

3 Strategies for "Green" and "Peace of Mind"

With the aim of contributing to the happiness of people, DENSO has been working to maximize the value it provides through its business activities in the fields of "green" and "peace of mind." To that end, we have established medium- to long-term targets to accelerate the maximization of value in these fields and are promoting the following specific initiatives in order to achieve these targets.



Aiming to Become Carbon Neutral by 2035

We aim to realize carbon neutrality within our production activities in the not-too-distant future of 2035 by further promoting the environmental efforts in which we have engaged thus far. To make this ambition a reality, we are pursuing efforts in the three fields of "Monozukuri (manufacturing)," "mobility products," and "energy use," while making use of the Green Innovation Fund* and other frameworks.

* Green Innovation Fund: An initiative offered by the New Energy and Industrial Technology Development Organization (NEDO) to provide ongoing support to companies committed to achieving ambitious goals related to achieving carbon neutrality through the research, development, demonstration, and practical application of their technologies over the long term within the priority areas for which action plans have been established under the Green Growth Strategy

Monozukuri (Manufacturing)

Aim: Realize complete carbon neutrality at our plants

We will reduce CO₂ emissions by utilizing renewable energy such as solar power and enhancing the efficiency of our manufacturing process. In addition, we aim to realize complete carbon neutrality at our plants, without the use of carbon credits, by capturing the CO₂ emitted in the production process and reusing it as energy.

Specific Initiatives	Target for 2035
<ul style="list-style-type: none"> At our plants, rigorously engage in energy-saving activities and promote the use of renewable energy by promoting in-house power generation through reforms to our production and supply structure Seek to achieve carbon neutrality in 2025 by offsetting the CO₂ emitted from electricity-derived energy through the procurement of renewable energy and offsetting the CO₂ emitted from gas-derived energy through the use of carbon credits Realize carbon neutrality at our plants by 2035 and work to expand and support activities geared toward carbon neutrality throughout the supply chain 	Achievement of complete carbon neutrality at our plants
	Current level of achievement
	CO ₂ from plants: 1.91 million tons (5% reduction globally compared with fiscal 2021*) * Adjusted to pre-pandemic levels

Mobility Products

Aim: Contribute to the electrification of cars to reduce CO₂ emissions to the greatest extent possible

We will help popularize HEVs, BEVs, FCEVs, and other electrified vehicles (xEVs) by advancing products powered by electricity. In addition, we will apply the electrification technologies cultivated in the automotive industry to the field of air mobility in an effort to significantly reduce CO₂ emissions in all facets of mobility.

Specific Initiatives	Target for 2025
<ul style="list-style-type: none"> Centered on driving systems and thermal systems, promote farsighted technological development in all facets of mobility, from HEVs, BEVs, and FCEVs through to eVTOL (all-electric vertical take-off and landing) aircraft, thereby realizing energy management that connects cars and other forms of mobility with society Apply electrification technologies to the new field of air mobility. At the same time, return the high-output, high-efficiency, and ultra-lightweight technologies acquired through this effort to the automotive industry 	Revenue from electrification domain ¥1 trillion
	Current level of achievement
	Revenue from electrification domain ¥580.0 billion

Energy Use

Aim: Realize an energy-recycling society through the development and popularization of technologies that make effective use of renewable energy

We will establish technologies that store and reuse energy in a highly efficient manner, regardless of location or time, and work to popularize them on a global basis. By doing so, we will help realize an energy-recycling society.

Specific Initiatives	Target for 2035
<ul style="list-style-type: none"> Develop and commercialize batteries that store fluctuating or excess renewable electricity, hydrogen manufacturing technologies, and fuel conversion technologies. Make full use of renewable energy and further contribute to its expanded introduction Realize technologies that can reuse energy by capturing CO₂ emitted from industry and CO₂ in the atmosphere at the necessary locations, then solidifying said CO₂ and converting it into resources, thereby reducing CO₂ emissions in society as a whole 	Revenue from commercialization of renewable energy ¥300.0 billion
	Current level of achievement
	Selected as a Green Innovation Fund project (Large-scale verification test of CO ₂ capture technologies)



Aiming to Become a Leading Company That Provides "Peace of Mind" to Society

For a company like DENSO, which aims to contribute to the happiness of people, part of our mission is to provide peace of mind to society by resolving social issues through our business activities. This section introduces the three pillars of DENSO's contributions to the field of "peace of mind," through which we aim to become a leading company that provides peace of mind to society.

Elimination of Fatalities from Traffic Accidents

Aim: Popularize safety products through efforts focused on "depth" and "width," thereby realizing free mobility without fatalities from traffic accidents

With the aim of eliminating fatalities from traffic accidents, we are promoting efforts under a two-pronged approach focused on "depth," which involves reaching the cutting edge of technology, and "width," which involves realizing the widespread adoption of safety products in a large number of cars. For "depth," we are further evolving our safety products and working to have them adopted in a greater number of advanced mobility fields. For "width," we are working to realize attractively priced safety products and enhance our lineup of retrofitted products.

Specific Initiatives	Target for 2025
<ul style="list-style-type: none"> Respond to various accident situations and strive to prevent accidents through not only 360-degree sensing but also in-vehicle sensing and vehicle-infrastructure linkages Fully leverage AI technologies to predict "unseeable danger" and provide such information to the driver, thereby ensuring the driver avoids hazardous situations In tandem with the evaluation of ADAS, expand lineup of retrofitted products that can be applied to already-sold vehicles in an effort to provide value that responds to various situations, vehicle types, and needs 	Revenue from the ADAS domain ¥500.0 billion
	Current level of achievement
	Revenue from the ADAS domain ¥360.0 billion

Creation of Comfortable Spaces

Aim: Enhance relevant technologies for creating peaceful, comfortable spaces

Following the progression of automated driving, there has been a growing need for providing cars not simply as a means of transportation but also as a "private space that enables mobility." To that end, DENSO seeks to create comfortable spaces by evolving the four environments within vehicles: temperature, sound, air, and visibility.

Specific Initiatives	Target for 2025
<ul style="list-style-type: none"> Innovate purification and sensing technologies to eliminate viruses and visualize toxic substances, thereby realizing safe and secure air quality Refine technologies to create and expand comfortable interiors in passenger vehicles and public transportation vehicles 	Popularize in-vehicle general-purpose products
	Current level of achievement
	Investment in Japanese market for commercial products

Support for Working People

Aim: Draw on the technologies we have cultivated in the mobility domain to establish a society where people are supported and their potential is nurtured

One major social issue is the significant decline in the workforce in various industries. To address this issue, DENSO will draw on the technologies it has cultivated in the mobility domain, such as automation technologies and ICT, to realize a society where all people are supported and can take on new challenges with peace of mind.

Specific Initiatives	Target for 2030
<ul style="list-style-type: none"> In the agricultural field, contribute to the stable and secure supply of food by resolving issues throughout the food value chain In the logistics field, provide ultra-high-quality comprehensive solutions that cover everything from frame-work improvement through to the rationalization of entire factories For plant operations and factory automation (FA), combine core technologies such as robots and sensors with automation technology and improvement know-how in order to provide systems and products catered to the front lines 	Revenue from the agricultural, logistics, and plant operations/FA fields ¥300.0 billion
	Current level of achievement
	Gradual progress in business expansion

Overview by Product (Industrial Solutions, Food Value Chain) [▶▶ P.94-97](#)

Main Results of Our Strategies Related to Green and Peace of Mind in Fiscal 2022 and Beyond

Since our founding, we have been working to maximize the value of green and peace of mind, and efforts to do so have been further accelerated under "Reborn21." In this section, we look back on the steady results we achieved with our initiatives over the course of fiscal 2022.

For more details, please see the "Newsroom" section of our corporate website.
<https://www.denso.com/global/en/news/newsroom/>



2021

2022

Green

We are striving to reduce CO₂ from our *Monozukuri* activities and develop and popularize mobility products that contribute to the electrification of automobiles.

Monozukuri

Commencement of Verification Test for CO₂ Circulation Plant

With the aim of achieving net-zero emissions from our plants, we commenced verification tests for a CO₂ circulation plant, which is a facility designed to capture and recycle CO₂.



Mobility Products

Alliance with Honeywell

Together with Honeywell International Inc., we are promoting the development of electric propulsion systems for aircraft. Through this joint development, we will work to apply DENSO's electrification technologies in the field of air mobility.



Mobility Products

Bolstering of Production Structure for Products Powered by Electricity

We started to manufacture inverters in 2005, and since then, our inverters have been praised by our customers for their quality, stability, and high level of performance. As of December 2021, we have produced a cumulative total of 20 million inverters on a global scale. To further promote the global shift to electrification in the future, we are working to bolster our production structure for inverters in Japan, China, and North America. Going forward, we will establish manufacturing lines in such regions as Europe and India with the aim of producing 12 million inverters a year starting from 2025.

Monozukuri

Receipt of Energy Conservation Grand Prize Award for 12 Consecutive Years

We received the Energy Conservation Center Chairman's Prize in the Examples of Energy Conservation Division of the Energy Conservation Center, Japan (ECCJ)'s Award Program, in recognition of our efforts to reduce the amount of steam used to heat pure water for the cleaning of semiconductors through the reuse of plant waste heat.



Mobility Products

Collaboration with USJC in the Manufacture of Automotive Power Semiconductors

We have agreed to collaborate with United Semiconductor Japan Co., Ltd. (USJC), a subsidiary of global semiconductor foundry United Microelectronics Corporation, in the production of power semiconductors that are needed for electric vehicles (EVs). Through this collaboration, we will realize the stable procurement of semiconductors, which in turn will help accelerate the transition to electrification.

Mobility Products

Adoption of DENSO Electrification Components in the Toyota bZ4X and Other Vehicles

We have developed new products that help enhance the practicality of EVs in such ways as increasing driving distance, shortening charging time, and extending battery life. These new products have been adopted in the Toyota bZ4X and other vehicles.

Peace of Mind

We are striving to develop safety products, provide services that realize comfortable spaces, and utilize the technologies we have cultivated in the mobility domain.

Creation of Comfortable Spaces

Development of Puremie Air Purifier That Realizes Safe In-Vehicle Environment

Our newly developed air purifier Puremie eliminates viruses in the air environment and visualizes air purity status through an air cleaning device, which is equipped with a high-performance filter, and a monitor that measures air purity. In this way, Puremie offers passengers peace of mind with regard to in-vehicle air quality.



Air purifier

Air quality monitor

Support for Working People

Development of the Compact Mobile Refrigerator D-mobico

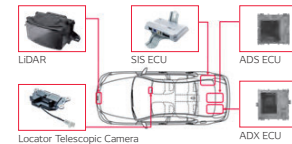
Together with Yamato Transport Co., Ltd., we have developed D-mobico, a compact, light-weight and portable refrigerator. D-mobico is able to flexibly respond to various transport needs and helps improve the fuel performance and reduce the CO₂ emissions of delivery vehicles.



Elimination of Fatalities from Traffic Accidents

Development of Products for the Advanced Driver Assistance Technology Advanced Drive

We have developed safety products that realize advanced driver assistance features, which help give passengers peace of mind and enhance the safety performance of vehicles. These products have been adopted in the all-new Toyota MIRAI.



Elimination of Fatalities from Traffic Accidents

Enhancing Performance and Expanding Functionality of the World's Smallest Stereo Vision Sensor

Compact stereo vision sensors help enhance the safety of lightweight vehicles. To that end, we have developed the world's smallest stereo vision sensor and have successfully enhanced the sensor's performance and expanded its functionality while still keeping it available at a low price.



Elimination of Fatalities from Traffic Accidents

Development of the Global Safety Package 3 Product for Accident Prevention and Safety Systems

We have developed Global Safety Package 3 (GSP3), which improves the safety of vehicles by giving them high sensing capability of their surroundings. We developed this product with the aim of expanding the settings in which accident prevention and driver assistance systems are used and of realizing a compact safety product that can be offered at a low price.

Support for Working People

Promotion of DX in the Healthcare Industry with the Aim of Improving the Quality of Medical Treatment

By utilizing OPeLiNK®, a platform developed by DENSO to integrate information from surgery equipment, we are participating in a platform business that promotes the digital transformation (DX) of medical education and hospital operations.

Management Foundation

We are working to bolster our management foundation to underpin efforts to maximize the value of green and peace of mind.

Selection as a Green Innovation Fund Project

Among the technologies we are developing to realize carbon neutrality, technologies being developed under the themes of "motor systems for mobility," "CO₂ separation and capture," and "next-generation power semiconductors" have been selected as Green Innovation Fund projects.

Issuance of Sustainability Bonds for the First Time

We issued sustainability bonds for the first time in order to strengthen our sustainability management. The funds raised through these bonds will be allocated to various investments in electrification, advanced safety, and automated driving.

Agreement on the Transfer of DENSO's Fuel Pump Module Business to Aisan

DENSO has agreed to transfer its fuel pump module business to Aisan Industry Co., Ltd., with a view to enhancing the competitiveness of both companies in the powertrain domain.

Transfer of Type III Alternator Business to Chengdu Huachuan Electric Parts

By transferring the type III alternator business to Chengdu Huachuan Electric Parts Co., Ltd., we aim to continue to fulfill our responsibility of supplying our customers. At the same time, we will promote the reshuffling of our business portfolio through collaboration with our business partners.

Investment in Semiconductor Manufacturer JASM

We have acquired a minority stake in Japan Advanced Semiconductor Manufacturing, Inc. (JASM), which handles the manufacture of semiconductors. Through this acquisition, we aim to realize the stable procurement of in-vehicle semiconductors over the medium to long term.


TOPIC: Green

Promotion of a Business Model That Contributes to the Carbon Neutrality of Automobiles, Industry, and Society at Large


Amid the rising interest in environmental issues, DENSO is working to not only help create eco-friendly automobiles but also go beyond the framework of automobiles to realize carbon neutrality in the manufacturing industry and in society as a whole, in collaboration with its various partners in the industry. To that end, we need to adopt a bird's-eye view of energy use to ascertain energy usage in individual automobiles, in the industry, and in society at large and implement energy management practices to ensure such energy is used efficiently. We will therefore aim to create businesses that realize carbon neutrality across society by applying, in a greater social context, the automotive and industrial technologies that we have cultivated since our founding.

SOCIETY


Carbon Neutral




Examples of areas of contribution and future technologies




Electric propulsion systems for aircraft



Non-contact charging systems




Traceability technologies



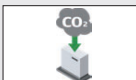
Household charge/discharge devices

INDUSTRY


Examples of areas of contribution and future technologies



CO₂ circulation plants



Artificial photosynthesis




Lean automation


AUTOMOBILES

Mechanical parts
Functioning as the body that follows instructions

Examples of products




Motor generators




Car air-conditioning units

Electronics
Functioning as the nerves and blood vessels that communicate instructions and transfer energy

Examples of products




Inverters




Battery ECUs

Software
Functioning as the brain providing instructions

Examples of products



Electronic platforms



In-vehicle edge computing technologies

4. Provide new value through energy management and new businesses that form links between automobiles, industry, and social infrastructure (society), by refining the technologies we have cultivated in automobiles and industry and applying them to social domains
3. Expand carbon-neutral plants, together with our partner companies, through the use of our energy utilization technologies and other measures
2. Realize carbon neutrality at our plants through the utilization of innovative energy-saving technologies and renewable energy and the introduction of green energy
1. Realize optimized energy management for automobiles by leveraging our system-building capabilities based on the three-pronged approach of mechanical parts, electronics, and software

TOPIC: Peace of Mind

Development of Global Safety Package 3 to Further Advance and Popularize Safety Products

To realize a society without fatalities from traffic accidents, which we adopted as part of our strategies related to peace of mind, we need to further advance safety products and equip vehicles with cutting-edge safety technologies. We also need to develop products that are attractive in terms of price so that we can realize the practical application of safety products in an even greater number of vehicles.

Global Safety Package 3 (GSP3) was developed with the aim of expanding the settings in which accident prevention and driver assistance systems are used and of realizing a compact safety product that can be offered at a low price.

Enhancement of Vehicle Safety Performance

Our Global Safety Package (GSP) combines information from a millimeter-wave radar sensor, which detects the shape of objects on the road, such as vehicles and guardrails, using radio waves, with information from a vision sensor, which uses a camera to detect the environment ahead of the vehicle, in an optimized manner. By doing so, these systems enable safe driver assistance. The newly developed GSP3 represents the third generation of the GSP series.

The vision sensor used in GSP3 adopts a wide-angle lens and a high-resolution imager. This doubles the area that the sensor is able to detect while maintaining the product size and price through circuit optimization. Additionally, the vision sensor makes use of new awareness logic that enables it to achieve such features as detecting additional objects and recognizing direction.

The millimeter-wave radar sensor makes use of a simple product design, which helps reduce numerous components to one-fifth of the size of conventional components and doubles the range of detection (of oncoming traffic), thereby reducing the overall size of the radar sensor by 43%. Furthermore, the millimeter-wave radar sensor has improved the product's functionality, allowing it to separate two objects and detect them individually based on their difference in speed and thereby enhancing the detection performance to a level where the radar sensor is able to distinguish between pedestrians and bicycles.



Millimeter-wave radar sensor

Vision sensor

As a result of this improved functionality, GSP3 is able to respond to potential accident scenarios, such as errantly turning left or right at intersections or colliding with oncoming traffic, that conventional safety products cannot. In fact, GSP3 is now able to cover approximately 70% of accident scenarios, as opposed to the roughly 40% covered by the previous GSP.

Efforts as a Comprehensive Systems Supplier

As a comprehensive systems supplier that handles everything from hardware to software, we gather together experts in each field of systems we handle to identify issues from their respective perspectives and examine measures to resolve such issues. Through this approach, we were able to successfully develop GSP3.

Going forward, we will promote technological development pertaining to advanced driver support so that we can realize mobility that is safe and free for all people, starting with drivers and pedestrians.

Message from an Employee
Aiming for the Ambitious Target of Eliminating Fatalities from Traffic Accidents

Without the cooperation of relevant parties, including our customers and suppliers, we could not have realized the development of GSP3 on our own. Thanks to the results of all relevant parties working as one team, a vehicle of one of our customers equipped with GSP3 won the five-star rating in the latest Euro NCAP safety testing. This rating demonstrates GSP3's high level of technological capabilities. We will continue to take on the challenge of developing cutting-edge technologies with the aim of delivering an even more comfortable mobility society to our customers around the world and of eliminating fatalities from traffic accidents.



Top left photo insert: Yoshiyuki Kato, ADGADAS Engineering Division 1
From left: Sho Okabe, ADGADAS Engineering Division 1; Keisuke Izumi, Hideki Tsukuda, ADGADAS Engineering Division 2; Hideaki Tanaka, Kohei Yamamoto, ADGADAS Systems Engineering Division; Shogo Matsunaga, Takumi Uematsu, J-OuAD DYNAMICS