



January 2015

Hitachi, Ltd. Tokyo Eco Recycle Co.,Ltd.

Development and Demonstration of a Home Appliance Recycling Plant/Development of Cryogenic Crushing Technology for Waste Industrial Products Utilizing Unused Energy (Cold Energy)



Construction of a New White Goods Recycling System in Collaboration with Local Governments and Manufacturers

Recycling Rate of Four Major Home Appliance Items: Approximately 84% of More Than 170 Million Disposed of Home Appliances

Japan has become an affluent country due to high economic growth after the Second World War. In the 1990s, however, it began to face problems such as a shortage of landfills, resulting in an increase of illegal dumping. In particular, the disposal of used large home appliances (i.e., TVs, air conditioners, refrigerators, washing machines) using landfills became a major social problem.

NEDO therefore implemented the Development and Demonstration of a Home Appliance Recycling Plant/Development of Cryogenic Crushing Technology for Waste Industrial Products Utilizing Unused Energy (Cold Energy) project (FY1992–FY1997) as part of its effort to construct a home appliance recycling system. Hitachi, Ltd., which had been engaged in the development of recycling technology for waste industrial products, participated in the project and worked to develop technologies that form the basis for home appliance recycling plants. These include technologies for disassembling, crushing, separating, and reusing used home appliances as well as system demonstration and hazardous waste prevention.

The results of research and development from this project contributed to the establishment of a new home appliance recycling system under the Act on Recycling of Specified Kinds of Home Appliances enacted in 2001. A recycling system unique to Japan (in which consumers bear recycling costs, retailers accept used home appliances, and manufacturers recycle them) was put into practice. Today, 49 home appliance recycling facilities operate nationwide. The recycling rate of used large home appliances is approximately 84%, and the cumulative number of disposed of home appliances has reached 170 million since 2001. As a result, the final disposal volume, which was 10,000 metric tons when the Act on Recycling of Specified Kinds of Home Appliances was enacted in 2001, decreased to 5,000 tons in FY2012, thereby contributing to a sustainable recycling-oriented society.



Magnetic separator that sorts out iron using magnetic force (Photo courtesy of Tokyo Eco Recycle Co., Ltd.)



Eddy current sorter that collects nonferrous metals (Photo courtesy of Tokyo Eco Recycle Co., Ltd.)



Nonferrous metals and plastics collected after various processes (Photo courtesy of Tokyo Eco Recycle Co., Ltd.)

Q. Why did this project start?

In the early 1990s, waste disposal problems, such as a shortage of landfills to keep up with increasing waste, were a major social issue. In particular, it became urgent to construct an economically viable and comprehensive recycling system that could cover all stages of recycling from dumping waste to collecting renewable resources from used large home appliances (bulk waste), such as TVs and refrigerators, in order to promote waste reduction and recycling. However, washing machine motors and refrigerator compressors are so hard that it was difficult to crush them using the existing technology. NEDO therefore launched a project to develop cryogenic waste crushing technology by using the fragility of iron when cooled and the cold energy generated during the production of liquid natural gas (LNG).

Q. What was the aim of the project?

Cryogenic crushing technology refers to technology in which metal, plastic, and gum are cryogenically crushed by utilizing their characteristic of becoming extremely fragile due to reduced impact strength when cooled to an ultralow temperature. In addition to cryogenic crushing technology, NEDO started to develop technologies to sort out and collect metal and plastic, and to collect chlorofluorocarbon from the perspective of a comprehensive recycling system, and a pilot plant incorporating these technologies was constructed in 1994. At this plant, demonstration tests using TVs, washing machines, and refrigerators were conducted for three years with a recovery rate of more than 90% achieved for all items. This was the first step in promoting the recycling and energy recovery of bulk waste, including used home appliances, which until this point had not been recycled sufficiently.

Q. What is the role of NEDO?

When the general public had less awareness of recycling than today, all raw materials that could be recycled for use as resources were wasted. However, the pilot plant developed with the support of NEDO attracted many visitors every day, raising the public's awareness of recycling. Elemental technologies for currently used home appliance recycling plants are based on the technologies used in the pilot plant. Although the shape of recycling machines changes with time, the foundation for current recycling technologies was built through the Development and Demonstration of a Home Appliance Recycling Plant/Development of Cryogenic Crushing Technology for Waste Industrial Products Utilizing Unused Energy (Cold Energy) project.