

5. Environmentally Friendly Technology

Establishment of administrative policies and organizations to deal with environmental matters

In April 1992, Mazda adopted the "Mazda Global Environmental Charter," and in March 1993, we established action plans concerning global environmental matters and the "Mazda Global Environmental Committee." For further environmental protection, Mazda established in 1998 a "Voluntary Action Plan for Recycling Promotion." Through vehicle recycling initiatives, such as collection of scrap bumpers, improvement in the recyclable rate of vehicles, and reduction in the amount of lead used in vehicles, Mazda is conserving our natural resources.

In September 1998, Mazda obtained ISO 14001 certification for its Hofu Nishinoura Plant in Japan, and for overall operations in Hiroshima in June 2000. With a combined total of more than 20,000 employees at these operations, the scale of this effort and award is unprecedented in the Japanese auto industry.

These environmental actions are compiled in an "Environmental Report" published annually.

In 2002, Mazda has set three new goals towards environmental protection.

- Fuel Efficiency: Achieving Japanese 2010 fuel efficiency standards in all weight categories of passenger vehicles by FY2005.
- Low Emissions: Raising the percentage of U-LEV passenger vehicles to 90% by the end of CY2005.
- Zero Landfill: Accelerating the reduction of waste landfill to achieve the zero levels by the end of FY2002 at all of its manufacturing sites in Japan.

Mazda's Environmental Principles

We aim to promote environmental protection and contribute to a better society, while maintaining harmony with nature in our business activities.

- 1) We will contribute to society by creating environmentally friendly technologies and products.
- 2) We will use the Earth's resources and energy sparingly, and never overlook environmental considerations when conducting our business.
- 3) Hand in hand with local communities and society at large, we will play our part in improving the environment.

Reduction of CO₂ emissions to slow the effects of global warming

- 1) Fuel economy improvement to reduce automobile CO₂ (carbon dioxide) emissions.

Technical challenge: Improve fuel economy by engine refinement and vehicle weight reduction.

- Introduced a small 2.0L "MZR-CD" turbocharged diesel engine with common-rail direct-injection. This engine delivers excellent fuel economy and clean emissions performance required to meet stringent "Euro3" standards in EC. It is mounted in the New Mazda MPV introduced in June 2002 and the Mazda6 (Atenza) introduced in September 2002 for the European markets.
- Introduced the all-new "MZR" aluminum inline 4-cylinder engine combined with excellent fuel economy and clean emissions performance. The 2.3L MZR powered New Mazda MPV, the 2.0L MZR powered Mazda6 (Atenza) and the 1.3/1.5L MZR powered Mazda2 (New Demio) all cleared Japan fuel economy standards for FY2010.
- In order to further enhance fuel economy, Mazda has been developing a direct injection gasoline engine that can run off an even leaner mixture.
- Vehicle weight reduction: streamlining basic body structure and layout, weight reduction of individual parts, use of lightweight materials.

- 2) Reducing factory CO₂ emissions

- Introduced fuel-efficient, low-pollution, energy-efficient cogeneration for heat and electric power at the Hiroshima plant in 1987, as well as an advanced, energy-efficient cogeneration plant at Hofu in July 1993.
- Began using LNG with lower CO₂ emissions for heat source at the Hiroshima plant from August 1998.

New manufacturing technology

- 1) Introduced "semi-dry process"

A semi-dry machining process for parts which greatly reduces the amount of lubricant required was applied to the machining line of the all-new aluminum inline four-cylinder MZR1.3/1.5 engines. Through this process, energy consumption is reduced by 75%, while reducing the amount of waste lubricant by 80%. This has largely contributed to minimizing the environmental impact.

- 2) Introduced "Three Layer Wet Paint System"

Mazda has successfully developed a new coating technology called "Three Layer Wet Paint System," which combines the primer coating process into the top coating process. This significant technology has been launched at its Hofu Plant 1 in Yamaguchi Prefecture. This has contributed to a reduction in energy consumption by 15% CO₂ discharge and emissions of VOC (Volatile Organic Compounds), such as toluene and xylene, by approximately 45%.

Development of alternative-fuel and clean-energy vehicles and other advanced technology

1) Fuel Cell Electric Vehicle (FC-EV):

- Participating in the Ford/DaimlerChrysler/Ballard alliance to develop fuel-cell technology for future vehicles through our close relationship with Ford Motor Company in 1998.
- Developed the "Premacy FC-EV," a new fuel cell electric prototype vehicle based on the Mazda Premacy in 2001. (Received the permission of the Minister of Land, Infrastructure and Transport, and conducted vehicle test runs on public roads for the first time in Japan.)

2) Electric vehicles:

- Started electric vehicle research program in 1966.
- Sold approximately 100 electric vehicles in Japan during the last 30 years.
- Developing high-performance battery and energy-saving equipment to improve running distance and efficiency.
- Developed high performance battery electric vehicles based on the Demio in 1997.
- Introduced electric-powered vehicles based on the Mazda E-Series (Bongo van) with minor changes in 1998.

3) Hydrogen-fueled vehicles:

- Working to improve the hydrogen-absorption efficiency of the metal hydride tank (hydrogen fuel storage tank) to increase running distance.
- Two hydrogen-fueled vehicles based on the Mazda626 wagon (Capella Cargo wagon) were licensed by the Ministry of Transport in May 1995 and were tested on public roads. (The total distance covered in the test was about 20,000 km per vehicle over 2 years.)

4) Natural-gas-powered vehicles:

- Introduced a compressed natural gas-fueled version of the Demio in June 2000, the Mazda T-Series (Titan) in November 2000, and the Mazda T-Series (Titan Dash) in April 2001 in Japan.

Reduction of automotive exhaust emissions

To reduce automotive exhaust emissions such as HC (Hydrocarbon), CO (Carbon monoxide) and NOx (Nitrogen oxide):

- Introduced a three-way catalytic converter system in 1976.
- Developed "Diluted-burn" engine in 1997 which recirculates large amounts of exhaust gas into the combustion chamber to improve fuel efficiency and to reduce CO₂ and NOx emissions under a wide range of driving conditions, including acceleration and stable driving.
- Developed the low light-off three-way catalyst with high thermal durability in 1998 for conventional gasoline to reduce HC, CO and NOx by half; it improves fuel economy and lowers CO₂.

In addition, obtained a rating of E-LEV ("Excellent Low Emission Vehicle" designated by the Ministry of Land, Infrastructure and Transport) by achieving 50% reduction on the Japan 2000 emission standards with the 2.3L MZR powered New Mazda MPV and the Mazda6 (Atenza), the 2.0L MZR powered Mazda6 (Atenza) and the 1.3/1.5L MZR powered Mazda2 (New Demio).

Recycling materials and resources and effective usage of waste

1) Reduced materials and resources for automotive use:

- Implemented a universally-applicable numerical coding system (ISO 1043 and 1629 based) for plastic parts of 100 grams and over on all new models from the introduction of the Mazda MX-3 (Eunos Presso/AZ-3) in June 1991.
- Developed parts using recycled plastics.
- Started to use recycled materials made from replaced bumpers, collected at dealerships nationwide, for bumper reinforcement parts of the Mazda 323 (Familia) series in January 2001.

2) Recycling and use of flammable and non-flammable waste from manufacturing and other processes:

- Reduced plant waste by 80% the 1990 level at the end of 2001.
- Began recycling all steel scrap from manufacturing process.
- Began incinerating flammable waste to create steam for factory use.
- Introduced a new waste paper collection system. Annually recycling some 1,400 tons of paper, roughly equal to 28,000 eight-meter trees with a 15 centimeter diameter.
- Began supplying more than 90% of the powder sand created in the process of casting to a cement maker as a raw cement material.
Cement makers also purchase all the coal ash generated by the energy center.
- Began supplying slag, another casting by-product, in 1988 as a foundation material for asphalt roads.
- The use of recycled papers has been promoted since 1991. Recycled paper is 100% used for photo copy papers, business cards and PR materials.
- Drew up new goals as our recycling target, aiming for 90% recyclability of new domestic models in and after 2002.
- Reduced lead as concerned material by 50% compared to the 1996 level for new models to be introduced in and after 2000. In addition, Mazda will phase-out the use of lead, 6-valent chromium, cadmium and mercury during 2003 and 2008 complying to EU Directive.