LONG-TERM VISION FOR TECHNOLOGY DEVELOPMENT

In 2007, Mazda announced the “Sustainable Zoom-Zoom” long-term vision for technology development. Based on that vision, Mazda has worked to provide both driving pleasure and outstanding environmental and safety performance.

In August 2017, Mazda announced “Sustainable Zoom-Zoom 2030,” its long-term vision for technology development that looks ahead to the year 2030. In light of the significant changes in the global automobile industry, the new vision takes a longer-term perspective and sets out how Mazda will make use of driving pleasure—the fundamental appeal of the automobile—to help resolve issues facing the earth, society, and people.

Sustainable Zoom-Zoom 2030

At Mazda, we see it as our mission to bring about a beautiful earth and to enrich people's lives as well as society. We will continue to seek ways to inspire people through the value found in cars.

Issues and the External Environment

- Need for substantial reductions in CO₂ emissions in order to reduce greenhouse gases, which are a primary cause of global warming
- Increasingly serious air pollution in major cities around the world

To address these issues and truly reduce greenhouse gases, we must work to reduce CO₂ emissions throughout a vehicle's life cycle. Accordingly, we are promoting the reduction of CO₂ emissions not just from the previous perspective, which evaluates CO₂ emissions while driving, but also from a well-to-wheel perspective, which evaluates CO₂ emissions from oil extraction to product manufacture and shipping as well. As specific objectives, in comparison with 2010 levels, we aim to achieve reductions in corporate average well-to-wheel CO₂ emissions by 50% by 2030 and by 90% by 2050.
To achieve these objectives, we are developing multiple solutions that enable us to offer appropriate powertrains that take into consideration each region's energy situation and power generation mix. We will continue to pursue advances in the internal combustion engine, which is widely expected to help power the majority of cars worldwide well into the future (see illustration below). Meanwhile, we plan to equip all combustion engine-powered cars with some form of electrification technology by 2030.

In addition, aiming to make fuels themselves as carbon neutral as possible, we will step up collaborative efforts with other companies and between industry, academia, and government to encourage the spread of renewable liquid fuels such as microalgae biofuels.

LONG-TERM VISION FOR TECHNOLOGY DEVELOPMENT

This approach and its goals are in alignment with the Paris Agreement, an international agreement to combat climate change and reduce greenhouse gas emissions, and the Strategic Commission for the New Era of Automobiles, under Japan's Ministry of Economy, Trade and Industry (METI).

CO₂ Emissions Reduction from Well-to-Wheel Perspective

To protect the earth, we will implement the following initiatives in order to maximize the effect of reduced greenhouse gas emissions under real-world conditions.

1. Aspire to make the best internal combustion engine in the world
2. Combine the ideal internal combustion engine with efficient electrification technologies
3. Introduce electric vehicles (EVs) and other electric-powered technologies in regions that use clean energy to curb global warming and in regions that implement government policies to reduce air pollution

Means to Achieve Our Targets

IEA / ETP—Energy Technology Perspective 2015

*fEV = Electrified vehicles (Battery EVs, plug-in hybrid EVs, hybrid EVs, and fuel cell EVs), based on the Interim Report by the Strategic Commission for the New Era of Automobiles under METI
Electrification Technologies

- Mazda will strive to reduce CO₂ emissions and enhance the joy of driving by deploying compact, lightweight electrification technologies while further refining the internal combustion engine.
- We will introduce EVs as the optimal solution in regions that generate a high ratio of electricity from clean energy sources or restrict certain vehicle types to reduce air pollution.

Mazda plans to deploy some form of electrification technology in all production vehicles by 2030. We expect that by 2030, internal combustion engines combined with some form of electrification technology will account for 95% of the vehicles we produce and that battery EVs will account for 5%.

In our in-house development of EVs, we aim to leverage the advantages of electric drive systems and be guided by our unique human-centered development philosophy that focuses on human traits and sensibilities. We aim to bring these EVs to market from 2020.

EVs True to the Mazda Spirit: Three Concepts

1. **Driving Pleasure**
   - We aim to offer true driving pleasure with EVs by offering an enhanced sense of connection with the car through the use of G-Vectoring Control and other technologies.

2. **Rotary engine range extender**
   - Mazda will develop two battery EVs, one powered solely by battery and another that pairs a battery with a newly developed range extender powered by Mazda’s small, lightweight, and exceptionally quiet rotary engine. The range extender will recharge the battery when necessary to effectively increase the vehicle’s driving range.

3. **Multi-xEV technology**
   - The concept behind the rotary engine range extender was to leverage the rotary engine’s small size and high power output to make multiple electrification technology solutions including plug-in hybrids and series hybrids possible via a shared packaging layout with different combinations of generators, batteries, and fuel tanks.

3. **Technologies That Can Contribute to Society: A Life in Which Your Car Can Act as a Power Source**
   - Taking advantage of the rotary engine’s compatibility with gaseous fuels, the rotary engine range extender is designed to also burn liquefied petroleum gas (LPG) and provide a source of electricity in times of emergency.

**SKYACTIV-X**

SKYACTIV-X is an innovative internal combustion engine that combines the distinctive high-revving performance of a gasoline engine with the fuel efficiency, torque, and response of a diesel. Using Mazda’s proprietary combustion method called Spark Controlled Compression Ignition (SPCCI), SKYACTIV-X is a new generation of engine. Achieving outstanding environmental performance, power, and acceleration performance, SKYACTIV-X is an engine that stands by the earth and people while supporting the Jinba-ittai “horse and rider as one” enjoyment that we strive to offer our customers. We are installing the engine in our new-generation products, starting with the all-new Mazda3. We will continuously evolve SKYACTIV-G and SKYACTIV-D engines to meet diverse customer needs across a broad engine lineup.
Society
Realize cars and a society that offer safety and peace of mind, and create a system that enriches lives by offering unrestricted mobility to people everywhere

Issues and the External Environment
Emergence of new causes of traffic accidents, especially in developed nations
• Accidents caused by young and inexperienced drivers
• Distracted driving due to increase in the volume of information from smartphones, etc.
• Driving errors by elderly drivers
• Dangerous driving under the effects of overwork and illness

Emergence of issues accompanying changes in the structure of society
• Weakening / disappearance of public transport in areas of depopulation
• Increase in numbers of elderly or disabled who have difficulty getting around

With the goal of realizing a motorized society without traffic accidents, we are striving to develop more advanced safety technologies under the Mazda Proactive Safety philosophy.

Means to Achieve Our Targets
1. Continuously evolve fundamental safety technologies and standardize them across all models
   • Driving position
   • Pedal layout
   • Visibility
   • Active Driving Display

2. Promote standardization of i-Activsense advanced safety technology, which helps drivers recognize and assess potential hazards
   Technologies to reduce accidents involving rear-end collisions, pedestrians, pedal mix-ups, and lane changes
   • Fiscal year March 2018: Standardize in Japan
   • 2018 and onward: Standardize globally
   The Mazda Co-Pilot Concept centers on people and leverages automated driving technologies
   • 2020: Commence testing
   • By 2025: Aim for standardization

3. Utilize connectivity technologies
   Using an advanced version of Mazda Connect, we will create a new business model that enables car owners to support the mobility needs of people in depopulated areas and those who have difficulty getting around
Connectivity Technologies
In line with its human-centered development philosophy, Mazda is developing connectivity technologies that offer an enriching experience of the joy of life, connecting people by facilitating the sharing of experiences and feelings through cars. We are contributing to the resolution of social issues, such as the weakening of interpersonal connections that has accompanied changes in society, by connecting people and society through connectivity technologies.

As a concrete example of such initiatives, in 2018, in Miyoshi City, Hiroshima Prefecture, we started trials with mobility services utilizing connectivity technologies in cooperation with local residents and the Hiroshima Prefectural and Miyoshi City authorities. We aim to build a social contribution model that will support regional revitalization through mobility service trials with an eye on future shared mobility. We are also working on technologies that connect customers to their car and technologies that connect customers to Mazda. To build a stronger customer relationship and connection for our business in the future, we will use connectivity technologies to drive business innovation.

Mazda Proposes Two Value Concepts
- Offer the ability to enjoy digital convenience, safely, while in your car
- Based on our human-centered development philosophy, provide an enriching lifestyle and experience of car ownership that energizes people physically and mentally

People
Enhance customers’ mental well-being with the satisfaction that comes from protecting the earth and contributing to society with a car that offers true driving pleasure.

Issues and the External Environment
- People today enjoy a more affluent lifestyle thanks to mechanization and automation. However, stress levels have also been rising due to a lack of exercise and opportunities for direct social contact.

Through our vehicles, we aim to offer driving pleasure and an enriched life to an even greater number of customers. Based on the Company’s major strength, the pursuit of Jinba-ittai— or “horse and rider as one”—enjoyment, which unlocks people’s potential and revitalizes them mentally and physically, and based on the philosophy of “breathing life into the car,” we will further develop Kodo design to raise vehicle design to the level of art that enriches the emotional lives of all who see it.

Mazda’s Approach to Issue Resolution

New-Generation Skyactiv-Vehicle Architecture Platform
Mazda’s Skyactiv-Vehicle Architecture was developed with an intensified focus on its human-centered design philosophy to maximize the human body’s inherent ability to balance itself. In this way, it offers all occupants a more comfortable and less tiring ride and enables them to respond quickly to environmental changes. As the human body is easily able to balance itself in response to driving inputs, the new vehicle architecture provides responsive driving and the ultimate Jinba-ittai driving feel.

Kodo—Soul of Motion Design Philosophy: A Step Further
Since 2010, Mazda has striven to create cars that embody the dynamic beauty of life through application of its Kodo—Soul of Motion design philosophy. Going deeper, matured Kodo design pursues the expression of a “new elegance” based on Japanese aesthetic sensibilities.
We started to launch the all-new Mazda3 as the first of our new-generation products incorporating new technologies targeting the realization of “Sustainable Zoom-Zoom 2030,” our long-term vision for technology development. Based on its human-centered philosophy, Mazda has dramatically improved every area: design, driving performance, NVH, environmental performance and quality feel, trying to create a new, hitherto unknown value.

The all-new Mazda3 adopts a matured Kodo design language that attempts to embody the essence of Japanese aesthetics. While the overall form presents a simple, single motion, subtle undulations bring the design to life through shifting light and reflections that glide over the body surface. The result is a richer and more powerful expression of vitality than previous Kodo models. Despite sharing the Mazda3 moniker, the hatchback and sedan models have distinct personalities—the design of the hatchback is emotive, the sedan elegant.

The all-new Mazda3 adopts Mazda’s new Skyactiv-Vehicle Architecture, designed to enable people to make the most of their natural sense of balance. The powertrain lineup comprises the latest Skyactiv-X, Skyactiv-G, and Skyactiv-D engines, each of which provides responsive speed control in any driving situation. Based on its philosophy of designing the car around the human being, Mazda has dramatically enhanced the car’s fundamental driving attributes such that accelerating, turning, and braking feel completely natural.

Mazda CX-30 Compact Crossover SUV, the Second New-Generation Model

The CX-30 is a new compact crossover that combines the bold proportions of an SUV with elegant styling that embodies Mazda’s Kodo design language.

As a new core model, the CX-30 will be rolled out to global markets, with sales starting in Europe in summer 2019.