Special Feature: Komatsu's Vision for the Workplace of the Future

Komatsu future 203X

Creating value through manufacturing and technology innovation to empower a sustainable future where people, businesses and our planet thrive together

Komatsu has released videos illustrating the safe, smart, clean, and highly productive workplaces of the future it aims to create. We hope you will take a look at these videos to see the workplaces we are working to create together with all stakeholders.

Web https://www.youtube.com/watch?v=-ikOXOyZpH0&list=PLI09JNAS3JIEL7iTnOAM674O6ZHKn6qZe&index=3

Formation of Komatsu GHG Alliance Together with Four Major Mining Companies

For the purpose of accelerating the reduction of greenhouse gas emissions from mining operations, Komatsu has founded the Komatsu GHG Alliance together with major mining companies that are also its customers. The founding members of the alliance are Rio Tinto plc, BHP Group Limited & Plc, National Copper Corporation of Chile (Codelco), and Boliden AB—global top-class, industry-leading mining companies. The alliance will serve as a framework for the co-creation of value with customers through which we will accelerate the development of a power agnostic concept truck that can run on a variety of power sources.

Power agnostic development truck undergoing testing at test site (Arizona, United States)

Founding Members of Komatsu GHG Alliance

Name	Head Office
Komatsu	Tokyo, Japan
Rio Tinto plc	London, United Kingdom
BHP Group Limited & Plc	Melbourne, Australia
National Copper Corporation of Chile	Santiago, Chile
Boliden AB	Stockholm, Sweden

Collaboration with Partners for Accelerating the Creation of the Workplaces of the Future

Komatsu is collaborating with partners that share its values to accelerate the creation of the workplaces of the future.

PC200i-11 hydraulic excavator being operated remotely from control pod (Ishikawa Prefecture)

Komatsu Field Test Department linked through 5G services (Oita Prefecture)

Utilization of NTT DOCOMO's 5G Service

Komatsu's First Time Achieving Continuous Discharge of Soil by Improving Automatic Loading Control as well as Remotely Switching to Multiple Construction Equipment Units in Operation

Web Please refer to the following video for a demonstration of the automation and remote operation technologies.
https://www.youtube.com/watch?v=S2me-S4G0PE

In its pursuit of the commercialization of construction and mining equipment automation and remote-control technologies, Komatsu has succeeded in verification tests of an automation technology that achieved the continuous discharge of soil by means of automatic loading control as well as remote control technology that enabled remotely switching to multiple units in operation via 5G services provided by NTT DOCOMO, INC.

Conceptual image of electric excavator

Collaboration with Proterra of the United States

Start of Proof of Concept Tests for Electrification of Small and Mid-Sized Hydraulic Excavators

Komatsu has signed a collaboration agreement with Proterra Inc. of the United States, to receive the supply of Proterra's lithium battery systems with the aim of electrifying its small and mid-sized hydraulic excavators (for developing battery-powered construction equipment). Proterra is a leader in commercial vehicle electrification technologies that delivers battery systems and electrification solutions to help heavy-duty and commercial vehicle manufacturers around the world electrify their vehicles. Komatsu plans to advance proof of concept tests starting in 2021 and move forward with the development of battery systems suited to small and mid-sized hydraulic excavators, which have higher output requirements, with the goal of commencing mass production sometime between 2023 and 2024. Based on this agreement, Komatsu will receive high-performance batteries and peripherals that Proterra has developed with its state-of-the art technology accumulated over its years of operation as a manufacturer of electric transit vehicles while also collaborating with this company as one of its strategic partners of joint proof of concept tests.

PC01 micro electric excavator (prototype) powered by the Honda Mobile Power Pack

Honda Mobile Power Pack

Commencement of Joint Development with Honda Motor

Development of Micro Electric Excavators Powered by Swappable Honda Mobile Power Pack Batteries and Establishment of Battery-Sharing System for Civil Engineering and Construction Industries

Komatsu has concluded a basic joint-development agreement with Honda Motor Co., Ltd., aimed at electrifying its micro excavators (less than one-ton class) with swappable Honda Mobile Power Pack batteries, and establishing a battery-sharing system that enables mutual use of Honda Mobile Power Packs among different construction equipment and other equipment for the civil engineering and construction industries. Under this agreement, the two parties will work to electrify Komatsu's PC01 micro excavator by equipping it with Honda Mobile Power Packs and an electrified power unit (eGX). The PC01 micro excavator is commonly used very close to people, trees, and flowers for pipe-laying work, gardening, agriculture, livestock, and other applications. Komatsu is working to launch the PC01 micro electric excavator by the end of FY2021.

* Honda Mobile Power Pack and eGX are registered trademarks of Honda Motor Co., Ltd.

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Pursuit of 2050 Carbon Neutrality

Komatsu's mid-term management plan, which has FY2021 as its final year, puts forth the targets of reducing CO_2 emissions by 50% from the level in 2010 and increasing the rate of renewable energy use to 50%, both of which are to be achieved by 2030.

Continuing down the path of these goals, Komatsu has decided to pursue carbon neutrality by 2050 to capitalize on the future business opportunities that this pursuit will create. **Specifically, the prominent trend toward a carbon-free society itself has been positioned as a business opportunity, and we aim to realize DANTOTSU Value (a positive cycle of resolving ESG issues and improving earnings through the creation of value for customers) by taking advantage of this opportunity.**

	Mid-Term Management Plan Targets 2030	2050 Carbon neutral
CO_2 emissions	50% reduction (from 2010)	Virtually Zero
Rate of renewable energy usage	50%	100%

CO_2 Emissions Across the Supply Chain for Komatsu Products

Komatsu calculates CO_2 emissions across the supply chain for its products on an annual basis in accordance with the guidelines of Japan's Ministry of the Environment.

The most significant source of CO_2 emissions from across the supply chain was product use (Scope 3, Category 11), which accounted for roughly 90% of total emissions, while emissions from corporate activities (Scope 1 and Scope 2) only represented 2% of all emissions.

Breakdown of CO_2 Emissions Across the Supply Chain

Scope 1:	Direct greenhouse gas emissions from business operator (fuel combustion, industrial processes)
Scope 2:	Indirect greenhouse gas emissions from use of electricity, heat, and steam supplied by other companies
Scope 3:	Indirect greenhouse gas emissions not accounted for by Scope 1 or Scope 2 (emissions from other companies related to a business operator's activities) Scope 3 is divided into 15 categories including Category 11: Use of sold products. Category 11 includes the total expected lifetime emissions from all products sold in the reporting year.

Komatsu's Carbon Neutrality Initiatives

Komatsu's carbon neutrality initiatives will not be limited to cutting emissions from its bases (Scope 1 and Scope 2) and from the use of its products (Scope 3, Category 11). Rather, we are broadening the focus of our initiatives to target customer workplaces in their entirety. With this focus, we will seek to reduce CO_2 emissions from society by evolving our Smart Construction solution and otherwise optimizing customer workplace.

We have also positioned our forestry machinery business, which supports a sustainable forest management cycle of planting, cultivating, and harvesting, as well as our remanufacturing (Reman) operations, which entail the restoration and reuse of components, as cyclical businesses that contribute to reductions in CO_2 emissions from society. Accordingly, these businesses will be strengthened as part of our carbon neutrality initiatives.

Komatsu's Initiatives

- Pursuit of carbon neutrality at Komatsu production bases
- Development of products that reduce environmental impacts (product improvements)
- Provision of solutions that improve customer workplaces (process improvements)
- Reduction of CO_2 emissions through forestry machinery business
- Reduction of CO_2 emissions through Reman operations

Identify business opportunities associated with carbon neutrality to drive Komatsu's growth strategies

*Calculation Policies and Assumptions for CO_2 Emissions Reduction Target of Mid-Term Management Plan

Mid-Term Target for 2030	Calculation Policies and Assumptions	
50% reduction in CO_2 emissions from 2010	Emissions from production	Annual per internal production value emissions calculated using all energy consumed by production bases in the reporting year
	Emissions from product use	Annual per work volume emissions calculated based on products sold in the reporting year

Scope 1 | Scope 2

01 Carbon Neutrality at Komatsu Bases

After achieving a 50% reduction in CO_2 emissions from 2010 in 2030, we will work to achieve net zero CO_2 emissions (carbon neutrality) from our production activities by 2050. In addition, we will deploy the relevant technologies at material suppliers and other partners to help them also achieve carbon neutrality in their operations.

In implementing its policies for carbon neutrality initiatives at production bases, Komatsu will prioritize energy conservation initiatives for reducing energy consumption through production technology innovation, then energy generation initiatives for producing renewable energy in-house, and lastly, purchases of renewable energy.

1 Energy Conservation

- **Reduction of Energy Consumption through Exhaustive Productivity and Efficiency Improvements**
  We will exhaustively reform and improve the efficiency of energy-intensive processes, such as casting, forging, and heat treatment processes.
- **Upgrades to High-Efficiency Next-Generation Structures**
  Whenever an aged structure built more than 50 years ago is replaced in the future, Komatsu will replace it with a zero emissions structure that uses sustainable energy.

Rendering of next-generation melting furnace using superinsulation

2 Energy Generation

- **Introduction of Cutting-Edge Renewable Energy Facilities (Solar Power, Biomass Power, and Others)**
  Komatsu will embrace cutting-edge renewable energy facilities through means such as using lightweight, high-efficiency solar panels when installing solar power generation facilities to greatly increase per-area efficiency and generation capacity.
- **Effective Utilization of Generated Energy through High-Efficiency Storage Batteries**
  The output of solar power and other renewable energy systems can vary greatly as a result of weather. For this reason, storage batteries are imperative to the reliable use of such systems. Komatsu is actively employing the latest storage battery technologies to ensure that it can utilize energy generation systems to the greatest extent possible.

New Komatsu Forest AB factory with roof covered in solar panels (scheduled to be completed in August 2021 in Umeå, Sweden)

3 Purchase of Green Power, LNG Gas, and Other Carbon Credits

- **Purchase of Green Power, LNG Gas, and Other Carbon Credits**
  CO_2 emissions that cannot be curbed through energy conservation and energy generation will be offset through the purchase of certified green power or carbon credits.

Biomass boiler at Ibaraki Plant

2050 Carbon Neutrality

Pursuit of 2050 Carbon Neutrality

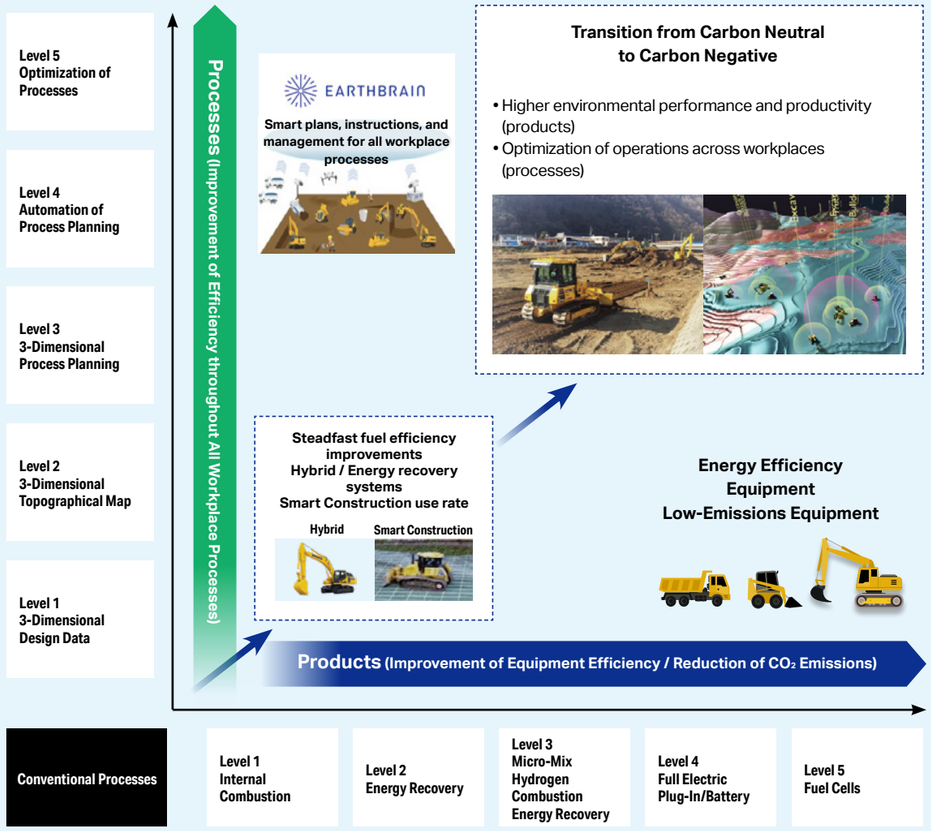
Scope 3

02 Carbon Neutrality from Product Use

1 Two-Pronged Approach of Improvements in Products and Processes

Komatsu is adopting a two-pronged approach toward reducing the amounts of CO_2 emitted during the use of its products. The first prong is improvements to products. **Initiatives in this regard will include increasing the work efficiency of equipment, pursuing steadfast improvements in fuel efficiency, and transitioning from diesel and other internal combustion engines to cleaner power sources, including hybrid and electric engines and fuel cells.** The second prong is improvements to processes. Specifically, **we look to lower CO_2 emissions by optimizing customers' workplace operations and processes in order to reduce the amount of equipment needed along with the operating times of this equipment.**

Komatsu seeks to contribute to carbon neutrality, at both construction and mining workplaces, through a combination of efforts to reduce CO_2 emissions by means of highly efficient equipment and measures for improving workplace efficiency via smart plans, instructions, and management.

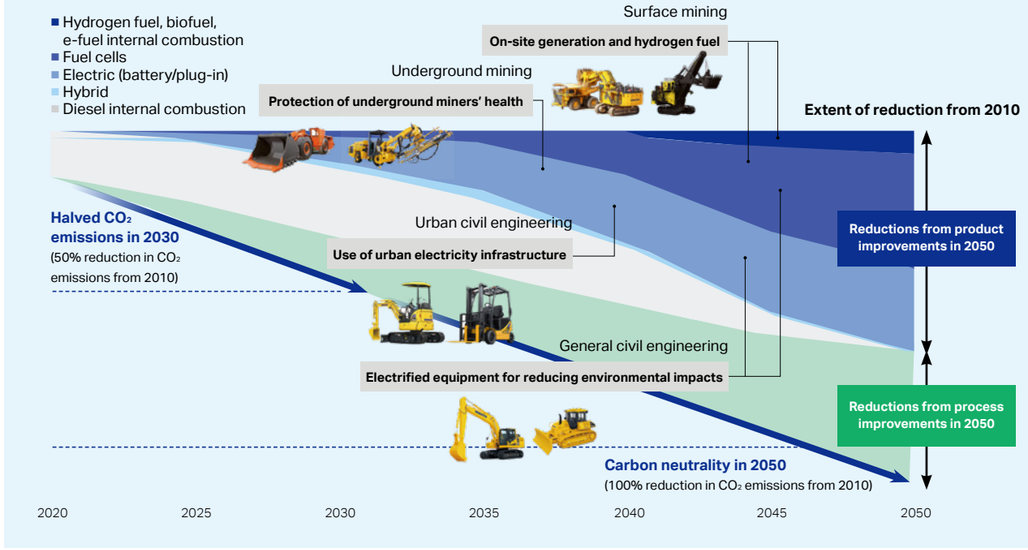


Pursuit of 2050 Carbon Neutrality

Scope 3

2 Development of Products That Reduce Environmental Impacts (Product Improvements)

The workplace conditions under which construction and mining equipment developed and produced by Komatsu is used can vary based on model and output. Accordingly, we are incorporating cutting-edge technologies to eliminate CO_2 emissions from products by model and by output class. At the same time, we are sharing our roadmap for carbon neutrality with external development partners and customers while making steady progress based on this map.



Voice

Komatsu will create the safe, highly productive, smart and clean workplaces of the future to contribute to the realization of a carbon-neutral society.

Komatsu has declared its goal of achieving carbon neutrality by 2050 along with its commitment of halving the CO_2 emissions from product operation by 2030. In the past, we have achieved massive success in improving the fuel efficiency of our products by developing and producing major components in-house and combining these components in an optimal manner. We also launched the world's first hybrid hydraulic excavator for sale in 2008. We will continue to pursue such improvements to product fuel efficiency in the future. However, we also realize that achieving carbon neutrality will require us to go further to adopt new drive sources. Construction and mining equipment is used for a variety of applications and under a wide range of conditions, meaning that we need to select a power source that is ideal for each piece of equipment in order to meet customer expectations. We are currently ramping up development of products that use drive sources that do not emit CO_2, like batteries and fuel cells. In this regard, we began offering rentals of the PC30E-5 electric mini excavator in Japan in April 2020. We have also announced plans for joint development of micro and mid-sized hydraulic excavators together with external partners, and we are committed to developing various models through mutually beneficial win-win relationships together with highly capable partners going forward. Komatsu is also examining the possibility of utilizing e-fuel and other new fuels that are compatible with conventional internal combustion engines. Another area being examined is hydrogen engines that use hydrogen as fuel. Meanwhile, we established the Electrified Equipment Development Center in April 2020. This center is playing a central role in efforts to develop electrified equipment.

In addition, we are evolving solutions to improve efficiency at customer workplaces and consequently reduce CO_2 emissions. For example, we provide solutions that utilize digital technologies to create a digital twin to be used for tracking workplace conditions and thereby optimizing workplace procedures. Moreover, we will apply automated operation, remote operation, and other sophisticated digital technologies to develop procedures that are more efficient than conventional procedures. These new procedures will be utilized to reduce the amount of personnel and equipment needed at workplaces while also shortening construction periods in order to achieve massive decreases in workplace CO_2 emissions. In this manner, Komatsu is evolving products and solutions to create safe, highly-productive, smart and clean workplaces of the future in order to contribute to the realization of a carbon-neutral society.

Seiichi Fuchita
Senior Executive Officer
President, Development Division

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3 Provision of Solutions That Improve Customer Workplaces (Process Improvements)

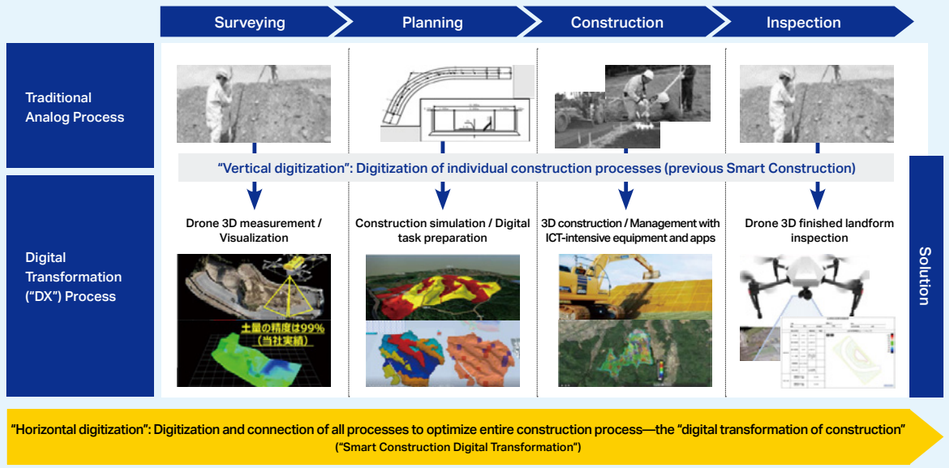
Smart Construction is a solution that contributes to the optimal deployment of construction equipment, dump trucks for transporting dirt and materials, and all other equipment. This solution can be applied to Komatsu construction equipment as well as to that made by other companies. **Optimizing all processes throughout a workplace makes it possible to reduce the amount of equipment needed, cut back on operating and idling time, and lower workloads, thereby contributing to reductions in fuel consumption and consequently CO_2 emissions.**

Web Smart Construction promotional website (Japanese only):
https://smartconstruction.komatsu/

The "Smart Construction Digital Transformation" solution introduced in April 2020 expanded upon the partial digitization of construction processes achieved by the previous version of Smart Construction ("vertical digitization") by allowing for digitization of all processes ("horizontal digitization"). This solution thus enables worksite operations to be optimized by synchronizing the actual workplace with its digital twin, thereby realizing drastic improvement in the safety, productivity, and environmental performance of the entire worksite.

Web Please refer to the following video for more information on the "Smart Construction Digital Transformation" solution.
https://www.youtube.com/watch?v=S2me-S4G0PE&t=312s

Customer Construction Process



In April 2021, Komatsu established EARTHBRAIN Ltd., a joint venture company, together with NTT DOCOMO, INC., Sony Semiconductor Solutions Corporation, and Nomura Research Institute, Ltd. EARTHBRAIN will be tasked with furthering the evolution of Smart Construction while also deploying this solution overseas. In addition, EARTHBRAIN will combine the insight, expertise, and technologies of its four owners through means such as providing services that impact all equipment and vehicles at construction worksites to create a next-generation Smart Construction solution that will accelerate the digital transformation of construction workplaces.

Pursuit of 2050 Carbon Neutrality

03 CO_2 Emissions Reduction from Forestry Machinery Business

Timber is a resource that is incredibly important for supporting people's lives and industry. The forest resources from which timber is harvested have been maintained through a sustainable cycle of planting, cultivating, and harvesting by human hands.

At the same time, trees absorb CO_2 from the atmosphere as part of their growth process, and it has been shown that younger, more rapidly growing trees absorb CO_2 at higher rates than older trees. For this reason, harvesting trees that have grown to a certain extent and replacing them with new trees is a process with the potential to limit global warming. By supporting forest management cycles as a cyclical business, Komatsu aims to help mitigate global warming while contributing to the realization of a carbon-neutral society.

Komatsu is working to mechanize forestry operation processing, including planting, cultivating, and harvesting trees, to contribute to sustainable forestry. In the realm of planting, we have developed subsoiling machines and automated tree planters based on our bulldozers, and we are currently supplying these machines to the Brazilian market. These machines have transformed the process of planting trees, which had previously been performed by people under the heat of the blazing sun, making it possible to plant 900 trees in one hour with exceptional speed and precision.

Web Please refer to the following video for an illustration of the D61EM automated tree planter in operation, which was introduced into the Brazilian market:
https://www.youtube.com/watch?v=00FNm4-gqwo

Komatsu is also promoting smart forestry, which entails digitally linking all forestry processes. In our smart forestry approach, we look to contribute to safe and highly productive forestry by supplying solutions that, for example, use drones to measure forest density and tree height and thereby make it possible to perform forestry procedures merely by inputting into machines such information as the lengths of timber and the type of trees required by the market.

Pursuit of 2050 Carbon Neutrality

04 CO_2 Reductions through Reman Operations

Komatsu Group is engaged in global remanufacturing ("Reman") operations in which it restores the engine and transmission components collected during regular replacements to the same status as if they were new so that these products can once again be sold on the market. Restoring these products entails a process with various steps including disassembly, washing, parts replacement, reassembly, painting, and shipping inspections.

Benefits for Customers
- **Guaranteed quality and performance on a level with new products**
- **Lower prices than new products**
- **Shorter equipment downtimes through supply of appropriately stocked Reman components**
- **Resource conservation and waste reduction through component reuse and recycling**

Reman operations are made possible by Komatsu's in-house development and production of key components. Moreover, these operations are based on the principles of the 3Rs (reduce, reuse, and recycle) as they help cut back on waste by restoring and reusing components and thereby contributing to reductions in CO_2 emissions.