

Special feature 1

Medium- to long-term R&D strategies

Komatsu has created new technologies throughout our history based on our commitments to quality and reliability and to manufacturing and technology innovation. This special feature introduces our medium- to long-term R&D (research and development) strategy to continue to meet customer expectations and create the safe, highly productive, smart and clean workplaces of the future.



Taisuke Kusaba
Senior Executive Officer (Jomu)
Chief Technology Officer (CTO)
President, Development Division

■ A global R&D structure that provides customers with the best value

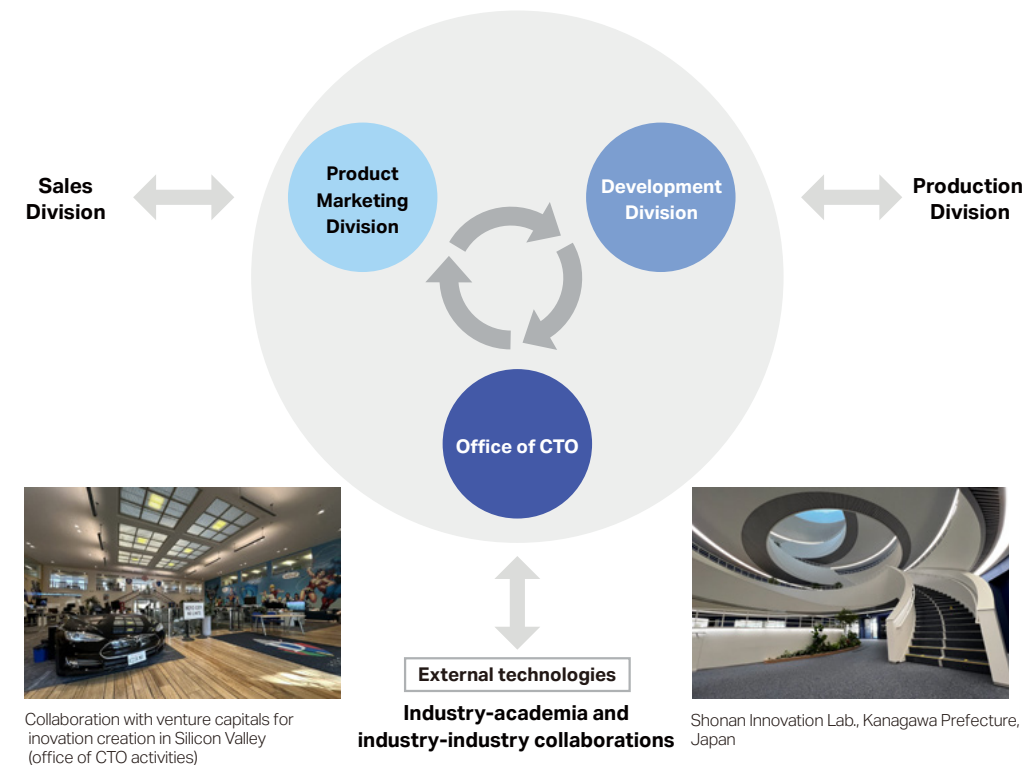
Our R&D structure consists of three main functions. The first is the Product Marketing Division. This division is responsible for planning and profit management. Duties include planning products in line with customer needs and planning sales and profits. The second is Office of CTO. The office is responsible for discovering new technologies to be applied to product development and determining the direction of research and development strategies. The third is the Development Division. This division is responsible for the two major tasks of improving the quality of existing products in mass production and developing new products. All three functions work together in R&D.

Komatsu has 24 development bases for construction and mining equipment worldwide, seven of which are located in Japan. Our production and development functions in Japan are located in the same locations to adopt advanced technologies into production and respond to quality issues in a timely and flexible manner. Our overseas development functions are operated in a similar manner. In this way, we conduct R&D on a global basis.

R&D of construction equipment, some mining equipment, and components is primarily conducted in Japan. On the other hand, we collaborate with the product marketing functions in each region to conduct product planning according to market characteristics in each region and the regulations and standards in each country. Surface mining equipment is mainly developed by our development centers in North America (three locations) and Europe (one location). To control quality, cost and delivery at the development stage, we hold product planning review meetings regularly. In this meeting, we evaluate and deliberate all development projects at their start and completion timing, and determine whether or not the product under review can be put into mass-production.

A major goal of R&D at Komatsu is to create innovation through collaboration among these three functions, combining our technologies with the cutting-edge technologies of the world and maximizing the value we provide customers.

Figure: R&D structure



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Technology strategies to achieve carbon neutrality

Komatsu engages in R&D in various areas to achieve our vision of creating the safe, highly productive, smart and clean workplaces of the future. Among various R&D activities, our effort to become carbon neutral is our answer to the major social issue of global warming, and we are working on this issue as the most important theme in our mid-term management plan.

There are various power sources to achieve carbon neutrality ranging from batteries, trolleys/cable, fuel cells, hydrogen engines, to hybrids, diesel-electric, biodiesel fuel and existing diesel engines with improved fuel efficiency. At present, countries around the world have different technological directions and policies for carbon neutrality. Considering the future, Komatsu has not narrowed down our technology options. Instead, we work on technology development from all directions. Looking at electrified construction equipment, for example, the first markets are being formed in Europe, where environmental awareness is high. Komatsu has introduced seven models of electrified construction equipment since 2020, mainly in the European and Japanese markets. In the future, we plan to expand our electrified product line-up to provide customers with more choices. With regard to power supply infrastructure, which is an issue in installing electrified construction equipment, we have partnered with other companies in a joint development to develop a generator using a hydrogen-mixed combustion engine. Proof-of-concept (PoC) experiments are underway to verify the use of this generator as a power supply device for electric mini excavators.



Battery-electric trolley mining truck (Concept machine)



New 20-ton class electric excavator equipped with lithium-ion battery (PC200LCE-11)

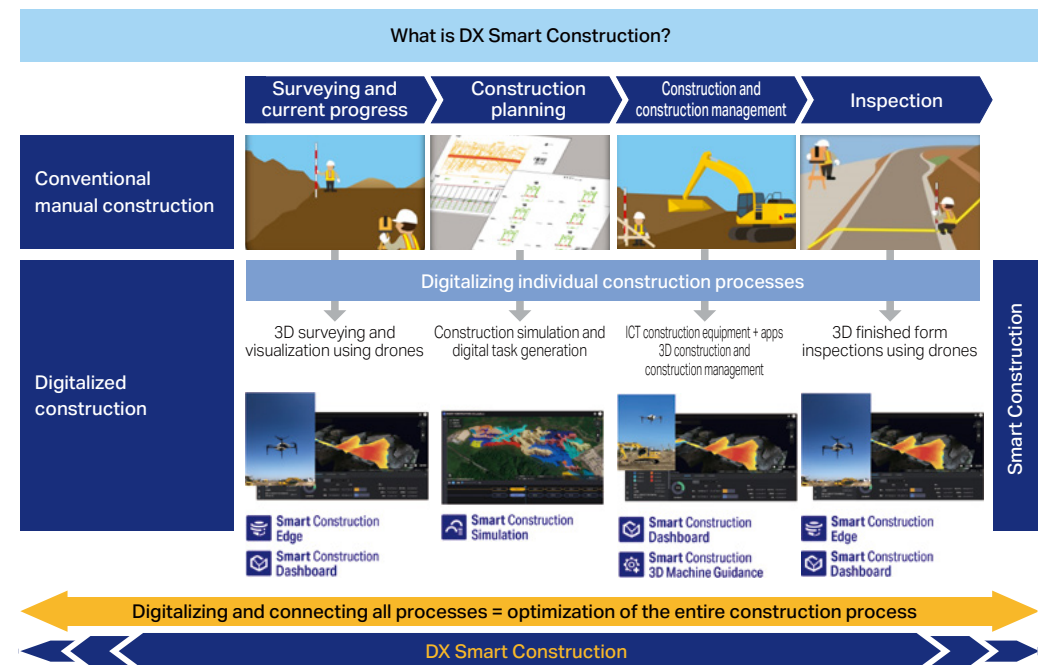


Portable hydrogen-mixed combustion generator for use in powering electric mini excavators (Concept machine)

Since in-house development and production of components is one of our strengths, our core technologies include components for internal combustion engines, such as diesel engines. However, we do not have enough knowledge of battery technology. To this end, we acquired American Battery Solutions, Inc. ("ABS"; USA), a battery manufacturer, in 2023 to accelerate technological innovation. Though ABS is a start-up company, it possesses advanced technologies and facilities for prototype testing and mass production. Moreover, company employees are highly motivated to take on the social issue of carbon neutrality. We will work with ABS to develop battery modules optimized for our construction and mining equipment. At the same time, we will continue to collaborate with various battery manufacturers, as we have a wide range of models and machine sizes.

As stated in the CEO Message, it is essential for Komatsu to not only take a product-based approach but also take a solution-based approach like Smart Construction to achieve carbon neutrality. Streamlining construction processes at job site will help reduce the amount of fuel used, thereby reducing CO₂ emissions. We will strive to make customer workplaces carbon neutral by combining our solutions for CO₂ reduction with the products most compatible with such solutions.

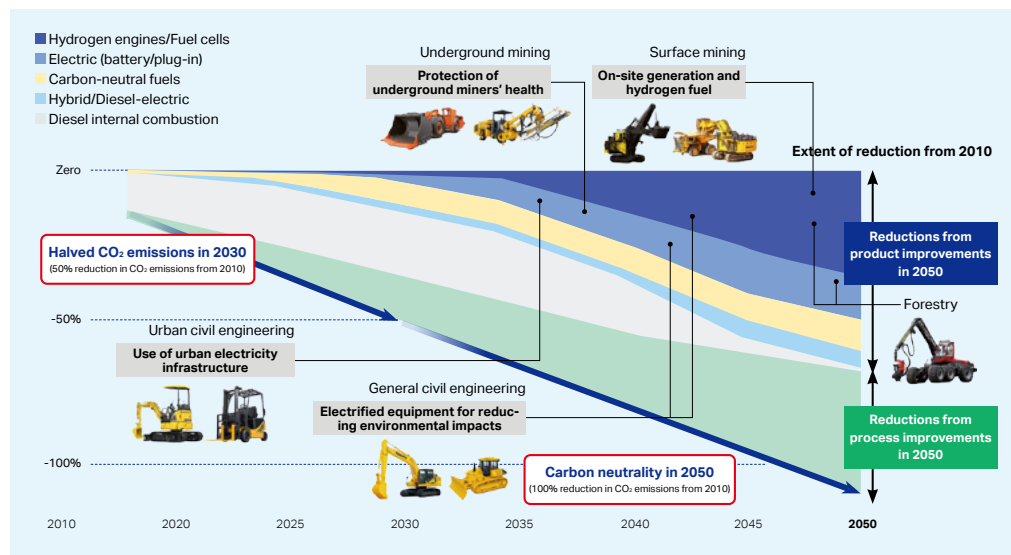
Figure: Approaches through Smart Construction and other solutions



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Komatsu sets our management goal to reduce CO₂ emissions from our products in use by 50% (compared to 2010 levels) by 2030 and by 100% by 2050. We are currently verifying our efforts on the visualization of CO₂ reduction effects by combining our products with solutions. We believe that we have almost reached the current targets in our roadmap (24% reduction (compared to 2010 levels) by FY2024, a KPI of the current mid-term management plan). The Office of CTO monitors technology trends around the world, while our marketing functions in each country keep a close eye on policy directions in their respective countries. Komatsu takes this information into account and updates our roadmap as we work to reach our targets.

Figure: Roadmap to carbon neutrality



Planting seeds for the Office of CTO to accelerate future innovation

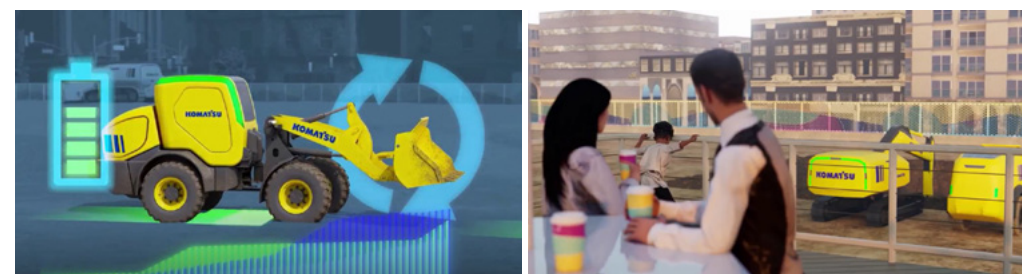
The Office of CTO plays an important role in ensuring that Komatsu makes steady milestones. Particularly important is the activities of the Office of CTO in exploring and acquiring cutting-edge technologies necessary for innovation.

Komatsu has engaged in collaborating with universities, research institutes, and venture companies around the world to create new value through the integration of in-house core technologies and external knowledge (i.e., open innovation). The main focus of industry-academia and industry-industry collaborations is to work together to create products while respecting the research themes and businesses of the other parties. We leverage the partnerships we have built in such collaborations to send our employees to collaboration partners to study abroad or for project assignments.

In addition, the Office of CTO holds an annual Technology International Advisory Board (IAB) meeting, a camp-type meeting attended by concerned Directors and Executives. We invite external experts and startup companies to our Technology IAB meeting to receive lectures on the latest technologies and technology trends and discuss medium- to long-term technology strategies.

The Office of CTO also assumes the responsibility to develop human resources with digital expertise. The office began focusing on the development of human resources with AI expertise five years ago. We select approximately 20 people a year from various functions, including development, sales, and aftermarket, and have them participate in a one-year in-house training program. There are several ideas discussed in this program which have led to practical applications. One such case is the development of an automatic detection support system using AI image analysis.

The activities to translate our vision for the future into a short film are also extremely important. We release at least one film a year featuring cutting-edge and sharp visions of the future that involve technological leaps. The topic of our fiscal 2023 film was *Social transformation through electric construction equipment*. The video is made public to all Komatsu Group employees to inspire them and promote the creation of new ideas. This video also serves to present the Komatsu vision to those outside the company in search of open innovation partners.



Social transformation through electric construction equipment (short film)

Web Short film *Social transformation through electric construction equipment*

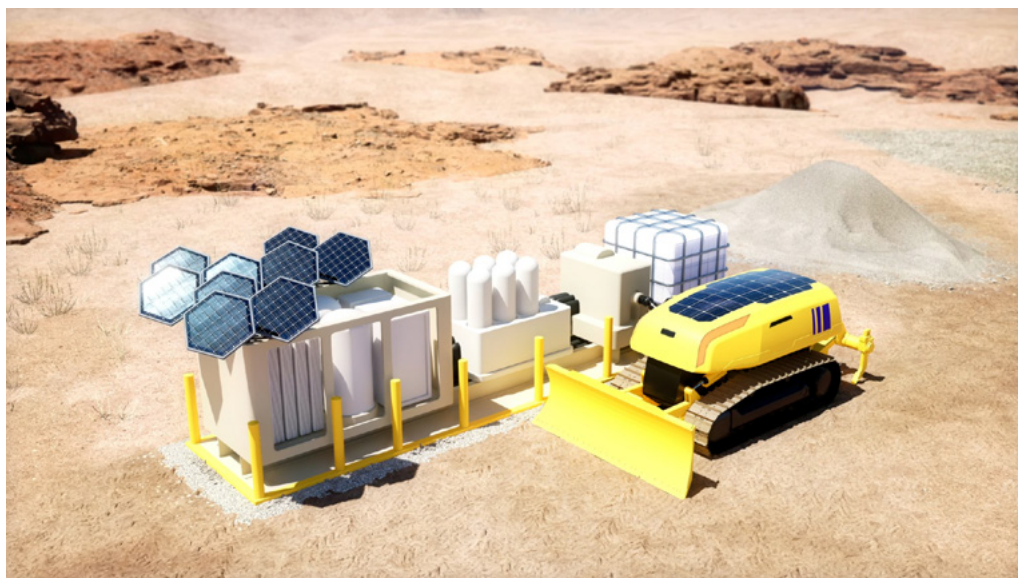
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Members of the Office of CTO travel around the world to present this short film to research institutes and venture companies and discuss future possible collaborations. The most important aspect of these conversations is relaying any knowledge and information on advanced technologies gained back to the development team so that the team can apply such technologies to actual product and services. The drone surveying technology introduced in Smart Construction is one example of how an encounter with a startup company in Silicon Valley led to practical application in our solution services.

We have been increasing R&D expenses gradually each year. These expenses amounted to ¥103.4 billion in fiscal 2023, which is approximately 3% of our consolidated net sales. We are working to allocate resources primarily to improve the equipment efficiency and electrification for carbon neutrality. We also strive to enhance automation, autonomous operation, and remote operation to address labor shortages.

Leveraging our strengths of in-house component development and production is significant. To this end, we also continue to allocate a large portion of our R&D expenses to the development of components and software.

Figure: Construction equipment of the future (excerpt from short film "All-around carbon neutral strategy")



Storing sunlight as hydrogen to convert into electricity to charge construction equipment

Resolving customer issues with Komatsu products and solutions

As a manufacturing company, our management is based in development and production, and our management value chain starts in the development functions. We view our technologies in terms of prioritizing the needs of job sites. To this end, we are confident in our technology, products, and solutions to solve customer issues. Without a strong passion, we would not be able to convince customers of our values and they would not choose Komatsu products. We believe that our most important mission is to devote our maximum effort to the pursuit of technology, convert that technology to customer value, and ensure customers continue to choose Komatsu as a partner. We will work with our customers to approach and solve the various issues they face at their workplaces by optimizing construction processes at their job sites and providing advanced products highly compatible with such process optimization solutions.

However, as society changes and technology advances, it has become increasingly difficult to create maximum value with our capabilities alone. Komatsu is committed to pursuing technologies by respecting and collaborating with various partners and transforming such technologies into our products and services, thereby providing higher value-added offerings.

Figure: Overview of industry-academia collaborations

