that allows Toyota to meet the ever-changing challenges of mobility by growing together with its employees and society.





## THE FUNDAMENTAL RULES

The guiding principles that govern Toyota's actions date back to 1937, when the company was founded as a car manufacturer, and were updated in 1997. They are the core of Toyota's business management philosophy. Their goal is sustainable development through respect and social responsibility, cultivating a balanced relationship with the environment and trusting relationships with peoples, cultures and nations. The guiding principles derive from the 5 fundamental precepts enunciated by founder Sakichi Toyoda, collected by Risaburo Toyoda and Kiichiro Toyoda, and published in 1935, on the fifth anniversary of his death.

### GUIDING PRINCIPLES

Honour the letter and spirit of the laws of each nation and conduct business activities in an open and fair manner to be a good corporate citizen of the world;

Respect the culture and customs of each nation and contribute to its economic and social development through business activities within their respective communities;

Dedicate our business activities to providing clean and safe products and improving the quality of life, everywhere through all our activities;

Create and develop advanced technologies and provide superior products and services that meet the needs of customers worldwide;

Promote a corporate culture that enhances both individual creativity and the value of teamwork, while honouring mutual trust and respect between employees and management;

Pursue growth through harmony with the global community thanks to an innovative management;

Work with partners in research and production to achieve stable, long-term growth that brings shared benefits, while remaining open to new collaborations.



## SAKICHI TOYODA'S PRECEPTS

01 Always be faithful to your duties, thereby contributing to the good of the company and everyone.

02 Always be studious and creative, striving to keep up with the times.

03 Always be practical and avoid superficiality.

*“Always be **faithful** to your duties, thereby contributing to the good of the company and everyone.”*

04 Always endeavour to create a welcoming and friendly atmosphere at work.

1867

1930

05 Always have respect for spiritual matters and always remember to be grateful.



TMI's Parts Logistics Warehouse - The photovoltaic system installed on the roof produces 25% of the energy used in the Toyota Motor Italia headquarters.

## SUSTAINABILITY

Sustainability for Toyota is a very broad concept, which goes beyond aspects related to environmental protection but also embraces social and economic aspects. It is a commitment that has deep roots and stems from the history and guiding principles that inspire Toyota's action towards its customers, employees, partners, suppliers, shareholders and society as a whole. Akio Toyoda says Toyota's mission is to provide goods and services that make people happy around the world. To do this, it is necessary to ensure the highest quality of products and contribute to the well-being of society by bringing a value that lasts over time, that is reliable and safe, that does not generate waste and frequent replacements, in line with the Sustainable Development Goals (SDGs) and the Green Deal. At the same time, Toyota believes in the relationship with stakeholders in the area in order to promote its concept of sustainability also among governments and local communities, promoting social inclusion, the development of work according to principles of equity and equal opportunities.

## THE TOYOTA PRODUCTION SYSTEM

Toyota has invented a production model called the Toyota Production System (TPS) that has led the way throughout the industry by bringing the concepts of lean manufacturing, integrated factory, kaizen and total quality to the central core. The historical father is Taiichi Ohno, a production engineer who in the early 1950s described it, codifying its principles and practices. The pillars of TPS are just-in-time and jidōka. The first consists of getting the right component, at the right time and in the right place within the production site. The second is 'automation with a human touch', 'intelligent automation' or 'autonomation' and derives from the G loom patented by Sakichi Toyoda: its innovation is that, in case of tearing of the fabric, it stopped automatically allowing the operator to correct the error. Toyota's production concept involves people and, affirming its irreplaceable nature, reaffirms that the best technologies are those that put people at the center. The pillars of the TPS will also guide Toyota in its transformation from automotive company to mobility company. In the CASE mobility of the future envisioned by Toyota, man will remain the central element and technologies will serve not to replace him, but to enhance all his faculties.

## KAIZEN AND KAIKAKU

Continuous improvement (kaizen) is the key to evolving existing standards, increasing the quality of products and services and exceeding customer expectations. It is therefore a daily, continuous activity that acts on processes through bottom-up communication, from the gembu (the workplace) to the management, but does not change the roots of the business model. The new challenges and Toyota's transformation from an automotive company to a mobility company, however, require kaikaku, a radical change that implies fundamental decisions by the company's top managers, to share through top-down communication so that the change is implemented by all the people working for Toyota: from workers to partners, from suppliers to sales and service organisations. Kaizen is part of the pulp of the fruits of the Toyota tree that define the tension towards quality and the customer. Similarly, it is kaikaku, in the form of constant innovation, the development of new technologies, the ambition to set ever more ambitious goals and to break new ground by changing its mission. That is why Toyota's history is marked by both kaizen and kaikaku.

*"We will be resolute  
in producing  
happiness for all".*

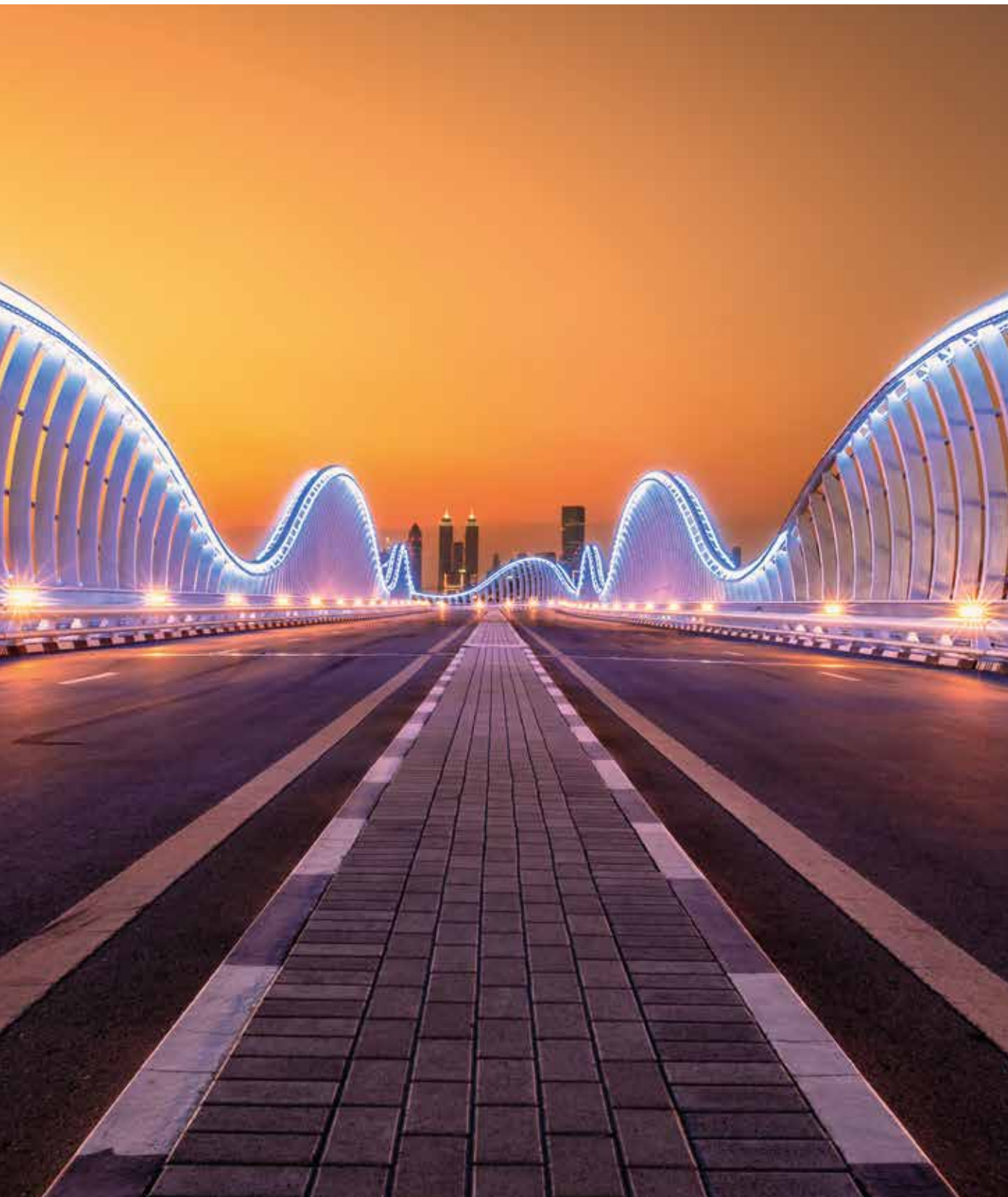
*- Akio Toyoda*



TIMELINE

- 1867** Sakichi Toyoda was born in Kosai, Shizuoka Prefecture.  
His father was a carpenter, his mother a weaver
- 1891** Sakichi opens his first weaving shop in Tokyo
- 1894** Birth of Sakichi's son, Kiichiro Toyoda
- 1908** Founding of Toyoda's Loom Works
- 1918** Founding of Toyoda Spinning & Weaving Co.
- 1933** Creation of an automobile development department
- 1936** Establishment of the first brand name and change of name to Toyota
- 1937** Establishment of Toyota Motor Company, first model the Model AA
- 1951** Birth of the first BJ or Land Cruiser
- 1955** Start of Crown production
- 1957** Incorporation of Toyota Motor Sales USA
- 1957** Toyota participates in a competition for the first time:  
the Australian Rally with a 48 hp Toyopet Crown 1500
- 1958** Beginning of production of the Corolla
- 1961** Beginning of production of the Publica
- 1963** The Dane Walter Krohn is Toyota's first distributor in Europe
- 1968** Toyota develops its first racing car: the '7' for track competition.
- 1967** Start of production of the 2000 GT, the first Japanese supercar
- 1967** Birth of the Century with V12 engine  
to celebrate Sakichi's 100th birthday
- 1970** Production starts on Celica
- 1970** Launch of Toyota Italiana Srl in Rome
- 1973** First success in a World Rally Championship race,  
with Walter Boyce's private Corolla at the Press-on-Regardless
- 1975** Founding of Toyota Team Europe (TTE) with Ove Andersson
- 1979** Launch of the Supra
- 1983** Launch of the Camry
- 1984** First Safari Rally victory with Celica driven by Björn Waldegård
- 1985** First participation in the 24 Hours of Le Mans with a 12th place finish
- 1989** Launch of Lexus brand and LS400
- 1990** Establishment of Toyota Motor Marketing Services Europe S.A. in Brussels
- 1990** First World Rally Championship victory with driver's title for Carlos Sainz
- 1992** Start of production at Burnaston (UK) plant
- 1992** First podium finish at Le Mans 24 Hours with TS010
- 1993** First World Rally Championship Constructors' title
- 1993** Birth of Toyota Motor Italia and official market entry

- 1994** Launch of the RAV4, the first-ever SUV
- 1995** Launch of the Toyota Technical Education Program (T-TEP)
- 1997** Introduction of the Prius, the first hybrid car in history
- 1998** Launch of Lexus RX, the first luxury SUV in history
- 1999** Milestone of 100 million units produced in Japan
- 1999** Yaris launched
- 2000** Yaris is Car of the Year
- 2004** Presentation of the Aygo at the Bologna Motor Show
- 2001** Start of production at the Valenciennes plant
- 2004** Lexus RX 400h is the first luxury hybrid SUV in history
- 2005** Prius is Car of the Year
- 2007** Supra HV-R is the first hybrid car to win a race,  
the Tokachi 24 Hours
- 2009** Akio Toyoda becomes President and CEO of Toyota Motor Corporation
- 2010** Production begins on the LFA, Lexus' first supercar
- 2012** Toyota returns to the World Endurance Championship  
and the Le Mans 24 Hours with the TS030 Hybrid
- 2012** Prius is the world's first plug-in hybrid car
- 2014** Toyota wins its first WEC Constructors' title
- 2014** Introduction of the Mirai hydrogen fuel cell car
- 2017** Toyota returns to the World Rally Championship with the Yaris WRC
- 2017** Toyota launches “Mobility for All” strategy  
and “Start your Impossible” initiative  
in partnership with the Olympic and Paralympic Games Committee
- 2018** First win at Le Mans 24 Hours with TS050
- 2018** Toyota wins its fourth WRC Constructors' title
- 2018** Toyota launches car sharing service YUKŌ with Toyota in the city of Venice
- 2018** Akio Toyoda announces at CES in Las Vegas that he wants to transform  
Toyota from an automotive company to a mobility company
- 2019** Toyota wins its third WRC Drivers' title with Ott Tänak
- 2019** Milestone 10 millionth Lexus produced on the 30th anniversary of its birth
- 2020** Milestone 15 million hybrid cars sold
- 2020** Launch of KINTO mobility brand
- 2020** Launch of the Lexus UX 300e crossover,  
Toyota group's first electric car for the European market
- 2020** Toyota wins its fourth WRC Drivers' title with Sebastian Ogier  
and the Le Mans 24 Hours for the third consecutive time



# 03.

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## VISION AND STRATEGY

**THE TRANSFORMATION OF TOYOTA**

- FROM AUTOMOTIVE COMPANY  
TO MOBILITY COMPANY
- WHO IS MORIZO
- THE THREE KEY ASPECTS  
TO GO TOWARDS THE FUTURE
- RAISE THE VALUE  
OF HUMAN RESOURCES
- COST REDUCTION,  
TPS AND INVESTMENTS
- MAXIMIZE THE GROUP'S  
COMPETITIVENESS
- FROM THE TOYOTA PRODUCTION SYSTEM  
TO THE TOYOTA MOBILITY SYSTEM

**CASE AND THE H FACTOR**

- CASE, OR CONNECTED, AUTONOMOUS,  
SHARED AND ELECTRIFIED
- PEOPLE BEFORE AND BEYOND  
TECHNOLOGY

**THE ROLE OF TECHNOLOGY,  
THE VISION OF GILL PRAT**

- FROM AI TO AI,  
FROM MACHINE TO MAN
- ARTIFICIAL INTELLIGENCE  
AT THE SERVICE OF SAFETY
- LEXUS AND ARTIFICIAL INTELLIGENCE
- ME, YUI AND THE LQ
- WHY TOYOTA IS DEDICATED  
TO ROBOTICS
- TOYOTA ROBOTS

**BEYOND ZERO**

- LEADERSHIP  
IN ELECTRIFICATION
- MOBILITY FOR ALL
- CREATING A MEMORABLE  
EXPERIENCE FOR THE CUSTOMER
- CONTRIBUTE TO A BETTER SOCIETY



# VISION AND STRATEGY

## THE TRANSFORMATION OF TOYOTA

The world is changing rapidly and, with it, mobility is also rapidly transforming. Toyota Motor Corporation has therefore decided to get ahead of the change and evolve its business model from an Automotive Company to a Mobility Company in the CASE era. To achieve this, Toyota wants to leverage its principles and values, embracing new ideas and new ways of thinking, in the knowledge that this transformation must also be carried out with the contribution of external partners, of friends ready to share the same aspirations and objectives: to contribute to the authentic well-being of society through sustainable and accessible mobility, allowing everyone to move freely in a safe and barrier-free manner. The new mobility will still have the car as a fundamental tool, but it will not be the only one. For Toyota the central element will be people, from employees to customers, protagonists of change, creators and users of the authentic well-being of society, of which everyone should be able to enjoy and to which everyone can contribute.

**«If we want to equip ourselves to deal with the period of transformation in which we find ourselves, we will have to return to prioritising the experiences that come from the real world at the genba (the place where things take place) and to enabling the growth of the people who will build the future».**

## FROM AUTOMOTIVE COMPANY TO MOBILITY COMPANY

The automotive sector is going through a phase of profound change. According to the President and CEO of the Toyota Motor Corporation, Akio Toyoda, we are experiencing the greatest transformation of the last 100 years. The mobility of the future will be driven by the so-called CASE, i.e. it will be increasingly connected, automated, shared and electrified. Toyota, which in its history has already evolved from a chassis manufacturer to a global automotive company, is now embracing a major new challenge. The company has entered a second era, embarking on a new path of profound transformation to become a 'Mobility Company'. And, as it has always done throughout its history, it will leverage its inspiring principles, determination and courage to overcome obstacles and accept new challenges. A goal – that of becoming a Mobility Company – also expressed by other car manufacturers. In his speech at the 46th Tokyo Motor Show, Akio Toyoda highlighted the ways in which Toyota wants to differentiate itself and gave his vision using his virtual alter ego Morizo. For Toyota, in addition to the forces of change represented by the CASE phenomenon, there is the "H" factor, the human factor, confirming the importance of the centrality of man over technology. Its vision is to be able to contribute, through technological development, its products and services to the creation of a society centred



around the person, inclusive, where everyone can be free to move. Toyota will do this by developing both innovative and electrified means of transport and new services that can connect people to society and to communities and offer them new ways to move around easily and sustainably.

### WHO IS MORIZO

At the Nürburgring 24 Hours in 2007, the Gazoo Racing team fielded a Lexus IS with the number 13 and driver Morizo at the wheel. On 23 June 2009, everyone finally got to know his true identity: he was Akio Toyoda, who on that day was appointed CEO and Chairman by the board of directors of Toyota Motor Corporation. To introduce his speech at the 2019 Tokyo Motor Show, Akio Toyoda has an avatar named Morizo as his assistant, who moves around on a screen behind him. In this way, the grandson of founder Kiichiro wanted to enliven the presentation of the fourth-generation Yaris and to hint at the concept of artificial intelligence according to Toyota as a







technology"amplifying"humanintelligence. Morizo is also the name of one of the two mascots of the World Expo held in Aichi in 2005. Created together with Kiccoro by anime artist Aranzi Aronzo, Morizo is described as a kind-hearted forest spirit who knows everything and has the power to create a breeze and transmit sunlight through the trees to the hearts of weary people. He is also endowed with other mysterious powers that can only be discovered in the future.

THREE KEY ASPECTS  
TO MOVE INTO THE FUTURE

The challenges of the future require huge investments. To meet them it is necessary to make what is ecologically sustainable economically viable, to act responsibly in order to be responsible to society and the environment. In the process of transforming mobility, attention to resources, in their broadest sense, must therefore be maximised by acting on three fundamental factors: human resources, reducing costs to strengthen investments and increasing the group's competitiveness. These are the three key aspects identified by Koji Kobayashi, Chief Financial Officer of the Toyota Motor Corporation, as well as member of the board of directors and advisor to Akio Toyoda.

RAISING THE VALUE  
OF HUMAN RESOURCES

Elevate not increase. For Toyota, quality is the fundamental value of its workforce, so the humanity of its employees is as essential as their respective skills in building a strong company. «People are the stones of the walls» said Shingen Tageda, a 16th century daimyō and general. For Toyota, true value does not lie in its factories, machinery and every material resource, but in the people who make it all work every day, transforming it into freedom of movement for everyone.

COST REDUCTION,  
TPS AND INVESTMENTS

The Toyota Production System has always been Toyota's strength. However, we need to rediscover its roots and make it the vital essence for dealing with new realities. According to this philosophy, to reduce costs it is necessary to analyse actions and make each operator and collaborator responsible. Only through this awareness will be generated savings that can be used for new investments in electrification, automation, connectivity and any new technology to be developed with partners and start-ups, according to the motto 'home and away', therefore with a more open and broader team spirit.

MAXIMISING THE GROUP'S COMPETITIVENESS

The constant striving for improvement is one of Toyota's principles, in every sector in which the group has been engaged since its foundation. Building on its expertise, Toyota has been able to tackle new areas of business. This was the case when Kiichiro Toyoda decided that his family's textile machinery company should become an automotive company. It is still the case today: Akio Toyoda's challenge is to complete the transformation from automotive company to mobility company by tackling unexplored fields to make Toyota even stronger and more competitive.

FROM TOYOTA PRODUCTION SYSTEM  
TO TOYOTA MOBILITY SYSTEM

In 1991, a study by the Massachusetts Institute of Technology (MIT) called the TPS "the machine that changed the world". This image measured the force of impact that the production system invented by Toyota had on world industry and taught a new way of producing. The principles of the TPS will also be fundamental to the mobility system that Toyota wants to develop. In the words of MIT: it will be the machine that makes people move, and it will do so while maintaining the two fundamental pillars of just-in-time and jidōka. Toyota's new mission is to provide everyone with the right vehicle, at the right time and in the right place, creating an ecosystem in which new propulsion and energy systems, increasingly advanced safety and assistance devices, digitalisation and artificial intelligence are at the service of people, their feelings and their needs. In short: mobility, according to Toyota, must be at the service of the freedom to move, to allow people to cultivate their desires and interests while contributing to the well-being of society. This great machine will be governed by human intelligence with the contribution of robotics and artificial intelligence because even these technologies alone are not enough to make it truly functional







and efficient. The mobility system needs to be given the human touch that Toyota has always considered indispensable for creating products and services that, made by people, improve people's lives. The traditional *monozukuri*, or doing things with commitment and love, must therefore become the movement of people with their feelings and everything that contributes to the growth of the individual and society as a whole.

## **CASE AND THE H FACTOR**

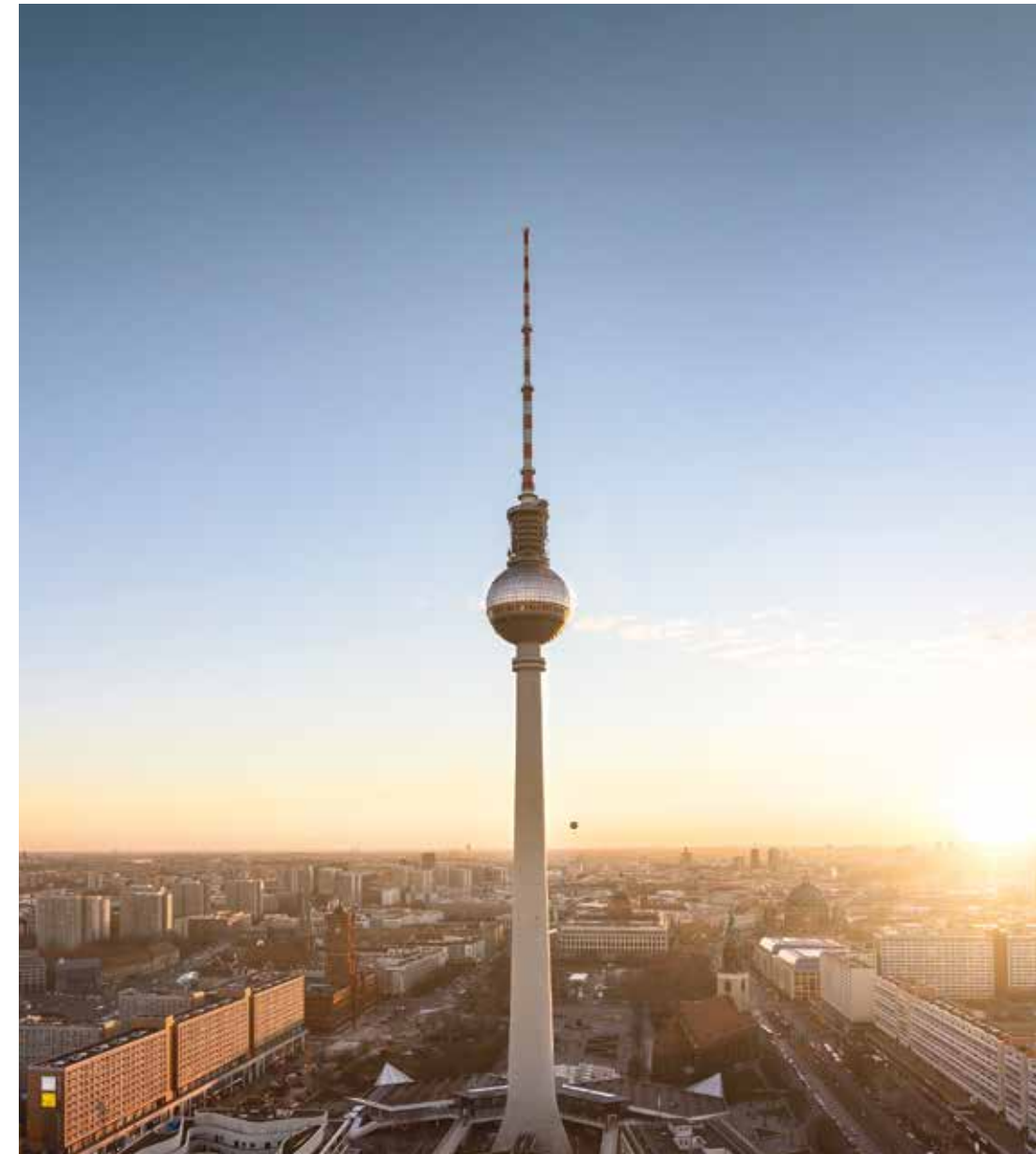
CASE or Connected, Autonomous, Shared and Electrified. These are the major driving forces that are already radically changing mobility and the automotive industry. According to Toyota, the new mobility already underway cannot be limited to the technological factors behind this transformation, which Toyota anticipated 30 years ago when it identified electrification as the main way to make cars more efficient and progressively reduce emissions. Toyota is actively involved and at the forefront of the development of all new technologies.





*I believe that our mission is to provide goods and services that make people all over the world happy or, in other words, to produce “mass happiness.”*

*- Akio Toyoda*



CASE, I.E. CONNECTED,  
AUTONOMOUS, SHARED  
AND ELECTRIFIED

CONNECTED

Connectivity, i.e. the technologies that enable dialogue with and between vehicles for more safety, more information and more entertainment content.

AUTONOMOUS

Autonomous or assisted driving, i.e. devices that prevent dangerous situations by assisting or replacing the driver.

SHARED

Sharing, i.e. services that maximise the use of all means of transport, making mobility more functional and efficient. The car will therefore increasingly be conceived not as a possession but as a mobility service.

ELECTRIFIED

Electrification, or all the ways in which electric propulsion supports or replaces traditional propulsion with the aim of reducing or eliminating emissions, making mobility increasingly sustainable.

Each of these is fundamental to the mobility of the future, but in Toyota's vision none, even the most advanced, can be the sole driver of change. Rather, the most important will be the H-factor, the human factor. Humanity is the starting point and, at the same time, the arrival point for every technology and technical tool created to improve people's lives, ensuring freedom of movement for all and, ultimately, producing happiness.

PEOPLE BEFORE TECHNOLOGY  
AND BEYOND

The mobility of the future must be centred on people: from the company's employees, with their commitment and creativity, to its customers, with their daily needs, with the aim of contributing to the real wellbeing of society. This is why the new mobility starts with respect for diversity and must include the car, but not only, to give everyone the chance to move around safely, freely and without barriers. According to Akio Toyoda, there are two strengths of the Toyota Group. The first is the Toyota Production System (TPS) with its Kaizen

spirit and its focus on quality and the customer. The second is the "ability to understand" different positions and ways of thinking, calling them to be part of the project of a society where the possibility of moving, interacting and establishing social relationships is the noblest expression of freedom.

*«I believe that our mission is to provide goods and services that make people all over the world happy or, in other words, to produce "mass happiness".*

*To achieve this, I believe it is necessary to cultivate the people Toyota has around the world to inspire them to have a 'you perspective', to be points of references to whom one can turn and to act for the happiness of others as well as of themselves. I also see this as being part of an active involvement in the sustainable development goals that the international community is aiming for, with the conviction that "no one will be left behind"»*

Akio Toyoda

THE ROLE OF TECHNOLOGY  
THE VISION OF GILL PRATT

In Toyota's vision, the development of technology will improve the quality of man's work, not replace it. Gill Pratt, one of the world's leading experts, who since 2015 has been CEO of the Toyota Research Institute (TRI) and a Fellow of Toyota Motor Corporation, explains the meaning of all this, starting from the concept indicated by the Japanese word "ikigai" (生き甲斐). Ikigai is part of Japanese culture and means "that which is worth living for". According to ikigai, human beings are more likely to feel satisfied and fulfilled if their lives include work that they love, that they feel good at, that benefits the people around them and, most importantly, that is appreciated by society. The Ikigai is a universally valid concept and Pratt compares it to the ancient concept of εὐδαιμονία (eudaimonia) of which Aristotle speaks through the voice of Socrates. The term derives from εὖ "good" and δαίμων "demon" or "spirit" and is the innate moral guide that indicates to man the good to be pursued for himself and for society. Like the εὐδαιμονία, the ikigai has a moral, ideal and also psychological value that is explained by Mihály Csíkszentmihályi's theory

of flow, according to which people are happy if they are part of a flow that allows for the individual's self-expression and for society to accept and welcome his talents. This concept applies to work, but also to sport and learning processes. Finally, according to Pratt, there is no ikigai without "joie de vivre", a concept that found its way into literature thanks to Emile Zola, and the "dolce vita", represented by Federico Fellini in one of the most celebrated films in the history of cinema. For Toyota, if technological development were only to replace the human being, working in his place and relegating him to the role of pure machine controller, the long-term effects could be negative. In some areas, such as the performance of dangerous or arduous tasks, the replacement of humans is desirable, but in many other circumstances it could be counterproductive and thwart the deepest-held aspirations of the human being, undermining the possibility of achieving ikigai. Conversely, according to Toyota's vision, technology has the task of assisting and enhancing human capacities in order to improve the quality of life, according to the jidoka concept, which foresees a central position for humans. Even the



Gill Pratt, Toyota Research Institute CEO.

most sophisticated robots are not enough to guarantee the best quality of production. At the same time, even the most advanced technologies cannot replace humans, even when they have human-like characteristics such as artificial intelligence and robotics.

FROM AI TO IA,  
FROM MACHINE TO MAN

The relationship between artificial intelligence and human intelligence, and that between human work and robotics, are fundamental themes in Toyota's vision. It is the relationship between man and machine that new technologies are pushing to redefine. In its original meaning, the term robot comes from the Czech "robota" meaning "forced labour" and first appeared in R.U.R. (Rossumovi univerzální roboti), a drama in three acts written by Karel Čapek in 1920. Robots and automation help man by freeing him from the most difficult, tiring and dangerous jobs, but in the Toyota Production System they cannot replace him, as man guarantees quality and continuous improvement. There is, therefore, a technology-replacement idea of Artificial Intelligence (AI) centred on machines, and there is an Intelligence Amplification (IA) centred on man, the aim of which is to exalt his faculties. The latter is the idea of technology that underpins Toyota's philosophy and aims to enhance human capabilities and not replace them. For example, robots will be able to lift the heaviest loads, while people will be able to closely follow other aspects of work. Automata will be able to help older people to stay active, to age with dignity, allowing them to continue to contribute to society and, at the same time, helping them to stay in touch with it. In cars, IA will be able to make sure that driving is safe in all conditions, while the driver need only be concerned about enjoying the joy of driving.

ARTIFICIAL INTELLIGENCE  
IN THE SERVICE OF SAFETY

Safety is one of Toyota's priorities, with humans and vehicles working together to keep people safe through artificial intelligence and robotics. These are the two fundamental disciplines for producing and developing cars equipped with increasingly advanced propulsion and driver assistance systems, including autonomous driving. For this reason, Toyota has turned to Gill Pratt and TRI, whose aim is to amplify human senses and analyse the potential of new materials and technologies to help speed up the transition to sustainable mobility and achieve the goal of zero accidents.



LEXUS AND ARTIFICIAL INTELLIGENCE

Lexus has represented the group's commitment to artificial intelligence in a creative way. In the 2002 Steven Spielberg-directed film *Minority Report*, protagonist Tom Cruise drives the Lexus 2054, a self-driving hydrogen-powered car equipped with artificial intelligence. Such technological themes, which are fundamental within the Toyota Motor Corporation, were repeated in 2017 on the *Skyjet*, the Lexus featured in "*Valerian and the City of a Thousand Planets*" directed by Luc Besson. In these two cases, artificial intelligence is the object of the creative process; instead, it becomes an active subject in "*Driven by Intuition*", the first commercial written by a computer in collaboration with the Visual Office, IBM and the University of New South Wales. The script was then passed on to Kevin McDonald, Oscar-winning director in 2000 for the documentary '*One day in September*', who made a 60-second short film of it. The main character is a Takumi

master who examines the new Lexus ES Hybrid before it goes on a long journey to where crash tests are carried out. The teacher follows the procedure on TV and, when the car avoids impact thanks to its automatic braking system, he hugs his daughter sitting next to him because his creation is still intact and has proved that it can save lives, even those dearest to him. With this experiment, Lexus has proved that artificial intelligence, by integrating with human intelligence, can arouse and represent deeply human phenomena such as emotions and feelings.

ME, YUI AND THE LQ

Artificial intelligence will also play a key role in so-called intelligent on-board assistants. The LQ concept, unveiled at the last Tokyo Motor Show, features electric propulsion, level 4 autonomous driving and Yui, an interactive artificial intelligence agent developed by the Toyota Research Institute. Yui interacts with the driver not only through his voice, but with all five senses, learning his lifestyle to offer him a customised mobility experience. This interaction will establish a strong bond between man and machine, designed to make mobility



Toyota LQ.

an experience that engages the emotions and does not simply transport people from one place to another, but also touches their deepest feelings and needs. The LQ has other notable features. The instrumentation is Oled and the man-machine interface is augmented reality on a head-up display that simulates the equivalent image of a 230-inch screen on the windscreen, projecting an image perceived by the human eye with a width of 7 metres and a depth of 41 metres. The headlights are equipped with one million micro-mirrors that project symbols and lettering onto the road surface in order to communicate with the surrounding environment. Thanks to a special coating on the radiator fan, ozone from photochemical smog is decomposed to 60% oxygen, purifying a volume of 1.000 litres of air per hour.

WHY TOYOTA IS DEDICATED TO ROBOTICS

Robotics is one of the two new disciplines pivotal to Toyota's transformation into a Mobility Company and to which TRI is dedicated. Robotics is fundamental to allowing the machine, even the car, to act within the real world and interact with it in the most human form possible. In the imagination, the robot is the humanoid that replaces man, but in Toyota's vision, robotics is the discipline that allows machines to put man at the centre, amplifying his possibilities. The robots in Toyota's factories build cars with a human touch, but in the future they will help us get around, ensuring freedom and safety for everyone. Cars of the future will also be able to move like robots thanks to autonomous driving, but only if the driver wants to. At the same time, robots will increasingly assist the elderly and disabled, allowing them to experience the joy of moving without obstacles. This is why Toyota is looking carefully at the development of motorised exoskeletons, capable of allowing movements such as walking or grasping an object. The aim of robots is therefore to move people by setting in motion not only their needs, but also their desires, emotions and feelings. Ultimately, robots will make all people move, allowing them to live out their humanity to the full.



### TOYOTA'S ROBOTS

Toyota has been developing robots since the 1980s and T-HR3 is the most advanced. It is a humanoid with a high capacity for interaction and complex movements. T-HR3 can move on its own or replicate the movements of an operator wearing the Master Maneuvering System, a full-body wearable. In this way, the human remotely controls the robot through its movements and - vice versa - receives all the information coming from the environment in which the humanoid moves and interacts. Thanks to research carried out with T-HR3, Toyota has created Welwalk WW-2000, a robot that enables motor rehabilitation of the lower limbs. Micropalette is a small robot capable of carrying and delivering small objects, while HSR (Human Support Robot) has an arm capable of grasping and holding objects, including the Olympic torch. CUE is the most fun robot of all. Developed by Toyota's leisure time specialists, it is capable of shooting three-point baskets without missing one!

### BEYOND ZERO

The mobility of the future must make it possible to achieve the important objectives of 'zero emissions' and 'zero accidents'. A goal that might still seem hard to achieve today. However, Toyota has a much greater ambition: to go further. Beyond 'zero'. In the context of profound transformation we are experiencing, Toyota's vision is to contribute to achieving a mobility where zero negative impact is only an intermediate step, towards a future in which moving around actually makes the world a better place, a place where people can move without barriers and limitations and in total safety. The well-being and happiness of people, in harmony with their environment, is an intangible asset, the goal that Toyota wants to help achieve. The strategy to go "BEYOND ZERO" is based on the development of electrified mobility, on the will to ensure individual mobility for all people, on the determination to provide everyone who uses Toyota's products and services with a memorable user experience, and on active participation to favour education and local communities, environmental protection and an improvement in the quality of life for everyone, including the disabled. As Akio Toyoda says, no one should be left behind. Toyota began its journey towards sustainability many years ago and has set a broader course with the Environmental Challenge 2050. In it there are 6 challenges that look at the optimal use of resources, the progressive reduction of emissions for products and production, but above all the creation of a society in harmony with the environment and the planet. Zero emissions are therefore a stage along the route, but not the

*«Toyota intends to provide three types of mobility service. The first is 'physical movement', when humans and objects actually move through space. The second is 'virtual movement', when the operator's whole body or part is moved virtually within a remote space through avatars or operators and T-HR3 is an embodiment of this. The third is 'emotional movement' whereby the previous two modes of mobility provide people with new experiences and encounters by inspiring their emotions. Toyota also sees the latter as a form of 'movement'. For each of these forms of mobility, Toyota has a team developing a robot».*

final destination for the Toyota Motor Corporation, because the future of the planet does not only lie in emission-free cars and factories, but in a world where all people can move freely and happily. This is the starting point for the "Beyond Zero" strategy, articulated in 4 pillars and supported by a communication campaign that aims to promote the journey that Toyota is making towards the future together with its customers. Beyond Zero is based on the lines of action already undertaken some time ago and indicates Toyota's horizon along the path that will lead it to the transformation from automotive company to mobility company.

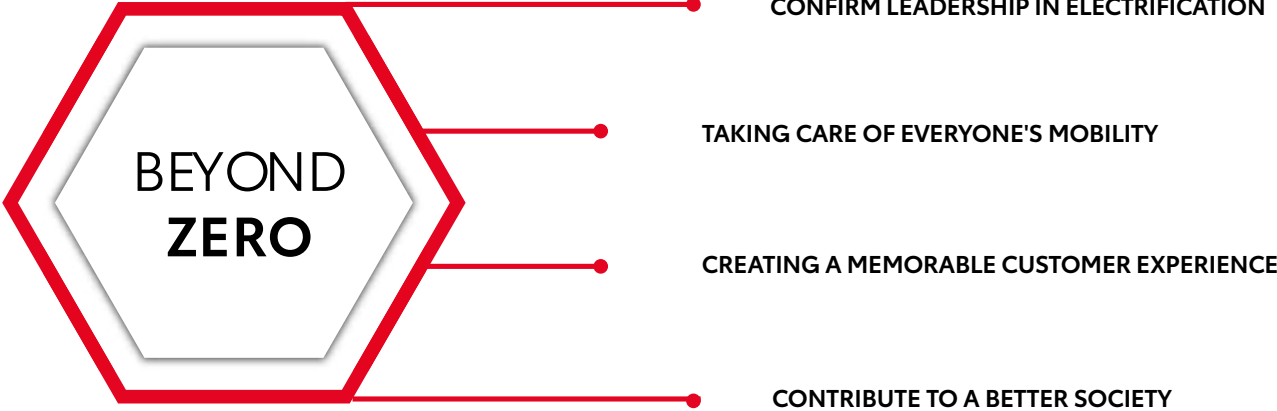
### LEADERSHIP IN ELECTRIFICATION

Toyota introduced the Prius in 1997, has produced over 16 million hybrid cars and is one of the pioneers of hydrogen fuel cells. It is also a pioneer in plug-in hybrids and will use all its electrification expertise in a new generation of electric cars. The goal is to produce at least 5.5 million electrified cars per year and at least one million with zero emissions by 2030. All forms of electrification are complementary to each other, each fulfilling different mobility needs. Among these, electric cars are intended to cover individual urban or



Toyota T-HR3.





suburban mobility needs, while hydrogen fuel cells are intended for buses, work, commercial and industrial vehicles or cars capable of travelling long distances. Toyota aims to cover all mobility needs while respecting the environment and using clean, sustainable energy.

**MOBILITY FOR ALL**

Toyota's transformation from automotive company to mobility company will allow it to create an ecosystem in which everyone, regardless of age or ability level, will have the right tool to move freely and responsibly, in the right place, at the right time. KINTO is Toyota's mobility services platform that is set to grow in the spirit of Start Your Impossible: if everyone has the opportunity to move around, nothing is impossible. An integral part of this strategy is the proximity to the world of sport, disability, education and to the territory where it operates with activities of inclusion, involvement and enhancement of diversity.

**CREATING A MEMORABLE CUSTOMER EXPERIENCE**

Customer satisfaction is the driving factor in the Toyota world and is based on product and relationship quality and continuous improvement. New technologies, such as connectivity, create new possibilities to strengthen the bond with the customer and to exceed their expectations. The aim is to add a human touch to the new forms of mobility that arouses a feeling of gratitude and makes their experience memorable. The MyT app enables constant interaction with the customer by implementing so-called digital kaizen, improvement activities carried out remotely in real time.

**CONTRIBUTE TO A BETTER SOCIETY**

For Toyota, being sustainable means being in harmony with the environment, the planet and society by contributing to people's economic, material and spiritual well-being. Social responsibility is therefore an integral part of Toyota Motor Corporation, its products and the way in which they are produced and marketed. WeHybrid is the formula that renders customers the protagonists of new technologies, encouraging them to derive the maximum benefit for themselves and for society. Toyota's aim is to reduce emissions and accidents to zero in order to improve people's quality of life. Woven City will be the living laboratory where the real value of an ecosystem based on new technologies for the creation of a better society will be tested.



Lexus LF-30 Concept.

# 04.

## LEADERSHIP IN ELECTRIFICATION

**ELECTRIFIED SOLUTIONS**

TOYOTA MOTOR CORPORATION'S  
ELECTRIFIED SOLUTIONS

HEV: IT'S EASY  
TO SAY HYBRID

THE MOBILITY MAP

**FULL HYBRID ELECTRIC**

HOW TO DRIVE

THE FULL HYBRID,  
THE ADVANTAGES EVERY DAY

FULL HYBRID ELECTRIC,  
THE BENEFITS  
MEASURED SCIENTIFICALLY

10 TRUTHS  
ABOUT TOYOTA HYBRID

**BEV, TOYOTA  
AND THE ELECTRIC CAR**

TOYOTA PROFESSIONAL  
READY FOR ELECTRIC

**LEXUS ELECTRIFIED**

THE BATTERY,  
THE NEW ENGINE  
ELECTRIFICATION

DIRECT 4  
ELECTRIFICATION  
FOR DRIVING PLEASURE

BATTERIES,  
DEVELOPMENT TOWARDS SOLID STATE

**HYDROGEN**

THE ADVANTAGES OF HYDROGEN

TOYOTA,  
THE PRESENT IS CALLED MIRAI

THE MIRAI  
OF POPE FRANCIS

TOYOTA TOGETHER  
WITH ENI AND VENICE  
FOR HYDROGEN



# LEADERSHIP IN ELECTRIFICATION

Toyota has always believed that the answer to environmental challenges lies in the progressive electrification of propulsion systems, either by supplementing traditional internal combustion engines with one or more electric motors or by replacing them altogether. Since the 1990s, Toyota has developed a strategy covering all forms of electrification and is a pioneer in this process. The more than 16 million full hybrid electric vehicles sold since 1997, including 3 million in Europe, are an enviable wealth of experience for the future development of all other electrified solutions based on the three fundamental components: the electric motor, the battery and the inverter. By 2025, every Toyota model in the world will have at least one electrified variant and the Toyota Motor Corporation's global goal is to sell at least 5.5 million electrified cars annually by mid-decade and at least 1 million zero-emission cars by 2030. In Europe, at least 60 new electrified Toyota and Lexus models or variants will be launched by 2025, and only 10% of vehicles sold will be equipped with conventional engines by the same year. These percentages are already a reality for some models: 9 out of 10 of the new Yaris models sold are hybrids and more than 50% of the Toyotas sold in the European Union in 2020 are equipped with Full Hybrid Electric technology.

## ELECTRIFIED SOLUTIONS FROM TOYOTA MOTOR CORPORATION

### HEV HYBRID ELECTRIC VEHICLE

Vehicle equipped with two types of engines: thermal and electric.

### PHEV PLUG-IN HYBRID ELECTRIC VEHICLE

Vehicle equipped with two types of engines: internal combustion engine and electric motor, but with a larger battery capacity that can be recharged from an external power outlet to ensure a greater zero-emission range.

### BEV BATTERY ELECTRIC VEHICLE

Vehicle whose traction is provided by the electric motor alone, powered by a battery of even greater capacity and which must be recharged from an external socket.

### FCEV FUEL CELL ELECTRIC VEHICLE

Electric vehicle that uses the energy produced on board by a fuel cell stack where hydrogen, contained in a tank, is combined with oxygen taken from the atmosphere.

## HEV

## PHEV

## BEV

## FCEV



## HEV: IT'S EASY TO SAY HYBRID

A hybrid car is fitted with an internal combustion engine and at least one electric motor with the aim of improving efficiency and reducing emissions, both in terms of CO<sub>2</sub> and pollutants (CO, NO<sub>x</sub>, PM10 and HC). This combination can take on numerous configurations, depending on the gearbox and operating mode that the two engines have in the driveline and the power of the electric part. There are various types of hybrids that can be distinguished by their operating mode and degree of electrification. A first method of classification takes into account the role and mode of operation of the two types of motor in relation to wheel drive.

### SERIES HYBRID

The traction is carried out only by the electric motor, while the thermal motor is detached from the transmission chain that drives the wheels and has the sole function of a generator to recharge the car's battery or provide additional power. An FCEV car can also be considered a series hybrid.

### PARALLEL HYBRID

Traction is provided by both the internal combustion engine and the electric motor, and both drive the wheels alternately or simultaneously. The main function of the electric motor is to assist the heat engine by providing additional power when needed.

### SERIES/PARALLEL HYBRID

Traction can be provided simultaneously by both types of engine or by the combustion engine alone or by the electric motor alone. In the latter case, the combustion engine does not provide motion to the wheels and can, if necessary, produce energy for the electric motor. Toyota has only ever used this scheme, which combines the advantages of both configurations. A second classification method takes into account the degree of intervention and the power of the system's electrical component.

### MICRO HYBRID

The heat engine is associated with a simple motor-generator which has a power output slightly greater than that of a starter/alternator. Its presence enables stop&start, i.e. switching off the internal combustion engine when stationary or at very low speed and restarting it when the driver presses the clutch pedal again or releases the brake on cars fitted with automatic transmissions.

### MILD HYBRID

The combustion engine is combined with a motor-generator of much greater power (usually 5-11 kW) than a starter/alternator and is connected to a high-efficiency accumulator (lithium-ion battery or supercapacitor), even at 48 Volt. Its function is to recover energy on release, to ensure stop&start by extending the shutdown situations of the internal combustion engine (cruising), and finally to provide an additional boost in starting and transients. These systems reduce fuel consumption and CO<sub>2</sub> emissions by 10-15%.

### FULL HYBRID

The combustion engine is connected to one or more electric motor generators with very high power, sometimes equal to that of the heat engine. These systems can operate in parallel, in series or in both modes, allowing the electric motor to operate in all driving conditions and even to move the vehicle on its own for a few kilometres, up to a certain speed. To provide the necessary power and energy, the electric system operates at very high voltages (up to 650 volts) and the battery has a significant capacity and size. It is recharged either by regenerative braking or by the internal combustion engine, whether the car is stationary or in motion. A third method of classifying hybrid vehicles is to calculate their degree of hybridisation. The degree of hybridisation (Hr) of a propulsion system is expressed by the ratio between the maximum power of the electric motor and the sum of the maximum power of the heat and electric motors.



$Hr =$  Electric motor power

Thermal motor power +  
Electric motor power

Battery electric vehicles have an  $Hr=1$ , those with only conventional powertrains have an  $Hr=0$ , hybrids between 0 and 1. So the closer it is to one, the greater is the preponderance of the electric component, the greater its the ability to deliver higher efficiency and lower local emissions.

TOYOTA MOTOR CORPORATION'S  
ELECTRIFIED SOLUTIONS

HEV HYBRID ELECTRIC VEHICLE

PHEV PLUG-IN HYBRID ELECTRIC VEHICLE

BEV BATTERY ELECTRIC VEHICLE

FCEV FUEL CELL ELECTRIC VEHICLE

HEV HYBRID  
ELECTRIC VEHICLE

The Prius was the first mass-produced, global hybrid car in 1997. Since then more than 16 million Lexus and Toyotas equipped with full hybrid electric technology have been produced. In Italy, 70% of Toyota sales are hybrid and Lexus has been the first 100% hybrid brand since 2013. The Toyota Hybrid System, which has evolved and improved over time, has always followed the same operating scheme. The fundamental part is the so-called Power Split Device, a planetary gearbox that links together the petrol engine, the electric motor and the generator, also acting as transmission and gearbox. A simple system with no clutches, torque converters, belts or other components subject to wear, and therefore virtually indestructible. The new milestone is the fourth generation Yaris Hybrid which is the world's most efficient unplugged car: 2.8 litres/100 km with CO<sub>2</sub> emissions of 64 g/km according to the NEDC standard, 20 per cent less than the previous generation despite a 16 per cent increase in system power.

PHEV PLUG-IN HYBRID  
ELECTRIC VEHICLE

The Prius was also the first plug-in hybrid car, i.e. equipped with a larger rechargeable battery to offer more performance and range in electric mode with zero emissions. Toyota's state-of-the-art hybrid is the RAV4 PHEV. The hybrid system delivers 306 hp and all-wheel drive. The RAV4 PHEV offers the best balance between performance and efficiency: it accelerates from 0 to 100 km/h in 6 seconds and claims a consumption of 1 litre/100 km equal to 22 g/km of CO<sub>2</sub> according to the WLTP cycle. In electric mode it reaches 135 km/h and has a range of 75 km in the mixed cycle and 98 km in the city driving cycle thanks to its 18.1 kWh lithium ion battery. Toyota's expertise allows the RAV4 PHEV to be 20% more efficient than its competitors when running on electric power and 30% more efficient when operating in hybrid mode.

BEV BATTERY  
ELECTRIC VEHICLE

Lexus UX300e crossover is the Toyota Group's first global electric car. Its 150 kW and 300 Nm engine enables it to accelerate from 0 to 100 km/h in 7.5 seconds. The lithium-ion battery has a capacity of 54.1 kWh for a range of more than 300 km (WLTP) and is guaranteed for 10 years or one million kilometres. For an optimal user experience, the Lexus Linkapp has been designed according to the Omotenashi philosophy and an integrated network with more than 160,000 charging stations has been set up. Compared to the Lexus UX Hybrid crossover, the UX300e has a more rigid body and a lower centre of gravity to offer superior dynamic qualities. The aerodynamics have been refined to increase efficiency. To increase comfort, soundproofing has been improved and ASC, an innovative noise suppression system, has been employed.

FCEV FUEL CELL  
ELECTRIC VEHICLE

In 2014 Toyota introduced the Mirai (a Japanese word meaning 'future'), the first mass-produced hydrogen fuel cell sedan. More than 10,000 units have been produced and a second generation is expected in 2021, with improved styling, performance, efficiency and user experience. The new Mirai is based on the new GA-L platform, has a dynamic design, enhanced by large wheels mounted on 19 and 20 inch rims, and has rear wheel drive. Also innovative is the arrangement of the three 700 bar hydrogen tanks for a range increased by around 30% compared to the current Mirai. The car interior is more spacious for five people and the driver's seat is more enveloping, promising a driving pleasure never before experienced in a hydrogen car.



THE MOBILITY MAP

According to Toyota, each electrified technology will contribute to sustainable mobility with a different role in different markets according to the principle of the right drive system, at the right time, in the right place and at the right price for any type of customer. The path to electrification and lower emissions will differ from country to country and will depend on many factors: the economic situation, the existence of charging and refuelling infrastructures, energy policy, the presence of incentives, the level of income per capita and, last but not least, laws and directives aimed at reducing both emissions and fossil fuel consumption. Another key factor will be the stage of maturity of individual technologies, their evolution and their specificity. Electric vehicles are still expensive and have low autonomy, and the recharging network is still critical, both in terms of its presence in the area and its timeframe. For this reason, we can foresee a greater diffusion of electric vehicles in urban areas for small vehicles, even for scooters, cycles and other personal mobility means of transport, and finally also for last-mile logistics. Hydrogen, on the other hand, thanks to its greater autonomy and refuelling speed, is the most functional for long distances and large vehicles, such as commercial and industrial vehicles, buses and trucks. In Toyota's vision, in the near future Full Hybrid will continue to represent the most flexible and accessible technology, the fundamental pillar that will accompany the growth of zero emission vehicles (BEVs and FCEVs) following the evolution of individual markets and offering, in every case, all the solutions to allow everyone to move around in the most sustainable way possible.

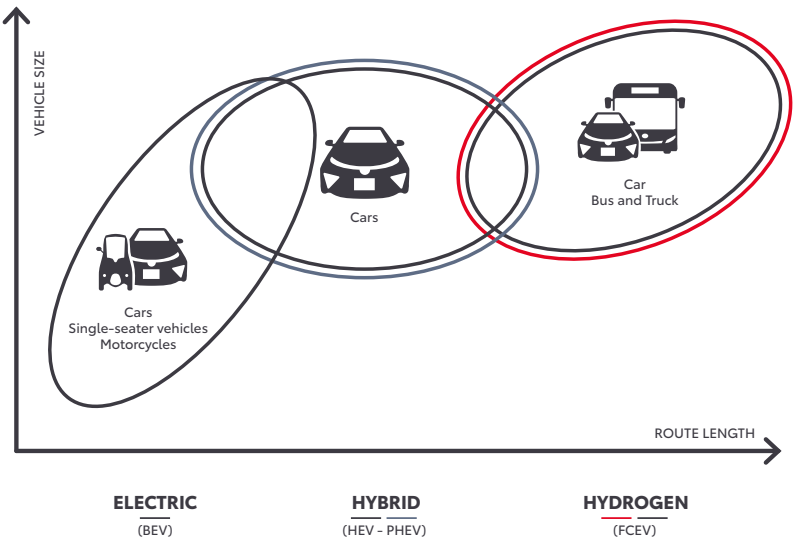
FULL HYBRID ELECTRIC

HOW TO DRIVE

- START**  
The system starts without an internal combustion engine and accelerates at low speeds with electric power, which is more efficient and emission-free.
- URBAN DRIVING**  
The car runs on electric and during stops, starting the thermal engine only when more acceleration is needed and using frequent decelerations to recover energy.
- ACCELERATION**  
As the throttle is pressed harder, the two engines work together to increase speed and achieve the desired pace.
- SPEEDING**  
Once the desired speed is reached, simply lift your right foot and the combustion engine shuts down (up to 130 km/h on the Yaris) and the car will run on electric power alone for as long as the battery charge allows.

- DOWNHILL**  
When the road descends, lifting your right foot off the accelerator and, even more so, pressing the brake pedal, the system recovers energy for the battery.
- HIGHWAY**  
At high speeds the hybrid system makes exclusive or predominant use of the internal combustion engine to optimise fuel consumption.
- SLOWING DOWN**  
Lift the accelerator pedal as soon as possible to initiate energy recovery and press the brake pedal as little as possible to convert all kinetic energy into electrical energy, minimising wear on pads, discs and tyres.
- STOP**  
When the car stops, the internal combustion engine stops and the electric engine does not consume battery energy.

THE MOBILITY MAP







NEW YARIS: ENERGY EFFICIENCY STUDY

	URBAN	EXTRA-URBAN	OVERALL TEST
Time ZEV	82.6%*	75.7%	78.0%
Space ZEV	76.1%	64.5%	66.3%
Consumption [l/100 km]	3.81	2.93	3.07
Overall system efficiency	34.0%	43.3%	41.5%

MORE THAN 80%\*  
OF TIME  
WITH ZERO EMISSIONS  
IN THE CITY

TWO THIRDS (66.3%)  
OF KILOMETRES TRAVELLED  
WITH ZERO EMISSIONS

OVER 30 km/l  
41,5% ENERGY  
EFFICIENCY

27% OF ENERGY  
IS RECOVERED  
EN ROUTES

THE FULL HYBRID, BENEFITS EVERY DAY

Toyota's Full Hybrid Electric offers multiple economic advantages to the user, many of which can be appreciated on a day-to-day basis and which guarantee the freedom to move without limits.

PURCHASE SUBSIDY

Many regional or municipal authorities offer a cash contribution to those who buy a hybrid car in addition to state incentives.

OWNERSHIP TAX

It is only paid according to the power of the combustion engine and in some regions there is partial or total exemption for up to 5 years.

FREE PARKING

In some cities, hybrid cars are exempt from paying on street pay-parking spot.

LOW EMISSION ZONE ACCESS

In some cities, hybrids can access for free or at a reduced charge within LEZ.

TRAFFIC BLOCKS

In the event of permanent or temporary traffic blocks or restrictions, hybrid cars can always be driven.

FULL HYBRID ELECTRIC, BENEFITS SCIENTIFICALLY MEASURED

Partial electrification provides objective and verifiable advantages for everyone. This is borne out not only by the 350,000 drivers who drive a Toyota or Lexus equipped with the Toyota Hybrid System, but also by the results of three separate studies carried out by CARE of Rome's Guglielmo Marconi University on the fourth generation of the Prius in 2016 and on the two different generations of the Yaris in 2017 and 2020 respectively. The Yaris studies were conducted together with ENEA. The research, conducted in the city of Rome, used identical methodologies with the aim of verifying the energy behaviour of Toyota vehicles equipped with a full hybrid electric propulsion system and scientifically quantifying the percentage of zero-emission mileage on a route representative of average use in an urban environment. The study on the Toyota Prius involved 20 drivers in 60 test drives and showed that a car equipped with a Full Hybrid Electric propulsion system can run at zero emissions up to 73.2% of the time, with peaks of 79.4% on urban stretches. 27.6% of the electrical

energy needed to recharge the battery is generated by recovering kinetic energy when releasing and braking, which would otherwise be lost in heat and would produce dust into the environment. The second study was carried out on the third generation of the Yaris, a widely used car and therefore capable of generating more marked changes in both fuel consumption and the environment. The research involved 14 drivers carrying out 42 tests for a month and a half, covering a total of over 1,500 km in more than 95 hours. The Yaris Hybrid operated on average 67.6% of the time on zero emissions, 75.4% on urban stretches and 40% on all-electric drive. The third study featured the new Yaris, equipped with fourth-generation full hybrid technology, and again involved 20 drivers, each of whom completed the route three times. The new Yaris significantly improved on the result of the previous model, driving the planned route with an average of more than 78% of the time on zero emissions (reaching 82.6% on urban stretches) and 66.6% of the time on electric traction only. Similar studies have been conducted by other prestigious academic institutes in Europe, producing very similar results.

# 10 TRUTHS ABOUT THE TOYOTA HYBRID

## IT IS EFFICIENT

Because it runs on zero emissions in the city at least 50% of the time.

## PRACTICAL

Because it recharges itself while driving without the need for sockets or columns.

## SUSTAINABLE

Because it reduces fuel consumption and emissions of climate-altering gases that are harmful to human health.

## POWERFUL

Because it uses both engines in synergy to deliver high performance.

## VERSATILE

Because it optimises fuel consumption in the city and guarantees efficiency even on out-of-town routes.

## SAFE

Because it has all the protection of Toyota Safety Sense as standard with the most innovative technologies.

## RELIABLE

Because it's made up of simple, robust technology that guarantees high reliability, which is why it benefits from the Toyota Hybrid Service warranty, which can be extended up to 10 years.

## ECONOMICAL

Because it minimises energy wastage, reduces brake consumption and has no traditional wearing parts (such as clutch and belt), it requires low maintenance costs.

## CONVENIENT

Because Toyota's quality, durability and reliability maintain its value over time.

## INNOVATIVE

Because the cars of the future are designed on the technology platform on which the Full Hybrid Electric is based.

## BENEFITS FOR PUBLIC ADMINISTRATIONS

### IMPROVES AIR QUALITY TODAY

The Full Hybrid Electric produces very low emissions of NOx and other pollutants harmful to health with over 300 thousand Toyotas circulating in our country.

### ENVIRONMENTAL PROTECTION

Toyota's Full Hybrid Electric produces 30-50% less CO<sub>2</sub> emissions than equivalent petrol engines and mild-hybrids.

### NO NEED FOR CHARGING INFRASTRUCTURE

Toyota Full Hybrid Electric vehicles recharge themselves and do not need external charging sources, unlike PHEVs and even more so than BEVs.

### NO CHANGE IN DRIVING HABITS

Suitable for all driving styles and drivers of all ages. A Toyota Full Hybrid Electric drives like a normal car with an automatic transmission.

### REAL ELECTRIFIED DRIVING EXPERIENCE

With around 50% of driving time spent with zero emissions in the city, Toyota's Full Hybrid Electric has the potential to give the majority of the population their own electrified driving experience.

## BENEFITS FOR COMPANIES AND FLEETS

### HELPS CORPORATE CAR POLICY

Full Hybrid Electric is an affordable technology available for a range of vehicles covering all volume segments up to the premium segments for executives and managers.

### SUPPORT OF CO<sub>2</sub> REDUCTION POLICIES

Reducing the average carbon dioxide emissions of the car fleet enables a lower CO<sub>2</sub> footprint, with effects on the balance sheet and on image.

### CONNECTIVITY

All Toyota Full Hybrid Electric vehicles are equipped with connectivity so that management by the fleet manager is facilitated in conjunction with services provided by Toyota.

### HIGH VALUE OVER TIME

Comprehensive safety features, Full Hybrid Electric efficiency, low maintenance costs, proverbial reliability and a warranty that can be extended up to 10 years or 250,000 km allow Toyota to maintain high value over time.

### LOW MAINTENANCE

The absence of wearing parts such as the gearbox and clutch, reduced brake usage and lower tyre wear means moderate maintenance costs and short downtime.

### LOW TCO AND COMMERCIAL PROPOSITION

The combination of affordability, high residual value, low maintenance costs and purchase and usage incentives results in a highly competitive TCO and, consequently, lower finance and rental fees.

### VIRTUOUS DRIVING

The Full Hybrid Electric stimulates a driving style that focuses on consumption and electric mileage and therefore also promotes safe driving. Convenient for the company, rewarding for the user.

### PROMOTES TRANSITION

Full Hybrid Electric minimises the financial risk of the transition from conventional fuels by introducing a future-oriented way of using a company car in the fleet.

### IDEAL FOR CORPORATE CAR SHARING

The Full Hybrid Electric allows employees to share a car for a variety of uses without the limitations of city use and without the problems of recharging for out of city journeys, which also impacts on usage rates.



## BEV, TOYOTA AND THE ELECTRIC CAR

Toyota Motor Corporation has been developing the electric car since the early 1990s, along with hybrid and hydrogen. The RAV4 EV was the first BEV and 1,484 examples were produced from 1997 to 2003 for the Californian market, many of which are still running. The second generation was produced from 2012 to 2014 with 2,600 units and marketed in California to meet local ZEV regulations. The first global electric model is the Lexus UX 300e crossover. Toyota Motor Corporation is working with Subaru on a new modular platform called e-TNGA (electric-Toyota New Global Architecture) for electric vehicles. Thanks to its flexibility, it will be the technical basis for vehicles of different sizes and segments, with front-, rear- or all-wheel drive. Over the next five years, six Toyota and Lexus models will be based on the e-TNGA, the first of which will be a SUV with dimensions similar to those of the RAV4. It is expected to arrive during 2021. Toyota has also established the EV C.A. Spirit Corporation with Denso and Mazda to develop technologies and components for electric vehicles.

## TOYOTA PROFESSIONAL READY FOR ELECTRIC

2021 will see the electrification of Toyota Professional, the third brand under which Toyota is present in Italy and Europe. The Proace City and the electric version of the Proace will debut in 2021. Developed in collaboration with PSA in the EU, the two commercial vehicles will have a range of up to 330 km, offering fleets and companies active in logistics an effective solution for reducing emissions and operating

costs, while respecting the environment and company policies, which are increasingly attentive to the "green" factor. The explosion of e-commerce and the prospects for growth in the coming years are driving the commercial vehicle market, in particular to cover the so-called 'last mile', that which connects directly to the end customer. This phenomenon risks increasing road traffic volumes with all that this entails in terms of safety, pollution and quality of life. This is why Toyota believes that the electrification of its range of commercial vehicles is a priority and that in this case BEVs are the best solution.

## LEXUS ELECTRIFIED

Lexus Electrified is the strategy with which Toyota's premium brand wants to reaffirm and relaunch its leading position and pioneering role in the field of electrification by offering premium mobility. Italy has played a pioneering role in this process. In 2013, Lexus decided to launch a range of models equipped exclusively with Premium Hybrid Electric propulsion in Italy, ahead of the European market where 96% of Lexus cars sold are equipped with this technology. In 2004 the Lexus RX 400h was the world's first luxury hybrid SUV and since then 1.8 million Lexus hybrids have been sold. The journey continues with the UX 300e crossover, Toyota Motor Corporation's first BEV for the European market, due to arrive in dealerships in early 2021. The Lexus Electrified strategy envisages all forms of electrification, including hydrogen fuel cell (FCEV) and plug-in hybrid (PHEV), which will make its debut in a Lexus in 2021. The transversality of this approach can be seen in the LF-1 Limitless, a concept presented at the 2018 NAIAS in Detroit and capable of accommodating any type of electrified propulsion (HEV, PHEV, BEV

and FCEV). Lexus' most advanced manifesto is the LF-30, a concept presented to celebrate 30 years of the brand born in 1989 and representing everything Lexus wants to be and wants to do by 2030: launching a new generation of electrified vehicles capable of representing the ultimate in performance, fun and safety involvement according to the values of social and environmental responsibility. The LF-30 is equipped with 4 electric motors delivering 400 kW to offer great performance and driving dynamics achieved by instantly controlling the torque and power delivered to each wheel. The 110 kWh capacity battery is rechargeable wirelessly and is composed of solid state cells, a technology that Toyota believes represents the future of automotive batteries. The Teammate autonomous driving system has two operating modes: Chaffeur, which allows the car to drive itself, and Guardian, which assists the driver by amplifying his senses. The driving position and shape of the steering wheel respond to the concept of tazuna, or "bridle", to establish the same relationship of trust and love with the vehicle that exists between man and his steed. In the broader vision of mobility outlined by Akio Toyoda, Lexus cars will therefore be the horses, or rather the most intelligent vehicles capable of offering the most involving experience.

**«In Lexus, we want to use electrification and all related technologies to create vehicles that elevate the original potential of the automobile».**

**Takashi Watanabe, Chief Engineer Lexus Electrified Vehicles.**

## THE BATTERY, THE NEW ENGINE FOR ELECTRIFICATION

The battery is the key component of electrification, not just for mobility but for society as a whole. The development of batteries has effectively revolutionised the way we live, work and use energy, and therefore the way we move around. The advent of electrification for cars has further accelerated the development of batteries to improve their cost, performance and capacity, but also their sustainability. In fact, according to Toyota, environmental protection is not limited to reducing and eliminating local emissions, but also to reducing the raw materials used,

their stationary use for a second life and the possibility of recycling rare and expensive chemical components such as cobalt. The quantity and origin of the energy required for both production and recycling is also an important consideration. The evolution of batteries has followed that of the Full Hybrid Electric system. The lithium-ion (LiOn) battery in the new Yaris Hybrid is 12 kg lighter (-27%) and more compact than the previous generation nickel-metal hydride (NiMh) battery, and is 100% faster at storing energy and 50% faster at delivering it. Compared to other forms of electrification, hybrids allow the use of smaller, lighter and therefore less expensive batteries for more accessible and more widely available vehicles. The new RAV4 Plug-in Hybrid also represents the state of the art for the battery and its management. Thanks to its dual

inverter, it is able to optimise its performance in both electric and hybrid operation, ensuring the best fuel consumption for a car with this type of system. Compared to the Prius Plug-in, it is 151% more powerful and 30% heavier, has four-wheel drive, less favourable aerodynamics and significantly more interior space, yet it has 24% lower fuel consumption and CO<sub>2</sub> emissions and 50% more electric range. The overall efficiency and impact of the hybrid therefore fits in with Toyota's broader concept of sustainability, which it has pursued consistently for more than 20 years, and is a means of effectively reducing fossil fuel consumption, CO<sub>2</sub> emissions and air pollutant emissions. Toyota's enviable experience in batteries is a wealth of knowledge that is essential for making cutting-edge products with any form of further electrification.





## DIRECT 4 ELECTRIFICATION FOR DRIVING PLEASURE

Lexus will use electrification to enhance the driving pleasure and refinement for which its cars are renowned. The technology to do so will be called DIRECT 4 and uses the ability to instantly adjust the thrust of electric motors to enhance performance and make it even more noticeable to the driver, establishing a more direct interaction between the vehicle and their body. DIRECT 4 stands for Direct 4 Wheel Drive Force Control and this technology will be applied to both electric and hybrid vehicles to offer all Lexus customers, through electrification, a new way to drive their cars and to derive a deeper, more engaging and rewarding experience.



## BATTERIES, DEVELOPMENT TOWARDS SOLID STATE

The Toyota Motor Corporation has always had Panasonic Corporation as its partner for battery development and production. The two companies formed the Prime Earth EV Energy joint venture in 1996, and in February 2020 they formed a new one called Prime Planet Energy & Solutions, which specialises in the production of automotive batteries made up of lithium-ion prismatic cells and which also aims to develop batteries with solid-state electrolytes. Compared to current batteries, they are more dense in power and energy, and therefore more compact and lighter, but also more stable, safe and long-lasting, and can provide faster recharges than current batteries based on liquid electrolyte cells. Toyota believes that solid-state technology is the next frontier for batteries. During 2020, Toyota also established a new joint venture with BYD (BYD TOYOTA EV Technology) and similar partnerships are being formed with CATL, GS Yuasa, Toshiba and Toyota Industries Corporation to support the growth of the range and demand for electrified cars in the coming years. The first application of solid-state batteries will be the e-Palette, a self-driving minibus that will be operational for the Tokyo Olympic and Paralympic Games.

## HYDROGEN

According to Toyota, hydrogen is the last frontier of mobility and its use as an energy carrier can bring great benefits to society as a whole. The study "Hydrogen, Scaling Up", carried out by McKinsey in collaboration with the Hydrogen Council and presented at COP23 in Bonn in 2017, states that

hydrogen could contribute 20% of CO<sub>2</sub> reduction by 2050, generating 18% of all energy needs, a turnover of \$2.5 trillion and 30 million jobs. This is why Toyota wants to promote a 'hydrogen society' where energy and mobility are decarbonised, the environment is protected and new prosperity is generated.

## THE ADVANTAGES OF HYDROGEN

### UNLIMITED AND CIRCULAR RESOURCE

Hydrogen is the perfect energy carrier because it is the most abundant chemical element in the universe and can be obtained from the most abundant substance on planet Earth, water, through the process of electrolysis. Once it has been used in fuel cells to produce energy, it reverts to water, creating the perfect, fully decarbonised cycle.

### DRIVES RENEWABLE ENERGY

Hydrogen can be stored in gaseous, liquid or even solid form for a long time. It can therefore act as a 'reservoir' to balance the discontinuity of renewable energy sources by encouraging their development, helping to balance the grid and reducing the use of hydrocarbon power stations. It is therefore flexible and virtuous.

### SAFE AND NON-TOXIC

Hydrogen can also be produced from a wide range of substances, including oil, gas, biofuels, hydrocarbon cleaning sludge and even as a by-product of chemical and refining plants. In addition, it is odourless, colourless, non-toxic and disperses easily into the environment without creating hazards or any impact on the environment.

## DENSE AND FAST

Hydrogen has a very high energy density: 1 kg of compressed hydrogen at 700 bar is equivalent to 2.1 kg of natural gas, 2.8 kg of petrol and at least 150 kg of the best lithium-ion batteries. For refuelling, the time (3-5 minutes) and procedures (including self-service) are identical to that of a common liquid fuel. These features make it possible to have vehicles that are easy to use and have great autonomy.

## HOW IT WORKS ON CARS

The hydrogen car is schematically a hybrid car that runs on an electric motor alone and whose primary source of energy is the fuel cell stack. Inside the fuel cell stack, hydrogen is brought together with oxygen naturally contained in the air, blown by a compressor, to trigger a chemical reaction that produces a large amount of electricity on board the vehicle itself, which is used by the traction motor. The only product of the reaction is water in the form of steam, which is expelled through an exhaust pipe. In order to achieve immediate throttle response and recover kinetic energy on release, hydrogen cars are also equipped with a battery similar to that used in hybrid cars.

## TOYOTA, THE PRESENT IS CALLED MIRAI

Toyota started its hydrogen car research programme more than 20 years ago, at the same time as hybrid and electric cars. The first mass-produced FCEV model is the Mirai (Japanese for future), presented in 2014, which takes advantage of all the knowledge Toyota has accumulated both about hydrogen and about the components of hybrid systems (electric motor,

battery and inverter). The new Mirai is more dynamic in its styling and driving style and is also more spacious thanks to the innovative arrangement of all the electrical and mechanical components. There are now three composite fuel tanks: the largest is positioned longitudinally, the other two under the rear seat and in the boot. The total capacity is 5.6 kg, 20% more and refuelling at 700 bar is completed in 5 minutes. The buffer battery is lithium-ion and weighs 44.6 kg (-2.3 kg) with a peak power of 31.5 kW (+24%). The fuel cell stack is now located at the front: it has a volume of 24 litres (-38%) and delivers 128 kW (+12%) with a power density of 5.4 kW/litre, 46% more. The inverter is also located under the bonnet and, for the first time on a Toyota, is silicon carbide. The engine is now at the rear and has a maximum output of 128 kW (+14 kW). The entire system has improved efficiency by 10%. As a result, the range is over 650 km, 30% more. The stack's air filter is highly innovative: the electrically charged non-woven catalytic layer captures sulphur dioxide (SO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>) and PM2.5 particles, even the finest PM2.5 by at least 90

per cent. Thanks to the optimisation of every component, the new Mirai is also more affordable with a price 20% lower than its predecessor. Once again, Toyota goes beyond zero emissions by making its vehicle more socially sustainable and capable of purifying the air breathed, returning it to the environment cleaner and free of carbon compounds.

## POPE FRANCIS' MIRAI

During his apostolic trip to Japan in November 2019, Pope Francis was provided with two specially outfitted Mirai cars to allow the Holy Father to review the faithful. The Mirai were made and donated by the Toyota Motor Corporation to the Japanese Bishops' Conference. One of the two hydrogen-powered 'popemobiles' was later brought to Italy and is therefore available to the pontiff. Pope Francis wrote the encyclical "Laudato si'" in 2015, which calls the faithful "to an integral ecology, lived with joy and authenticity" and speaks of the planet as the common home. A number of initiatives have been launched in the Vatican that aim for CO<sub>2</sub> neutrality, starting with mobility.



Delivery of the Mirai Popemobile to Pope Francis - October 2020.



**TOYOTA TOGETHER WITH ENI  
AND VENICE FOR HYDROGEN**

For the moment, the spread of Mirai in Italy is being held back by the lack of a hydrogen refuelling network. In Italy, there is only one active distributor capable of delivering 700 bars, the reference standard for cars and future trucks. In the rest of the world, the situation is quite different, and many countries such as Japan, the United States and China are proceeding apace with the planning and creation of a widespread distribution network. In Europe, the most committed country is certainly Germany, where today there are already 87 distributors spread throughout the country and another 19 in the process of being completed. Denmark, with 6 distributors, has also ensured coverage of the country. In other countries, such as Great Britain (10 distributors), France (5 distributors and 2 in preparation), Norway (5), the Netherlands (5), Switzerland (4 and 7 in preparation), Sweden (4) and Austria (5) hydrogen cars can already circulate in large areas of the country. To boost the development of a distribution network in Italy, Toyota has signed two agreements with ENI. The first one, which also involves the Metropolitan City of Venice, foresees the construction of a hydrogen refuelling station within the territory of the municipality of the lagoon city. Once completed, Toyota undertakes to supply a fleet of 10 Mirai cars. The agreement is part of the collaboration that Toyota has with Venice, for the realisation of mobility projects such as KINTO Go car sharing and a hydrogen distribution network. The second one foresees an identical commitment, for the construction of another hydrogen refuelling station in San Donato Milanese.



Toyota and ENI together for hydrogen.





# 05.

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## MOBILITY FOR ALL

WHAT DOES  
MOBILITY FOR ALL MEAN?

PERSONAL MOBILITY

TRI, OR  
TOYOTA RESEARCH INSTITUTE

THREE LOCATIONS, ONE MISSION

WOVEN PLANET

START YOUR IMPOSSIBLE

THE UNBREAKABLE  
AND THE ART OF KINTSUGI

KINTO

KINTO, A NAME  
FROM THE WORLD OF FANTASY

KINTO SERVICES

KINTO SHARE, THE CAR SHARING  
SERVICE IN VENICE



## MOBILITY FOR ALL

Toyota aims to create inclusive mobility, to ensure that everyone has the freedom to move around safely and responsibly, in harmony with the society and environment around us, without barriers or limitations. In line with this ambition, Toyota's mission is to evolve from an Automotive Company to a Mobility Company by embracing new technologies that will enable it to make ever better cars and offer innovative and efficient services. A momentous change, but anchored on the trunk and solid roots of the Toyota tree. To make this evolution consistent and visible in the run-up to the Tokyo Olympic and Paralympic Games, Toyota in 2017 became a mobility partner of the Olympic and Paralympic Games Committee until 2024, creating a global programme called "Start Your Impossible".



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THE — UN  
BREAK  
ABLE

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## WHAT DOES MOBILITY FOR ALL MEAN?

The future of mobility lies in a range of services and means that gives everyone the opportunity to get around at any time. There is therefore a need to create an ecosystem ready to meet everyone's needs with the right means, at the right time and in the right place. Within this ecosystem, the car will continue to be central, in the same way and with the aim of creating such an ecosystem, Toyota is developing new tools designed for individual mobility.

### PERSONAL MOBILITY

#### I-ROAD

The i-Road is an electric three-wheeler, 2.35 metres long and only 87 cm wide, powered by two 2 kW motors for a maximum speed of 45 km/h. The lithium-ion battery recharges in 3 hours for a range of 50 km. Its special feature is the Active Lean steering system that uses the combined effect of the rotation of the rear wheel with the inward tilt of the vehicle, like a motorbike. The driver lies comfortably in a shell a short distance from the ground, and it is possible to carry a second passenger. The i-Road is the star of Cité Lib by Ha:mo, Toyota's first car sharing project in Europe, which has been running in Grenoble since 2014. Other trials are underway in Tokyo and in Toyota City.

#### ULTRA-COMPACT BEV

The Ultra-compact BEV is a 2.49 metre-long, four-wheeled electric vehicle with a lithium-ion battery that can be recharged in 5 hours and is capable of travelling 100 km. It reaches 60 km/h and two versions have been produced. The first is a two-seater designed for the last mile of commuters, new drivers, the elderly or customers/guests of a company or accommodation facility. The second is the single-seater Business version and is designed as a mobile office or relaxation room for short distances.

#### WALKING AREA BEV

These are three individual electric micro-mobility devices. The Walking Area BEV Standing Type allows movement while standing and is



Toyota Concept i-RIDE

Toyota Concept i-WALK

Toyota Concept LQ



intended for patrolling or maintenance in very large areas in need of being controlled. The Walking Area BEV Seating Type allows those who have difficulty walking or who have heavy luggage to move around in a seated position. The Walking Area BEV Wheelchair-linked Type, on the other hand, is a kind of trailer which, attached to the wheelchair of a disabled person, allows them to move quickly and effortlessly from the car or bus to their final destination. The range varies from 10 to 20 km with a recharge time of 2.5 hours and a speed of up to 10 km/h.

#### MAAS, MOBILITY AS A SERVICE

In the near future there will be self-driving vehicles that will go alone to where they are needed, providing mobility and also ancillary services. A meeting point between individual needs and public service, which can be requested and managed by the user using a smartphone.

#### E-PALETTE

An autonomous guided vehicle 5 metres and 25 centimetres long, capable of accommodating 20 people (including the on-board operator) or 7 people with 4 wheelchairs. It interacts with pedestrians thanks to signals produced by external displays. It reaches 19 km/h and is already a reality: the e-Palette will be operating in the village that will host the athletes of the next Olympic and Paralympic Games in Tokyo. It can be a bus, an office, a shop and even a hotel, so it offers multiple services to meet the needs of ever-changing mobility. Toyota aims to market the e-palette in different countries and geographical areas by 2025.

#### APM

This stands for Accessible People Mover. It is a chauffeur-driven vehicle that will also be operational for the Tokyo Olympic and Paralympic Games and is designed to offer "last mile" mobility during major events for able-bodied people, the elderly, pregnant women and families with small children. It can carry up to 5 passengers or 2 plus a wheelchair. It reaches 19 km/h and has a range of 100 km.

#### E-CARE

Self-driving health care vehicle that can drive itself to the home of the person in need. Inside and during transport it is already possible to carry

out remote diagnostic examinations and communicate with the doctor. It can also function as a means of transport to and from elderly care facilities or as a mobile clinic.

#### E-4ME

Self-driving taxi equipped with a soundproof cabin and tinted windows to allow maximum privacy for the passenger while travelling.

#### E-TRANS

A multi-purpose, compact ride-sharing vehicle with a passenger compartment that can be configured to carry people or goods.

#### E-CHARGEAIR

A support vehicle for those who are stranded or without power. It is equipped with a large battery to recharge them without the need for wires. It also acts as a wi-fi hotspot and has an air purifier.

### TRI, OR TOYOTA RESEARCH INSTITUTE

The most advanced technologies must first be incubated and then cultivated and developed. This is the model that Toyota is putting into practice through the Toyota Research Institute, founded in 2015 and funded with \$1 billion. TRI consists of a multidisciplinary team and its mission is to innovate so as to improve the human experience through technologies that enhance the senses, improve people's quality of life and accelerate the electrification process. The key disciplines for achieving these goals are artificial intelligence and robotics, which are increasingly being applied to make vehicles ever more intelligent, but also to research tools, manufacturing methods and decision-making processes. TRI also aims to find new materials for batteries and fuel cells to make them more efficient, durable and sustainable. Thanks to machine learning, a subset of artificial intelligence, it will be possible to recharge batteries faster and limit their decay. The fundamental principles of the TRI include Kaizen and Hansei, i.e. self-reflection on mistakes as an integral part of learning and the process of research into scientific results that can improve mobility, people and society.

### THREE LOCATIONS, ONE MISSION

The Toyota Research Institute has three locations. The first is located in Los Altos in Silicon Valley. It collaborates with Stanford University to explore new technologies and works closely with AI Toyota Ventures, a venture capital firm charged with identifying and funding the most promising start-ups in the fields of artificial intelligence, autonomy, mobility, robotics, data and cloud. The second is in Cambridge, in close contact with the

Massachusetts Institute of Technology, one of the world's most prestigious academic institutions, and focuses on robotics. The third is in Ann Arbor, working with the University of Michigan, in the heart of one of the world's centres of the automotive industry, and has at its disposal the research and development facilities of the Toyota Collaborative Safety Research Center, which specialises in autonomous driving.

## WOVEN PLANET

In March 2018, the Toyota Research Institute-Advanced Development Inc. was established. (TRI-AD) based in Tokyo, the CEO is James Kuffner. The Toyota Research Institute-Advanced Development Inc. (TRI-AD) is a pioneer in the development of software for automated driving at Toyota Motor Corporation. Its mission is the research and development of advanced technology with the aim of contributing to the realisation of increasingly safe mobility, as well as of strengthening coordination with the research results of the Toyota Research Institute (TRI) and advanced research and development within the Toyota Group. Activities include the development of software for automated driving and the development of advanced data management systems. As of January 2021, TRI-AD has changed its name to Woven Core, Inc. part of the newly formed Woven Planet Holdings, Inc. and will have the objective of developing, implementing and expanding automated driving technologies.



James J. Kuffner Jr  
CEO of Woven Planet Holdings, Inc.

#### IN-DEPTH

James J. Kuffner Jr. joined Google in 2009 and was a member of the engineering team that designed the software developed for Google's self-driving car. In January 2016, Dr. Kuffner joined the Toyota Research Institute (TRI) where he was appointed Chief Technology Officer and Area Lead, Cloud Intelligence. In March 2018, he became CEO of TRI-AD and in June 2020, he was appointed to the Board of Directors of the Toyota Motor Corporation, where he is also the Operating Officer and Chief Digital Officer at the Advanced R&D and Engineering Company. He continues to work as an associate professor at the Robotics Institute, Carnegie Mellon University and as an executive advisor to the Toyota Research Institute (TRI). In January 2021, he became CEO of the newly formed Woven Planet Holdings, Inc.

## START YOUR IMPOSSIBLE

"Start Your Impossible" brings Toyota and the world of sport together, uniting in the values of friendship, respect, perseverance, courage and excellence, to celebrate together the highest heights of human potential realisation. The fruits of the Toyota Tree include exceeding expectations, enriching people's lives, encouraging talent and passion, and setting ambitious goals. The link between Toyota's vision and the world of sport is also fully expressed in the concept of Ikigai: finding one's reason for living in sport, expressing one's talent, creating a positive flow between the happiness of the individual and the development of a better society. "Start Your Impossible" means inexhaustible passion, cultivating the spirit of those who are never satisfied with the results achieved but always look beyond, even when it seems impossible. In "Start Your Impossible" there is the dream, the vision beyond the obstacle and the strength to overcome it, fulfilling oneself and realizing something irreplaceable for the world around us. It is the spirit of those who transform their physical limits into unbridled strength, participation, joy and freedom, in other words everything that Toyota imagines for the mobility and society of the future: starting from man and reaching man, leaving no-one behind and calling on everyone to participate and give their best. Because when everyone, without distinction, is free to move, anything is possible. Start Your Impossible therefore expresses the drive towards an inclusive society, in which there are no limits or barriers, even for those who due to their age or for other reasons have more difficulty in movement. Because movement, the ability to move around, to be active, to interact and establish social relationships, is one of the noblest expressions of freedom. This is the spirit that inspires Toyota's vision of "Mobility for All".

*«Under the Olympic and Paralympic flag we want to reaffirm the power of sport to bring people together».*

- Akio Toyoda



**ANDREA PUSATERI**

Born in 1993, he was a Paralympic Road Cycling athlete. In 1997, at the age of four, he lost his leg in an accident that also cost his mother her life and in 2015, after another accident, he won his first World Cup in Maniago. Today Andrea has switched to long-distance triathlon and is training for a new challenge, competing in the "Iron Man".



**GABRIELE DETTI**

He is an Italian swimmer specialising in freestyle. In 2017 he was world champion in the 800 freestyle, a speciality in which he was Italian and European record holder with his 7'42"74 from 2014 to the following year. At the 2016 Rio Olympics, he won two bronze medals: one in the 400 metres and the other in the 1.500 metres freestyle. In July 2019, during the World Championships in Glasgow, he set a new Italian record in the 400sl winning the Bronze medal.



**ILARIA NAEF**

Ilaria is the first Italian athlete in Wheelchair Motocross (WCMX), a Paralympic freestyle discipline invented by Aaron Wheelz. She won the bronze medal at the specialty world championships in Dallas in 2016 and in 2019 became the first in the world to perform a backflip on snow. In the same year she set another record this time on the water, reaching a speed of 30 knots and jumping onto a ramp with a wheelchair resting on a sort of surf.



**BEBE VIO**

Bebe Vio has been fencing since the age of 5. After contracting a very serious meningitis that led to the amputation of her legs and arms, she accepted the challenge by winning 4 gold medals at the European Championships, 3 World Championships and one at the Rio Games in 2016. In 2019, she decided to try her hand at a new challenge, the sabre and is preparing to play an absolute starring role at the Tokyo 2021 Olympics.



**ARIANNA FONTANA**

A short track skater, Arianna won a bronze medal at the 2010 Winter Olympics in Vancouver in the 500 metres and silver in Sochi in 2014 along with bronze in the 1.500 metres. In 2018 she was chosen as the Italian flag bearer at the Winter Olympics in PyeongChang, where she won the most prestigious medal in the women's 500 metres, as well as a silver in the relay and a bronze in the 1.000 metres.



**IVAN ZAYTSEV**

Nicknamed the Tsar, he began playing volleyball at the age of 7 in St. Petersburg. In 2008 he moved to Italy, where he will play until 2020. Today he plays for Kuzbass Volleyball (Russia) and is captain of the Italian national team. With the Italian national team he won the bronze medal at the 2012 London Games and the silver medal in Rio in 2016, to which he can add two silvers and a bronze at the European Championships.



**IVAN FEDERICO**

Born in 1999, Ivan got on the board when he was only 4 years old and from that moment on skateboarding became his great passion. Despite his young age, Ivan can boast of several X-Games and Dewtour appearances: since 2015 he has been competing in the Vans Park Series, the World Cup of park skateboarding. In 2016, as the only European competing, he came third, while in 2017 he won two stages in Australia and Canada and finished first in the World Qualifying Series. In 2019 he is the first Italian to win the American stage of the X-Games in Minneapolis.



**VANESSA FERRARI**

Vanessa is the Italian gymnast who has won the most medals of all time: for this reason she is nicknamed The Butterfly of Orzinuovi or The Cannibal. Despite four operations on both Achilles tendons, she prides herself on a very rich wealth of awards with more than 70 medals, including 22 national championships. In 2020, at the age of 30, she will return to training on the 4 apparatuses with the aim of arriving in Tokyo as the first Italian gymnast to take part in 4 consecutive Olympics.



**SIMONA QUADARELLA**

Simona has been swimming since the age of one and in 2018 at the European Championships in Glasgow she won 3 gold medals for freestyle over 400, 800 and 1.500 metres. In the longer distance, she also won gold at the 2019 World Championships in Gwangju setting a new Italian record (15'40"89) and gained silver in the 800 freestyle. Also in 2019, Simona won two golds at the European Short Course Championships in Glasgow.



## THE UNBREAKABLE AND THE ART OF KINTSUGI

What makes us unique? Never giving up, overcoming every obstacle, cultivating a dream even if simple normality seems impossible. This is the spirit of "Start Your Impossible" and "The Unbreakable", stories of people who, after overcoming a difficult moment, have given a new meaning to their lives and to the word "move". By overcoming the limits imposed by their bodies and society, they have rewritten the rules and shown that freedom of movement really does make the impossible real. It is the spirit of those who have been 'broken' by life, who have picked up the pieces and put them back together to achieve extraordinary goals. This is also the philosophy of Kintsugi, the ancient Japanese art that consists of repairing the fragments of a broken object with gold, making a wound not a defect to be hidden, but a characteristic to be exalted, because the golden weave is unique and is now an integral part of the reassembled object, making it unrepeatable and priceless.



*«In my opinion it is when you understand the strength of your team that you become an Unbreakable. For me, being free to move does not mean solving a limitation of the individual, but a limitation of society».*

*Giovanni Zappatore, inventor of the first 3D-printed bionic limb*

*«For me, being free to move means having the necessary tools to satisfy our natural curiosity, which is what makes us truly human».*  
*Mattia Barbarossa, the world's youngest founder of an aerospace company*

*«For me, waste is not rubbish: it is a resource. The starting point of a new life cycle that is not just functionality: it is beauty. For me, being free to move means imagining what the future will be made of. And then building it».*

*Alessia Guarnaccia, inventor of the Ecoplasbrick*

*«When you can't change yourself, you can still discover how to change things. Being free to move for me always means having the right to be autonomous».*

*Marco Dolfin, Paralympic swimmer and orthopaedic surgeon*

*«A true Unbreakable knows how to recognise an opportunity in what for everyone else is just a limitation. For me, being free to move means claiming the right to be who you are every day».*  
*Daniele Regolo, founder of the first recruiting platform for people with disabilities*

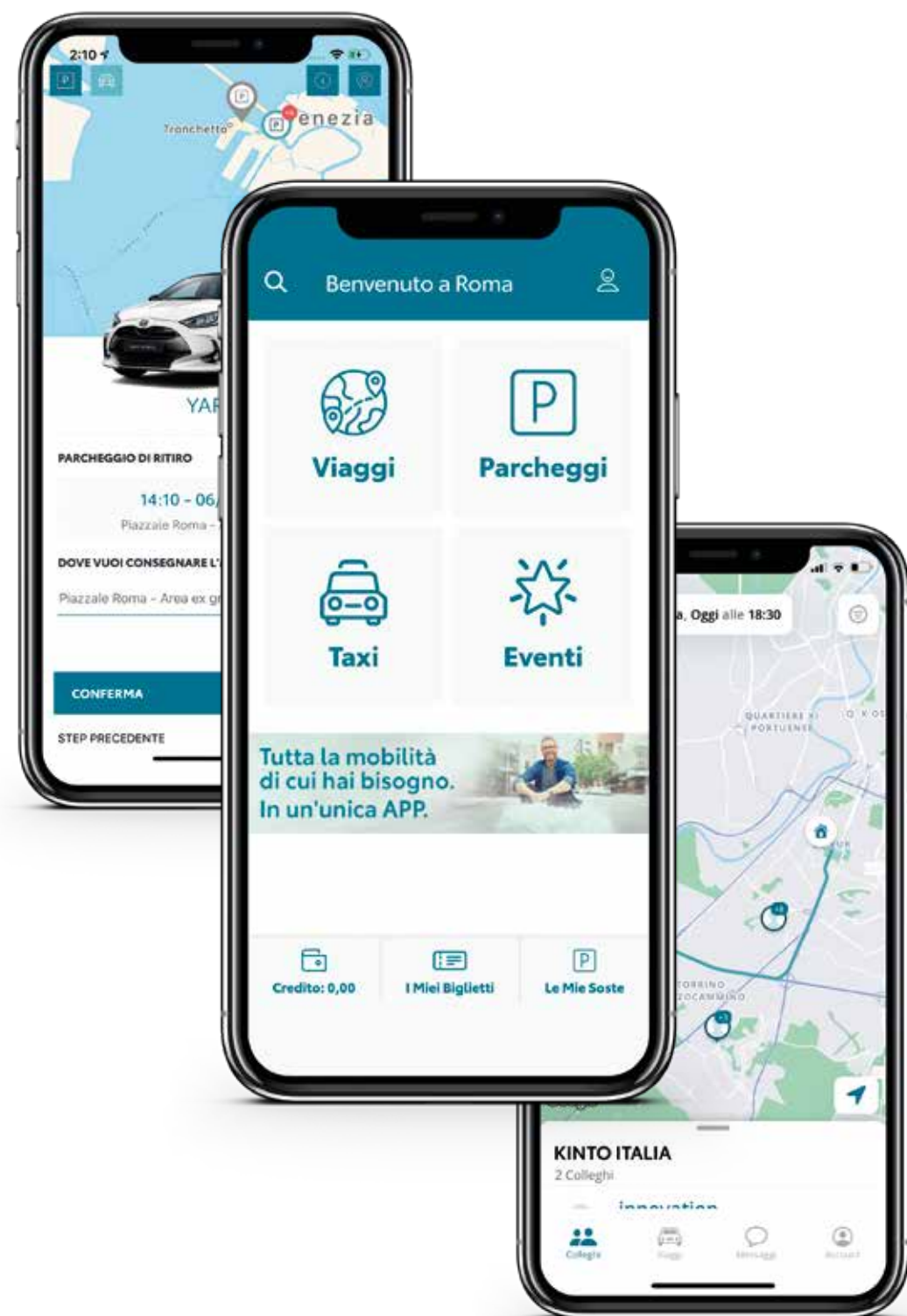
*«You become Unbreakable when you find yourself doing things you didn't think you were capable of. Just like that, without realising it. To be Unbreakable is to be alive».*

*Silvia Bonomi, Unbreakable sheep farmer*

*«I have never lacked tenacity and that is what has made me an Unbreakable. For me, being free to move means breathing the oxygen that comes from the world».*

*Sofia Corradi, creator of the Erasmus programme*





## KINTO

KINTO is the Toyota Group's mobility services brand, a significant step in Toyota's evolution from an Automotive Company to a Mobility Company. Its goal is to offer a wide range of mobility services for people, to ensure freedom of movement for all.

*"Our new mobility brand KINTO testifies that the company is more determined than ever to meet modern customer mobility needs. Toyota and Lexus are established automotive brands with quality and reliable cars. With KINTO, our ambition is to create an equally strong brand for mobility services, one that consistently delivers exceptional experiences to its customers, whether for short trips close to home or long journeys. KINTO embodies Toyota's ambition to deliver Ever Better Mobility for All."*

**Matt Harrison EVP Toyota & Lexus Sales Toyota Motor Europe**

The KINTO brand aims to be synonymous with 'inclusive and reliable', 'simple and intuitive' and 'sustainable' and leverages the resources of Toyota Fleet Mobility and Toyota Connected to offer an integrated range of services that are set to grow over time.

### KINTO, A NAME FROM THE WORLD OF FANTASY

The name KINTO derives from Kinto Un, Japanese for "acrobatic cloud" and is the golden flying nembo that carries Goku, the main character in the cartoon Dragon Ball. It is given to him by Master Muten (Kame-Sennin in the original version) for saving his turtle Umigame and allows him to move quickly by flying, but can only be used by those who cultivate purity in thoughts and feelings. An image that suggests free, sustainable, easy-to-use and reliable mobility, but also inclusive and based on kindness and gratitude as values that go beyond mere customer satisfaction.

## KINTO SERVICES

### KINTO ONE

This is the long-term rental service, the formula that allows you to have an all-inclusive package of services (insurance, ownership tax, roadside assistance, administrative services, ordinary and extraordinary maintenance, etc.) for a fixed, worry-free monthly fee. Initially designed for large companies, long-term rental has over time increasingly won over small and medium-sized businesses, professionals and even private customers.

### KINTO FLEX

This is a short-term subscription service that allows KINTO customers to use the full range of Toyota and Lexus vehicles flexibly throughout the year according to their needs and includes all services, including maintenance. The service will soon also be introduced into Italy.

### KINTO SHARE

This is a wide range of car sharing services, aimed at companies, public and private customers. The service is currently active in Ireland, Italy, Denmark, Spain and Sweden, with more markets to be added. In Italy, the KINTO Share service was launched in 2018 in Venice initially under the name "YUKŌ with Toyota". To date, it is also available in Milan, Bologna and Cesena, with a "Station Based" formula located at Toyota and Lexus dealerships.

### KINTO JOIN

KINTO JOIN is a company car pooling solution that allows employees to create their own network for travel to work. The service has been launched in Norway and Italy and will soon be introduced in the UK, with the aim of reducing the number of cars used daily for home-work journeys, contributing to a reduction in vehicle traffic, fuel consumption, polluting emissions and employee costs. Thanks to KINTO Join's platform technology, companies can constantly have certified confirmation that journeys have been shared and obtain a quantification of the environmental benefits produced quickly and easily.

### KINTO GO

KINTO GO is a multimodal aggregator of integrated mobility services offering a wide range of personal and leisure mobility solutions (public transport, taxi services, parking, events). With KINTO Go you can plan a trip, find the best route and use multiple means of transport, and participate in events. With just a few clicks, the app finds the fastest buses, trams and trains to reach your destination and allows you to buy tickets. KINTO Go can also find and book a seat for a concert



or visit to an exhibition, call a taxi, permitting the selection of the operator, find the nearest parking space and pay for parking in paid parking areas. At the moment, in Italy KINTO Go covers about 5 thousand locations and 70% of the Italian national territory.

**«KINTO is part of our strategy to grow our business in Europe. In markets where it can be viable and sustainable, adding mobility services to our traditional business model will allow us to respond to new customer needs and support the new mobility requirements of Cities and Regions».**

**Johan van Zyl, President and CEO of TME**

#### IN-DEPTH

In 2018, Toyota began laying the necessary foundations to prepare the European organisation for the integration of new mobility services with its existing car manufacturing and distribution activities. To this end, Toyota established two new entities, respectively a fleet management company (Toyota Fleet Mobility, based in Cologne, Germany) and a digital platform company (Toyota Connected Europe, based in London, UK).

#### TOYOTA FLEET MOBILITY (TFM)

Focuses on the growth of long-term rental services in the European market. TFM is growing both organically (with current affiliates in Italy, Spain and France) and through acquisitions. It has recently acquired Inchcape Fleet Solutions (IFS) to grow its business in the UK.

#### TOYOTA CONNECTED EUROPE

It is the European subsidiary of Toyota's connectivity and digital data management systems development company. It develops and implements a range of products and services associated with vehicle connectivity systems such as the Toyota Big Data Centre, as well as services based on Toyota's proprietary Mobility Service Platform (MSPF).

#### KINTO SHARE, THE CAR SHARING SERVICE IN VENICE

The car sharing service in Venice, introduced on 1 June 2018 under the name "YUKŌ with Toyota", changed its name and look in November 2020 to become KINTO Share. The cars, signage, website and App have a new customisation, while the functionality of the App, which retains its characteristic flexibility, has not changed. Since its introduction, the service has achieved successful and continuously growing results.

Today it has 4,000 registered customers and a total of around 19,000 rentals. In addition, thanks to the fleet of Full Hybrid Electric cars, around 23 tonnes of CO<sub>2</sub> have been saved, with a total of 700,000 km travelled more than 48% of the time at Zero Emissions. In November 2019, the service was enhanced with the introduction of the Lexus UX Hybrid crossover into the fleet, with a "Premium" formula, and in November 2020 with the inclusion of the new fourth-generation Yaris Hybrid, which will help make the KINTO Share service even more environmentally friendly.







# 06.

## THE CUSTOMER EXPERIENCE

OMOTENASHI  
THE ONE AND ONLY  
**QUALITY: EVER BETTER CARS**  
RECOGNISED QUALITY  
TOYOTA QUALITY MANAGEMENT  
VALUE OVER TIME  
EVIDENCE OF SUSTAINABILITY  
TAKUMI

**SAFETY**  
INTEGRATED SAFETY MANAGEMENT CONCEPT  
ACTIVE SAFETY  
PASSIVE SAFETY  
5 STAR EURO NCAP  
TOYOTA HUMAN MODEL FOR SAFETY  
AUTOMATED DRIVING  
EASIER MOBILITY FOR ALL  
THE DRIVER AND THE CAR, TEAMMATES

GUARDIAN  
CHAFFEUR  
6-LEVELS AUTONOMOUS DRIVING  
DIGITAL MAPS: HIGH DEFINITION ROADS  
THE FIRST EXPERIMENTS  
TRI-P4  
**CONNECTIVITY**  
AN ANCIENT LOGO FOR A CONTEMPORARY CHALLENGE  
MyT

**WEHYBRID**  
**MOTORSPORT: PUSHING THE LIMITS FOR BETTER AND BETTER CARS**  
BUILDING PEOPLE WHO BUILD CARS  
TOYOTA AND RALLIES  
TOYOTA AND ENDURANCE RACING  
TOYOTA AND THE NÜRBURGRING  
DRIVING PLEASURE





# THE CUSTOMER EXPERIENCE

The Customer Experience is the experience that the customer has from the moment he comes into contact with a company or a commercial enterprise, establishing a positive relationship of trust with it. It therefore begins before a purchase and continues afterwards, making of every opportunity of interaction with the customer something valuable in order to exceed their expectations. The customer is present in Toyota's guiding principles, in the Toyota Global Vision and in the "Customer First" and "Quality First" philosophy contained in Sakichi Toyoda's 5 precepts. Toyota's corporate culture is therefore based both on the customer and on the quality of its products as well production, sales and service processes. This is what generates kaizen and enables customer expectations to be continually exceeded, making them satisfied, smiling and grateful. In customer satisfaction are therefore gathered all the fruits of the Toyota Tree where the central element is the attention to people, whether they are employees, partners or users of Toyota's products and services. This is why Customer Experience is the lymphatic system of Toyota also in its transformation from Automotive Company to Mobility Company.



## OMOTENASHI

Customer satisfaction finds its concrete nature in the attention paid to their prerogatives, and in the dedicated ways of listening to their needs. At the basis of this attitude there is omotenashi, a word that indicates Japanese hospitality and does not simply mean welcoming, but also anticipating the customer's needs and surprising him. In Japanese culture the customer is a guest and should be honoured as such, because hospitality in Japan is spirit and art. This is why the concept of omotenashi is directly linked to customer experience, customer satisfaction, quality and kaizen. Only by building cars and providing better and better services it will be possible to anticipate the customer's needs, exceed their expectations and achieve their satisfaction. Omotenashi is therefore a complex of culture and processes that allows Toyota to be a global company, attentive to diversity and different cultures and institutions, but solidly anchored to the Toyota Way.

## THE ONE AND ONLY

In 1969, Toyota launched a quarterly communication campaign called 'The One and Only Toyota'. 'The one and only' was the customer and the campaign was divided into 12 ads, with testimonials and photos of Toyota employees dedicated to their work and the 'Customer First' principle. The last ad saw the chairman of Toyota, Taizo Ishida, talking to Konozuke Matsushita, chairman of the company of the same name (now known as Panasonic) about the importance of listening to the voices of the customer and of the activities with which a company works to serve them and put them

at the heart. In 2007, the campaign was reintroduced as 'The One and Only Car' until 2009, shifting the perspective from the people involved in production to those in sales and dealerships. The message, however, was similar: every customer is important. Akio Toyoda, then vice president of marketing for the Japanese market, was in charge of the campaign, and the pivot was again the principles that have always guided Toyota. In 2020, the president and CEO of Toyota Motor Corporation, following the same philosophy adopted 13 years earlier, decided to propose yet again the campaign as 'One and Only Day', interpreting it according to our times in which the relationship with the car based on possession is flanked by new forms of sharing. Half of the campaign is dedicated to staff and half to customers and their experiences with the aim of promoting Toyota's vision. It talks about Toyota's relationship with the territory through its dealerships, the development of human resources, customer satisfaction that arouses happiness and smiles, orientation towards people by giving them the means to move around and to move their hearts and, in doing so, establish a deep connection with other people. The transformation from Automotive Company to Mobility Company will therefore not change either the principles or the objective of the Toyota Motor Corporation: to satisfy the customer by providing him a memorable experience that exceeds his expectations and, in addition, moves his feelings.

## QUALITY: EVER BETTER CARS

Commitment to quality is one of the fruits of the Toyota tree. Quality is the key to customer relations and

the result of a way of working. It depends on technical tools, processes, but above all on the people who add an irreplaceable contribution to the product and service. Even in the transformation from an Automotive Company to a Mobility Company, Toyota's commitment to product quality remains intact, and is even intensified in order to give the new mobility tools the quality and reliability that are proverbial Toyota hallmarks.

## RECOGNISED QUALITY

The quality of Toyota products is perceived by customers primarily through their durability and reliability. All statistics conducted by independent bodies such as the German TÜV and J.D. Powers or by magazines such as the British 'Which?', the American 'Consumer Reports' and the Italian 'Altroconsumo' place the Toyota and Lexus brands at the top of the lists for quality, reliability and the number of defects found in the vehicles they produce. It is precisely the focus on quality, reliability and durability that allows Toyota and Lexus to guarantee their products - designed to last - for up to 10 years. Toyota and Lexus are also among the brands that offer the best customer satisfaction and customer retention.

## TOYOTA QUALITY MANAGEMENT

Toyota Quality Management (TQM) is a management tool that allows problems to be identified through genchi genbutsu, promotes talent and diversity, values teamwork, and allows increasingly ambitious goals to be set and better ways to make a component, product or service from the point of view of cost, sustainability and quality. Ultimately,

it enables kaizen by acting as a starting point for exchanging information from the customer and continuously updating standards.

## VALUE OVER TIME EVIDENCE OF SUSTAINABILITY

The quality and long-term reliability of Toyota and Lexus cars are directly reflected in the residual value of the products on the used car market, which, especially for full hybrid models, are often at the top of their respective segments. For Toyota, ensuring the highest quality of its products also means making good on its commitment to sustainability - formalised in the Toyota Environmental Challenge 2050 - by bringing long-lasting value, a product that is reliable, does not generate waste and does not require frequent replacements. In this sense, sustainability is a broad and profound concept for Toyota, which goes beyond (BEYOND) emissions reduction targets and has the ultimate goal of contributing to the well-being of society and people.

## TAKUMI

According to Toyota, quality cannot be separated from humanity. Even robots on the assembly line must have intelligence and the human touch. The highest and most singular figures of quality in the Toyota production system are the takumi, master craftsmen with extraordinary sensitivity and manual skills who are employed to design, build and check every car produced. To become a takumi master it takes 60,000 hours of work, equal to about 30 years of experience, and being able to complete an origami model of a cat using their non-dominant





hand in less than 90 seconds. The Lexus plant in Miyata employs 7,700 people and only 19 are the "masters". Takumi represent Japanese craftsmanship within an industrial process and are one of the fruits of the Toyota Tree as they are an example of the enhancement of talent and experience to give products the highest quality. The contribution of takumi is particularly evident in Lexus, both for the higher quality levels and for the working processes undertaken. On the LS flagship the Alcantara coatings are pleated like origami, details in kiriko crystal and wood are used, made according to the shimamoku method or with the method used by the master luthiers to make musical instruments. The internal mouldings are made of bamboo or finished with the hadori method, used for 700 years for katanas, while the sashiko stitch is used for leather seats, which has been used for centuries to make judo and kendo kimonos. With takumis, the concept of monozukuri ("doing things") is firmly joined with hitozukuri ("making people").

## SAFETY

Safety is one of the primary objectives contained in Toyota's Global Mission as a Mobility Company. The same is for vehicles' emissions, propulsion systems and with what results from production and sales processes, Toyota aims to reduce to zero the number of victims of road accidents. There are three main areas of action: vehicles, road infrastructure and people. Technologies for the prevention and protection of occupants, pedestrians and cyclists are essential. Alongside these, Toyota believes that educating people and adopting an efficient infrastructure with modern signage are equally important.

## INTEGRATED SAFETY MANAGEMENT CONCEPT

Since 2006 Toyota has structured a scheme called Integrated Safety Management Concept (ISMC) that supplements vehicle development with the aim of improving their safety in real traffic conditions by providing the driver with the best support in every phase: from the simplest one, such as parking help, to the more complex and dramatic ones, such as collision avoidance, eventual accident and post-accident. The ISMC allows you to integrate preventive technologies (active safety) with retention systems and protective measures (passive safety).

### ACTIVE SAFETY

Toyota Safety Sense and Lexus Safety System are the names that, for their respective brands, indicate the package of active safety devices, i.e. the driving assistance systems designed to avoid accidents or minimize their consequences. The new Toyota Yaris represents the state of the art in safety and the desire to offer safe mobility for all, thanks to the presence as standard in the entire range of devices of features such as the Pre-Collision System (capable of recognizing pedestrians and cyclists even during nighttime), Road Sign Assist, Lane Trace Assist, Lane Departure Alert, Auto High Beam, Intersection Support and Emergency Steering Assist. Other features are available, like Intelligent Cruise Control Full Range with Stop & Go, Intelligent Clearance Sonar with automatic anti-collision braking, Blind Spot Monitor and Rear Cross Traffic Alert Brake. The Lexus LS, the spearhead of the Group's premium brand, is equipped with the Lexus Safety System + A that, if the car does not

have enough space to stop in front of a pedestrian or cyclist, automatically steers to avoid them. The Lexus LS therefore has what, in Akio Toyoda's vision, the horse offers to man: the ability to autonomously avoid obstacles that the driver was unable to identify.

### PASSIVE SAFETY

Toyota designs global cars that meet the most stringent crash-test regulations. For this reason, since 1995 it has had a specification defined as Global Outstanding Assessment (GOA) with the aim of offering all its customers the highest safety levels. The study of the chassis is fundamental, in order to absorb maximum energy in the event of a collision and transmit as little as possible to the occupants. The new family of TNGA (Toyota New Modular Architecture) modular platforms, thanks to the massive use of high and very high strength steels, allows for a stronger and lighter structure at the same time. The new Yaris, based on the GA-B platform, has a body that weighs 20 kg less and boasts a 35% higher torsional stiffness. In addition, it is among the very first cars in its class to adopt the central airbag, which improves protection for the occupants in the event of a side impact.

### EURO NCAP: 5 STARS

All of Toyota's most recent models (Prius, C-HR, Corolla, RAV4 and Yaris) and all Lexus vehicles have been awarded 5 Euro NCAP stars, which is the highest rating. The Euro NCAP, a European authority belonging to an independent consortium with the aim of assessing the safety levels of cars, applies among the strictest parameters in the world for both passive and active safety,

also verifying the effectiveness of the so-called ADAS (Advanced Driver Assistance Systems). The new Yaris has been awarded 5 stars according to the most up-to-date standards. The new tests, introduced in 2020, in fact provide for a new offset frontal impact and the impact against a side barrier carried out with a truck equipped with a mass and a speed greater than was used previously. The new tests also evaluate the interaction of the car with other vehicles and of the occupants (including children) inside the car in the event of an accident and even the post-accident phase, in particular regarding the possibility of extracting the occupants in safe conditions. For the ADAS assessment, more numerous and complex scenarios are also envisaged, at high and low speed. The new Yaris is the first car ever to have achieved Euro NCAP 5 stars according to 2020 standards and with standard equipment.

## TOYOTA HUMAN MODEL FOR SAFETY

Passive safety, or the level of protection offered in the event of an accident, basically depends on the interaction of the vehicle with occupants' bodies. Again, Toyota has established in-house since 1997 a development method called Toyota Human Model for Safety (THUMS), in collaboration with Toyota Central R&D. It is a virtual model of the human body that can simulate the effects that an accident can have on every single part and tissue of the human body that otherwise could not be detected and measured through using the dummies used in crash tests. Thanks to THUMS, the effects of an accident on over 80,000 digitized elements of the human body can be studied for



individuals of different ages, sizes and genders, both for cases involving an occupant or a pedestrian. The THUMS reached version 6.0 in 2019 and is capable of simulating the change in posture, shapes and resistance of the body as well as a higher level of detail for the skeletal structure, muscles, internal organs and brain.

### AUTOMATED DRIVING

Automated or autonomous driving represents the next frontier of safety with benefits also for the environment and urban planning. This evolution is already underway with the driving assistance systems (ADAS) whose function is to support the driver in avoiding dangerous situations and to help him to manage them in the best possible way. The introduction of increasing levels of automated driving will be the decisive element towards eliminating accidents, but must be preceded by

a new legislative framework which is still under definition. Automated driving presents highly complex technological challenges related to robotics, artificial intelligence, connectivity, data protection, cybersecurity, connection with infrastructure and between vehicles and digital maps. There are also questions of social, ethical, moral and even legal and insurance acceptability when faced with the transfer of responsibilities concerning the driving of the vehicle from the human being to the car. The views on this matter are divided.



EASIER MOBILITY FOR EVERYONE

According to Toyota, automated driving will make mobility easier, safer and freer for many people who today can either make use it with difficulty or not at all. Thanks to automated driving, the quality of life will improve, but humans will never completely entrust the driving of the vehicle to the car since technology must not replace humans, but rather accompany them by amplifying their senses. Toyota has been studying automated driving since the 1990s and today there are several subsidiaries at work such as Toyota Automated, Toyota Research Institute - Advanced Development (TRI-AD), Collaborative Safety Research Center (CRSC) and Toyota Research on Automated Cars in Europe (TRACE) in collaboration with dozens of universities and research institutions.

THE DRIVER AND THE CAR, TEAMMATES

The concept of autonomous driving, according to Toyota, is summed up by the word "Teammate" or "team companion". The logo, with the car holding the steering wheel together with the driver, is the emblem of the collaboration between two forms of intelligence: human and artificial. According to Toyota, technology must ensure that man and machine team up to ensure maximum safety. This philosophy is based, once again, on the centrality of people and on the assumption that the human being must always be enabled to make choices by enhancing their abilities thanks to the machine without being replaced by it. The Teammate concept includes two approaches: Guardian and Chaffeur.

GUARDIAN

Guardian represents the collaborative approach between humans and artificial intelligence assistance systems. The machine acts like the autopilot of an airliner: the driver maintains control of the vehicle while the systems monitor the surrounding environment and, if necessary, prevent it from making wrong manoeuvres and intervene to avoid dangerous situations or accidents. Toyota defines it as "blended envelope control" or combined control within an "envelope" of safety conditions.

CHAFFEUR

Chaffeur is the approach dedicated to those who cannot, for reasons of age or physical infirmity, or who do not want to drive temporarily, and entrust the vehicle to "drive" the car. Artificial intelligence completely replaces the human, without collaboration, performing all the manoeuvres and all the commands that allow you to arrive at your destination in complete safety. In this case we speak of automated or autonomous driving in the proper sense and not of driving assistance.

AUTONOMOUS DRIVING ON 6 LEVELS

In 2014 the Society of Automotive Engineers (SAE) drew up a classification with the various degrees of automated driving providing a reference scheme for the entire automotive industry. The J3016 standard establishes 6 levels, from 0, where the car does not provide any assistance to the driver, up to 5 in which the car completely replaces the driver in every driving situation.



00

**LEVEL 0**  
The driver has full control of the vehicle at all times and there is no device to assist in identifying hazards or avoiding accidents.

01

**LEVEL 1**  
The vehicle provides an elementary degree of assistance through devices such as cruise control, warning for some potential dangerous situations and autonomous braking.

02

**LEVEL 2**  
The vehicle provides active driving assistance in certain traffic conditions, acting on the steering wheel, accelerator and brake, but the driver maintains control and responsibility of the vehicle at all times.

03

**LEVEL 3**  
The vehicle provides active driving assistance in all traffic conditions by allowing the driver to take his hands off the steering wheel, but warns the driver in advance when he needs to regain control.

04

**LEVEL 4**  
The vehicle is capable of driving alone in any traffic condition, even without the driver's visual control, but the driver can take back the controls at any time.

05

**LEVEL 5**  
The vehicle is capable of driving alone in any traffic condition, even without the presence of the driver or other occupants. Therefore it can be without the steering wheel and the accelerator and brake pedals.





Lexus TRI-P4.

**DIGITAL MAPS: HIGH DEFINITION ROADS**

High-definition digitization of roads is one of the key prerequisites for giving vehicles the ability to accurately locate and drive autonomously. Digitization, in addition to being extremely precise, must therefore be dynamic and can thus be updatable and updated in real time by all vehicles. Toyota, through TRI-AD, has created, in collaboration with Maxar Technology and NTT Data, a cloud mapping platform called Automated Mapping Platform (AMP). AMP can update itself through the images and data collected by the cameras and sensors of the cars to be sent to the cloud. In this way, the cartography presents maximum accuracy by recording every slightest variation in real time. Finally, AMP is open source, therefore it collects and distributes data and information that can potentially be used by any vehicle.

**THE FIRST EXPERIMENTS**

Autonomous driving will make it possible to offer new mobility services such as ridesharing which presents the most interesting business opportunities, optimizing costs and creating the conditions to reduce traffic congestion and emissions. Toyota has established collaboration and experimentation agreements with Amazon, DiDi, Mazda, Pizza Hut and Uber. Together with Denso and SoftBank, it has invested \$1 billion in Uber ATG (Advanced Technology Group) to accelerate the development and commercialization of ridesharing services through Level 4 automated guided vehicles.

**TRI-P4**

The TRI-P4 is the Toyota Motor Corporation's most advanced research vehicle for automated driving. It is based on the fifth generation Lexus LS 500h and its goal is to develop, within real scenarios, both Guardian and Chaffeur approaches using RADICAL (Robust Autonomous Driving Incorporating Cameras and Learning), the artificial intelligence platform developed by the Toyota Research Institute. RADICAL is installed on a high-potential computer powered directly by the battery of the hybrid system and is able to reconstruct, through numerous sensors of various types, the complex scenario that surrounds the vehicle, predicting the behavior of each of the active elements that move inside it. Thanks to particularly advanced machine learning, it can use low-cost cameras for merging images with high-definition maps and, in some cases, even managing to do so without them. The TRI-P4 represents Toyota's vision for automated driving and is used for road tests in Tokyo at the Odaiba neighborhood, Ann Arbor, Michigan, and Los Altos, California.





## CONNECTIVITY

The new mobility will need a large amount of data to connect vehicles, people and service providers continuously and simultaneously. Connectivity on cars has already opened up a scenario for the world of mobility services whose boundaries are virtually infinite and which allows for the creation of a new Customer Experience. To explore these areas, Toyota has created Toyota Connected, a subsidiary articulated in a worldwide network and charged with developing new businesses in the following areas: connectivity platforms, big data, mobility services, telematics and charging, digital marketing, sales promotion and also the so-called digital kaizen. For Europe, Corporate office is in London and the headquarters is in Nagoya, but there are other offices in Tokyo and in China (Beijing and Guangzhou), India (Bangalore and Chennai), Middle East (Dubai), Thailand (Bangkok) and in Plano, Texas, headquarters of Toyota Motor Sales.

### AN ANCIENT LOGO FOR A CONTEMPORARY CHALLENGE

The Toyota Connected logo is a T with the horizontal part of the letter appearing to dissolve and decompose into squares of various sizes and colors. Inspiration comes from the original Toyota branding, featured on the hood of its first model, the AA and featuring the stylized characters of Toyoda in Chinese with a wing. The message is to create a future based on new technologies, but one that has solid roots in the skills and values that Toyota has cultivated since its foundation. Toyota is addressing directly the issues of data management and confidentiality and cybersecurity. In 2019 it set up the Toyota Blockchain Lab to explore the potential of this technology for validating the authenticity of information by allowing users to easily and securely enjoy different services by sharing them on a single platform called Mobility Service Platform (MSPF). The MSPF is a global cloud created by Toyota to manage data relating to vehicles, customers and services in complete safety. Blockchain technology and MSPF therefore allow the sharing of information by multiple partners, including suppliers and dealers, to manage an increasingly distinct and complex business such as the automotive one and to direct it in a simple and immediate way towards the end customer.

### MyT

Toyota customers have already been experiencing the benefits of connectivity through the MyT app for years. MyT provides all vehicle data and helps improve your driving style by making the most of the potential of the Toyota hybrid system. MyT also allows you to plan the itinerary on your smartphone and send it to your car's navigation system and vice versa, in order to complete the last mile of it on foot or by other means. Finally, MyT remembers where we parked our car and allows us to customize both the assistance plan and the financing plan.

## WEHYBRID

Thanks to the digital birth of the new Yaris, Toyota has introduced a revolutionary program: WeHybrid. WeHybrid is a real "ecosystem" complete with technologies and services, which aims to promote sustainable zero-emission mobility, where the protagonist is the customer using the car: the more the customer travels in electric mode, the greater are the benefits which he can access. Customers can view directly on their smartphone, through the "Hybrid Coach" function present on the MyT app, the time and kilometers traveled in electric mode, obtaining valuable information to improve their driving style, make it more sustainable and responsible, and maximize the advantages it can achieve.

### WEHYBRID INSURANCE

Insurance becomes barrier-free because it does not depend on age, residence and insurance class, but on the driving behavior of the customer and is paid monthly. With WeHybrid, in fact, the electric kilometers traveled are free and you only pay for those done with the internal combustion engine: 4 cents per kilometer with RCA coverage and 5 cents for the Kasko Collision policy.



The customer can constantly check the percentage of zero-emission mileage through the instrumentation and the Hybrid Coach of the MyT application. This mechanism encourages the customer to drive virtuously by making substantial savings on the insurance premium, reducing actual fuel consumption and, consequently, limiting emissions into the atmosphere.

### WEHYBRID CHALLENGE

By maximizing the distance covered in electric mode, "green credits" are accumulated and can be converted into vouchers to spend on KINTO Go, the integrated mobility platform of the Toyota group. In this way, the customer's virtuous driving style turns first into a collective benefit for the environment and then into an advantage that can be spent on the active services available in one of the 5,000 cities where KINTO Go is present. It is therefore possible to pay for parking spaces, buy bus and metro tickets, book taxis and entrances to events using the credits obtained on the integrated mobility platform.

### WEHYBRID SERVICE

Increasing electric mileage reduces the wear of components and therefore maintenance costs. WeHybrid Service allows this advantage to be increased in favor of the customer by giving the possibility of discounts on service check-ups based on the kilometers traveled with zero emissions.

## MOTORSPORT: PUSHING TO THE LIMIT FOR ALWAYS BETTER CARS

Toyota is present in motorsport with Toyota Gazoo Racing at the highest level in the FIA World Endurance Championship and FIA World Rally Championship. It also takes part in the Dakar Rally, the Nürburgring 24 Hours and e-motorsports with the GR Supra GT Cup on PlayStation 4. The Supra GT4 was developed for customer teams participating in the GT championships. Toyota Corporation's motorsport activity follows two principles. The first is "pushing to the limit to build better and better cars" and the other is "roads build people, people build cars". These statements reflect Toyota's Global Vision and the Toyota Tree in the commitment to innovation and in meeting the most ambitious challenges by engaging the talent and passion of people



«Manufacturers have to participate in car racing to test the endurance and extreme performance of their vehicles and to show them off. With competitions, progress comes alongside the fun enjoyed by motoring enthusiasts».

**-Kiichiro Toyoda**

«Races are the most important phase for testing methods and for raising human resources. Making cars is not something to be resolved in words and data; on the contrary, discussions must focus on real cars that can be seen and touched with our hands».

**-Hiromu Naruse**

who believe there is always a better way to do things and to overcome every existing compromise. The objectives of motorsport are therefore to develop technologies that make mass-produced cars more efficient, sustainable, safe and pleasant to drive, arouse the emotions of customers by strengthening the sentimental bond with their car and finally give the opportunity to express people's talent by cultivating their personal vocation and raising their skills. Racing is therefore a way to "train" both cars and the people who build them.

**BUILD THE PEOPLE WHO BUILD CARS**

According to Toyota, motorsport is also fundamental to developing mobility and its most important component: humans. Commitment to competitions needs a force to be exerted in the search for continuous improvement of every detail that can prove decisive for victory. Motorsport is therefore kaizen. It is an activity that requires maximum concentration, produces adrenaline, but enhances the team and competitive spirit, consolidates respect for the work of others, as well as that of opponents, by bringing out the talent and passion for what one does. Being stronger on paper and applying the most advanced technology does not ensure victory. The response is seen on the competition fields where the pace is frenetic and any unforeseen event must be faced with speed and inventiveness, getting to the root of the problems and accumulating valuable experience in every area. Motorsport is therefore genchi genbutsu. You go fast so as to win, you prepare with the utmost commitment, but only one person achieves victory. The other competitors feel the bitterness of defeat, but it is from that sensation that one can find again an even greater strength and desire to win. Motorsport is therefore also kintsugi. That's why motorsport, according to Toyota, is about "building the people who build cars".

**TOYOTA AND RALLIES**

Toyota's history in official racing began in 1957 with the Toyopet Crown, a 4-door sedan with a 48hp 1.5-liter engine at the Australian Rally, a 17.000km long competition to be covered in 19 days, with only 5% on asphalt. The crew consisted of two mechanics, Kunio Kaminomura and Koujiro Kondo, together with Australian navigator Lindsay Hedley and took 47th place out of 86 starting crews. Toyota has written its name in other gruelling competitions such as the Safari Rally (8 wins) and the Dakar Rally, won in 2019 with the Hilux led by the crew of Nasser Al Attiyah and Matthieu Baumel. Toyota is also among the most victorious car manufacturers in the world rally championship where it has won 4 Constructors' titles (1993, 1994, 1999 and 2018) and 6 Drivers (1990, 1992-1994, 2019 and 2020), the last ones obtained with the Yaris WRC.

**TOYOTA AND ENDURANCE RACING**

Toyota was the first manufacturer in the world to win a race with a hybrid car: the 2007 Tokaichi 24 Hours with a Supra HV-R powered by a 4.5 V8 and three electric motors. Since 2012 it has participated in the FIA World Endurance Championship in the major category called LM-P1. The first prototype was the hybrid TS030 equipped with a 3.4 V8 engine, two electric motors and all-wheel drive. Toyota has won 3 Team titles (2014, 2018 -19 and 2020) and as many for Drivers. It has also won the last 3 editions of the Le Mans 24 Hours (2018, 2019 and 2020) and holds the lap record (3'14"791 at an average of 251.881 km / h). The TS050 is equipped with a hybrid system consisting of a V6 2.4 biturbo, two electric motors and a lithium-ion battery capable of emitting over 1,000 HP with extraordinary efficiency: it consumes 35% less than the TS030 despite being 20% more powerful and 10 seconds faster on the lap. This is a demonstration of how competitions can accelerate technical progress by sharing it with over 15 million hybrid cars produced. The TS050 ended its career with 19 wins and 16 pole positions out of 34 races. Since 2012, the TS030, TS040 and TS050 have collected 29 wins, 26 pole positions and 24 fastest laps out of 64 races. Toyota is the first manufacturer to join the new Le Mans Hypercar category with a hybrid propulsion system in use from 2021.

**TOYOTA AND THE NÜRBURGRING**

Toyota Gazoo Racing came into being in 2007 and debuted the same year at the Nürburgring 24 Hours. It was founded by Hiromu Naruse, head of Toyota test drivers, and Akio Toyoda who participated in the famous endurance race under the nickname of Morizo. The aim was to test the Lexus IS F before its debut in one of the toughest and most gruelling endurance races and on a track that is the ultimate-test for any car. Subsequently, the Lexus LFA, the Toyota GT-86 and the GR Supra have also passed this test that aligns with the genchi genbutsu principle: going beyond the data and the best technologies to see the robustness of the cars in extreme conditions and whether they respond

as predicted to the driver's commands. Green Hell - this is the nickname of the old Nürburgring circuit - has the fiery furnace to forge both cars and people. Since 2017, all official sports activities globally have been brought together under Toyota Gazoo Racing and the abbreviation GR is the brand that identifies the sports versions of Toyota.

**DRIVING PLEASURE**

Toyota believes that the pleasure of driving and moving around is a value to be cultivated and autonomous driving will allow everyone to enjoy it. At the same time, the growth of autonomous and shared mobility represented by vehicles such as the e-Palette, will in turn increase the demand for private mobility capable of providing emotions represented by the e-Racer, the concept presented at the 46th edition of Tokyo Motor Show, or by LQ, a totally electric concept with level IV autonomous driving equipped with an artificial intelligence called Yui, able to establish a deep emotional bond with the driver, learning to know him, to understand his emotions, his physical state, even engaging in a conversation with the driver, to offer him a personalized mobility experience. These antithetical forms of mobility will complement each other and have the common goal of putting people at the heart. The car is a vehicle and an object of feelings and will be so in the future as well. For this reason, autonomous driving will not cancel out the passion for the car or the pleasure of driving, just as the car, when it replaced the horse in its day, did not wipe out race horses or the pleasure of riding - but it has indeed made them irreplaceable. That's why in mobility, transport horses like the e-Palette and race horses like the e-Racer will coexist while continuing to emotionally evoke in people their deepest passions, feelings and needs.

**«The car is the only industrial product which is an object of love»  
Akio Toyoda.**



**IN-DEPTH**

According to the CEO of the Toyota Motor Corporation, carriages will coexist with horses in the mobility of the future. The former are the symbol of shared vehicles and whose function is essentially to transport people and goods from one point to another. The latter are instead an individual means of ownership that we will choose to satisfy our human desires such as the pleasure of driving and the need to move freely and safely. The existence of shared self-driving vehicles will lead people to seek more personal forms of mobility. Something like this has already happened. When the automobile made its appearance in the US, 15 million horses were replaced by new means of transport, but racing horses and the joy of riding in symbiosis with them remained. Horses are animals beloved for their intelligence, because they communicate and arouse feelings and are also able to avoid danger. Horses are therefore the natural form of artificial intelligence and autonomous driving according to Toyota's creed: in fact, they should not replace man, but enhance his senses by establishing a sincere and trusting relationship between the human being and the machine. Automation and artificial intelligence mustn't be scary or have the cold character of a machine, but they must have that human touch that connects people with warmth and kindness, evokes feelings and ultimately exalts people and their humanity. Toyota, to be an authentic Mobility Company is committed to providing mobility where horses and carriages, products and services allow everyone to move safely and responsibly.





# 07.

## A BETTER SOCIETY

2015, THE YEAR OF THE TURNING POINT

**ENVIRONMENTAL CHALLENGE 2050**

IN LINE WITH CO<sub>2</sub> TARGETS

TOYOTA IN EUROPE,  
100% RENEWABLE

TOYOTA MOTOR ITALY,  
ENERGY THANKS TO THE SUN

**COMMITMENT TO A BETTER SOCIETY**

BRIT

THE DEALER  
IS THE FIRST CUSTOMER

ICHIBAN, THE CUSTOMER IS  
"NUMBER ONE"

THE VALUE OF THE COMMUNITY

THE TIME FOR KINDNESS  
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WEHYBRID, A SUSTAINABILITY  
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**THE HYDROGEN SOCIETY**

A HYDROGEN SOCIETY  
IS POSSIBLE

TOYOTA AND HYDROGEN

OTHER HYDROGEN APPLICATIONS

**A GIFT TO SOCIETY**

**WOVEN CITY**

# A BETTER SOCIETY

Toyota aims to create a better society in harmony with nature. To build it, it is not enough to build the best cars, with the most respectful production methods for the planet and equipped with the most advanced technologies for the environment and safety. A new awareness needs to be developed that unites industry, the economy, politics and society. Toyota intends to play its part by engaging in building better, cleaner and safer cars, and allowing everyone to move freely, but also by engaging in social activities for the environment, for inclusion, for diversity and for the material and spiritual well-being of society through global and local initiatives. At the heart there are always people, who have always been the protagonists and the end destination of the journey that Toyota is making together with its customers to deliver better mobility in a better world to our children.





2015, THE YEAR OF THE  
TURNING POINT

2015 will be remembered as the year of the environmental turning point since there was a move from an idea of social and scientific reflection to the theme of the health of the planet becoming the focus of actions and decisions by the political, economic and religious world. Expo 2015 opened in Milan on May 1st, with the theme "Feeding the planet, energy for life". It is the first edition of the Universal Exhibition that has focused on environmental sustainability. On May 24th, 2015 Pope Francis published "Laudato si", the first papal encyclical that speaks of "ecological conversion" urging governments to formulate policies aimed at drastically limiting the production of pollutants and climate-altering agents. In September 2015, over 150 international leaders gathered under the aegis of the UN and approved the 2030 Agenda for Sustainable Development, a document divided into 17 objectives and 169 sub-objectives to guide the processes of social and economic development, and to fight against poverty and inequality while preserving natural resources. The document establishes the indivisibility between human well-being and the health of natural systems. In December 2015, the Paris Climate Conference (COP21) officially recognized the correlation between man-made carbon dioxide emissions, temperature rise and climate change. The 195 participating countries have therefore entered into the first global agreement with which they have undertaken to adopt measures to contain the increase in the average temperature of the planet to within 2 °C compared to pre-industrial levels and to 1.5 °C in the long term. In October 2015, prior to COP21, Toyota launched its Environmental Challenge 2050.

ENVIRONMENTAL  
CHALLENGE 2050

The Environmental Challenge 2050 is a holistic action plan divided into 6 distinct objectives with which Toyota has taken on a tangible and long-term commitment to take actions to protect the environment, across all sectors of its business and further social initiatives for the promotion of values of respect for the planet and for the conservation of natural resources.

Reducing the average CO<sub>2</sub> emissions of new models by 90% compared to 2010 levels. Toyota expects to sell 5.5 million electrified vehicles in 2025 and 1 million zero-emission vehicles (BEV and FCEV) by 2030. The efficiency of Toyota group cars has improved by 15% from 2010 to 2018 and, thanks to the 16 million full-hybrid cars sold, 120 million tons less CO<sub>2</sub> have been released into the atmosphere. In 2030, Toyota will emit 35% less CO<sub>2</sub>.

Eliminating CO<sub>2</sub> emissions at every stage of vehicle life, by calculating the procurement and processing of materials, production, storage, transport, sales, running and disposal. Toyota intends to reduce CO<sub>2</sub> emissions from vehicles throughout their life cycle by 25% in 2030 compared to 2013, also involving all suppliers that make up the value chain. Since 2019, all of Toyota's manufacturing, logistics and commercial operations in Europe use 100% renewable energy. Toyota Motor Italy has decreased its energy consumption by 17% compared to 2017 and has projects in place to increase energy efficiency involving suppliers and the dealership network.

Eliminating CO<sub>2</sub> emissions from production plants in the operating cycle. Toyota intends to reduce CO<sub>2</sub> emissions by at least 35% compared to 2013 and halve them in 2020 compared to 2001 levels. Increasing use of renewable energies (geothermal, co-generation, solar and wind power) and hydrogen, new production systems and continuous daily improvement activities (daily kaizen). Manufacturing facilities in Japan (including subsidiaries) currently produce 60% of Toyota's total emissions worldwide.

Minimizing the quantities of water used in vehicle production plants, optimizing their use and paying attention to the quality of waste water (Toyota Water Environmental Policy). Toyota reduced the use of water for vehicle production at plants in Japan in the fiscal year of 2019 by 23% compared to 2002. The Toyota Water Environment Policy aims to improve the sustainability of water resources at manufacturing plants. Toyota's European plants are the most virtuous with a consumption of 1.5 m<sup>3</sup> per vehicle produced compared to the global average of 3.2 m<sup>3</sup>.


2050  
ENVIRONMENTAL  
CHALLENGE




CO<sub>2</sub> 0




New vehicles with zero CO<sub>2</sub> emissions




CO<sub>2</sub> 0




Eliminate CO<sub>2</sub> emissions in cars' life cycles




CO<sub>2</sub> 0



Achieve zero CO<sub>2</sub> emissions also in production plants



Efficient management of waste water and water consumption during production





Build a society and systems based on recycling





Create a society in harmony with nature



Contributing to the creation of a society based on recycling, using eco-friendly materials, extending the life of spare parts, improving recuperation technologies and reusing materials from vehicle disposal. Toyota wants to promote the circular economy by reducing the use of petroleum derivatives and by improving vehicle design to optimize the recovery of components and materials, in particular of the rare earths in electric motors and of precious metals in batteries. Since 1998, 41 tons of magnets and 132 thousand batteries have been recovered, destined for other use and recycled. In 2019, the volume of production waste decreased by 62% and that of packaging materials by 35% compared to 2006.

Contributing to the creation of a society in harmony with nature, by strengthening support for the activities carried out for environmental conservation and education. Toyota has always promoted educational and environmental protection activities. More than 12 million trees were planted in Japan from 2005 to 2019. The Toyota Motor Company has a biodiversity conservation project in Southeast Asia in conjunction with the WWF. 230 hectares of land have been redeveloped at the Burnaston plant (UK), and 20,000 trees have been planted in Sakarya (Turkey). Toyota Motor Italy participated with FAI in the refurbishment of Villa Gregoriana in Tivoli and together with Treedom planted 214 trees in Kenya, capable of absorbing over 74 tons of CO<sub>2</sub> per year.

### IN LINE WITH CO<sub>2</sub> TARGETS

Toyota is in line with the CO<sub>2</sub> targets set by the European Union and which provide for fleet emissions of no more than 95 g/km by 2021. This milestone was achieved thanks to early implementation of electrification throughout the range allowing the widespread diffusion of efficient vehicles with high safety standards. Aygo, Yaris, C-HR, Corolla and Prius claim to have CO<sub>2</sub> emissions below the

95 g/km CO<sub>2</sub> threshold for all versions in the range. The introduction of the new Yaris Hybrid (64 g/km), the RAV4 PHEV (22 g/km), the new hydrogen Mirai and the electric Lexus UX 300e crossover will enable the setting out along the path to a further 15% reduction in CO<sub>2</sub> by 2025, as required by the regulations. As a step closer, Toyota plans to reduce CO<sub>2</sub> emissions from its cars by 10% by the end of 2021 compared to 2019 levels.

### TOYOTA IN EUROPE, 100% RENEWABLE

Since January 1, 2019, Toyota in Europe has used only energy produced 100% from renewable sources in all its activities and facilities. Toyota is present on our continent with 9 production plants, 14 spare parts logistics centers, 7 vehicle logistics centers, 29 national distributors (NMSC), the headquarters of Toyota Motor Europe in Brussels with its branches and the Toyota technical center, consuming a total of 500 GWh. The goal was reached a year in advance and represents an important step towards the goals set by the Environmental Challenge 2050.

### TOYOTA MOTOR ITALY, ENERGY THANKS TO THE SUN

Since 2003 Toyota Motor Italy has had the UNI EN ISO140001: 2015 Environmental Management System certification and extended it to the multi-site Environmental Management System of the Toyota and Lexus dealership network in 2008. For some time, Toyota Motor Italy has been using only energy from sustainable sources and in recent years it has launched an important energy efficiency process at its premises in Rome, in line with the Toyota Environmental Challenge 2050 global strategic plan. Examples are:

The solar panels installed on an area of 5,700 square meters, capable of producing 625 MWh of energy per year, reducing CO<sub>2</sub> emissions by 254 tons. The solar panels used are SUNPOWER MAXEON 3 390 watts, in very high efficiency monocrystalline silicon. With the completion of the new photovoltaic system, consisting of 1,137 very high efficiency panels (443.43 kW of peak each), it is able to autonomously produce over 25% of its needs. The project for the new photovoltaic system was entrusted to the ISOMECE company, which also carried out the refurbishment of the roof of the Toyota spare parts and accessories warehouse building.

The modernization of the new air conditioning system with about 1,000kW cooling capacity, serving the Office and Multipurpose building with two new multipurpose air-cooled units. The multipurpose units are able to simultaneously produce hot and cold throughout the year, ensuring maximum energy efficiency and minimizing local CO<sub>2</sub> emissions.

## COMMITMENT TO A BETTER SOCIETY

Toyota wants to be an active part of society through global activities and wherever it is present, in accordance with its guiding principles and values. Respecting the laws, culture and customs by providing products and services that satisfy customers and promoting economic and social progress in harmony with the environment is the way in which Toyota conceives its corporate citizenship and the relationship with its own partners, customers and all stakeholders. Enabling the mobility of all people and improving the quality of life of its customers in a better world is Toyota's mission, looking beyond zero emissions as a starting point in its areas of action. Heeding the customer's voice is the driving factor behind client satisfaction. For customer the first personal interaction occurs with dealers, who are the first to listen to him and his needs. In the transformation from Automotive Company to Mobility Company, the Network represents for Toyota the first line of contact with the territory, transmitting the Beyond Zero message to customers through its 4 pillars. Therefore, an increasingly electrified range to confirm a twenty-year leadership position, ever better cars and new mobility solutions to ensure everyone can avail of the freedom to move in the best way, constant improvement in activities to give the customer a memorable experience and an effective presence through activities that go beyond commercial promotion. Thus dealers become ambassadors of Toyota's values and protagonists of their respective areas, helping to create a better society.

### BRIT

Toyota's vision for its dealership is embodied in BRIT, a short form for Best Retailer in Town. The dealership will increasingly become the reference point for local mobility needs, offering the customer a memorable experience with the Toyota and Lexus brands. To do this,



it must constantly update standards and processes and recruit the best staff by continuously improving their training. Toyota therefore sees in its human resources, consisting of the customer and the people who work in the dealerships in the area, the decisive pillar to ensure long-term growth for itself, its partners and the whole company and the way to undertake together the transformation process from Automotive Company to Mobility Company.

### THE DEALER IS THE FIRST CUSTOMER

Toyota is the brand that satisfies its dealers the most according to the DealerSTAT study in 2020. Compared to the previous edition, 3 places were gained, while Lexus gained 6 places to reach 12th place. It is a recognition that reaffirms Toyota Motor Italy's desire to grow together with its network by putting into practice its values. In the Toyota philosophy, each element of the supply chain acts as a customer for the previous one. Therefore, if the final customer has his own point of reference in the dealer, the dealer is in turn the distributor's customer. In this too, the principle of "customer first" and teamwork applies as a means to acquire stable and long-term growth that brings shared benefits, both tangible and intangible.

### ICHIBAN, THE CUSTOMER IS "NUMBER ONE"

Since 2007, Toyota has established the Ichiban award at European level, meaning "number one" in Japanese, awarded to those who honor the principle of "customer first" and who stand out for their levels of customer



satisfaction by interpreting the "omotenashi" spirit in the best possible way, welcoming the customer and trying to anticipate his needs. In 2020, out of over 2,500 dealers, 45 were awarded, including three in Italy:

Nordauto (Treviso)  
Oliviero (Vicenza)  
R. Motors (Palermo)

## THE VALUE OF THE COMMUNITY

In addition to the numerous initiatives to protect the environment, to support people with disabilities and in the sports field, the relationship between dealers and local communities is divided into a series of projects ranging from support to hospital departments for the renewal of premises or the supply of medical equipment, donations to associations and non-profit organizations to support the less affluent or other disadvantaged groups, including support for education, locally and internationally. The link with the area of operation is a fundamental element for the success of the brand and is a concept fully assimilated and put into practice by the dealers, often as the lead figures, through sponsorships and collaborations, of large local shows and events. It is through these initiatives that the Toyota and Lexus network shares with society the value it helps to generate, strengthening the sense of community of which the brand and its network are an integral part.

## THE TIME FOR KINDNESS WITH THE ITALIAN RED CROSS

Since April 2020 Toyota Motor Italy has been collaborating with the Italian Red Cross to tackle the Covid-19 pandemic by providing a financial contribution and a substantial fleet of vehicles. Toyota and Lexus cars were delivered directly to the Italian Red Cross Committees in the field to be used by volunteers for services to the population such as home health care and the delivery of medicines and basic necessities. The Italian Red Cross, in addition to providing health and

logistical support, has intensified psychological support activities for the population and for those most vulnerable people, including through a toll-free number. This complex of actions has been called "Time for Kindness" and is ideally linked to Akio Toyoda's vision for mobility in the service of people which leaves no one behind; a free, sustainable, reliable, but also inclusive mobility based on kindness and gratitude.

## T-TEP, TRAINING ON THE TERRITORY

Making better and better cars, to sell and service with better and better people. Toyota has been doing this in Italy since 1995, the year in which it introduced the T-TEP, the Toyota Technical Education Program which, in an agreement with the Ministry of Education, the Toyota Academy, 19 technical institutes and dealers, has created a solid link between the world of schooling and the world of work. The goal of T-TEP is to nurture existing workers, continuously improving their skills, and to react promptly to new professional needs that emerge by creating new profiles, necessary to anticipate in advance the customers' needs and give them a memorable experience. The T-TEP therefore promotes education, enhances people's talent and works as an effective recruiting tool to train the individuals intended to represent Toyota and Lexus operationally in the area, in direct contact with the customer. That is to allow dealers to be the Best Retailers in Town. The Toyota educational workshop for electrified vehicles was added to the 19 T-TEP schools, being inaugurated in November 2020 at ELIS, an important non-profit educational facility, which for over fifty years has contributed to the training and integration of young people into the world of work. It is aimed at professionals and companies by building training courses, innovation projects and sustainable development activities with them. (<http://www.elis.org/chi-siamo>).

## YOURFUTURE, LOOKING AT TALENT

Since 2020 Toyota has given itself a new tool for the recruitment of personnel in the territory, and for the territory. It's called YourFuture © and it's a web platform that acts as the connecting point between job offers from the Toyota and Lexus dealerships network and job applicants. YourFuture represents a system of selection of qualified personnel to support the evolution of the market and business models in the automotive sector, recruiting new staff for both sales and assistance. The goal of YourFuture © is to insert new staff members within individual business organizations who can enrich the human and professional resource heritage by improving the competitiveness of Toyota and Lexus in the long term through their dealers, to make them the Best Retailer in Town and offer customers a memorable experience. The YourFuture © platform will also draw from the privileged pool of candidates made up of students from the 19 T-TEP and ELIS Schools, which can be thought of as real skills-building factories.



Toyota hybrid vehicle fleet available for volunteer activities of the Italian Red Cross.

## INNOVATION MAKES BEST EMPLOYER

Toyota considers inclusion and diversity the basic elements for its organization and for making the workplace a welcoming environment, an aim outlined as desirable in one of Sakichi Toyoda's precepts, where everyone can show their talent. The human element is central to have a customer-based orientation. Toyota Motor Italy has received the Top Employer certification for the sixth consecutive year. Such a certificate is awarded by the Top Employer Institute to the most virtuous companies for the quality of their work environment and for their enhancement of people and their talents. Toyota also implemented Beaconforce, a digital platform that monitors each employee's motivation to strengthen their engagement through dialogue and stimulate their proactivity. Toyota has also invested in the construction of a digital workplace to allow 100% of its employees to work remotely with the aim of strengthening motivation and productivity through flexibility and accountability, promoting social life and creating the conditions to reduce the environmental impact originating from the commuting and travelling of personnel. This vision, the kaizen applied to personnel policies, and these innovations have allowed Toyota and its collaborators to better address the critical issues posed by the global pandemic.

## DIVERSITY, THE POTENTIAL OF INVOLVEMENT

Involving people's talent and passion to take up the challenge of offering safe, barrier-free and environmentally friendly mobility to all, is part of Toyota's Vision, is among the fruits of the Toyota Tree and is part of both the Toyota Way and its guiding principles. Diversity is what allows the individual to unleash their potential and is the flip side of inclusion. Both concern Toyota employees, partners and all customers with their multifaceted needs, therefore people. Diversity of a biological, cultural, gender, sexual orientation, ethnicity, race, nationality, religion and age nature, as well as that relating to attitudes and mobility needs, are part of Toyota's values and underpin corporate citizenship and social responsibility, in every context in which Toyota is present.

## A FEMALE COMPANY

Over 30% of Toyota Motor Italy's workforce is made up of women as against the average of 18% in the entire automotive industry. This result is the fruit of a strategy and a framework of values that guide Toyota's action on a global level. On 8 March 2019 Toyota Motor Italy was the first automotive company to have signed the Valore D Manifesto, the first Italian association of companies that supports gender balance and the culture of inclusion within organizations active in our country. The Valore D Manifesto consists of 9 points that set clear and measurable objectives and has been signed by 190 companies for a total of over 2 million employees.

## SAFETY FOR EVERYONE

Safety is a fundamental element for a company that produces mobility. In compliance with this principle, Toyota Motor Italy obtained the ISO 45001:2018 standard in 2019 from the certifying body TÜV Italy, which sets new standards for health and safety in the workplace. This certification is accompanied by the renewal of ISO 9001: on quality and the environment ISO 14001: 2015 that Toyota has had since 2003 and in 2008

extended to its entire dealer network. Quality, environment, health and safety in the workplace represent essential values and objectives and reaffirm Toyota's desire to put people at the heart of its vision and therefore also of the processes and procedures that govern its organization.

**THE BNKR TOYOTA WHEEL PARK IN ROME**

In 2018 was inaugurated in Rome the first skate park in Italy open to everyone, including people with reduced mobility and ready to host any sport on wheels. The facility was inaugurated in the presence of Ilaria Naef, star of WCMX, and of the skater Ivan Federico, both members of the Toyota Italia Team, together with Giovanni Malagò president of the Italian Olympic Committee, Giovanni Pancalli president of the Paralympic Committee and Mauro Caruccio, CEO of Toyota Motor Italy. The park is the concrete representation of the "Start Your Impossible" movement and of the power of inclusion, coming together and integration achievable through sport experienced within the same spatial confines, both by the able-bodied and people with disabilities. It is a demonstration of the fact that, by creating spaces where we can move around together and without any obstacles, we can build a better society.

**TOYOTA STARTUP ACCELERATOR**

The Toyota Startup Awards is a competition launched in 2020 by Toyota Motor Europe to recruit the best startups and cultivate the best ideas in terms of mobility. It was attended by 200 startups from over 45 countries among which only 5 were admitted to a tutoring course called Toyota Startup Accelerator, created in collaboration with ISDI Accelerator. Among the fundamental parameters of choice are accessibility, ease of use and the ability to provide everyone with the freedom to move, overcoming practical and social obstacles.

**PROJECTS**

**SEAMLESS VISION (ISRAEL)**

A start-up which is developing a robot that helps blind people to move independently within urban areas, helping them to explore all places safely.

**SOCIABILITY (UK)**

SociAbility is an app that allows people with disabilities to collect and share detailed and reliable information on meeting places, commercial areas and businesses.

**WHEELIZ (FRANCE)**

It is the first website that allows you to rent wheelchair vehicles directly from other people who share the same condition.

**PROSFIT (BULGARIA)**

Solution to provide affordable, high quality and comfortable prostheses, even in remote areas of low and middle income countries.

**ABLE HUMAN MOTION (SPAIN)**

It is the first lightweight and easy-to-use exoskeleton that allows mobility for people who have suffered lower limb paralysis.

**WEHYBRID, A SUSTAINABILITY AGREEMENT WITH THE CUSTOMER**

The Yaris launch was accompanied by WeHybrid, a Toyota program to establish a pact of trust and sustainability with the customer through which the potential of Full Hybrid Electric technology is transformed into a benefit for the customer himself, for the environment and therefore for the whole of society. WeHybrid is an ecosystem in which services and technologies coexist to improve everyone's quality of life thanks to the behavior of individual customers. WeHybrid therefore transposes one of the two pillars of the Toyota Production System, the jidoka, into the world of mobility. Human activation makes the machine truly intelligent by helping to generate a more significant quality of products and that no automated process alone can create: a cleaner environment and more sustainable mobility for all. With WeHybrid, the customer and the person become the protagonists of technological innovation, fulfilling its complete potential and undergoing a memorable experience.

**THE HYDROGEN SOCIETY**

In Toyota's mobility map, hydrogen is the most advanced solution as it completely eliminates carbon from the energy cycle, not only for mobility, but potentially for every human activity. This is why Toyota's vision looks at a hydrogen society by condensing into this definition the conviction that a broad involvement of all stakeholders is needed to make the richest chemical element in nature the energy vector to stimulate the production of renewables and reduce CO<sub>2</sub> emissions, especially in so-called "hard-to-abate" areas such as the industry sector which is responsible for 23% of carbon dioxide emissions, equal to that of the transport sector, but less susceptible to corrective measures in terms of efficiency from both the technical and financial points of view. The prospect of hydrogen in the energy transition process therefore does not only concern cars and mobility, but the whole of society and is part of the "Beyond Zero" strategy whose horizon looks beyond zero emissions and looks to social well-being. Toyota wants to make its contribution to the development of a hydrogen society. A society less and less dependent on fossil origin energy sources and in which energy needs are met by renewable energy sources or by fuels produced from biomass or from waste treatment. In the future hydrogen society, a perfect complementarity is envisaged between the electricity distribution network and that of hydrogen. The latter will be able to provide a concrete answer to the need to store for a long time and transport and reuse the renewable energy produced in excess and not immediately usable. In this way, hydrogen can be produced in a "green" way through increasingly efficient electrolysis processes and used as a fuel both in industrial processes - for civil use - and in transport, or reconverted into electricity and re-introduced into the electricity grid.







Woven City.

**A HYDROGEN SOCIETY IS POSSIBLE**

Hydrogen is receiving increasing interest from governments around the world and from large energy companies that have identified its potential to achieve environmental and economic sustainability goals. All major oil companies are looking to hydrogen and 10 energy utilities firms, joining together under the initiative called Choose Renewable Hydrogen, have sent a letter to the Executive Vice President of the EU, Franz Timmermans, asking for hydrogen to be included in the European Green Deal for the so-called “hard-to- abate” sectors, in other words sectors that, by their nature, struggle to reduce CO<sub>2</sub> emissions such as heavy industry, road freight transport, aviation and shipping. The EU currently has 1 GW of electrolyzers to extract renewable hydrogen and aims to reach 6 GW in 2025 and at least 40 GW in 2030 when its cost will be competitive with that obtained from fossil sources. The expected investment by 2050 ranges from 180 to 470 billion euros. The most active country in the world for the

promotion of hydrogen is Japan, where 160 filling stations will be active by the end of the year, and there will be 320 in 2025. For the Olympic and Paralympic Games in Tokyo, that will hopefully take place in 2021, all public mobility will be carried out exclusively with hydrogen vehicles. In China there are 61 stations, 64 in the United States, 35 in California alone, where the California Fuel Cell Partnership plans 200 in 2025 and 1.000 in 2030 to serve a fleet of one million vehicles. The South Korean government expects 1.200 stations by 2040. Currently, there are 108 refueling stations for hydrogen at 700 bar in the EU, of which 83 are in Germany and only one in Italy. In the meantime, hydrogen has entered the energy plans of both the European Union and Italy and is also part of the industrial plans of numerous energy and oil companies that see hydrogen as an essential tool for industrial conversion and a business opportunity with significant economic and social repercussions. A favorable context is therefore in a phase of maturation for hydrogen in which those who have always believed in it, like Toyota, look with confidence and are ready to take up the challenge by offering their contribution not only in terms of technology and industry, but also of values and vision.

**TOYOTA AND HYDROGEN**

Toyota is strongly committed to spreading knowledge of hydrogen and promoting its large-scale adoption. The Toyota group is part of the Hydrogen Council, together with 53 other large industrial agglomerations that have a total revenue of 1.8 trillion dollars and 3.8 million employees, and is a member of the Japan Hydrogen Association

(JH2A), formed by 9 companies with the goal of building the hydrogen value chain and establishing promotion agreements for hydrogen around the world, both with companies and with institutions. The Toyota Motor Corporation is also a member of Japan H2 Mobility (JHyM) along with 10 other major companies, including Honda and Nissan, to collaborate with the government on the development and construction of a hydrogen refueling network. In Europe, Toyota has actively participated in the HyFIVE and H2ME projects in collaboration with the European Union. In Italy it has established master agreements with ENI and the Metropolitan City of Venice, and also collaborates with LIFEalps which hinges on the Bolzano fueling station, the only one in Italy with 700 bars. To spread the use of hydrogen and the creation of a refueling network for road transport, in 2014 Toyota introduced the Mirai to the market, the first hydrogen-powered sedan produced in series and distributed in over 10.000 units, followed by the second generation at the end of 2020. Starting from 2020, Toyota has planned to increase the production of fuel

cells tenfold, from 3 thousand to 30 thousand units per year after 2020. The hydrogen fuel cell technology developed by Toyota can be used in multiple areas and is available to build a sustainable world according to the “Beyond Zero” vision, in which the ultimate goal is not simply to reduce emissions, but to fulfill the 6 objectives of the Environmental Challenge 2050 and ensure a sustainable future for the entirety of society. For this reason, Toyota has decided to share its technology on Fuel Cells and hydrogen propulsion systems with other industrial partners, both in the context of industrial collaborations with other car manufacturers (such as with the BMW group), and as components supplier or complete systems for different types of applications, both by making a large number of its patents available for free use. To this end, to develop new collaborations on the European market, Toyota Motor Europe has set up the Fuel Cell Business Group, a business unit based in Brussels expressly dedicated to promoting the development of a hydrogen company on our continent, by introducing hydrogen in all economic sectors and in all fields of the life of society.



## OTHER HYDROGEN APPLICATIONS

### HEAVY DUTY COMMERCIAL TRANSPORT

In 2021 Toyota will build, with its subsidiary Hino, heavy goods vehicles with a capacity of 25 tons for the Japanese market and an articulated truck for the North American market. Toyota, Kenworth, the ports of Los Angeles and Long Beach and the California Air Resources Board (CARB) are working on the construction of a logistics system based on 10 hydrogen trucks as part of the ZANZEFF (Zero and Near-Zero Emissions Freight Facilities Project). Toyota is also part, with a 65% share, of the United Fuel Cell System R&D (FCRD) joint venture for the construction in China of a commercial transport system based on hydrogen.

### MOBILE ENERGY

Toyota is developing with Denyo small fuel cell trucks capable of carrying 65 kg of hydrogen and delivering 72 hours of zero-emission energy. The Toyota Motor Corporation and Honda R&D have jointly created Moving e, a mobile power station consisting of a bus equipped with a hydrogen power generation system for 490 kWh, 56 portable batteries and 36 mobile generation devices to intervene in areas affected by disasters. Inside it there is also a rest area.

### BUSES

For the Tokyo Olympic and Paralympic Games the Toyota Motor Corporation will supply 100 SORA (Sky Ocean, River, Air) hydrogen buses with a capacity of up to 79 passengers. The two 114 kW stacks, the two motors and the 10 tanks are derived from the Mirai and applied modularly. Toyota is also supplying these modules and components to the Portuguese Caetanobus Company for the construction of hydrogen buses in Europe.

### TRAINS

The Toyota Motor Corporation has an agreement with East Japan Railway Company and Hitachi for Hybari (HYdroge-HYBrid Advanced Rail vehicle with Innovation), an electric train equipped with a hybrid propulsion system that uses three 120 kWh capacity lithium-ion storage batteries and four 60 kW hydrogen fuel cells fueled by 20 tanks of 51 liters divided into 4 modules of 5.

### NAVIGATION

The Toyota Motor Corporation has developed specific fuel cell stacks for navigation in collaboration with the Energy Observer, the catamaran that has been traveling around the world for 6 years using only renewable energy produced on board. The systems have been tested for over 20,000 nautical miles in the most extreme sailing conditions and represent a zero-emission solution for the transport of passengers and freight by water.

### STATIONARY PLANTS

The Toyota Motor Corporation has an agreement with Tokuyama Corporation to test stationary hydrogen power plants using the same



Hybari (HYdrogen-HYBrid Advanced Rail vehicle for Innovation).



Sora.



Lunar Cruiser.



Energy Observer.

stacks as in the Mirai. Toyota has been using the same technology in its Honsha plant since 2019. At Long Beach port Toyota will build Tri-Gen, a plant that will produce several megawatts of hydrogen, water and electricity from agricultural waste. In Europe, Toyota has partnered with Energy Observer Development to supply its fuel cell technology to be used within 60kW generating sets which are to be introduced soon.

### FORKLIFT TRUCKS

The Toyota Industries Corporation manufactures fuel cell powered forklifts with which the Toyota Motor Corporation intends to replace all 170-180 conventional forklifts operating

within its Motomachi plant. Since 2017, an integrated experimental project has been underway in Yokohama for a plant consisting of a fleet of 12 forklifts powered by hydrogen produced with wind energy. In Europe, Toyota Material Handling has started the development of hydrogen-powered forklifts soon to be introduced on the European market, which will be produced in the group's Italian plants.

### SPACE

The Toyota Motor Corporation is developing with the Japan Aerospace Exploration Agency (JAXA) a pressurized vehicle for the exploration of the lunar soil called Lunar Cruiser, in honor of the off-road Land Cruiser. The prototype is expected to be finalized by the end of fiscal 2020 (March 2021) and with the evaluation tests to be completed by March 2022. The goal is the lunar mission that Japan is preparing for 2029.



## A GIFT TO THE COLLECTIVITY

WITH 24.000 PATENTS  
FOR THE BEST COMPANY

2015 was the year of the environmental turning point. In 2015, Toyota drew up its Environmental Challenge 2050 and in 2015 it liberalized the use of 5.680 hydrogen-related patents, demonstrating that its vision extends to society as a whole, not just the automotive industry and mobility. The aim is to transform its technological assets into an open source platform that allows energy transition to be accelerated by calling on everyone to undertake the journey that can lead us towards zero emissions and the creation of a better society, in harmony with the environment and the planet. Of these 5.680 patents, 1.970 concern the fuel cell stack, 290 high pressure tanks and 3.350 control systems, while 70 are those for refueling stations. In 2019 Toyota went further by freeing up the use of its knowledge in the field of electrification : 23.740 patents concerning hybrid, plug-in hybrid, electric and hydrogen – the result of over 20 years of research and development, with over 16 million electrified cars worldwide. Meanwhile, patents for hydrogen tanks have grown to 780 and those for stacks to 2.840. Toyota offers 2.590 patents relating to electric motors, 2.020 relating to control units, 2.200 for charging and still more others. The use of these patents is granted free of charge, subject to negotiation and agreement with the Toyota Motor Corporation, until 2030. With this initiative, Toyota intends to promote electrification in all fields, but above all to promote a new way of thinking by allowing everyone to provide their own contribution towards the development of technologies capable of eliminating emissions. Toyota reaffirms the social vision of its corporate citizenship and its industrial and research activity: technologies are at the service of mankind and people and of those who, with their talent and creativity, are ready to give everyone the opportunity to move around freely without barriers, in a safe and sustainable way, in harmony with the environment, already today preparing for a better society.

### TOYOTA HUMAN MODEL FOR SAFETY

THUMS is used by over 100 car manufacturers, suppliers, research centers and various institutions. The Toyota Motor Corporation has decided to make access to THUMS free and open from 2021 with the aim of promoting the development of road safety for the entire automotive industry and thus reducing the number of accidents. The THUMS demonstrates Toyota's fidelity to the principle of the centrality of the person and to a vision that looks at the well-being of society.

## WOVEN CITY

Toyota will build a city from scratch to experiment with all the technologies concerning the mobility of the future and smart cities. It will be called Woven City and its name is linked to Toyota's roots as a manufacturer of textile looms and to the idea that society must be an orderly intertwining, like fabric and warp, between the most advanced technologies and man. It will be built on an area of approximately 70 hectares on the slopes of Mount Fuji, near Toyota's main R&D center and the famous test track, which became its own property in the year 2000. Woven City will be powered by renewable energy and hydrogen, with its roads driven on by shared zero-emission vehicles and autonomous driving, it will be totally connected and finally will be managed by an integrated system of Artificial Intelligence. Robotics will serve as a support for everyday life, in particular for the elderly and people with disabilities, and also to construct buildings, made of wood from renewable sources according to an ancient Japanese technique. The houses will be equipped with advanced home automation systems and sensors capable of perceiving the health of the occupants. Its urban planning envisages that there is no distinction between residential and working districts, to promote social mixing. There will be a central square and park, and the roads will have 3 types of roads: one for fast vehicles, one for low-speed traffic and one consisting of horizontal parks or avenues reserved for pedestrians. The use, collection and recycling of water will be managed by an integrated system, the vegetation will be spontaneous or grown with hydroponic techniques. Woven City will be designed by the Danish architect Bjarke Ingels, previously architect of the World Trade Center in New York, of the Google offices in Mountain View and in London and of the Lego House in Billund, Denmark. Woven City will therefore be a real smart city, a living laboratory where all CASE technologies will be present with the addition of the human element which, according to Toyota's philosophy, gives them meaning and makes them really smart. It will therefore be an incubator where the interaction between the technological and the human factor will be tested to verify all of its applications and implications. Initially, Woven City will welcome about 2.000 people including Toyota employees with their families, retired couples, visiting scientists, dealers and other partners involved in developing all the technologies that will change the face of the company in the near future. The start of its construction is scheduled for 2021.



Woven City.

«Building a complete city from scratch, albeit on a smaller scale as in this case, is a unique opportunity to develop future technologies, including a digital operating system for the city infrastructure. With people, buildings and vehicles all committed and communicating with each other through data and sensors, we will be able to test connected Artificial Intelligence technology, both in virtual and real terms, maximizing its potential».

– ***Akio Toyoda***



**TOYOTA**