

ELECTRIFICATION SYSTEMS

Supporting electrification in all areas of mobility to realize an enriched environment and comfortable movement

To deliver electrification systems for vehicles that are eco-friendly and enable even more comfortable travel, we have built up a solid track record with the development of electrification technologies, realizing high performance, compactness, and fuel efficiency for the major products needed for HEVs. Going forward, we will leverage our expansive business domains to form linkages between various in-vehicle systems and products in an effort to efficiently manage energy within vehicles. In this manner, we will further improve fuel efficiency and contribute to the conservation of energy.



Jiro Ebihara
Head of Business Group

Business Strengths

System Development Capabilities

Global Production and Supply Structure

Manufacturing for a New Era

It has become increasingly important to improve the environmental performance of vehicles as electrification intensifies. The DENSO Group offers the full range of components used in electric drive systems, the heart of electric vehicles. Our system development capabilities involve having a thorough understanding of how each hardware component in a vehicle is used and being able to incorporate that knowledge so that higher levels of performance and reliability can be realized as a whole, satisfying diverse market needs.

From approximately 50 bases in 19 countries including Japan, DENSO supplies high-quality products to customers around the world. Maximizing these existing assets, DENSO Manufacturing Tennessee, Inc. (DMTN) began manufacturing electrified products in 2019, followed by Tianjin DENSO Engine Electrical Products Co., Ltd. (TDS) in 2021. Looking ahead, the Company will strengthen its production and supply structure for electrified products in Europe and India, where growth is gaining momentum.

At our Electrification Innovation Center established at the Anjo Plant, we are rapidly and efficiently developing and introducing next-generation manufacturing technologies, such as prototyping production lines that help conserve energy and preserve the environment by restricting CO₂ emissions, and a CO₂ recycling plant on mass production lines for an adjoining electrified product plant.

Business Strategy for 2022

DENSO is efficiently shifting management resources to electrified product businesses by accelerating the reorganization of businesses nearing their final stages. We intend to expand electrified product businesses by quickly adding products to our lineup that address global and customer needs as society becomes more electrified in a bid to become carbon neutral.

Growth Strategy	Amid the accelerating movement toward BEVs, DENSO has been steadily adapting to Toyota Motor's electrification strategy that will be the basis for future development. The Company is creating new business models while expanding its product lineup in order to increase sales to existing and new automakers in Europe, the United States, and China. In China, a key market, DENSO will commit more resources than before and improve ties with its Chinese partners.
Strategy for Businesses Nearing Final Stages	For businesses nearing their final stages, DENSO is efficiently restructuring production and supply structures, including consolidating production facilities, while maintaining the quality demanded by its customers and fulfilling its responsibility to supply products. As a part of these efforts, in June 2022, the Company moved its alternator and starter operations to the Powertrain Systems Group and stepped up business activities.
R&D	DENSO aims to enhance the value of electric-powered mobility, from compact distribution vehicles to passenger cars and large distribution vehicles, through a combination of software and hardware in power supplies and electric drive systems, while concentrating on motors and electric drive control technologies that magnify the competitiveness of its components for electric vehicles. At the Electrification Innovation Center established at the Anjo Plant in April 2020, we aim to rapidly commercialize new businesses through fast-paced development integrating mass production trials.
Monozukuri	Through production reforms, DENSO is expanding its production and supply structures in tandem with the quickening shift to electrified products. The Company aims to become carbon neutral at an early stage through the use of methane gas generated from CO ₂ in production processes (as of 2021), as well as the installation of hydrogen composition facilities, such as SOFCs ^{*1} /SOECs ^{*2} and power conditioning with storage batteries and EVs (as of 2022).
Hitzukuri	DENSO is accelerating the reassignment of personnel to growth businesses while reorganizing businesses nearing their final stages. We are training personnel to take an active role in new businesses while working to resolve social issues along with customers in a world of diversifying needs.

*1 Solid oxide fuel cells

*2 Solid oxide electrolyzer cells

Outcome of Green and Peace of Mind Strategy

Objectives	Results
Reinforce development structure and expand lineup of electric drive products	Completed lineup in Core & Customization Strategy for electric drive systems. Launched System Engineering Department and strengthened the overall structure of the energy management system
Advance development of new green businesses	Developed new motors for electric-powered aircraft with Honeywell. Began to develop high-voltage battery packs for BEVs
Promote CO ₂ -neutral plants	Commenced operations at facilities to generate methane gas at CO ₂ recycling plant

Efforts toward Quality

One of our most important business assets is our reputation for quality in markets where we have continued to deliver large volumes of products around the world. Sharing this knowledge with customers, we are able to guarantee the quality of our electrified products, which must never have severe defects because they are depended upon by AI-driven vehicles. We are also enhancing our ability to respond to sudden changes in the business environment while ensuring the quality of existing products, such as by rapidly adopting alternative parts and materials as a part of our BCP that has become increasingly important today.

Specific Initiatives to Achieve Strategic Aims

Shift to Electrified Product Businesses and Expansion of Production and Supply Structures

DENSO is accelerating business restructuring in mature products in order to effectively utilize existing assets while rapidly and efficiently shifting them to growth businesses.

DMTN (North America) and TDS (Tianjin) have commenced production of inverters and motor generators in growth businesses. In January 2022, DENSO transferred the type III alternator business to Chengdu Huachuan Electric Parts Co., Ltd.,

which had been receiving technical support from DENSO for a while. In addition to restructuring production bases in Japan and overseas, DENSO will accelerate the shift of resources to growth fields while fulfilling its responsibility to supply products and advancing collaboration with partners.

Diversifying Markets, Responding to Faster Growth in BEVs



ESU (Electricity supply unit)

To realize this growth scenario, DENSO is expanding its lineup of electrified products based on its Core & Customization Strategy for its standardized product line. In January 2022, Toyota Motor's new NOAH and VOXY models began to feature our new high-power and compact inverters that reduce loss in battery power by 20% compared with previous products. DENSO commenced mass production of electricity supply units (ESUs) with functions for charging, power conversion, and power distribution for Toyota Motor's bZ4X model in May 2022 and for Subaru's Solterra model in mid-2022.

Resolving Social Issues through Our Businesses

Relevant SDGs	
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Contributing to a Sustainable Mobility Society with Electrification Technologies

DENSO is developing electrification technologies that support all forms of electric-powered mobility, from compact distribution vehicles to passenger cars and large distribution vehicles.

In a joint initiative with Honeywell International Inc., a long-time alliance partner, the Company newly developed an electric motor for electric-powered aircraft that do not emit CO₂ while ensuring a quiet and comfortable flight. Our electric motor was adopted for use in an eVTOL (all-electric vertical take-off and landing) aircraft being developed by Lilium N.V. of Germany.

This aircraft is a form of air mobility that solves the issues of congestion in urban areas, the emission of CO₂, and access to

suburban areas and outlying regions far away from core transportation lines via a high-speed direct transportation network. The electric drive motor that has been selected for this aircraft is a safe and environmentally conscious system that is compact and lightweight thanks to innovative design, and it does not emit exhaust gas when operating.

For the air mobility field, DENSO will apply its electrification technology and high-quality mass production technology amassed in products for vehicles in the automobile industry. By reapplying technologies it refines in the aircraft business to the automobile industry, we aim to contribute to a sustainable mobility society.