September 2022
Okuma Corporation

Green-Smart Machine

Combining Eco-friendliness with High Productivity and High Accuracy
The Smart Machine Suited for a Decarbonized Society
Produced at Okuma's Carbon Neutral Factories

Background

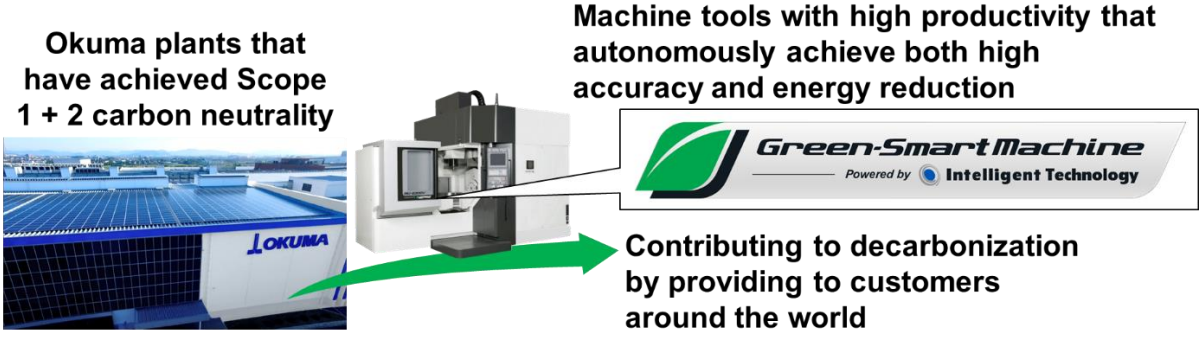
Efforts are underway around the world to realize a decarbonized society as one of the solutions to the global challenge of climate change. In the field of production machining, Okuma's role in addressing these social issues will be to attain high productivity with high accuracy and to reduce energy usage in factories.

"Green-Smart Machine" Declaration

As a step towards turning the decarbonized society into reality, Okuma has defined "Green-Smart Machine" as intelligent machine tools that contribute to resolving environmental issues by autonomously achieving both stable dimensional accuracy and reduced energy usage, and the company offers a full product lineup.
Okuma has been using automation and process integration as a part of its effort to reduce energy usage while still achieving high-productivity, high-accuracy machining for becoming carbon neutral at three Japan plants which are its main production bases. In addition to these measures, Okuma will start using green energy from October 2022, and its three plants in Japan will become carbon neutral plants ahead of schedule (Scope 1 and 2).
In its wide lineup of products, which ranges from small 2-axis CNC lathes to multitasking machines, 5-axis machining centers, and large double-column machining centers, Okuma has incorporated Intelligent Technology to achieve high-accuracy and high-efficiency machining and enhanced the technology to contribute to high-quality and stable-accuracy production. Okuma has issued a declaration that its "Green-Smart Machine" is an eco-friendly smart machine suited for a decarbonized society because of its autonomous reduction of energy usage and recording of CO_2 emissions, which were made possible by Okuma's proprietary technology developed over the years.
Okuma will produce these products in its carbon-neutral factories and provide them to the world, and together with its customers, Okuma will contribute to offering solutions for the social issues faced by the manufacturing industry.

Green-Smart Machine
Powered by Intelligent Technology

Green-Smart Machine emblem



Green-Smart Machine for realizing a decarbonized society

Green-Smart Machine

To reduce energy usage per part for achieving greater decarbonization, technologies that shorten production time and that reduce energy usage during machine operation are essential.
In terms of the production processes, process integration by multitasking machines and 5-axis control machining centers would be effective in reducing energy usage. However, the complexity of the machine structure makes it difficult to achieve stable machining accuracy, and the warm-up operation and air conditioning control required to stabilize accuracy, as well as human intervention to check machining accuracy, use a large amount of energy and can inhibit customers' high productivity.
Okuma has solved this problem by developing machine tools that provide high-accuracy and high-efficiency machining. To achieve decarbonization, Okuma has integrated its proprietary technologies, which are based on its machine tools developed up to now, for allowing machines to autonomously reduce their energy usage, and the complete embodiment of this technology package is the "Green-Smart Machine."

[1] Clearly identifying the machine as a smart machine suited for a decarbonized society (machine with emblem)

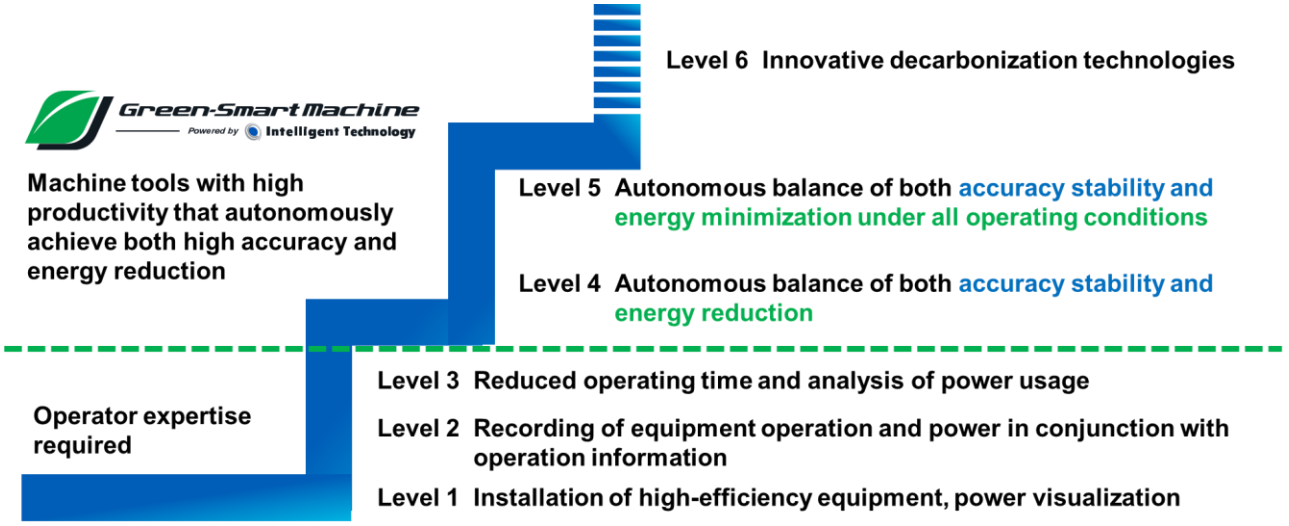
- A "Green-Smart Machine" emblem is attached to certified machines for providing a clear identifier to the world.
  This will raise awareness of Okuma's management policy and technologies and products as it works with manufacturers and customers around the world for decarbonization.
- The emblem will be attached to machines in future orders for domestic Japan shipments from April 2023.

[2] Maturity model of machine tools for decarbonization

- A maturity model for machine tool decarbonization was established to identify the machine tools needed to achieve a decarbonized society. This model functions as a compass for machine tools to achieve decarbonization.
- The "Green-Smart Machine" eliminates operator intervention required to maintain high accuracy and reduce energy usage, and achieves Level 4, "autonomous energy reduction with accuracy stability" where the machine autonomously controls the equipment.
- Furthermore, Okuma will continue to develop Level 5 technology that enables "autonomous balance of both accuracy stability and energy minimization under all operating conditions."

[3] "Green-Smart Machine" manufactured in a carbon-neutral factory

- Carbon neutrality has already been achieved for these machines at the three Japan factories, which are the main production factories, ahead of schedule from October 2022.
- Produced in an automated factory/smart factory that has been proven to reduce energy usage and produce products with high accuracy and high efficiency.
- Plans are underway to expand the use of green energy through the installation of mega-solar facilities and the use of geothermal heat, for instance, as well as to expand the products coming under "Green-Smart Machine" and develop environmentally friendly production.



Maturity model of machine tools for decarbonization

Green-Smart Machine technology

[1] The Thermo-Friendly Concept, an Intelligent Technology that allows machines to autonomously maintain a stable high level of accuracy

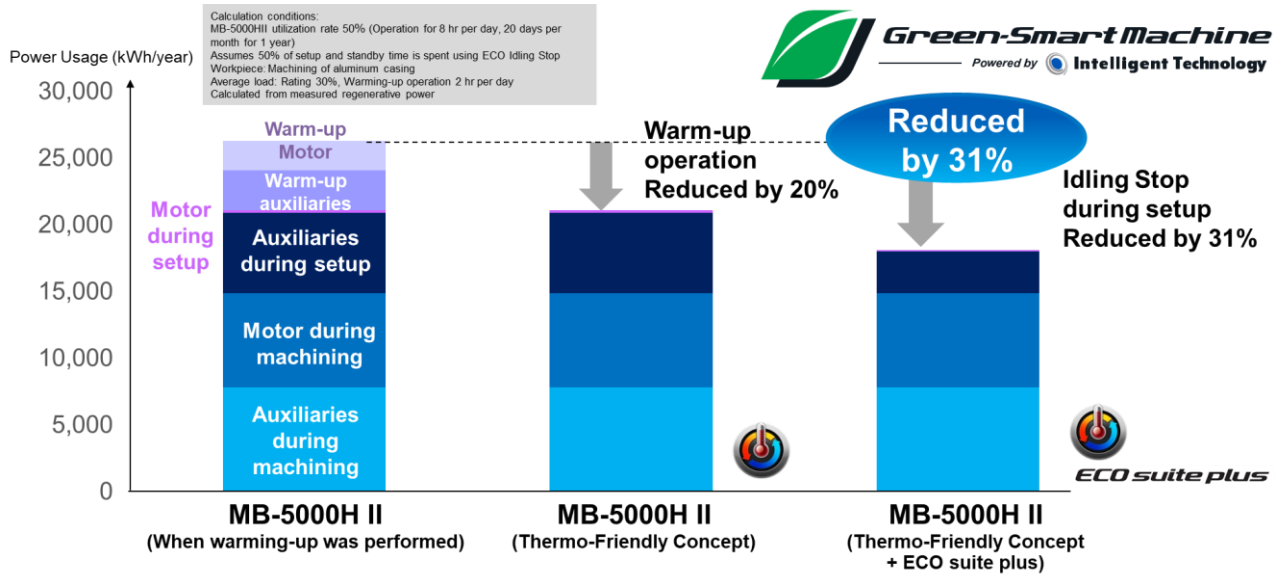
- Reduces the time and energy used on warm-up and dimensional correction processes for maintaining high accuracy.
- Enables high accuracy to be maintained for a variety of machine usage conditions, making equipment shutdown more feasible.
- AI-based innovative, intelligent technology that combines both machine design technology and control technology and that matches the human senses has been incorporated into more and more machines since its launch in 2001 and is standard on 125 models. This technology has a proven track record in production for customers around the world with a total of over 60,000 units produced in 20 years.

[2] Energy-saving system "ECO suite plus" for decarbonized society

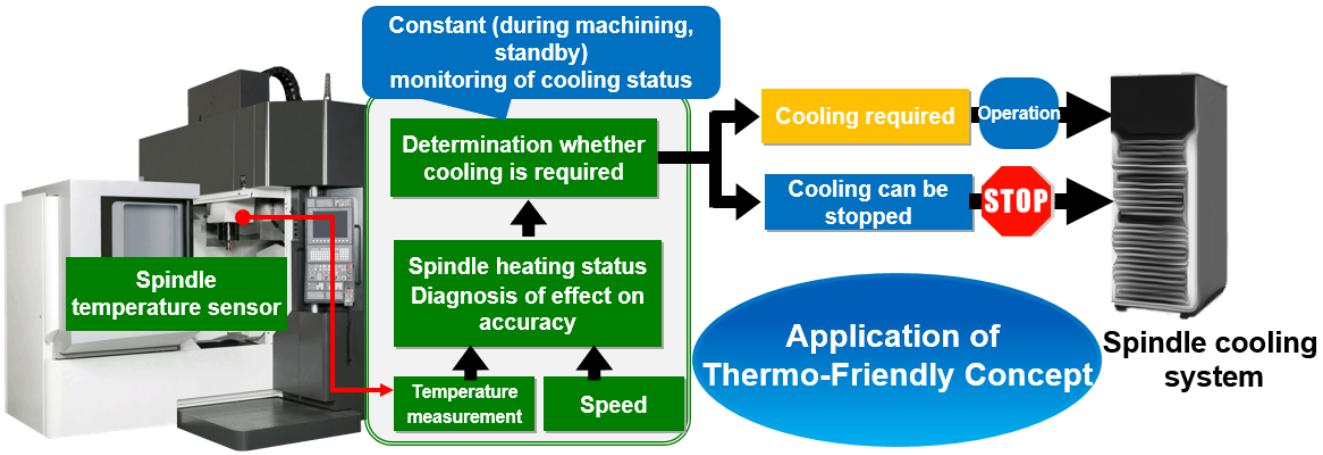
- Autonomous energy-saving function "ECO suite plus" is incorporated as standard in Okuma's OSP series of NC units.
- Enables data analysis based on machine operating information and equipment-specific operating information and supports recording of CO_2 emissions for traceability.
- Applies Thermo-Friendly Concept technology to maintain the required accuracy and proactively shut down equipment without operator intervention for achieving Level 4, "autonomous energy reduction with accuracy stability."
- Including its predecessor "ECO suite," more than 42,000 units have been delivered since its launch in 2014, reducing factory energy usage worldwide.

[3] New operation control technology for spindle cooling systems that achieves Level 5, "autonomous balance of both accuracy stability and energy minimization under all operating conditions"

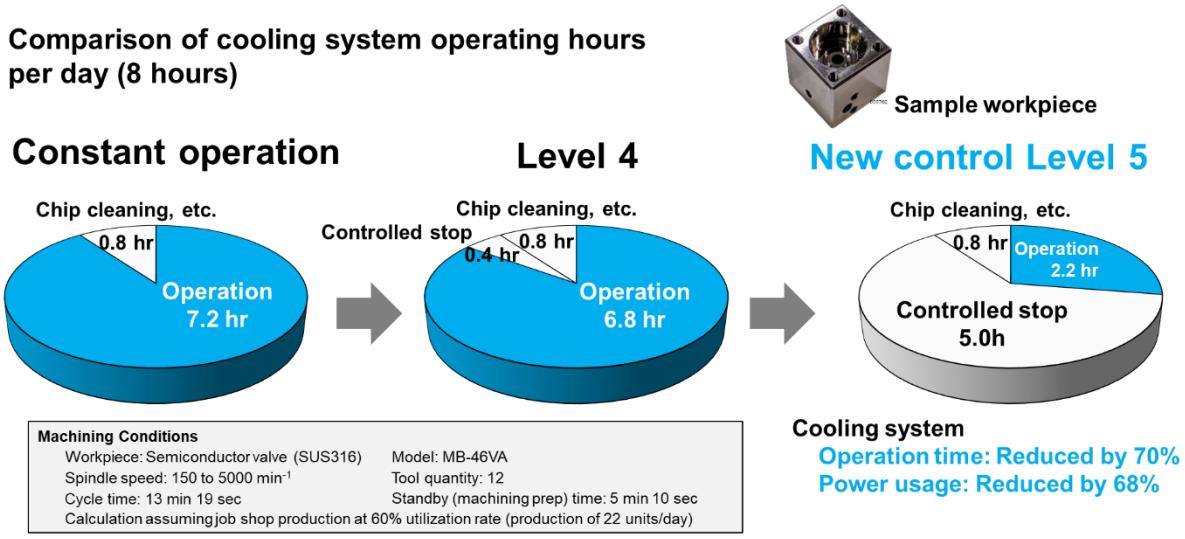
- The cooling system, which is constantly operating because of the heat generated by the spindle during machining, is stopped based on optimization of cooling system operation needed by the machine, even during the machining process.
- After developing Level 4 technology for achieving "autonomous energy reduction with accuracy stability," Okuma has been able to successfully realize Level 5, "autonomous balance of both accuracy stability and energy minimization under all operating conditions" by simulating changes in machining accuracy in real time based on machine status information in the control unit and autonomously controlling the cooling system for optimal operation.
- Demonstration tests of energy usage reduction, including during machining, were conducted on a sample workpiece simulating a stainless steel valve, and the effectiveness of the cooling system was confirmed by a 68% reduction in energy usage.



Reduction of power usage by Green-Smart Machine



New operation control technology for spindle cooling systems that achieves Level 5, "autonomous balance of both accuracy stability and energy minimization under all operating conditions"



Level 5: Example of reduction effects by new operation control technology in cooling systems