

THERMAL SYSTEMS

Contributing to a more pleasant world by solving heat-related issues faced in a mobility society

With the arrival of a carbon-neutral society and the era of CASE vehicles,* the automotive industry is undergoing a paradigm shift. Amid this shift, the Thermal Systems Business Group is helping create the society of the future by taking maximum advantage of strengths as the leading global supplier of thermal systems to provide thermal management systems that increase the value of BEVs and realize comfortable, reassuring vehicle interiors.

* CASE vehicles: Connected, autonomous, shared & service, and electric vehicles



Yasuhiko Yamazaki
Head of Business Group

Business Strengths

Thermal Management Technologies	Relationships of Trust with Diverse Customers	Global Supply Chain
<p>A differentiating strength of the Thermal Systems Business Group is its thermal management technologies, which are backed by world-first products and approximately 2,400 patents—approximately 1.5 times more than those of competitors. We have built up these technologies through the development of cooling and air-conditioning products since our establishment. Due to the transition from internal combustion engines, which utilize engine heat, to BEVs, which have no heat source, demand for thermal management that efficiently controls heat in vehicles and utilizes it without waste is set to increase even further.</p>	<p>Through our mainstay heating, ventilation, and air-conditioning units and compressors, which firmly maintain the No. 1 shares of their respective markets, we have built relationships of trust with a wide range of customers, including not only Toyota Motor Corporation and other Japanese automakers but also European, American, and Chinese automakers, as well as manufacturers of commercial, agricultural, and construction equipment. DENSO will continue using its diverse customer network and nine technical centers located around the world to identify technological trends and needs worldwide and provide solutions based on thermal management technologies.</p>	<p>To enable the delivery of products to many different customers, the Thermal Systems Business Group operates more than 50 production bases in 26 countries around the world. We achieve optimal costs in each region through manufacturing that is rooted in regions. For example, we encourage local procurement and the rationalization of facilities on a regional basis. On the other hand, global supply networks and standardized product lineups enable the provision of inter-region production backup in emergencies. We will maintain and strengthen our global supply network through production reorganization in line with business portfolio transformation.</p>

Business Strategy

We will both help realize a carbon-neutral society and build a highly profitable business structure by advancing transformation of our portfolio from businesses that provide products for internal combustion engines toward businesses that offer thermal management products for BEVs.

Realization of Sustainability Management	To lay solid business foundations for business portfolio transformation, we will continue strengthening our ability to adapt to changes. For example, we will streamline operations, establish manufacturing that can adjust to fluctuating volume, and establish a system for using entire supply chains to mitigate market volatility.
High Aspirations and Meticulous Work	In catering to diversifying thermal management needs, transformation of development processes and manufacturing is essential. To simultaneously expedite development and heighten quality, DENSO will build an environment for model-based systems engineering development and entrench digital technology-enabled development processes. As for manufacturing, we will improve production efficiency through Factory-IoT (F-IoT) while realizing the concept of factory innovation through flexible production lines that incorporate the Core & Customization concept.
Business Portfolio Transformation	We will accelerate the development and sales growth of thermal management products for BEVs by transferring resources and assets freed up through the de-emphasizing or discontinuation of internal combustion engine products. In addition, we view the maintenance of supply chains and the discontinuation of businesses during the transitional phase of de-emphasizing and discontinuing internal combustion engine products as an issue for the entire automotive industry. Accordingly, we will give concrete form to exit strategies and co-create schemes that transcend the boundaries of customers, affiliates, and competitors.
Realization of Carbon Neutrality	Through increased sales of thermal management products, we will contribute to the popularization of BEVs, thereby helping realize a carbon-neutral society. Further, DENSO will step up carbon neutrality efforts throughout the value chain. For example, we will promote carbon-neutral materials that use recycled materials and begin demonstration tests of plants that achieve carbon neutrality through the utilization of renewable energy and hydrogen power generation.
Creation of New Value	We will solve thermal issues in fields beyond our traditional field of mobility by providing such products as air conditioners for air mobility and other new types of mobility and temperature controllers for computers compatible with self-driving cars.

Specific Initiatives to Achieve Strategic Aims Realization of a Scenario for the De-Emphasis and Discontinuation of Internal Combustion Engine Products with the Aim of Business Portfolio Transformation

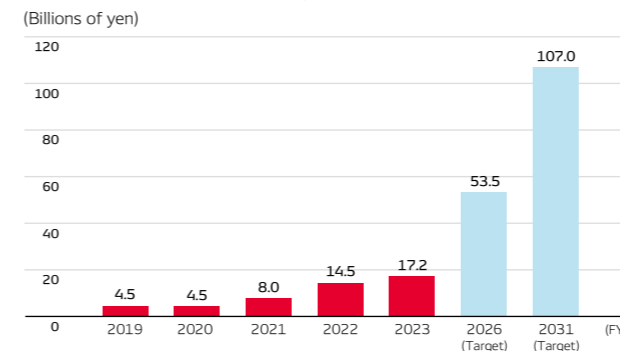
As BEV penetration accelerates, demand for internal combustion engine products will gradually contract. A major challenge going forward is the replacement of products in our lineup with thermal management products for BEVs while minimizing losses and fulfilling business obligations with respect to existing internal combustion engine products. Based on a strategy for internal combustion engine products formulated in fiscal 2023, the

Thermal Systems Business Group will work closely with customers and affiliates to realize a scenario for reorganizing and consolidating the global production of internal combustion engine products. In addition, to maximize the use of existing human resources, technological assets, and production foundations for the thermal management products of the next generation, we will tackle as an industry issue the building of a reorganization scenario that has continuity in all aspects, including technological development, human resource development, and manufacturing.

Outcome of Strategies for “Green” and “Peace of Mind”

Objective:	Complete planning for the de-emphasis and discontinuation of internal combustion engine products
Results:	Based on internal combustion engine products, which will see contraction as BEVs are introduced, completed formulation of strategies in line with the business phase of each product (mature, late stage, end stage); in addition, activities underway to maintain competitiveness during the transitional period, including revision of appropriate selling prices to reflect business phases, establishment of optimal production systems, and cost reductions through the use of general-purpose materials
Objective:	Complete conceptualization of thermal management modules incorporating differentiated technologies
Results:	Completed product concepts and strategy development; became involved in the early stages of our main customers' vehicle development and began product development; aiming to realize concepts during fiscal 2024

Revenue of Thermal Management Systems



Driving distance: 20% increase

One barrier to the proliferation of BEVs is driving distance, and a factor that limits driving distance is the electricity consumed for heating. DENSO's heat pump systems use heat in the air as a thermal source for heating, thereby reducing the consumption of electricity and greatly extending driving distance. Moreover, thermal management systems that use heat pumps enable the efficient adjustment of temperatures in vehicles and the cooling of batteries, which helps to inhibit battery degradation and shorten recharging times.

Resolving Social Issues through Our Businesses



Reduction of CO₂ Emissions throughout Product Life Cycles by Utilizing Recycled Materials

Aluminum is the main material of heat exchangers, and the large amount of electricity needed to refine this metal is an issue. As well as efforts to realize carbon-neutral *Monozukuri* through energy savings and the use of renewable energy, we are involved in materials development, entailing the development of technologies that utilize post-industrial recycled*1 materials. Through these efforts, we aim to significantly reduce CO₂ emissions during the aluminum refining process. Our goal is to help realize a recycling-based society by reducing energy utilization and CO₂ emissions throughout product life cycles and by utilizing materials in ways that minimize resource requirements. To these ends, we will establish products with environmentally friendly designs that incorporate post-consumer recycled*2 materials and introduce the repair and restoration of products themselves.

*1 In-house reuse of end materials by a materials manufacturer
*2 Reuse of scrap materials that are on the market

