ELECTRIFICATION SYSTEMS

Popularizing vehicle electrification systems and products to lead the global carbon-neutral trend and help provide mobility that is safe, reassuring, and highly convenient

We are working to reduce the size, enhance the performance, and improve the quality of electrification products such as inverters and motor generators. In addition, we are striving to enhance system technologies such as energy management technologies, which efficiently control electricity and thermal energy, and power supply system technologies, which can optimize and safely make full use of batteries. By doing so, we will continue to improve the performance of various kinds of mobility as we work to realize a carbon-neutral society and provide safe, secure, and highly convenient mobility.

Tsuneo Maehara
Head of Business Group

Relevant SDGs

Business Strengths

Technology Development Capabilities and Product Lineup

Our basic strategy is vertical integration. At each operational level, from systems through to products and semiconductors, we establish in-house production capabilities, and the competitiveness of each operational level is further strengthened through the mutual sharing of technological know-how among the levels. Built up during more than 25 years of experience in vehicle electrification operations, our technology capabilities at each operational level are competitive. Going forward, we will expand our vertical integration to the energy management field to create further competitiveness and provide a product lineup that meets customer expectations.

Global Production and Supply System

To meet the growing demand for electric vehicle components, we have more than 50 bases in 19 countries, supplying products to customers around the world. At the Anjo Plant, which is DENSO's global mother plant, the Electrification Innovation Center is rapidly and efficiently developing and introducing next-generation manufacturing technologies. For example, on the mass production lines of the adjoining electric vehicle component plant, the center is conducting verification tests of a CO_2 recycling plant and an energy-saving environmental production line that curbs CO_2 emissions.

In-vehicle Reliability

Quality is becoming increasingly more important in order to reduce vehicle breakdowns. We must manage quality-related breakdowns while realizing systems that optimally integrate vehicle functions for driving, turning, stopping, and comfort. DENSO has built up expertise in the reliability of in-vehicle systems, products, and semiconductors based on experience garnered in its founding electrical equipment business and from vehicle electrification operations. We provide optimal quality by managing the stress that products are subjected to as well as the strength of products throughout entire systems.

Business Strategy

Even as the trend toward electric vehicles becomes more complex, we aim to achieve a 30% share of the electrification domain by fiscal 2031 through the development of technologies ahead of our competitors, the establishment of supply capabilities that meet customer expectations, and the provision of quality that exceeds customer expectations.

Business Portfolio Transformation	• Update on electric drive strategy: The battery electric vehicle (BEV) products that we have strengthened in recent years have been informally adopted by certain customers, proving the competitiveness of our products. The business will expand by combining BEV products with hybrid electric vehicle (HEV) products, which are one of our existing strengths, to prepare products not only for plug-in hybrid electric vehicles (PHEVs) but also for fuel-cell vehicles (FCVs) and for commercial, agricultural, and construction vehicles. Also, we will accelerate the development of future technologies, especially the development of next-generation semiconductors, to maintain our competitiveness. • Creation of a second mainstay in the power supply business: Enhancing the convenience of electric vehicle charging has already emerged as an issue. As electric vehicles become more widespread, electric vehicle power supply systems themselves will diversify, and in the age of automated driving, optimal redundant power supply systems will become even more necessary. We have been providing power supply products that operate batteries and detect and assess their status so that battery cells can be used up safely. However, by offering a complete lineup of power supply products other than battery cells, we will transform ourselves into a supplier that can propose and provide optimal battery system solutions. In this way, we will grow operations into a second mainstay of the power supply business.
Realization of Sustainability Management	Maximization of earnings from existing businesses: In the motor generator business, where automakers have a strong preference for in-house production, we will not only expand our product lineup to meet needs but also maintain strong partnerships with customers and suppliers in relation to *Monozukuri* and the creation of core technologies. Through such efforts, we will strengthen the foundations of the business. Further, we will rigorously maximize earnings in all aspects of our business activities. For example, we will convert integrated starter generators and electric power steering motors for use in compact vehicles and electric motorcycles. Also, we will utilize these products for in-plant automatic guided vehicles and autonomous mobile robots, which dramatically increase our production efficiency.
Creation of New Value	Market creation through the realization of air-cooled power conversion with high power outputs: To expand in all types of vehicle electrification markets, the business will initiate innovations that combine its advantages in the compact power domain with regard to technologies for electromechanically integrated rotating machines. By realizing air-cooled power conversion with high power outputs that surpass conventional limits, we will pursue new enhancement of mobility value.

Business Analysis Q&A

Q: What is the impact of the slowdown in the global trend toward BEVs?

A: The expansion of the BEV market has recently softened, while the HEV and PHEV market is expanding again. However, we will not change our basic strategy of strengthening our competitiveness through vertical integration that establishes in-house production capabilities for everything from systems through to products and semiconductors. Few suppliers can offer both HEV products, which have always been our strength, and BEV products, which we have bolstered in recent years. Therefore, we believe that the situation has in fact become favorable for us.

Q: How do you plan to compete with the development speed of China's market?

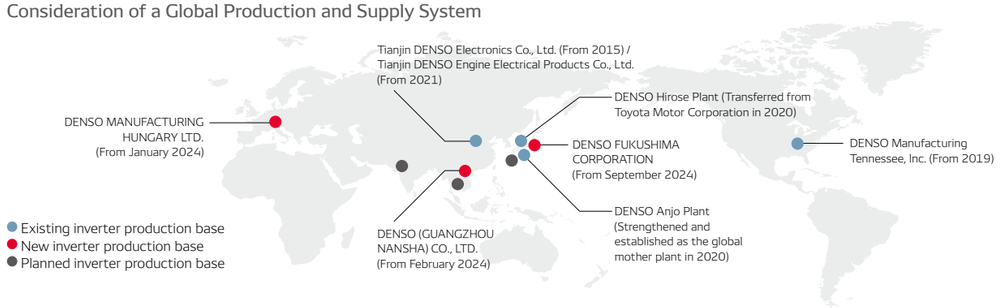
A: With respect to increasing development speed, we will continue our existing practice of giving first priority to vehicle safety and quality. With this practice as a basic premise, we will enhance development efficiency through integrated management of the advancement of all stages—from development and design through to manufacturing processes—in both the digital technology and physical technology areas. These efforts will be conducted by the Electrification Innovation Center, which has been established within the Anjo Plant. By fiscal 2026, we will halve the development lead time from product design through to mass production compared with that of fiscal 2023.

Objectives and Results of Strategies for Green and Peace of Mind

Objective: Establish a five-pole global bridge system for inverters that both meets regional demand and hedges supply risk
Results: Began additional inverter production in Europe to respond to the diversification of customer demand due to the expansion of the electrification market; followed on from the commencement of production in the north of China by starting up production at bases in the south of the country; began establishing production capabilities in India and ASEAN countries in light of customer trends and in preparation for further market expansion; and in Japan, as part of efforts to strengthen production bases near customers, began production at DENSO FUKUSHIMA CORPORATION for eastern Japan and new production in western Japan currently under consideration

Objective: Begin development of zero-carbon motors to realize net-zero CO_2 emissions throughout product life cycles
Results: Advanced the development of design technology for high torque density to achieve compactness and the development of application technology for low CO_2 materials; completed estimation of torque density potential; in fiscal 2025, will advance development prototype production by specifying elements required for high torque density designs; and will aim for an 80% reduction in CO_2 emissions

Consideration of a Global Production and Supply System



Resolving Social Issues through Our Businesses

Contributing to the Realization of a Sustainable Carbon-Neutral Society by Evolving Electrification Technologies for All Types of Vehicles and Popularizing Products

In addition to providing electrification technologies for HEVs, PHEVs, BEVs, and other passenger cars, we are developing such technologies to support all types of electric mobility, including everything from automated conveyors in plants and warehouses, compact vehicles, and two-wheeled vehicles in the domain of compact electrification, to commercial vehicles, agricultural construction equipment, and aircraft in the domain of large-scale electrification. In particular, we are developing electric motors (e-motors) for electric vertical take-off and landing (eVTOL) aircraft, which solve the issues of traffic congestion in cities and the resulting CO_2 emissions as well as the need for high-speed transportation networks that enable travel for the shortest possible distance and are connected to suburban and sparsely populated areas that are distant from trunk communication routes. By doing so, we have added to our product lineup e-motors that can be applied to two types of propulsion: propellers and jets. Our newly developed e-motors are both compact and lightweight to an extent that exceeds conventional standards, thanks to the use of lightweight materials and enhanced cooling performance.

We will apply technologies cultivated for vehicles in the automotive industry to aircraft, including electrification technologies and technologies for the mass production of high-quality products. At the same time, we will apply technologies honed in the aircraft business to the automotive industry. In this way, DENSO will contribute to the realization of a sustainable mobility society.

e-motors for eVTOL aircraft:
60% weight reduction versus conventional motors


Jet propulsion-type motor


Stator


Rotor