

We Tackle Environmental Issues by Making Full Use of Technologies

We conduct our technology development activities from the perspective of global environmental protection.

1 Promotion of Environmental Preservation Technologies in Diverse Areas

<http://www.ntt.co.jp/kankyo/e/2002report/qa/chapter3/q01.html>
http://www.ntt.co.jp/kankyo/e/2002report/qa/chapter3/q05_1.html
http://www.ntt.co.jp/kankyo/e/2002report/qa/chapter3/q06_1.html
http://www.ntt.co.jp/kankyo/e/2002report/qa/chapter5/q03_1.html

The NTT Group embraces a wide range of research and development activities related to environmental protection technologies, including global warming prevention technology, waste recycling technology, and IT-based technology to reduce environmental loads.

● Energy Development

To ensure sustainability and environmental responsibility in the information age, the NTT Group has restricted energy use related to telecommunications and has focused on developing clean, highly efficient energy technologies, including a photovoltaic power generation system, a cogeneration system, fuel cells, and fuel reforming machines.

In regard to fuel cells, the NTT Telecommunications Energy Laboratories has already completed development of a system that uses a phosphoric acid fuel cell (PAFC) and is now in the field testing phase of a polymer electrolyte fuel cell (PEFC). The company has also developed a compact, high-performance "Plate-Fin Type Methanol Reforming Device for Fuel Cells," which produces the hydrogen

necessary for power generation.

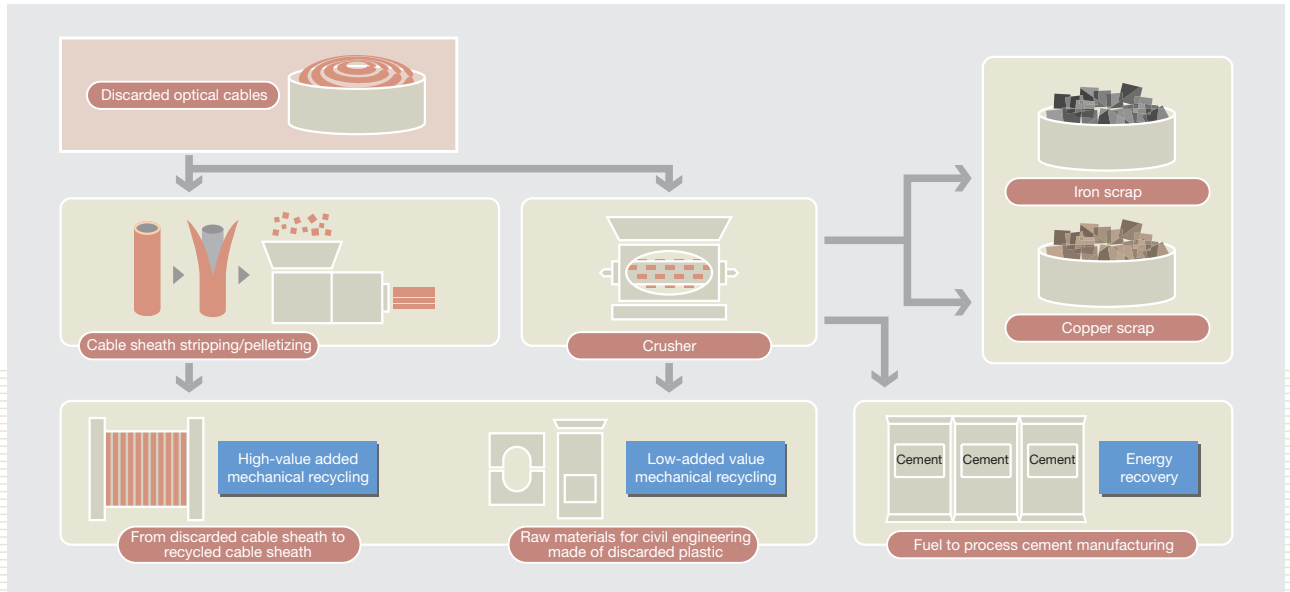
NTT Facilities supports the implementation of DC power systems as one strategy for reducing energy consumption as more data centers are constructed toward achieving our goal of an IT-based society. The approach dramatically reduces transformer power loss compared to AC power systems and also enhances reliability and saves space. DC power systems are ten times more reliable than AC power systems, with 20% improved electricity generation efficiency resulting in the reduction of both electricity charges and CO₂ emission by 20%.

● Environmental Enhancement

The NTT Group has been developing technologies to reduce waste, including the dismantling of telecommunication facilities (Reduce, Reuse, Recycle).

The NTT Access Network Service Systems Laboratories has developed key technology for the realization of an optical cable recycle system. Optical cables are made of expensive materials; the disassembly, crushing and separation into different materials was economically unfeasible. With this new technology, energy recovery in the cement manufacturing process, mechanically recycling into engineering materials, and sheath-material recycling of optical

● Recycling system of discarded optical cables



cables have become possible.

We have also developed a high-speed excavation robot which digs forward by vibrating the soil on the front side of the propulsion machine without discharging soils outside the hole. This robot is different from conventional "mole robots" and can excavate through firm soil.

NTT Lifestyle and Environmental Technologies Laboratories has developed a compact, light, high-precision plastic identifier which instantly distinguishes types of plastic materials on site with an accuracy of 95%. The NTT Group and many other waste treatment facilities use this identifier, expecting to encourage the recycling of plastic.

NTT EAST and NTT WEST have developed an environmentally friendly fax machine that bears the environment label, "Dynamic-eco."

NTT AUTO LEASING and a venture company have been collaborating in the development of a fuel reforming machine as a solution to growing concerns over nitrogen

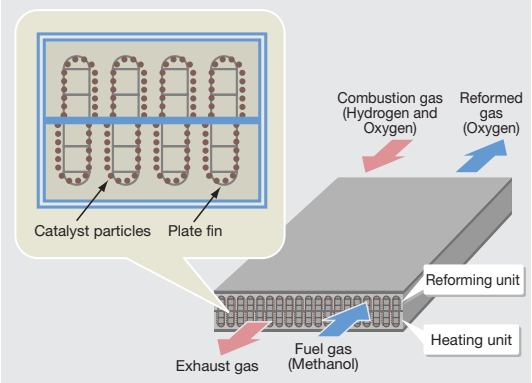
oxides and black smoke, as well as particles such as PM and SPM emitted from diesel cars. The machine reforms fuel during combustion and reduces the amount of harmful air-polluting substances in the emitted gases.

As an answer to the ever-present sewage and sludge disposal concerns, we have also been developing sewage and sludge disposal vehicles. These vehicles are equipped with an onboard organic excess polluted-soil stabilizing system for the active treatment of polluted water at sewage-treatment facilities. Additionally, each vehicle is rigged with an automatic monitor and control system for unattended operation, thus providing exciting mobile eco-solution.

NTT-ME has developed an ozone water generator, using oxygen in the atmosphere, perfectly suited for sanitizing, cleaning, deodorizing, and bleaching. This machine is utilized in agriculture to prevent or remove damage from disease, pests, or disease-causing germs, and as a result it effectively reduces the use of agricultural chemicals.

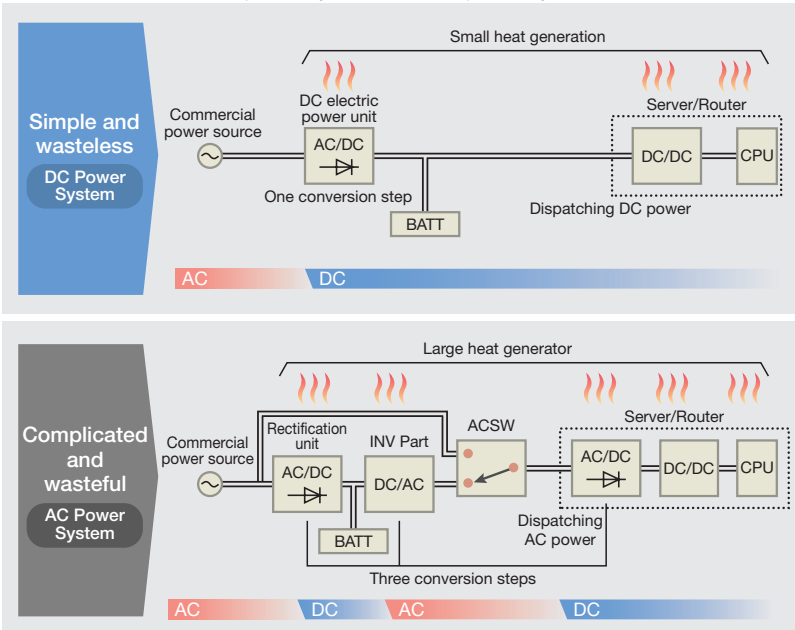
● Kinds and characteristics of fuel cells and their development phases

Fuel cell	Phosphoric Acid Fuel Cell (PAFC)	Polymer Electrolyte Fuel Cell (PEFC)	Solid Oxide Fuel Cell (SOFC)
Operating temperature	150~200°C	70~100°C	800~1000°C
Electricity generation efficiency	35~45%	35~45%	45~60%
Phases	Marketing	Field testing	Research and development



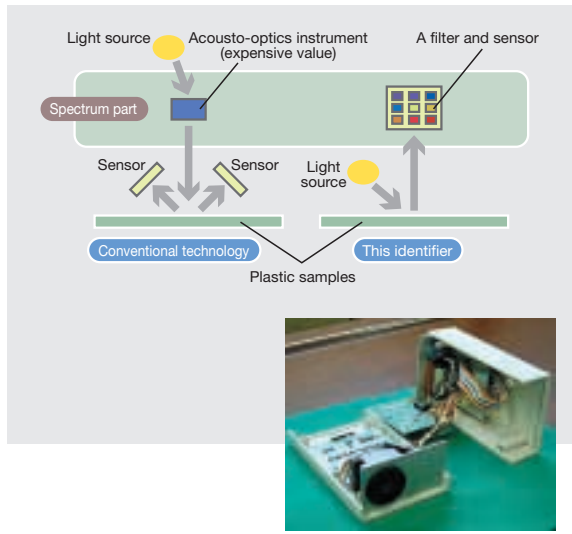
● Plate-fin Type Methanol Reforming Device

● Difference between DC power systems and AC power systems

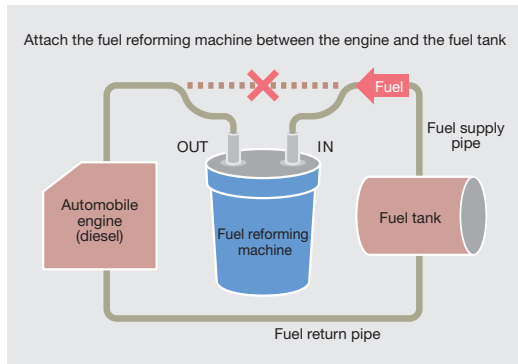


AC: alternate current DC: direct current AC/DC: conversion point from AC to DC DC/AC: conversion point from DC to AC
ACSW: AC switcher BATT: backup battery

● Plastic identifier



● Fuel reforming machine



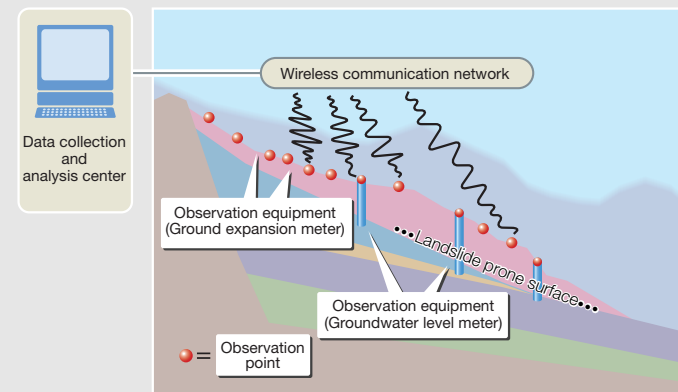
● Ozone water generator



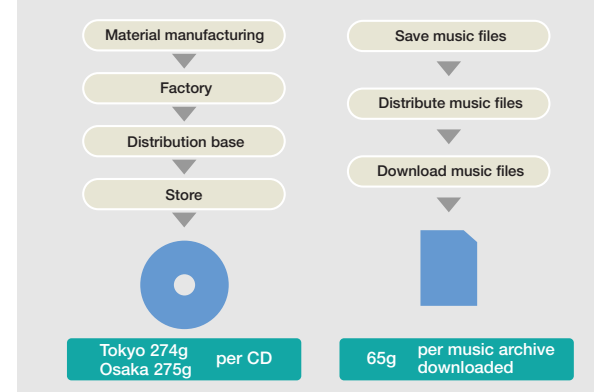
- Result of noise pollution displayed by the roadway environmental assessment system



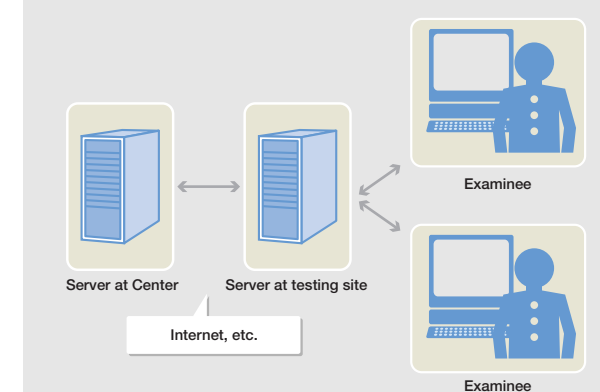
- Automatic remote-supervisory landslide monitoring system



- Deemed effects: environmental load for obtaining music files (CO₂ emission)



- Digital testing system



2 Environmental Issues Solved through IT

http://www.ntt.co.jp/kankyo/e/2002report/qa/chapter3/q02_1.html

The NTT Group recognizes IT as an important tool to address environmental issues in addition to the contributions it provides toward improving the quality of life. Here are some of our latest IT developments.

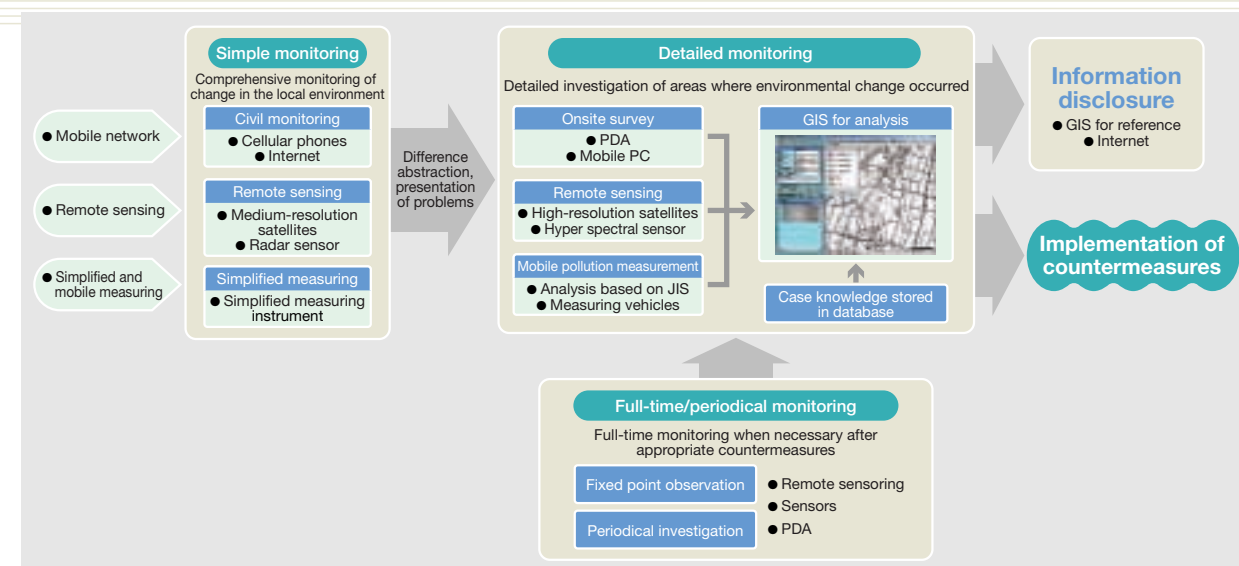
NTT Lifestyle and Environmental Technology Laboratories has developed a PRTR-GIS system and a roadway environmental assessment system. The former is a PRTR data management and tabulation system which enables graphical tabulation and analysis on a map using the Geographic Information System (GIS). Local governments can leverage information disclosure with this system to promote reduction of environmental loads. The latter is a forecast system which enables the swift evaluation of noise pollution experienced by the surrounding areas, by inputting noise values measured on the road.

NTT-ME CHUGOKU has developed an automatic remote-supervisory landslide monitoring system that uses the wireless data communications service, through NTT DoCoMo's packet communications. The data from observation equipment such as ground expansion meters and groundwater level meters installed on landslide prone surfaces are collected at remote monitoring data centers through the communication network. In the event of abnormal readings, the data collection and analysis center is alerted.

NTT EAST, NTT WEST, NTT Communications and NTT DoCoMo have introduced a new service to notify customers of their bank transfers through the web instead of through postal mail. The service contributes to the conservation of paper resources.

In September 2001, six companies, including NTT DATA, NTT DoCoMo, NTT DoCoMo KANSAI, and NTT DATA INSTITUTE OF MANAGEMENT CONSULTING, launched the Environmental Monitoring Consortium. The consortium builds systems that monitor various environmental issues, including illegal dumping, destruction of natural environments, and localized pollution by harmful substances, using the latest IT such as cellular phones, GIS, and the advanced monitoring technology, including an artificial satellite and a simplified measuring instrument.

NTT-AT, in charge of basic design and service design of the system for the Tama River and Basin Museum, is focusing on three activities: support of a river observation group; maintenance of the community's river facilities, such as the riverside walking trails as to create a space where people can come close together, and providing information availability for access by personal computers and cellular phones, enabling information exchange and search.



- Information flow of comprehensive environmental monitoring system

3 Effect of Reducing Environmental Loads Utilizing IT

http://www.ntt.co.jp/kankyo/e/2002report/qa/chapter3/q04_1.html

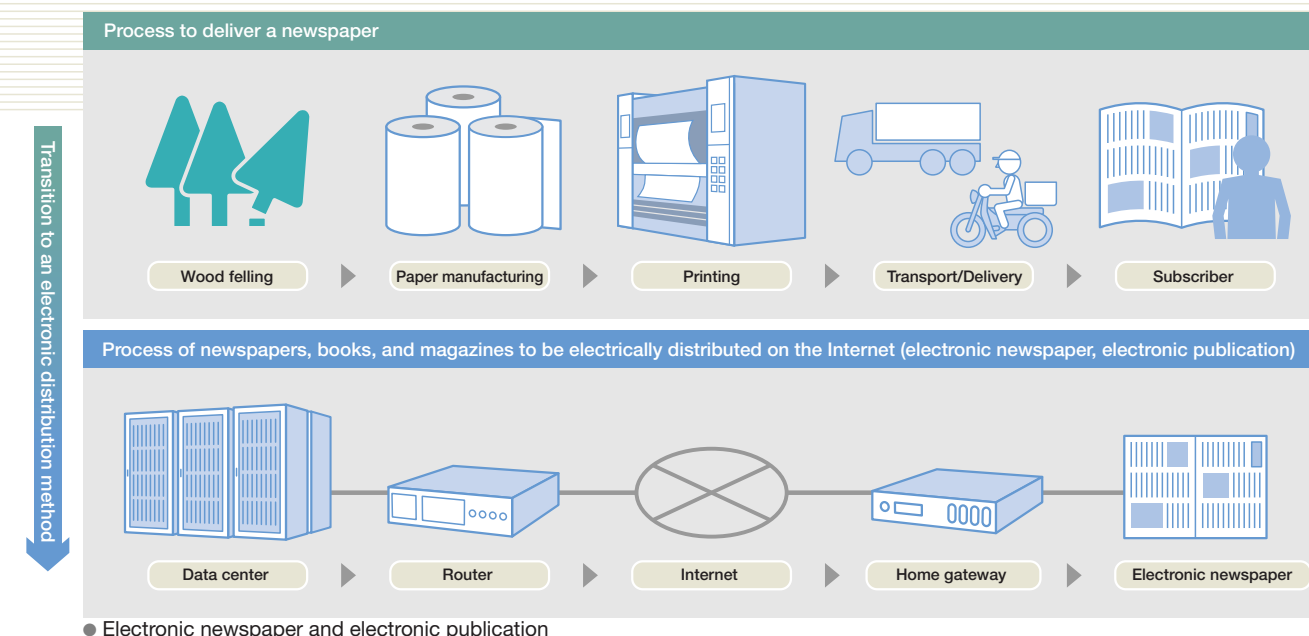
The sustainability of society, avoidance of risks, and reduction of environmental loads are possible through IT.

Music distribution by downloading provides clear environmental advantages. The environmental load, measured in terms of CO₂ emissions, generated when obtaining music through conventional CDs reached 274g in Tokyo and 275g in Osaka per CD, while when one music file was downloaded from a music distribution service using mobile terminals the emissions amounted to 65g.

The NTT Cyber Communications Laboratory Group is engaged in the development of technology necessary for the distribution of various content (newspapers, magazines, books, music and films) over network services. It is estimated that we impose environmental loads of 19.12 million tons per year in CO₂ emissions (1.59% of national emission) and 6.26 million tons per year in the usage of pulp products when reading a newspaper or a book. On the other hand, the amount of CO₂ emissions are 2.94 million tons per year when these publications were over network services. According to these estimates, CO₂ emissions could be reduced by 1.61 million tons per year (0.13% of national emission) and the

amount of pulp products could be cut back by 0.62 million tons per year if 10% of printed newspaper and books were replaced by electronic newspapers and electronic publications. The Laboratory Group also estimates the reduction of environmental loads by implementing a digital testing system, which allows remote examinees to take a test with terminals that are connected to a server at testing sites. If 510,000 examinees used this site for an exam twice a year, CO₂ emissions could be reduced by 87 tons.

NTT Information Sharing Platform Laboratories estimates the reduction of environmental loads by comparing electronic voting to existing, paper-based voting methods. The conditions of the assessment were: approximately 3.3 million voters; electronic voting using an exclusive server to gather all votes from voters' homes via the Internet; and taking into account the existing method that uses paper ballots, which must be manually collected and counted at 76 voting stations. The estimate indicates that electronic voting reduces energy consumption by 8.2% and CO₂ emissions by 42.1%, or 55 tons.



- Electronic newspaper and electronic publication