



focus ^{2013.}
No.49
NEDO

Reporting on Today and Tomorrow's Energy, Environmental and Industrial Technologies

|| Featured Article ||

Frontier of Energy Conservation Technologies

**Contributing to the Global Environment and
Improved Technology Level of Industrial Technologies**

Frontier of Energy Conservation Technologies

Contributing to the Global Environment and Improved Technology Level of Industrial Technologies

NEDO is contributing to global economic growth through the strategic development of energy conservation technology. This issue covers some of NEDO's current initiatives related to energy-saving technologies.

Image of energy conservation technology strategy

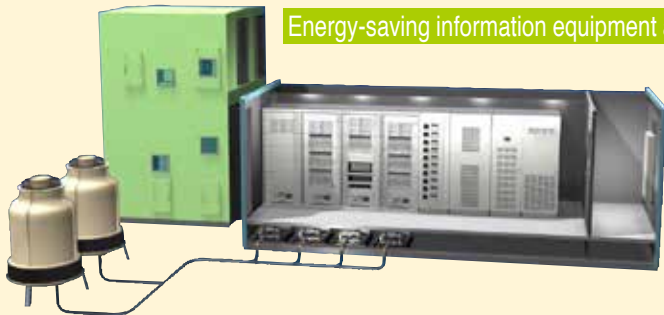
Consumer sector

Aiming for a balance between comfort and efficiency in people's life and work, and energy conservation.

ZEB and ZEH / Comfortable and energy-saving human factors, Pages 10-11



Energy-saving information equipment and systems, Page 12



Cross-sector

Aiming to create next-generation innovative technologies that transcend individual sectors.

Next-generation heat pumps and power electronics



Industrial

Cross-

Consumer sector



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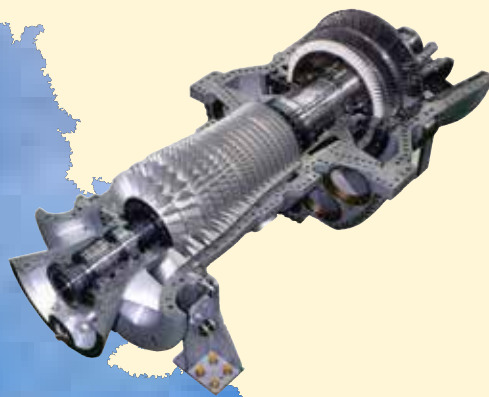
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Aiming to improve Japan's world-class energy efficiency and technology level of industrial technologies.

Innovative manufacturing processes and laser processing



sector

sector

Transportation sector

Transportation sector

Aiming to realize futuristic transportation and logistical solutions for society, as well as to develop next-generation vehicles equipped with state-of-the-art technologies.

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Next-generation vehicles and intelligent logistics system



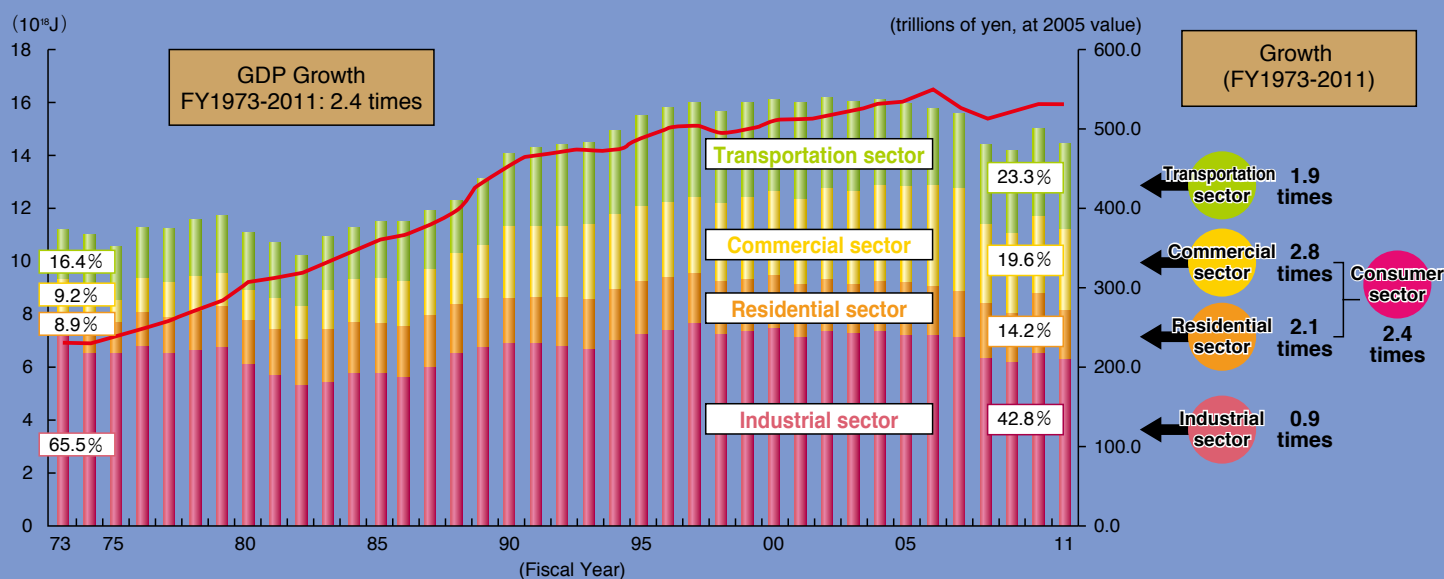
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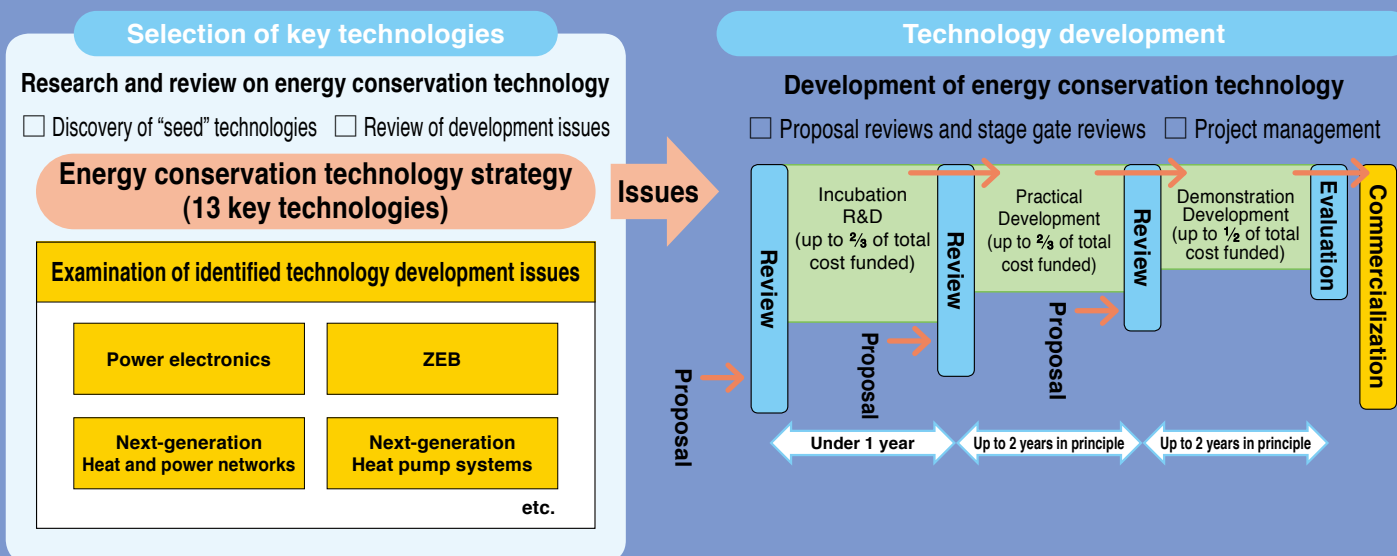
NEDO's Energy Conservation Technology Strategy for Improving the Technological Level of Japanese Industrial Technologies

NEDO views energy conservation as one of the important pillars along with new energy. Up to now numerous energy-saving technologies and products have been created through NEDO's technological development. For this issue, we spoke with NEDO Energy Conservation Technology Department Director General Sato Yoshiteru about the current state and future direction of NEDO's energy conservation technology development.

Changes in final energy consumption and real GDP



Schematic diagram of the strategic innovation program for energy conservation technologies



For a country with limited natural resources like Japan, energy conservation technology development is a major issue

Energy conservation is an important issue directly connected with solving worldwide problems such as extending the life of fossil fuels and reducing CO₂ emissions. In addition, reducing the amount of energy needed for manufacturing and developing energy efficient products also contribute to improve the technological level of Japanese industrial technologies.

Especially, reducing the amount of imported energy is a critical mission for Japan that does not have abundant energy resources. In this sense, the introduction of new energy and the development of energy conservation technology are driving components like the two wheels of a bicycle for Japan with its limited resources.

In the realm of industrial energy conservation technology, Japan has something that makes it a world leader. Compared to other countries, the amount of energy consumed per product is extremely low. For example, Japanese car makers are building vehicles such as hybrids that have excellent fuel consumption.

Nonetheless, compared to 1973, Japan's energy consumption for 2011 was 1.9 times as high in the transportation sector and 2.4 times as high in the consumer sector that combines residential and commercial use. For this reason, NEDO's goal is to further accelerate energy conservation technological development with two key initiatives. The first is technological development as a national project. It is quite difficult for one company to develop some technologies on their own, and it may not be possible to succeed without collecting a variety of insights, such as those gained from industry-university cooperation. The second is our "Strategic Innovation Program for Energy Conservation Technologies".

Promoting the development of thirteen key technologies through a strategic program

In the midst of a diverse range of energy conservation development efforts, NEDO has taken into consideration the potential impact of energy conservation technologies in Japan and in 2011 we put together a "Strategy for Energy Efficiency Technologies" that designates thirteen key technologies from the consumer, industry, and transportation sectors, as well as the intersection of those sectors. With a focus on these key technology areas, we are providing support through the "Strategic Innovation Program for Energy Conservation Technologies." Within these sectors, we have designated four technologies as "Special Technological Development Themes" where we anticipate high energy saving effects. These four include ZEB and ZEH (zero emissions buildings and homes); next-generation heat pump systems; power electronics; and next-generation heat and power networks (cogeneration).



Tokyo Gas Co., Ltd. Earth Port (Kohoku NT Building) was retrofitted with the aim of ZEB status through NEDO's "Demonstration Project for Next-generation Buildings Using Energy Efficiency Technologies."

Yoshiteru Sato

Director General
NEDO Energy Conservation Technology Department

Profile

Completed a Master's degree in Resource Development Engineering at The University of Tokyo Graduate School of Engineering in March 1980. After serving at the National Research Institute for Pollution and Resources at Agency of Industrial Science and Technology he currently works for the New Energy and Industrial Technology Development Organization (NEDO).



In other words, we set targets for the energy efficiency level and time period for commercialization of each individual technology. In this way, we believe we can efficiently direct our limited resources towards particular development goals. The people in charge of each project at NEDO were instrumental in setting these goals. The goals were set through discussions with outside experts while taking advantage of NEDO's accumulated past project management, including market trends and technological development progress in those technology areas.

Through this process, NEDO is moving forward with the "Strategic Innovation Program for Energy Conservation Technologies" to enable the early commercialization of the thirteen key technologies, including the four special technologies that were identified.

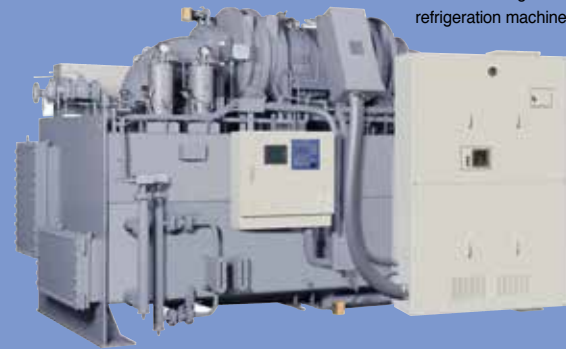
With this program we request proposals from companies to resolve problems in the process of putting key technologies into practical use. Commercialization of the technologies by the companies submitting proposals are considered a prerequisite.

Naturally, funding is provided if a company is selected. However, we ask companies to shoulder a certain portion of the cost. That is the special characteristic of this program. Since companies also face risk, we thought that they would engage with the project even more seriously and figure out how to bring the technology to completion.

At NEDO we want to support companies that are able to continue business operations with successful practical applications for technology. We want to cooperate both directly and indirectly with companies. For example, we want to support exhibits at various trade show events for small and medium-sized companies that have limited financial resources.



The SKYACTIV-D is a clean diesel engine commercialized by Mazda Motor Corporation. Utilized clean combustion technology results from a NEDO project with industry-university cooperation between Hiroshima University and others.



Ebara Refrigeration Equipment & Systems Co., Ltd. developed a super-high-efficiency turbo refrigeration machine. Widely adopted for air conditioning in large-scale facilities such as large-scale buildings and factories. Achieved through cooperative R&D with NEDO to reach higher efficiency in turbo refrigeration machines.



Kobe Steel, Ltd. developed a small-scale steam heat electric generator. Developed as part of a NEDO project that focused on utilizing steam efficiently without wasting pressurized energy. Achieves high-efficiency electric generation with steam as the heat source through a small-scale once-through boiler which was deemed hard to achieve in the past.

Actively promoting overseas development

Since its inauguration in 1980, NEDO has prided itself on making contributions to the Japanese industrial sector through efforts in various energy conservation technology development. Among those contributions, the development of high-performance industrial furnaces is a good representative example of our results, and it is currently garnering attention overseas.

The key to these high-performance industrial furnaces is what is called a "high-cycle regenerative burner." This device utilizes discharged heat that had previously been wasted. The results show that compared with conventional furnaces, these furnaces reduce energy usage by over 30% and emissions of NOx by over 50%.

Currently, among the roughly 40,000 industrial furnaces in use in Japan, more than 1,300 high cycle regenerative burner units have been put into service.

In addition, heat pumps, superconductive cables, and organic electroluminescent lights are great results, and given that energy conservation cannot be realized through one single technology alone, we believe that it is necessary to expand all areas of research. The way various layers of technological efforts interconnect together is important in energy conservation. It is also important to educate going forward in terms of how these technologies are used as part of a whole system since we have reached our current point of energy conversation based on savings of individual pieces of equipment. Furthermore, we are actively promoting international development as we consider the importance of expanding the use of Japanese energy conservation technologies throughout the world. For example, the high-performance industrial furnace mentioned earlier has already been introduced in Thailand.

Global development of energy conservation technologies advanced by NEDO

On February 6, 2013, a grand ceremony attended by officials from the Thai Ministry of Industry was held to celebrate the completion of an environmentally friendly high-efficiency arc furnace in Chonburi Province, located about one hour southeast by car from the Thai capital of Bangkok. The facility was commissioned by NEDO and installed by JP Steel Plantech co., and demonstration operations were executed jointly by the Thai Ministry of Industry and UMC Metals Ltd.

The arc furnace incorporates revolutionary technology and it has received high praise. This is because it can reduce energy usage and CO₂ emissions by roughly 30% compared with conventional electric furnaces, and it also satisfies Japanese atmospheric emissions standards due to integrated dioxin treatment facility. At NEDO we are planning to build on this project to expand the use of high-efficiency arc furnaces in steel industries in



(1)



(2)



(3)

1. Equipment installed for the "Model Project for Increasing the Efficient Use of Energy Using a Coke Dry Quenching (CDQ) System" in India.
2. & 3. The completion ceremony held on November 28, 2011.

Mayumi Yoshizaki
Chief Officer
Energy Conservation Technology
Department



I hope that the spread of Japan's advanced energy conservation technology around the world will contribute to resolving the problem of global warming.



Completed test facility for the "Environmentally Conscious High-Efficiency Arc Furnace Demonstration Project" in Thailand (combustion tower inside the exhaust gas treatment facility)

Thailand and neighboring ASEAN countries.

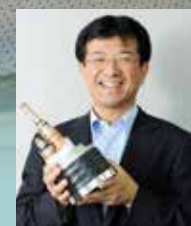
Although NEDO has so far promoted the expansion of energy conservation technology in Asia, we want to proceed on a more global scale in the future. Even before this project in Thailand was finished, last year we completed an energy-saving high-efficiency coke dry quenching (CDQ) facility model project in India. This project was advanced in collaboration with the Indian Ministries of Steel and Finance, Nippon Steel Engineering Co. Ltd. (currently NSENGI), and Tata Steel Ltd. Through this project, the CDQ was established at the Tata steel mill in Jamshedpur, beyond the energy conservation effects, the soot suppression results, and the contribution to the stable operation of the blast furnace by harmonization of the coke have already been confirmed.

Japan's state-of-the-art energy conservation technology has attracted a great deal of attention globally. NEDO is disseminating our results to the world through overseas demonstrations while cooperating with partner governments, in hopes of the spread of energy conservation technology on a broad scale and positive contributions to solving the problem of global warming.



Cross-sector

Developing Superconductor Technology to Realize a Stable and Efficient Power Supply



Nobuhiko Kusunose
 Director
 Energy Conservation
 Technology Department

I believe that utilizing superconducting technology is effective to solve the problems relating to power supply and to respond to an increase in power demand.

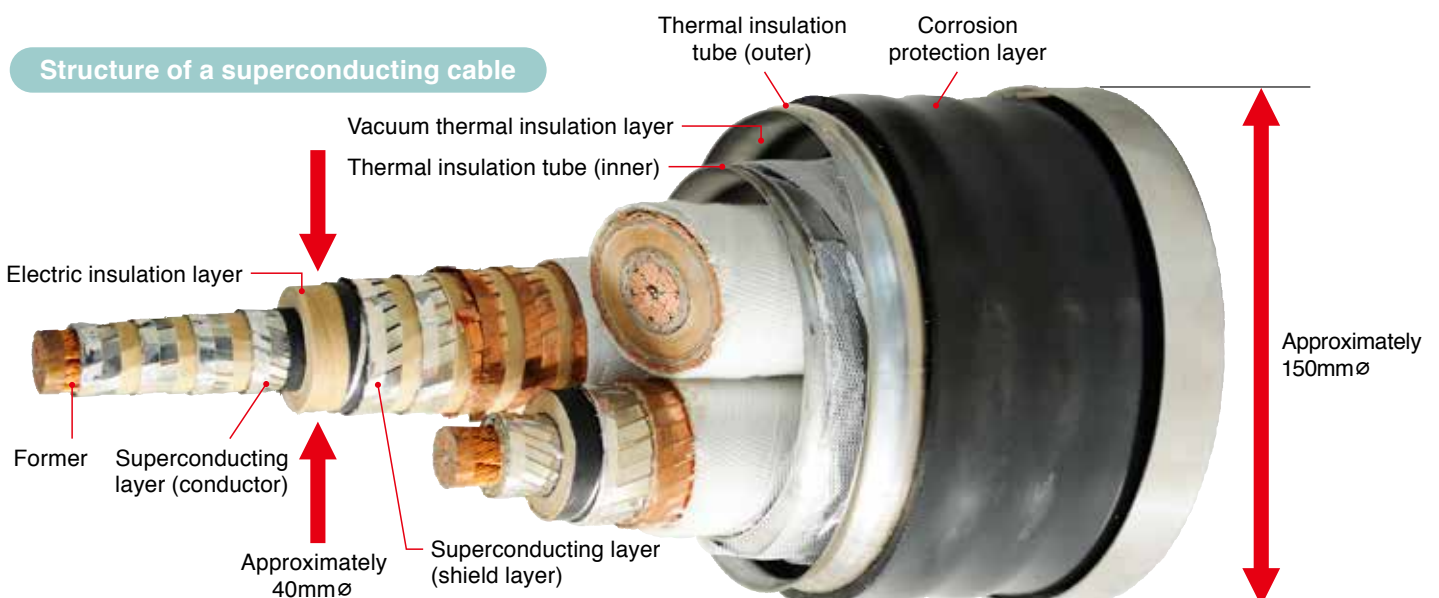
In the current electricity transmission system, a loss of approximately 5% occurs when transmitting electricity from power plant to homes. This amount is equal to the output from five large-scale power plants. Superconductor technology is capable of significantly reducing this transmission loss. NEDO is currently developing two types of superconducting cables based on bismuth and yttrium that will greatly reduce transmission loss if they can be put into practical use.

Superconductor technology has advanced greatly over twenty years

Superconductivity is a phenomenon that occurs when certain materials such as metals are cooled to very low temperatures causing their electrical resistance to become zero. By using this phenomenon, transmission losses can approach close to zero even over long distances. Moreover, it is possible to create a strong magnetic field by passing a large current through superconductors, leading to the possibility of applications in various fields other than power. For this reason,

superconductivity is called a “dream technology”, and it has attracted great expectations so far.

Superconductivity was first discovered by a Dutch physicist over 100 years ago in 1911. Currently, in order to achieve a superconductive state with metallic-type superconductors it is necessary to cool the material down close to absolute zero (-273°C) using high-cost liquid helium. For this reason, although superconductors have been used in medical equipment



such as MRI machines, cost has proven to be a large barrier to their use in industry.

In 1986 ceramic-based high-temperature superconductors were discovered, and in the following year materials that enter a superconducting state when cooled by liquid nitrogen (-196°C) were also discovered. This led to a worldwide boom in the development of high-temperature superconductivity and accelerated research and development even more.

Since it became possible to maintain a superconducting state using liquid nitrogen at a lower cost than liquid helium, the range of possible applications for superconductors in the industrial world has increased dramatically and NEDO began efforts towards superconductor development. With the aim of applications to power equipment, NEDO has continued its research and development efforts with an energy conservation point perspective also in mind.

Through these efforts, Japanese superconductor technology has made great progress.



Demonstration test of a superconducting cable at Tokyo Electric Power Company, Incorporated's Asahi substation.

Demonstration tests at a Yokohama City substation are aimed at early commercialization

As part of a NEDO project we have successfully developed a superconducting cable that can transmit three times the electricity of conventional copper cables by using a bismuth-based superconducting wire.

Currently we are conducting demonstration tests at Tokyo Electric Power Company, Incorporated's Asahi substation in Yokohama City in Kanagawa Prefecture. In this project, which is attracting attention from around the world, we are verifying the operation and reliability of an actual cable system by installing a superconducting cable with a three-

wire core (200,000 kVA-class capacity) and an overall length of approximately 240 meters, using liquid nitrogen cooling to maintain a superconducting state, and connecting it to an actual grid system.

In addition, unmanned operation has been implemented for some time. This is revolutionary, and we are steadily approaching commercialization.

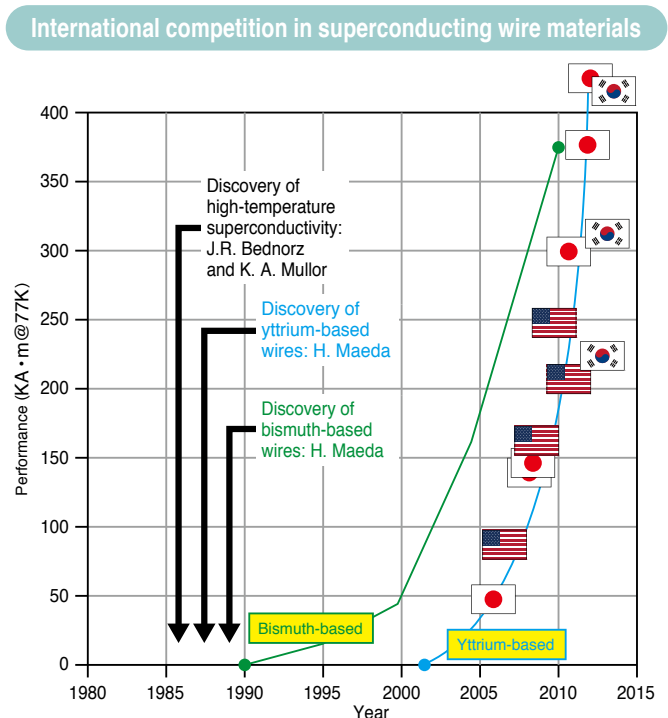
The demonstration tests have now exceeded 250 days and the system remains in continuous operation without any problems.

Meanwhile, Sumitomo Electric Industries, Ltd., Furukawa Electric Co., Ltd., and Fujikura Ltd. have successfully developed superconducting cables that reduce electric transmission loss even further with yttrium-based high temperature superconducting wires. If these types of superconducting cables can be commercialized we anticipate huge energy savings.

In particular, the redevelopment of urban areas and aging facilities are posing problems for developed countries everywhere including Japan. Although civil engineering work is needed to lay new cables to increase the supply of electricity available for redevelopment and updated facilities when using copper wire, since the electrical capacity superconducting cables can carry is greater civil engineering work to accommodate expansion is not necessary and there are clear cases where cost benefits emerge.

Superconductors are an important technology to contribute to energy conservation society and the global need for them is growing. Already we have received interest from other countries that want to consider the introduction of superconducting cables if the demonstration tests prove successful.

At NEDO we are aiming for commercialization as quickly as possible.



 **Consumer Sector**

Energy-saving Technology for Buildings and Homes Aiming for Zero Utility Costs



Hiroyuki Usuda
Chief Officer
Energy Conservation
Technology Department

In the future, ZEB-related technologies will be implemented in many buildings and I think that we will become a society that naturally uses comfortable, energy-saving technologies.

The residential and commercial sectors account for 30% of the energy consumed in Japan and each passing year the increase in consumption is becoming more pronounced. In response, NEDO is developing technologies with the aim of bringing the utility costs of houses and buildings down to zero in order to make a large contribution to energy conservation in these areas.

Moving towards new “Zero Energy” homes and buildings by 2030

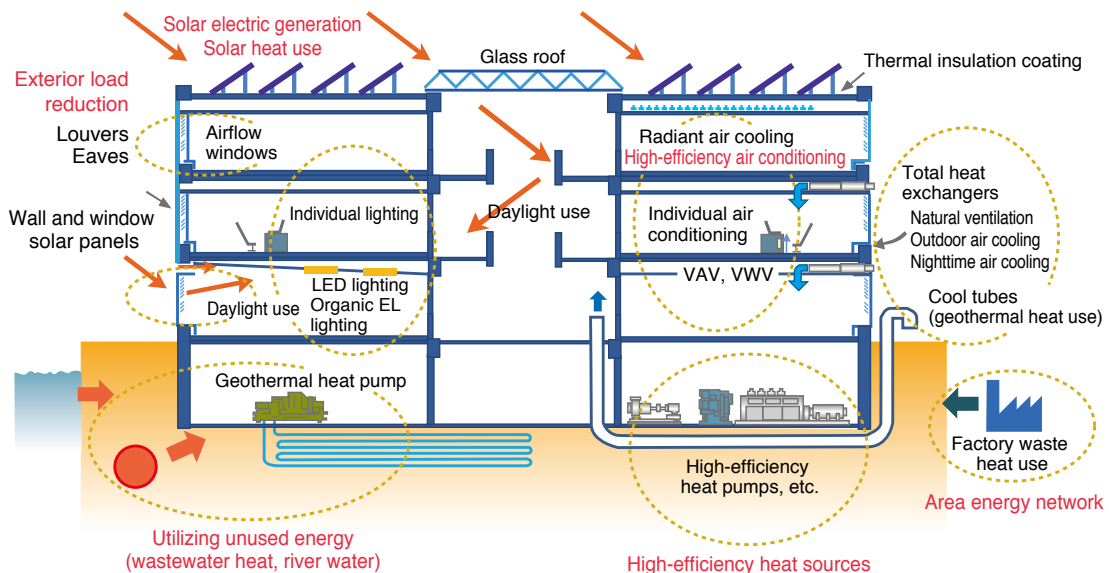
“ZEB” and “ZEH” are abbreviations that refer to net zero energy buildings and homes, respectively. Specifically, these terms refer to structures that combine energy-saving technologies for air conditioning, lighting, insulation, etc. with renewable energy from sources such as sunlight or biomass for energy self-sufficiency, dropping utility costs to zero. In order to establish the practical concepts of ZEB and demonstrate technical elements to promote its spread by 2030, we have been conducting activities related to ZEB and ZEH such as

implementing the “Demonstration Project for Next-generation Buildings Using Energy Efficiency Technologies” in 2009.

Comparing the amount of energy consumed in 2011 with the energy consumed at the time of the first oil crisis in 1973, the industrial sector currently consumes about 0.9 times as much energy as before, while the transportation sector now consumes 1.9 times as much energy and use by the consumer sector has increased to 2.4 times as much energy. Since some sort of response is required, we have started working to convert

ZEB (Net zero energy building)

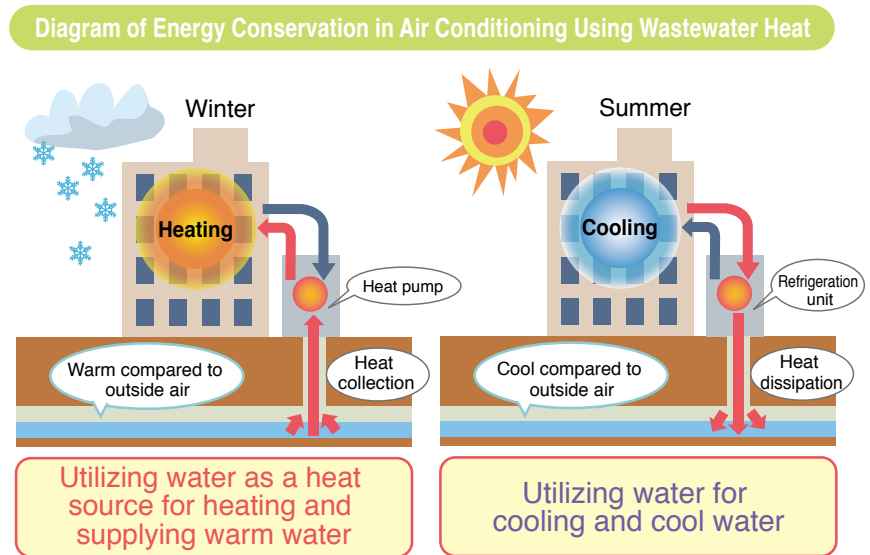
Source: Compiled from Agency for Natural Resources and Energy, “Study Group Report on Realizing and Implementing ZEB.”



buildings and homes into ZEBs and ZEHs for the purpose of reducing the energy use of both.

The countries of Europe and the US are also showing great interest in ZEB and ZEH. The EU has agreed to make all new homes and buildings roughly zero energy from 2020. In addition, the US has decided to make all new commercial buildings ZEB by 2030 and convert all commercial buildings to ZEB by 2050.

Japan will also gradually expand the conversion of buildings to ZEB and homes to ZEH from 2020 and is planning to build all new homes and buildings to ZEH and ZEB standards by 2030.



Focusing on developing technologies important to the realization of ZEB and ZEH

At NEDO, we are putting our energies into two technology development efforts to achieve ZEB and ZEH. Since air conditioning and providing hot water are two activities that roughly half of consumer energy consumption, those two efforts are next-generation heat pump system R&D and R&D to make use of solar thermal energy in housing.

In our next-generation heat pump system R&D, we are promoting the development of heat pump systems that use energy from a variety of heat sources such as wastewater heat or groundwater heat in addition to air heat sources. In demonstration tests conducted at Shinshu University it was shown that the electricity consumption of a heat pump could be reduced by more than 50% by utilizing wastewater heat.

In addition, test demonstrations are being conducted on heat pumps using wastewater heat at the Osaka City Chishima Sewage Treatment Facility. Since the wastewater is warmer than the outside air in winter and cooler during daylight in the summer, we anticipate being able to dramatically reduce the electricity consumption of heat pumps using the wastewater system.

On the other hand, through the use of solar thermal energy our goal is to cut electricity consumption by air conditioning and hot water supply in half based on primary energy conversion. Currently R&D in high performance insulation, thermal storage construction materials, and solar thermal energy utilization systems for detached houses is underway.

To realize the future vision of ZEB and ZEH we need to ensure that the spread of buildings happen according to characteristics of buildings and their surrounding environments. For this reason, we believe it is important to combine a range of technologies, including area energy network and waste heat utilizations which we are pursuing through our next-generation heat pump systems R&D.

In addition, by taking advantage of control and sensor

technologies, there is also a need to strive for energy efficiency while maintaining comfort, considering human factors such as comfort and other human sensitivities in order to realize optimal residential and office environments rather than forcing people to endure energy conservation.

At NEDO we are continuing to work on the development of various technologies going forward geared towards achieving ZEBs and ZEHs that are adapted to different application cases based on shape and purpose of the building as well as the surrounding environment.



Upper: Heat collection testing facility measuring and comparing energy conservation under changing building and equipment conditions.

Lower: Humidity control (desiccant) test equipment being developed to reduce air conditioning energy consumption. (photo courtesy of OM Solar)



Consumer Sector Reducing Electricity Consumption by 30% or More through the Development of Next-generation Data Centers



Aki Maruyama
Chief Officer
Energy Conservation
Technology Department
In the era of big data, I think energy conservation technology for data centers like this will become very important.

In an era when IT equipment processes vast amounts of data, energy consumption has been increasing, and establishing technology for drastically reducing the energy consumed by IT machines has become an urgent issue. Broad energy saving with IT equipment is connected to improving the global environmental problem.

With this background in mind, NEDO has been working to develop technology to reduce electricity consumption by over 30% in data centers and networks as part of the Green IT Project started in FY2008. One of the results of this project is the development of next-generation module-type data centers.

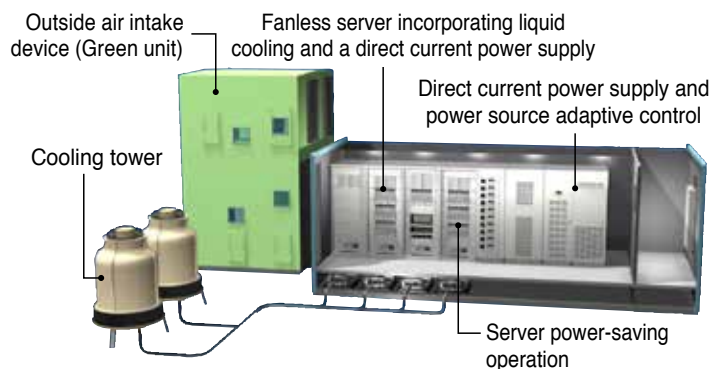
The reality is that power consumption of IT equipment in data centers only makes up half of the possible energy savings, because the rest of the power is consumed by cooling systems and air conditioning for the IT equipment. Therefore, reducing the energy consumption of air conditioning, power supply, and storage systems, as well as the server itself, are important for achieving energy efficiency.

For this reason, fanless liquid-cooled servers have been developed. Using this technology, heat generated by the server is reduced considerably. As a result, the air conditioning does not need to be set to as low a temperature as before, and a device has been developed that introduces outside air that can cool the servers without using air conditioning. In addition, with the development of power supply control technology and a variety of other improvements, we achieved more than 30% energy savings, which was our goal for FY2012.

Nonetheless, along the way there were many difficulties. Since energy conservation in standalone pieces of IT equipment have already been advanced considerably by individual companies, it was not possible to achieve significant energy savings by simply combining these elements together. For this reason, we worked toward optimizing energy efficiency along with development specialists from each company, identifying a large number of challenges among the fundamental technologies and making fine adjustments accordingly.

In addition, there were contingency situations where the division of areas of responsibility in consideration of excessively

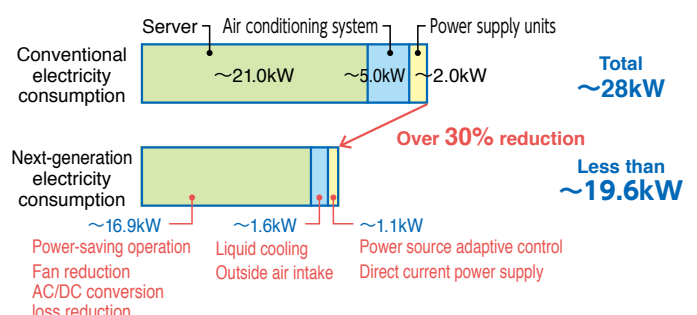
Diagram of the next-generation module-type green data center



high design requirements became the source of problems, creating conditions where equipment would not cooperate together properly. With the commitment of our project and sub-project leaders, we optimized things that would have become excessive performance requirements when combined as much as possible. Although there were various other hurdles, we believe that NEDO fulfilled its role in mitigating those challenges because we are a public institution.

One technology that came out of this project has already been commercialized, and there are also plans to take advantage of a demonstration environment constructed as part of this project for developing new IT equipment. Through these types of projects, NEDO aims to improve the technology level of industrial technologies.

Comparison of electricity consumption between conventional data centers and the next-generation data center





Transportation Sector

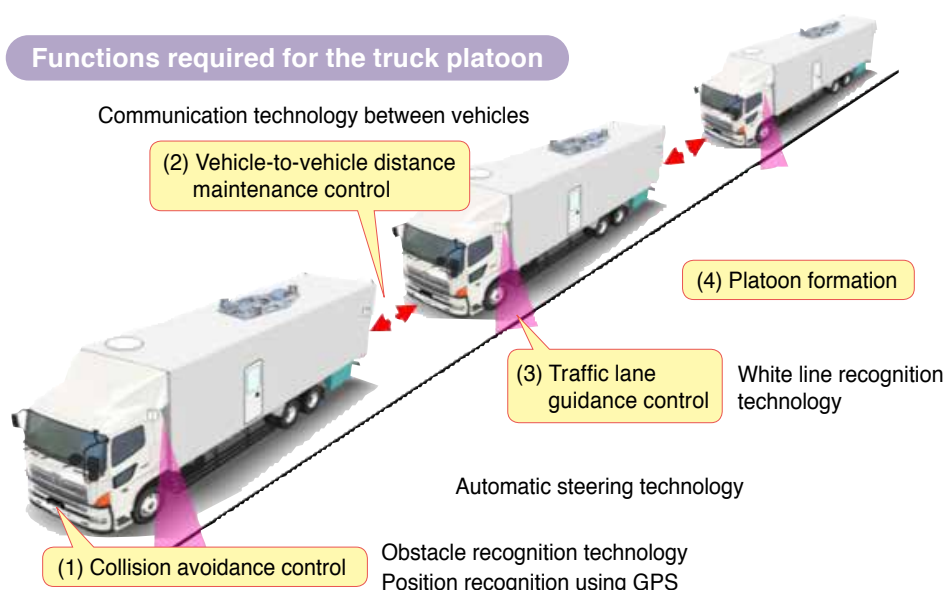
Aiming to Improve Fuel Efficiency by 15% or More through Automated Truck Platoons



Masahiro Honda
Chief Officer
Energy Conservation
Technology Department

I expect that the outcome of this project will be put into practice in the future transportation society.

Functions required for the truck platoon



Chairman Kazuo Furukawa, speaking at a press conference on automatic truck operation and platoon technology demonstrations from the "Development of Energy-saving ITS Technologies Project"



Image of four large-sized trucks in a test of automatic speed and vehicle distance control.

At the National Institute for Advanced Industrial Science and Technology test course late February 2013, a test demonstration of the automatic operation of three large-sized and one small-sized truck running in a platoon at a speed of 80 km was opened to the public. The distance between vehicles was four meters. Although this interval would be quite impossible for a human to maintain while travelling packed into such a close distance between vehicles, it is possible to improve fuel efficiency by over 15% by significantly reducing the air resistance of the vehicle group, and we also anticipate a lessening in traffic congestion due to increased road capacity.

Since 20% of Japan's CO₂ emissions are from vehicles, CO₂ reduction and energy conservation are both challenges. In FY2008, NEDO began collaborating with research institutions, private companies, and universities on R&D related to operational control and platooning of trucks as part of the Development of Energy-saving ITS Technologies Project. We successfully developed the world's top-level technology for automatic truck platooning with an operating interval of four meters between vehicles.


This automatic convoy running technology can be divided into four broad groups of technologies based on function. The first is


platoon formation. In other words, how the vehicles are going to be grouped together. The second is vehicle distance maintenance control. Using vehicle-to-vehicle communication technology we can shorten the inter-vehicle distance and maintain safe control. The accelerator and brakes are controlled automatically because a human cannot operate well when vehicles are packed together tightly. The third technology is the traffic lane guidance control, and the fourth technology is collision avoidance control.

Trucks running in the platoon are equipped with a variety of sensors, cameras, and radar. Using these, the system recognizes the traffic lane and the cars and obstacles ahead of the platoon, and the steering, acceleration, and deceleration of each vehicle is controlled based on this information.

If this type of technology is put into practical use, not only will fuel consumption be improved but it will improve safety and reduce the burden placed on drivers.

In terms of practical application, we will start with speed and vehicle distance control and then aim for automated steering control in the future. Recently there has been remarkable innovation in vehicles, and research and development projects like this have played a role.



 **Industrial Sector**
Contributing to Energy Conservation in Power Generation Facilities through the Development of High-efficiency Gas Turbines



Toru Maruuchi
Energy Conservation
Technology Department
I'd like to continue contributing to a stable supply of electricity by improvement the efficiency of thermal power generation.

Since the Great East Japan Earthquake the level of dependence on thermal power generation has increased and thermal power generation now accounts for approximately 90% of the total Japanese electric power supply. For this reason, raising the efficiency of gas turbine power generation using natural gas as the main fuel has become extremely important.

Gas turbines

A gas turbine, a type of internal combustion engine, is a heat engine that can generate power or propulsion by using the flow of a hot gas to rotate a turbine (impeller). The gas turbine is mainly used for power generation, ships, and aircraft.

One special characteristic of using gas turbines for electric power generation is that a high output can be achieved at a smaller size when compared to other power generating systems. Furthermore, in contrast to coal-fired electric generation, gas also has the advantage of easier control of the amount of

emissions of gases like CO₂ and NO_x.

In addition, currently the “Gas Turbine Combined Cycle Electric Generation System” (GTCC) holds promise as the system with the highest thermal efficiency among those using natural gas as fuel. This system combines gas and steam turbine electric generation methods and results show that it has over 10% higher thermal efficiency than either a single gas turbine or steam turbine system.

Raising the efficiency of single gas turbine systems is also linked to the even higher efficiency in GTCC systems, and we expect that it will make great contributions to Japan’s current electricity demand and efforts to curb global warming.



1500°C-class gas turbine rotor developed by Mitsubishi Heavy Industries, Ltd..



Gas turbine in the Mitsubishi Heavy Industries, Ltd. Takasago Machinery Works test plant.

NEDO's gas turbine technology development

So far NEDO has engaged in a number of technological development efforts related to raising the efficiency of gas turbines.

One example of this effort is the “Development of Materials for Members of Turbine Blades of a High Efficiency Gas Turbine” conducted by Mitsubishi Heavy Industries, Ltd. and National Institute for Materials Science. In this project, we developed turbine blade parts essential for achieving 1,700°C (combustion outlet gas temperature) class gas turbines, as well as foundry technology that can correctly control the composition of ultra-heat-resistant alloys, and we have gotten closer to establishing manufacturing technology that can maintain reliable quality turbine blade parts during mass production.

Generally, raising the temperature of the gas in combustion improves the efficiency of gas turbines. Up until now we conducted technological development and put into service 1,500°C and 1,600°C-class gas turbines as part of national projects. Currently the Ministry of Economy, Trade and Industry carries out a technology development demonstration project focused on putting 1,700°C-class turbines into practical use in parallel with NEDO's projects

Another example is Hitachi, Ltd.'s efforts in “Commercialization Research and Development of Advanced Heat-resistant Coating for High-efficiency Gas Turbines Project.” In this project, 950°C class heat-resistant coatings for gas turbine single crystal blades were developed to apply to mid-volume gas turbines in operational use (Goi Coast Energy, Ltd.'s Goi Power Plant) in hopes of putting this technology into practical

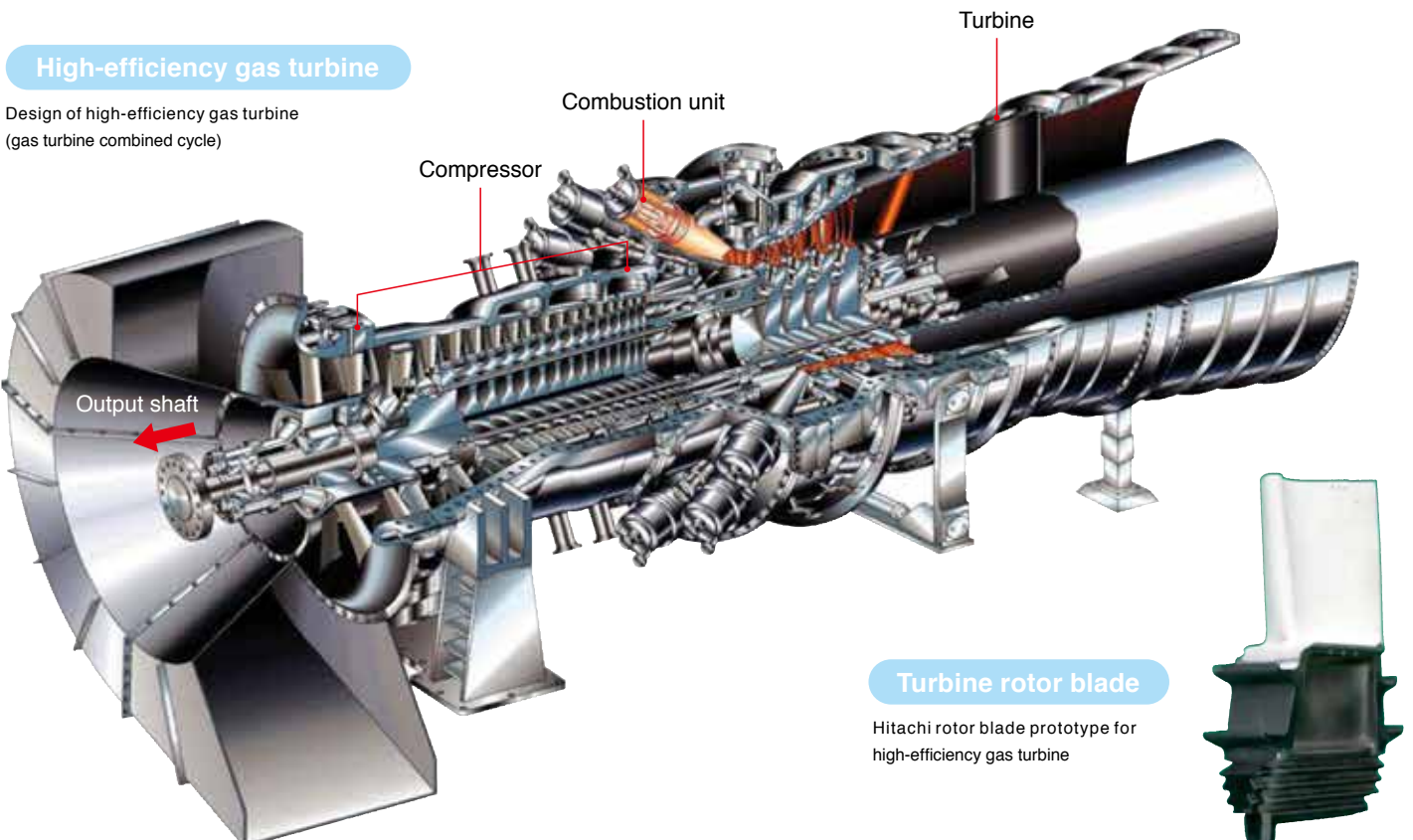
use in the near future.

In addition to raising the temperature of gas combustion to increase gas turbine efficiency, reducing air cooling of high-temperature parts can be effective. In contrast to conventional means, by implementing this technology, high-efficiency in gas turbines can be achieved by raising the gas combustion temperature and reducing air cooling of the parts.

At NEDO, we are conducting a range of technological development other than these projects related to achieving high-efficiency gas turbines. Going forward it is our goal to support the effort to achieve ever higher efficiency with a focus on developing critical gas turbine technology through financial support and other support mechanisms.



Hitachi, Ltd. developed gas turbine blades with high-durability heat-resistant coating.



Turbine rotor blade

Hitachi rotor blade prototype for high-efficiency gas turbine



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