Consider the Life Cycle of the Refrigerator

What is the product life cycle?

The "product life cycle" is the "life of the product" from the procurement of raw materials and components, manufacturing, transportation, usage, collection, recycling, and up to disposal. The input of resources and energy, etc. must be minimized at each stage of the product life cycle and the environmental load (the burden of human activities on the global environment) must be reduced.

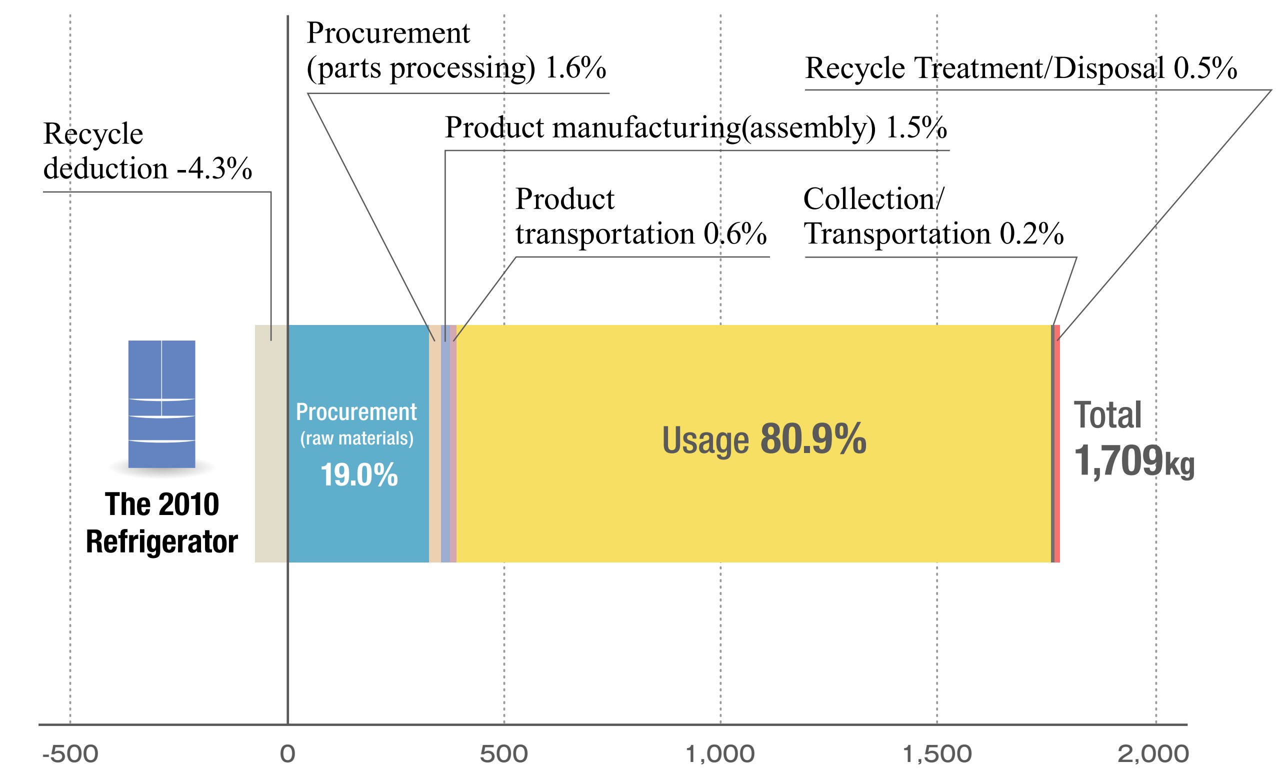
How much is the environmental load of the refrigerator's life cycle?

The graph below shows the calculated results of estimated CO_2 emissions when a model 501-liter 6-door refrigerator that was sold during the period between October 2009 and September 2010 (hereafter referred to as the 2010 Refrigerator) is used for about ten years at home. The CO_2 emissions throughout the life cycle have been calculated as 1,709 kg.

In terms of each stage of the life cycle, the Usage Stage accounts for 80% of the total, and we can see that energy savings at the Usage Stage is most effective in reducing the CO_2 emissions in the entire life cycle. For this reason, consumer electronics manufacturers have been actively promoting the development of refrigerators with reduced power consumption.

In addition, refrigerators that have already been used are recycled in accordance with the Home Appliance Recycling Law, and the CO_2 emissions when recycling and disposing of them at home appliance recycling plants account for only 0.5%. Materials that have been collected (metals and plastics) are recycled as raw materials for new products, contributing to a 4.3% reduction in CO_2 emissions (the Recycle Deduction). Thus, we can say that recycling is effective in reducing CO_2 emissions by 3.8%.

CO_2 emissions from the 2010 Refrigerator at each life cycle stage



Note: Because the percentages are rounded off, they do not sum up to 100%.

Comparison with the previous refrigerator

Compared with a 400-liter 4-door or 5-door refrigerator that was sold during the period between October 1998 and September 1999 (hereafter the 1999 Refrigerator), the 2010 Refrigerator has a significantly improved energy savings performance due to the adoption of vacuum insulation panel and a high-efficiency compressor. In addition, the 2010 Refrigerators are recycled at home appliance recycling plants in accordance with the Home Appliance Recycling Law, and the specifications of the product and its life cycle have changed dramatically.

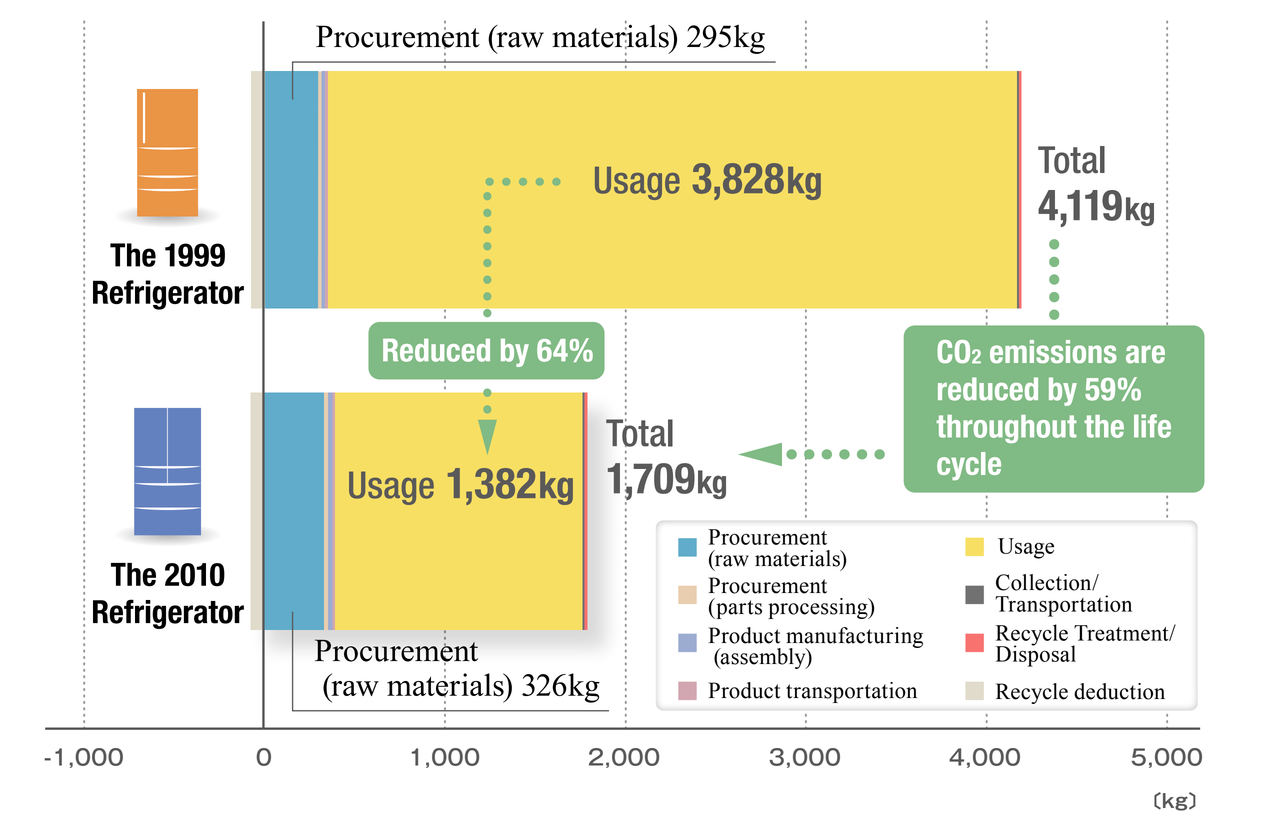
The graph below shows the comparison results of the CO_2 emissions at each stage of the life cycle for the two refrigerators.

At the Procurement (Raw Materials) Stage, an increase of about 10% in CO_2 emissions is seen in the 2010 Refrigerator, but this is thought to be an effect of the increased product mass by about 20% (from 85 kg to 103 kg) due to the increase in the refrigerator volume.

On the other hand, the improved energy savings performance due to the adoption of vacuum insulation panel and a high-efficiency compressor has reduced the CO_2 emissions by 64% at the Usage Stage.

As a consequence, the CO_2 emissions from the 2010 Refrigerator have been reduced by 59% over the entire life cycle compared with the 1999 Refrigerator.

Comparison of CO_2 emissions at each life cycle stage



Which of "Continue to use" or "Replace" is more eco-friendly?

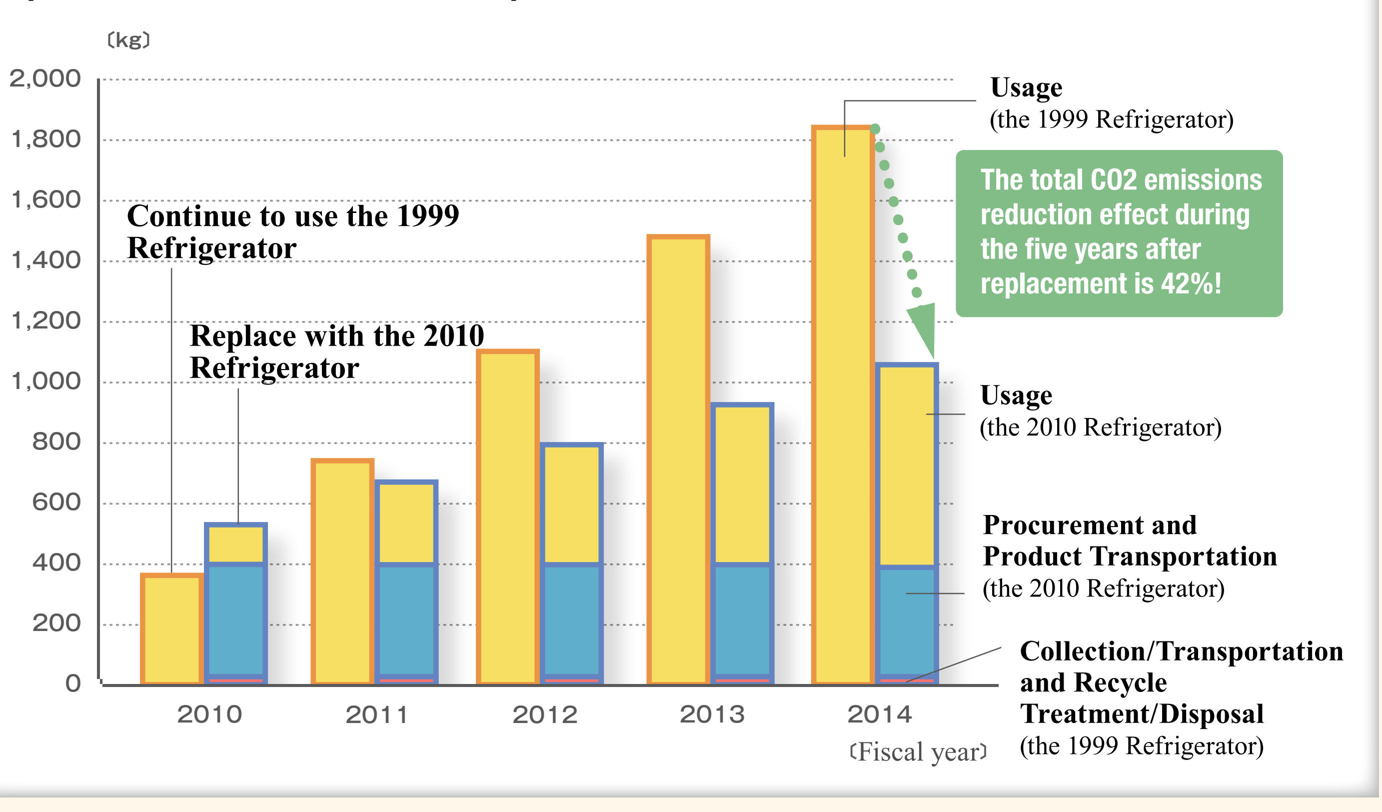
The graph below shows the calculated results for the estimated effect of replacement on the reduction of CO_2 emissions.

During the year of replacement, the CO_2 emissions produced by replacement with the 2010 Refrigerator are greater than those produced by continuing to use the 1999 Refrigerator, due to the effect of the load involved in the collection and recycling of the 1999 Refrigerator and the Procurement and the Product Transportation Stages of the 2010 Refrigerator. However, because the energy savings effect at the Usage Stage is greater, the replacement with the 2010 Refrigerator results in less CO_2 emissions than does continue to use the 1999 Refrigerator in the following year.

In addition, it has also become apparent that the total CO_2 emissions during the five years after replacement with the 2010 Refrigerator are reduced by 42% as compared with the case where the 1999 Refrigerator continues to be used.

These results suggest that the CO_2 reduction effect through replacement by a new product with advanced energy savings performance is significant.

Comparison of CO2 emissions between the case where the 1999 Refrigerator continues to be used and the case where it is replaced with the 2010 Refrigerator (Cumulative values since 2010)



* Life cycle inventory means the input (input of energy and materials) and the output (exhaust gas and emissions of waste) throughout the entire life cycle for the product system of interest.