

## THERMAL SYSTEMS

### Contributing to a more pleasant society for the earth and its people by solving heat-related issues faced in a mobility society

With the arrival of a carbon-neutral society and the CASE era, the automotive industry is undergoing a paradigm shift. Amid this shift, the Thermal Systems Business Group is working to leverage its strengths as a leading-global thermal systems supplier to the greatest extent possible to help create the society of the future through heat management systems, which resolve issues related to BEVs, such as extending driving range, and products that improve air quality, which create comfortable vehicle interiors.



Yasuhiko Yamazaki  
Head of Business Group

#### Business Strengths

##### Thermal Management Technology

There are three issues hindering the proliferation of BEVs, namely, driving range, battery degradation, and recharging times. To solve these issues—i.e., to extend driving range, inhibit battery degradation, and shorten recharging times—it is necessary to solve a variety of heat-related issues, such as saving electricity used in air-conditioning and managing the temperature of batteries. DENSO provides optimal solutions for managing the thermals of vehicles with the Thermal Systems Business Group's thermal management technologies and lineup of world-first products, as well as system controls that combine these two.

##### Moving from Quantity to Quality Manufacturing

DENSO has fulfilled its responsibility to supply products while constantly evolving the manufacturing of products in the Group with advanced automated production lines, standardized from design to process, and synchronized direct manufacturing for zero intermediary inventories. As products for thermal management systems become more diverse and complex, we are shifting from the mass production of standardized products to the small-lot production of many varieties of products, and further evolving our manufacturing structure into one that does not depend on volume.

##### Global Network

Since the establishment of DENSO (Thailand) Co., Ltd. in 1972, the Thermal Systems Business Group has addressed the needs of customers around the world through nine technical centers and more than 50 production bases in 26 countries. We will tackle new issues with customers in the CASE era while using our robust network built up over 50 years.

#### Business Strategy for 2022

DENSO is reshuffling its portfolio of thermal management products for BEVs from its lineup of internal combustion engine products. The Company is creating a high-earnings business structure while striving to realize a carbon-neutral society.

<b>Growth Strategy</b>	DENSO aims to establish de facto standards and unique technologies in the future, completing its modular concept for thermal management systems while cornering the market during the BEV proliferation phase by meeting the diverse needs of automakers for heat pump systems.
<b>Strategy for Businesses Nearing Final Stages</b>	DENSO is concentrating on shaping up growth scenarios and utilizing its assets (people, technology, and supply networks) built up with identified resources, while accelerating the streamlining of businesses nearing their final stages (existing products for internal combustion engine vehicles, such as radiators and capacitors), in addition to withdrawing from older products and transitioning production.
<b>R&amp;D</b>	In addition to the knowledge accumulated by the Thermal Systems Business Group, DENSO is utilizing the wisdom of the entire company, industry and academia, accelerating the development of new businesses. The Company is helping to increase the speed of vehicle development with more efficient development processes based on MBSE* to deal with the growing complexity and diversity of vehicle development, as competition heats up on the electrification front. <small>* Model Base System Engineering (MBSE): An approach that aims to increase the efficiency of the development process through digital simulation that leverages accumulated data and know-how in systems development</small>
<b>Monozukuri</b>	DENSO is creating a flexible manufacturing system able to produce a large variety of products in smaller quantities, reducing economic units through compact process designs relative to the increase in system combinations with its lineup of products for thermal management systems.
<b>Hitozukuri</b>	DENSO is reinforcing its structures for creating thermal management systems, training human resources in software able to control complex systems entirely, in addition to its mechanical product knowledge and thermal technologies. While exchanging human resources around the world, we are creating the foundations for diverse human resources to maximize the use of their experiences and knowledge in special improvement activities led by senior personnel.
<b>Reinforcing Our Business Foundation</b>	While maintaining a slim posture attained during the pandemic, the Company is increasing its responsiveness to change in an uncertain business environment, while rebuilding its production supply structure to take into account country risk. While identifying industry issues such as rising costs (transportation and materials) due to a deterioration in conditions, we aim to rightsize our supply chain and continue to fulfill our responsibility to reliably deliver products.

### Outcome of Green and Peace of Mind Strategy

	Objectives	Results
Green	Finish thermal management system strategy for future growth, expand market by increasing sales of heat pump systems	The Company's heat pump systems have been adopted by automakers in Japan and around the world, including for Mitsubishi Motors' Outlander and Renault's Megane models, while solving problems from the vehicle development phase. We also defined the product lines and technologies needed to solve heat-related issues we identified in BEVs. We formulated strategies while exploring theoretical solutions with cutting-edge development partners, including Toyota Motor and other automakers.
Peace of mind	Bring to market air quality products that offer peace of mind in car interior environments	DENSO introduced on the market air cleaning equipment for buses and taxis to satisfy needs for higher air quality due to the pandemic. In addition to automakers, we obtained feedback from end-users and will use this information to expand our products that offer peace of mind.

### Efforts toward Quality

DENSO aims for a fresh start in true quality through concurrent engineering that integrates processes from design to manufacturing with DX, and to improve gate management on a global basis, going beyond product quality to encompass work quality throughout the entire process, from initial flow to mass production.

### Resolving Social Issues through Our Businesses

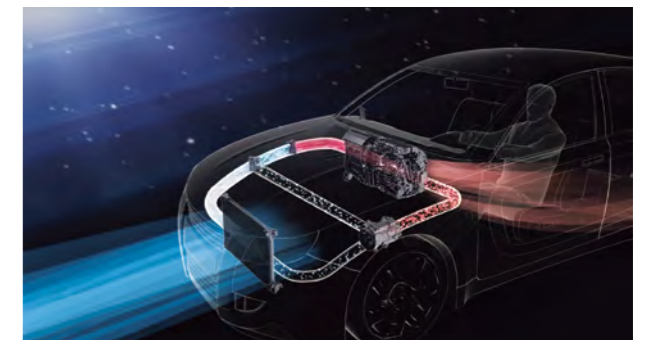
Relevant SDGs



#### Contributing to the Proliferation of BEVs with Thermal Management Systems

BEVs are key to becoming a carbon-neutral society. One barrier to their proliferation is driving range. Electrical energy consumed for heating is one factor that reduces driving range. DENSO's heat pump systems use heat in the air as a thermal source for heating, thereby reducing the consumption of electrical energy and greatly extending driving range.

Moreover, thermal management systems that use heat pumps enable the efficient adjustment of temperatures in vehicles and the cooling of batteries, facilitating the proliferation of BEVs with inhibited battery degradation and shorter recharging times.



Heat pump system

#### Specific Initiatives to Achieve Strategic Aims Expanding Sales of Thermal Management Products

DENSO is developing markets for its thermal management systems by solving heat-related issues in BEVs with automakers by proposing a wide range of products and systems. As a recent



High-efficiency eco heat pump system

achievement, our high-efficiency eco heat pump system, a world-first product, was adopted in Toyota Motor's bZ4X model and Subaru's Solterra model in 2022. We aim to expand sales for BEVs around the world.

#### Enhancing Response to Diversifying BEV Market

In August 2021, DENSO turned Chongqing Chaoli Electric Appliance Co., Ltd. into a consolidated subsidiary in order to realize its growth scenario. In addition to reinforcing our product lineup and supply structure, we are expanding our points of contact with customers, including local automakers in China and emerging automakers from other industries, and strengthening operations in China, a leading market for BEVs, while addressing new needs.