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Special Reports

Environmental Technologies for a Safe and Comfortable Society

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Environmental Technologies for a Safe and Comfortable Society

Development of Eco-Friendly Technologies
ARINOBU Mutsuhiro

Toshiba Environmental Technologies and Environmentally Conscious Products
HONDO Kojiro / AMEMIYA Takashi / NAKAGAWA Kazuaki
The rise in people's consciousness of global environmental issues has become a major current over the past decade. Under government environmental policies aimed at making the transformation to a sustainable economic community, the social infrastructure is also undergoing significant changes toward the realization of a new economic society where emphasis is placed on coexistence with the environment.

On the basis of this recognition, the Toshiba Group is promoting corporate activities that place priority on contributing to a sustainable community, taking responsibility for recycling as a manufacturer of various products supplied to the community. This paper introduces topics related to Toshiba's latest environmental technologies and environmentally conscious products centering around social infrastructure, in various fields from office and home electronics to mobile equipment.

Advanced Energy Supply Systems for Low Environmental Emissions
MURAKAMI Toshiaki / KATO Masakazu / KIZAKI Yasumi
Ratification of the Kyoto Protocol will require further significant reductions in greenhouse gas emissions in the power generation field. Toshiba is developing advanced power supply systems with low environmental emissions, as well as improving the efficiency of conventional power systems. As part of the movement toward use of renewable energy, micro-hydroelectric generation equipment, micro wind power generation equipment, and grid-interconnected equipment that promotes the introduction of wind power systems are now on the market. Moreover, chemically recuperated power generation systems, which reform fuel to hydrogen-rich fuel and reduce environmental emissions, are also being developed.

PEFC Systems
MIYAHARA Hideo / MATSUZAWA Kazuyuki / HIGAKI Shigetoshi
Polymer electrolyte fuel cells (PEFCs) are expected to be widely used in residential, commercial, automotive, and other applications due to their high efficiency and environmental friendliness. Toshiba International Fuel Cells Corp. (TIFC) has developed a 1 kW-class residential system with a power generation efficiency exceeding 35 %, which is one of the criteria for commercialization. TIFC has also developed a 5 kW-class light commercial system in collaboration with UTC Fuel Cells, LLC. (UTCFC) incorporating a partial oxidation reforming system, which is advantageous for fuel versatility and quick startup within nine minutes.

Carbon Dioxide Capturing System Using Ceramic Sorbent
YAMADA Kazuya / NAKAGAWA Kazuaki / HAGIWARA Yoshikazu
Toshiba has developed a unique ceramic sorbent that has a CO_2 capturing capacity of 400 times its own volume. The principal constituent of this ceramic sorbent is lithium orthosilicate. It absorbs CO_2 at 550 to 650°C and releases CO_2 at 800 to 850°C. These are reversible reactions, and it is possible to reuse the ceramic sorbent repeatedly.

We are also developing a CO_2 capturing system using this ceramic sorbent.s The system will be installed close to a boiler burner, where it will collect CO_2 from the exhaust gas or carbon contained in the burned fuel, and supply CO_2 at the point of use. The characteristics of the system have been evaluated using a ceramic sorbent-packed column apparatus. This system is considered to have excellent potential in terms of performance and cost compared to a conventional CO_2 capturing system.

Notebook PC with Electric Power Peak Time Shifting Function
NINOMIYA Ryoji / MORISAWA Toshikazu / SAKAMOTO Kei
Toshiba has developed an electric power peak time shifting function for personal computers (PCs) to help reduce the peak load of power stations and average the power load. To reduce the power load during peak electricity consumption times, the PC cuts off the power from the AC adapter and draws the power from the battery, or disables battery recharging. Some Toshiba PC models already support this function, so the installation of a special utility software enables this function to save energy without the need for any special equipment. This electric power peak time shifting function is attracting attention in the PC industry as a new technology for reducing the burden on the environment.

Energy-Saving Technology in Multifunctional Peripherals: Fusing System Using Induction Heating
TAKAGI Osamu / KINOUCHI Satoshi
Multifunctional peripherals, combining the functions of a copier, printer, facsimile, scanner, and filing machine, are widely used in offices. Recently, the need has arisen for greater energy saving to conform with various environmental standards.

Toshiba TEC Corp. has responded to the expectations of users by concentrating its attention on the fusing system, which consumes 70% of the overall system energy of such peripherals. We have applied induction heating (IH) technology to this system for the first time in the world. As a result, we have improved the machine by achieving a shorter warming-up time and significantly reducing energy consumption in standby mode.

Environmental Approach to Construction of Clean Room Plants
KATO Toshiaki / YANAGISAWA Toshihiko / SOEDA Katsuyuki
Social expectations are increasing for the earth's environment to be taken into consideration in business activities. Toshiba's Construction Department considers the influence on the environment from a comprehensive perspective at the time of factory construction and incorporates energy-saving and other measures into the design for environmental preservation. From the standpoint of high energy consumption, particularly clean room factories for the manufacturing of semiconductors and liquid crystals are implementing measures to achieve energy saving.

This paper introduces improvements made to the air-conditioning circulation system, freezer efficiency, etc. at the Oita Factory. Air flow simulation, which is an effective method for improving cleaning schemes, is being used effectively for saving energy by reducing the power required for the air supply in the clean room.

Mobile Sludge Dryer System Enabling Sludge Recycling
MORIKAWA Akira / HAYASHI Koji
The treatment of sludge generated by sewage treatment systems has become a major problem.Toshiba has developed a mobile sludge dryer system that enables sludge recycling as a measure to protect the environment.This system makes it possible to treat sludge in various locations, and has a high rate of operation.The dry sludge can be used for fertilizer.

Highly Efficient Recycling Technologies for Manual Disassembly of Waste Electric Home Appliances
TAKADA Noritaka / TAGA Kenji / UEYAMA Daijiro
The recycling of waste electric home appliances, which began in Japan in April 2001, is propelling the construction of a recycling-based society.The next task of this business sector is further improvement of the recycling rate, with 2006 as the target year.

TERM Corp. has already anticipated this movement in advance, and has been recycling electric home appliances by manual disassembly such as implementing the separation of glass from TV cathode ray tubes (CRTs), and easy classification and simple foreign-substance removal technology for plastic materials.This has contributed to a more than 10 % improvement over the normal recycling rate. The recovered materials are reused as materials in electric home appliances, so that a closed recycling system has started.Products targeted for manual disassembly will also be expanded from now on, such as personal computers, as an effective method of promoting a recycling-based society.

e-blue™ Realizing Significant Reduction in Paper Consumption
USUKI Shoji / MATSUMURA Fumiyo / SANO Kenji
Toshiba has launched a decolorable toner enterprise called e-blue™.In the typical office, Ninety percent of printed paper is disposed of within a short period.For such temporary use, e-blue™ reduces paper consumption as well as recycling energy and material use.We have confirmed that e-blue™ is effective for the reduction of carbon dioxide in a life cycle assessment (LCA)-like evaluation.Therefore, we have succeeded in realizing both low cost and environmental performance.The incorporation of e-blue™ is perfectly suited to the requirements of ISO 14001.

Techniques for Simplified Analysis of Dioxins
TAKAYANAGI Shuji / KOGA Ikumi / NOMAKI Tatsuo
Environmental pollution due to dioxins (PCDDs, PCDFs, Co-PCBs) has recently become a serious problem.The analysis of very small concentrations of dioxins requires complex recovery and analysis procedures.However, to implement countermeasures against soil pollution by dioxins and perform daily control of incinerator operations, a quicker and more convenient analysis method needs to be established.

TERM Corporation has established simple analytical techniques consisting of the enzyme-linked immunosorbent assay (ELISA) and ion-trap gas chromatography/mass spectrometer/mass spectrometer (GC/MS/MS) methods.These methods sharply reduce the time and cost of analysis.In addition, the results obtained using these methods are comparable to the results obtained by the official method.We have performed efficient environmental investigations and implemented countermeasures to reduce dioxins applying these simple methods.

"Non-fluorocarbon the SENZOHKO" Refrigerator
IWAI Takayoshi / NAEMURA Yoshiro / NOGUCHI Akihiro
Refrigerators are electric home appliances that are deeply related to protection of the global environment. Toshiba has changed the refrigerants and insulation used in refrigerators to non-fluorocarbon types and developed energy-saving models to reduce CO_2 emissions from electricity generation, as measures to contribute to the protection of the ozone layer and the prevention of global warming.

Moreover, Toshiba's line of refrigerators with "SENZOH" control (the connotation of which is to maintain the freshness of food while storing it) perform cooling, germ removal, deodorizing and other functions. This helps to save resources by decreasing the volume of scrapped food materials, which amounts to around 30,000 yen (approx. $US 275) annually in value terms per household in Japan.

Toshiba developed non-fluorocarbon refrigerators in January 2002, prior to its competitors. We have now developed a new model called "Non-fluorocarbon the SENZOHKO," featuring digital signal processor (DSP) vector control and vacuum insulation panels, as the third-generation refrigerator in this line.

Lead-Free Soldering Technologies
MAEHARA Yoichiro / TADAUCHI Masahiro / KAWAKAMI Takashi
Toshiba's third voluntary plan (voluntary environmental action plan) includes the theme of lead reduction. Based on this plan, we have been expanding the application of lead-free soldering to products since fiscal 2000.

In fiscal 2002 and 2003, we investigated reflow/flow lead-free soldering technology to expand its application, the Sn-Zn soldering process to widen the process margin, and lead-free solder coating technology for the leads of electronic devices to make completely lead-free products. We have also applied reliability design technology, a diagnosis system for lead-free soldering processes, and a skill education system for lead-free soldering to the manufacturing scheme.

Risk Assessment of Endocrine Disruptors Using Gene Analysis
SUGANO Mitsuko / AKAHOSHI Eiichi
Endocrine disruptors such as dioxins are a serious problem due to the damage they cause to human health. As endocrine disruptors have many actions, various organs are known to be affected. This means that advanced assessment not based solely on estrogenic disorder is required. For screening endocrine disruptors, a technique is desired that can extensively evaluate toxicity and enable high-throughput examinations.

Toshiba has developed a high-throughput screening system for endocrine disruptors based on a genetic analysis technology. This system can be used for the assessment of neurotoxicity. Features of the system are (1) in vitro assays using cultured neuroblastomas, and (2) the detection of marker gene expressions, such as TIA-1, as a toxicity indicator.

Advanced Monitoring of Environmental Pollutants Using Eco-sensor — Measurement of VOCs, Heavy Metals, Pesticides, and Endocrine Disruptors
ISHIMORI Yoshio / KAWANO Koichiro
An original biosensor (eco-sensor) based on a bilayer lipid membrane mimicking a cellular membrane has been developed by Toshiba for the real-time and highly sensitive measurement of various environmental pollutants in groundwater. The bilayer lipid membrane in water is only 10 nm in thickness and very fragile to physical or electric shock. Up to now, such membranes have not been considered suitable for practical application. Toshiba has developed a mechanism where a small volume of a lipid solution is ejected into water by a pumping system, and is working on the creation of a prototype eco-sensor system incorporating a bilayer lipid membrane based on the principle that a new membrane will be automatically formed when the membrane is broken. This will make it possible to develop an advanced environmental monitoring system (AEMS) based on real-time monitoring of various environmental pollutants in groundwater.

Integrated Chemical Management System
NODA Hideki / INAMI Osamu / KURITA Noriaki
The management of chemicals and disclosure of product environmental performance information have become important for manufacturers due to enforcement of the Pollutant Release and Transfer Register Law, various EU directives such as those on Waste Electrical and Electronics Equipment (WEEE) and Restriction of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS), and the Law on Promoting Green Purchasing. Toshiba has applied an environmental management support system called the Eco Club, which supports chemical management in the manufacturing process and product quality. We are now developing an integrated chemical management system by linking Eco Club with an environmental information disclosure system for factories. This integrated system will contribute to improved efficiency of chemical management in such areas as manufacturing process management, product quality management, design of environmentally conscious products, green procurement management, and product environmental performance information disclosure.

System Control Technologies for Overflow Water of Combined Sewers
UMEDA Kenji / TSUTSUMI Masahiko
Recently, not only increased urban flood damage due to the decrease in rainfall infiltration areas, but also deterioration of public water quality from the outfalls of combined sewer systems have been attracting attention as social issues. The national government, local public bodies, educational facilities, and private enterprises have been studying combined sewer overflow (CSO) reduction and drawing up plans. In particular, expectations are being placed on system control technologies due to their advantage of low-cost operation.

Toshiba is developing technologies for CSO reduction such as real-time control (RTC).

Environmental Communication through Services to School Education
MINAKAMI Ko / MIHARA Masakatsu
Demand for environmental communication with external parties is increasing in accordance with the growing concern of stakeholders regarding environmental protection activities. Changes in lifestyles and values have taken place in environmentally advanced countries, and the importance of the changes has been emphasized in the "White Paper on the Environment" and other documents in Japan. Considering these circumstances, services to education, especially to school education, have become an essential element of appropriate environmental communication.

Toshiba, which published the "Environmental Report for Kids" in fiscal 2000, aims to contribute to the sustainability of society as a whole by engaging in two-way environmental communication with children, their parents, and teachers at classes held at local elementary, junior high, and high schools.

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