

## Closed-Loop Recycling of Plastic

### The Mitsubishi Electric Group's "Closed-Loop Recycling" Initiative

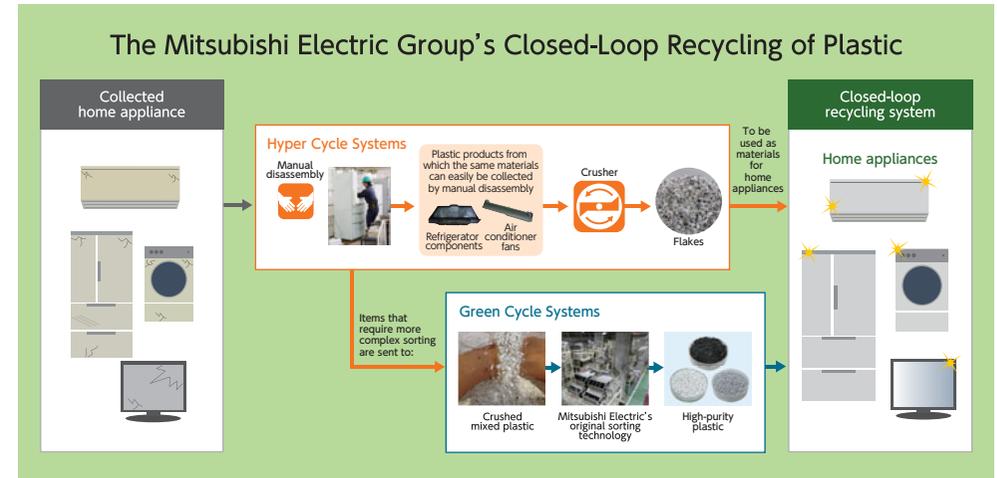
The Mitsubishi Electric Group, which aims to realize a sustainable society, has set out achieving a recycling-oriented society as one of its priority initiatives in an effort to solve environmental issues. The Group promotes the "3Rs"; reduce, reuse, and recycle, and engages in recycling of plastic in used home appliances as a business.

### What Is the Mitsubishi Electric Group's "Closed-Loop Recycling" Initiative?

Since 1999, which was before the enforcement of the Home Appliance Recycling Law in Japan in 2001, the Mitsubishi Electric Group has been operating the industry's first home appliance recycling plant to promote the recycling business. Since 2010, the Group has been fully implementing "closed-loop recycling," in which plastic collected from used home appliances is reused in Mitsubishi Electric's new home appliance products. In this recycling system, it is important to collect as much plastic without foreign matter as possible from products composed of diverse materials.

Hyper Cycle Systems (HCS), a home appliance recycling plant, and Green Cycle Systems (GCS), a plant which sorts plastic, play the main role in this initiative. HCS first disassembles used home appliances, which are then crushed with machines. Among them, selected plastics are then sent to GCS, which sorts different types of plastic. GCS currently recycles approximately 80% of mixed plastic that it has procured into "high-purity plastic" at a level of quality equal to virgin materials. In these processes, the Mitsubishi Electric Group's various technologies are utilized to achieve high-precision separation. We are also developing new technologies as needed.

Through collaboration between HCS, GCS, and Mitsubishi Electric's works and laboratories, a "closed-loop recycling" system has been achieved to reclaim plastic used in home appliances and which can be utilized again for new home appliances. The Mitsubishi Electric Group's endeavor is far from over for further improvement of the system.



→For recycling of home appliances, please refer to the websites below.

#### Defining a Recycling-Based Society

[https://www.MitsubishiElectric.com/en/sustainability/environment/ecotopics/plastic\\_sp/defining/index.html](https://www.MitsubishiElectric.com/en/sustainability/environment/ecotopics/plastic_sp/defining/index.html)

#### Hyper Cycle Systems: Reclaiming Resources from End-of-Lifecycle Products

[https://www.MitsubishiElectric.com/en/sustainability/environment/ecotopics/plastic\\_sp/hypercycle/index.html](https://www.MitsubishiElectric.com/en/sustainability/environment/ecotopics/plastic_sp/hypercycle/index.html)

#### Green Cycle Systems: Refining Old Plastics into Industrial-Grade Materials

[https://www.MitsubishiElectric.com/en/sustainability/environment/ecotopics/plastic\\_sp/greencycle/index.html](https://www.MitsubishiElectric.com/en/sustainability/environment/ecotopics/plastic_sp/greencycle/index.html)

Example

Producing “Materials” for Reclaimed Plastic by Disassembling and Crushing Home Appliances—Initiatives at Hyper Cycle Systems (HCS)—

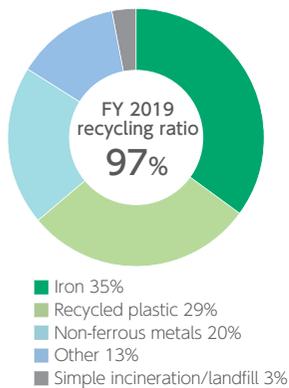
HCS receives nearly 950,000 units of home appliances, etc. annually. Disassembly work starts from components that are easily removable from the home appliance manually. As each product has a different specification, workers use the know-how they have accumulated to separate large components, such as motors and compressors, and toxic substances, such as CFCs and mercury, one by one. Large sections of products that cannot be disassembled manually are crushed using a grinder, and then metals, such as iron, copper, and aluminum, are isolated and recovered using magnetic forces etc. The remaining plastic after recovering metals is called “mixed plastic” as it is not composed of a single material and has various foreign matter in it. Because mixed plastic is useless in Japan, much of it has been exported.



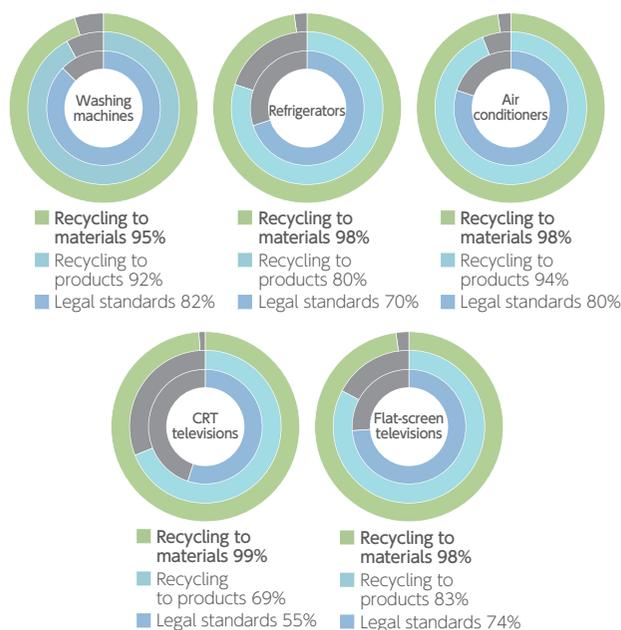
The Mitsubishi Electric Group focused on the value of this mixed plastic. It is finely crushed to a manageable size using HCS’s unique fine crushing technology so that it can easily be handled in the sophisticated sorting process, and is then sent to GCS which is responsible for the post-process in which “material” for reclaimed plastic is processed.

The vegetable containers and door pockets in a refrigerator are typical examples of simple plastic which is easily recyclable and HCS sends these directly to the recycling process.

HCS’s Recycling Results



Results of Home Appliance Recycling by Item

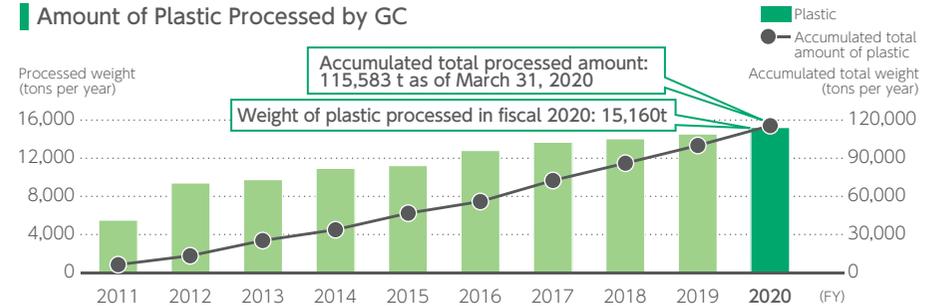


Example

Using Proprietary Sorting Technology to Sort and Recover High-Purity Plastic from Mixed Plastic—Initiatives at Green Cycle Systems (GCS)—

The mission of GCS is to remove foreign matters from procured mixed plastic, sort and recover mixed plastic by type, and produce high-purity plastic that can be recycled at low cost. GCS has been developing technologies required for pursuing this mission one after another in collaboration with Mitsubishi Electric’s laboratories. The Mitsubishi Electric Group was the first in Japan to successfully put high-purity sorting technology for polypropylene (PP), polystyrene (PS), and acrylonitrile-butadiene-styrene (ABS), the three main types of plastic used in home appliances, into practical use. GCS has so far processed an accumulated total of 120kt of mixed plastic. Today, almost 80% of procured mixed plastic is put into material recycling as “high-purity plastic” with the same level of quality as virgin material. Of this 30% is used for home appliances manufactured by Mitsubishi Electric, realizing closed-loop recycling. The remaining 70% of reclaimed plastic is also utilized at various locations as material used in distribution or as construction material in Japan which requires high quality (fiscal 2020 results).

Amount of Plastic Processed by GC



VOICE Recycling Business Supervisor

When we first started the business, the material recycling rate of plastic was around 55%. Because improving the recovery rate while maintaining high-purity in reclaimed plastic is difficult, the Group united to review all kinds of processes and make steady improvement efforts and finally achieved the current recycling rate of 80%.

GCS’s ultimate goal is to improve the value of material, put as much reclaimed material as possible into Mitsubishi Electric’s new home appliances to be manufactured, thereby increasing the rate of closed-loop recycling, while reducing the cost of its home appliance products at the same time. In collaboration with Mitsubishi Electric’s works and laboratories, we will continue to expand the scale of closed-loop recycling. Replacing virgin material with recycled material is not easy as it requires changes of product design and so on. I believe that the Mitsubishi Electric Group was able to steadily undertake the transfer to making more use of recycled materials because of its clear policy which reflects how seriously the Group considers environmental issues.



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