

PAPER RECYCLING IN JAPAN

April, 2012

Paper Recycling Promotion Center

Table of Contents

1 Definition of Recovered Paper	1
2 Sources and Types of Recovered Paper	2
1) Types of Recovered Paper	2
2) Sources of Recovered Paper	3
3) Paper Collection and Role of Supplier	3
3 Products from Recovered Paper	4
1) Recovered Paper as Raw Material for Paper Manufacture	4
2) Use for Non-Paper-Items	5
4 Current State of Paper Collection	5
1) Recovery Rate	5
2) Trends in Recovery Volumes and Recovery Rates	5
3) Upper Limit of Recovery Rate	6
5 Trends in Recovered Paper Consumption and Utilization Rates	6
1) Utilization Rate	6
2) Trends in Consumption Volumes and Utilization Rates	7
6 Recovery Rates and Utilization Rates	7
1) Recovery Rates Exceed Utilization Rates	7
2) Exports of Recovered paper	8
7 Importance of Paper Separation	8
1) Why Paper Is Separated	8
2) Recovered Paper Quality Standards	9
8 Recovered Paper Treatment Process	10
1) Defibering	10
2) Dust removal	10
3) Dispersing	10
4) Deinking	10
5) Bleaching	10
6) Washing and drainage	11
9 Supply and Quality of Recovered Paper	11
Paper Recycling Issues	
1 Paper Recycling Efforts by Local Authorities and Citizens	12
2 Paper Recycling and the Environmental Problem	12
3 Recovered Paper vs. Wood Pulp	12
4 Paper Recycling at the Office	13
1) Major challenges for paper recycling at the office	13
2) Five points for good functioning of paper recycling in office building for tenants	13
3) Five points for successful paper recycling in an office building	13
5 Legal Framework for Paper Recycling	13
Selected References	14
Appendix	
Grouping and Major Grades of Recovered Paper	15
Guidelines for sorted residential old paper and paperboard, and sorted office paper	16
Production and consumption/recovery volume and utilization volume	18

Japan's total production of paper and paperboard for 2011 came to 26.612 million tons, making the country the third largest producer after China and the USA. Paper (newsprint, printing & copier paper, wrapping paper, sanitary paper, etc.) accounted for 58.1% of the total (at 15.449 million tons), while paperboard (corrugated paper base, white paperboard, patent-coated paperboard, color paperboard, etc.) accounted for 40.1% (11.163 million tons).

Paper and paperboard are made from wood pulp and recovered paper. For 2011, use of recovered paper for this purpose stood at 16.997 million tons, while use of wood pulp came to 10.024 million tons.

1 Definition of Recovered Paper

The term of *recovered paper* generally refers to used paper recovered for use as raw material in the manufacture of new paper and paperboard.

Under government notification (3 Consumer Goods Industries Bureaus Notification no.343, December 24, 1991) issued pursuant to the Law for Promotion of Utilization of Recyclable Resources (put into force on October 25, 1991), now the Law on the Promotion of Effective Utilization of Resources (hereinafter “the Recycling Law”), recovered paper is defined as:

Material that is known or believed to have value in use as an ingredient in the production of paper, where such material comes from an article (such as stationery, paper products, and books) that consists in whole or in part of paper and that has been used, or discarded, or collected unused (and inclusive of such material imported into Japan following collection abroad).

But the law also specifically excludes from the definition

...those materials generated during the process of paper production at paper-making mills and operational sites operated by paper manufacturers, and also, in case of processing at paper-making mills (including those processed by other business operators commissioned by paper manufacturers before shipping products) and used by the paper manufacturers as paper stock without being shipped as goods.

The definition enables a differentiation to be made between waste paper and recovered paper, in line with the same differentiation made by paper manufacturers and recyclers in the United States and Europe.

The Place of Recovered Paper in the Paper/Pulp Industry

Use of recovered paper as raw material for new paper is an important means for reducing waste and effectively using resources, and is therefore of considerable social importance. In 2011, recovered paper (including pulp from recovered paper) accounted for 63.0% of the raw material for production of new paper, making it the significant resource for paper production.

2 Sources and Types of Recovered Paper

1) Types of Recovered Paper

Recovered paper can be divided into two main categories, according to source: *post-consumer recovered paper* from residences, stores, and other such end users, and *pre-consumer recovered paper* from paper processing sites. An intermediate category may also be defined: *commercial recovered paper*, consisting of empty corrugated containers and other such material generated in large quantities by shopping malls, supermarkets, and other such businesses. The figure 1 shows the types and sources of recovered paper.

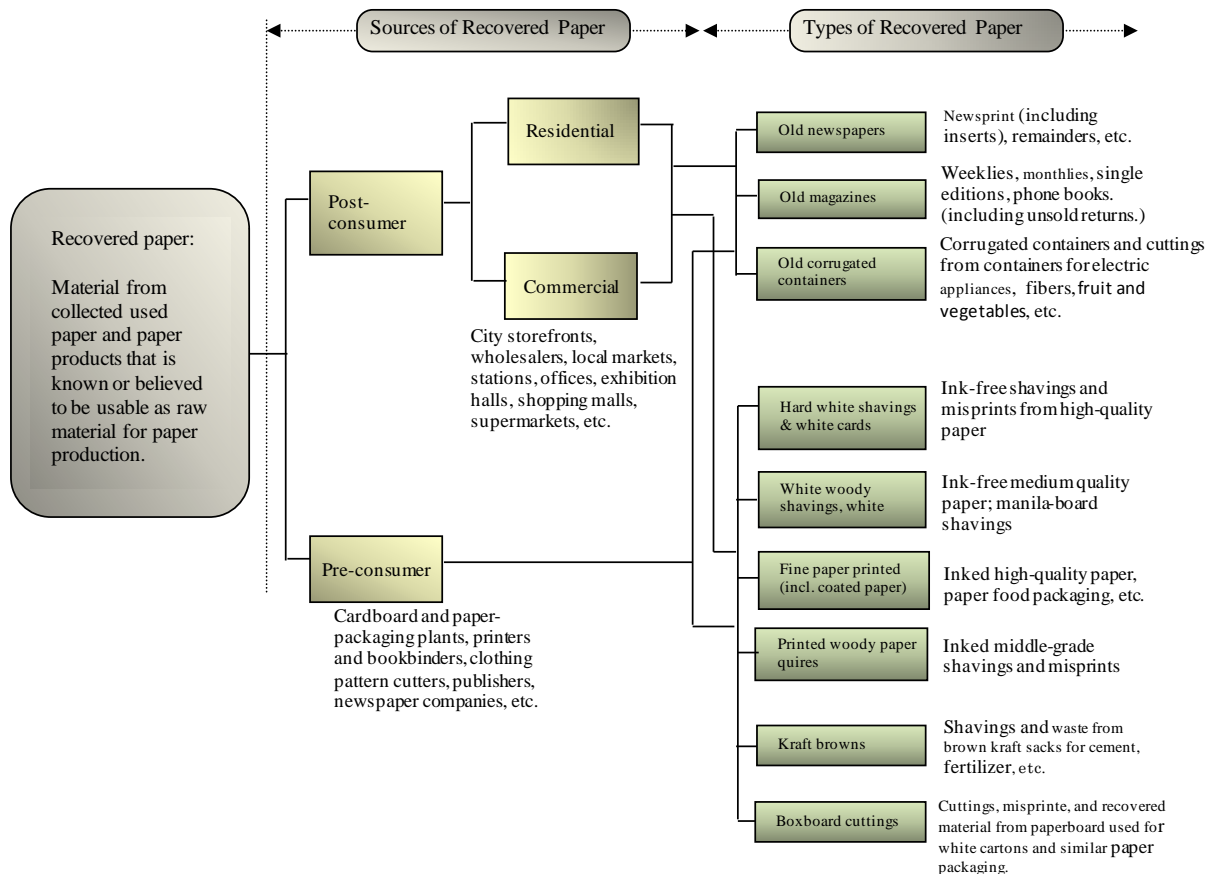


Figure 1 Sources and Types of Recovered Paper

Source: Paper Recycling Promotion Center, *Survey Report on Recovered Paper Use and Environmental Impact*, March 2001.

The Ministry of Economy, Trade and Industry defines nine statistical groups (subdivided into 26 grades) that serve as general categories. In the marketplace, however, recovered paper from sources such as printing and bookbinding facilities is further divided into additional, more closely defined categories. (Source: Grouping and Major Grades of Recovered Paper)

Three categories—*newsprint*, *magazines*, and *corrugated container*—account for over 80% of all recovered paper. Pre-consumer paper recovered from printing and bookbinding plants, sheet cutting facilities, newspaper plants, and similar businesses is divided into categories such as *white shavings* and *cards*, *high-grade white wood-containing shavings* and *white wood-containing shavings* (high-grade white unprinted wood-free), and *white ledger* and *color ledger* (printed).

2) Sources of Recovered Paper

As previously mentioned, recovered paper is generated by residences, offices, printers and bookbinders, carton box and corrugated container manufacturers, shopping malls, grocery stores, and other such sources. Throughout the world, recovered paper is generated from the following four sources.

① Residential

Single family and multi-family residences generate newspapers, magazines, corrugated containers as well as sorted mixed paper.

② Commercial

Shopping malls, stations, local markets, and supermarkets, etc. generate large quantities of corrugated containers.

③ Industrial

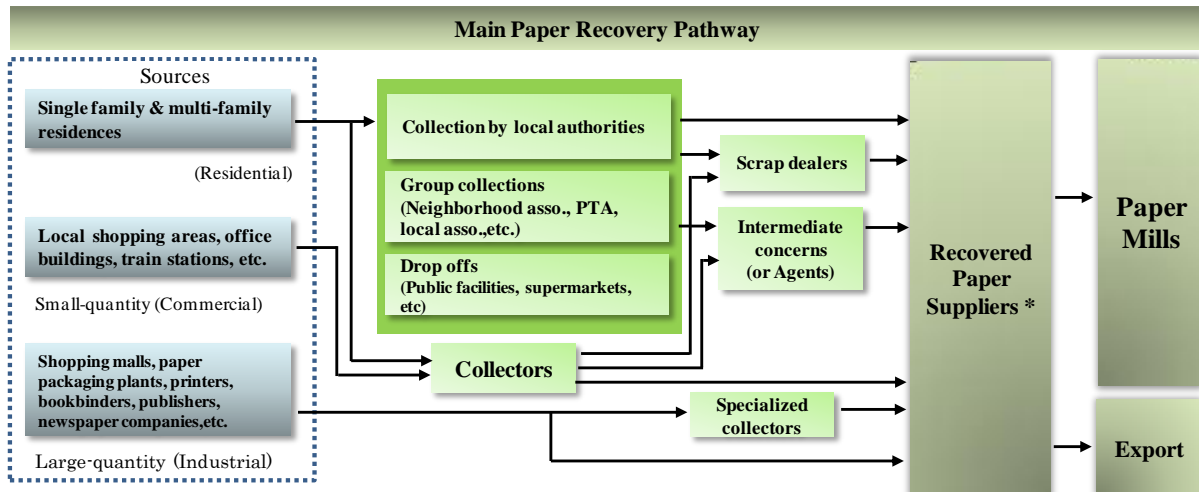
Paper processing concerns (printers, bookbinders, newspaper companies, and others) generate shavings, misprints, and leftovers, etc.

④ Office and institutional

Business offices generate copier paper, classified documents, newspapers as well as magazines, etc.

3) Paper Collection and Role of Supplier

Specialized collectors collect paper from large-quantity sources, and then pass the paper to a supplier* who can then deliver it to mills for use as raw material (Figure 2). Some suppliers also undertake collection on their own. While recovered paper follows a variety of pathways from its source, it ultimately lands in the hands of the supplier. The supplier weighs the paper, presses it with a pressing machine into approximately 1-ton units, and sells it to mills. The supplier is responsible not only for gathering the requisite quantities, but also for ensuring that the delivered paper is of uniform quality and contains no constituents unsuitable for reuse as raw material. Accordingly, the supplier must check quality when purchasing and shipping, and sort the recovered paper carefully prior to packaging it for delivery.



* Supplier refers to recovered paper dealers entitled to deliver recovered paper to paper making mills by paper and paperboard manufacturers.

Figure 2 Paper Collection and Role of Supplier

3 Products from Recovered Paper

1) Recovered Paper as Raw Material for Paper Manufacture

The most prominent characteristic of paper recycling is that it converts paper back into new paper. In 2011 Japan recovered about 21.58 million tons of paper, of which it exported about 4.43 million tons. The country also imported about 0.04 million tons. Domestic reuse, therefore, came to about 17.19 million tons, of which 99% was used as raw material for new paper manufacture.

Recovered paper is suitable for producing a wide variety of papers and paperboards. Paper uses include newsprint, magazines, phonebooks, mid-grade and low-grade printing paper, and tissue paper. Paperboard uses include boards for corrugated containers and paper containers (Figure3).

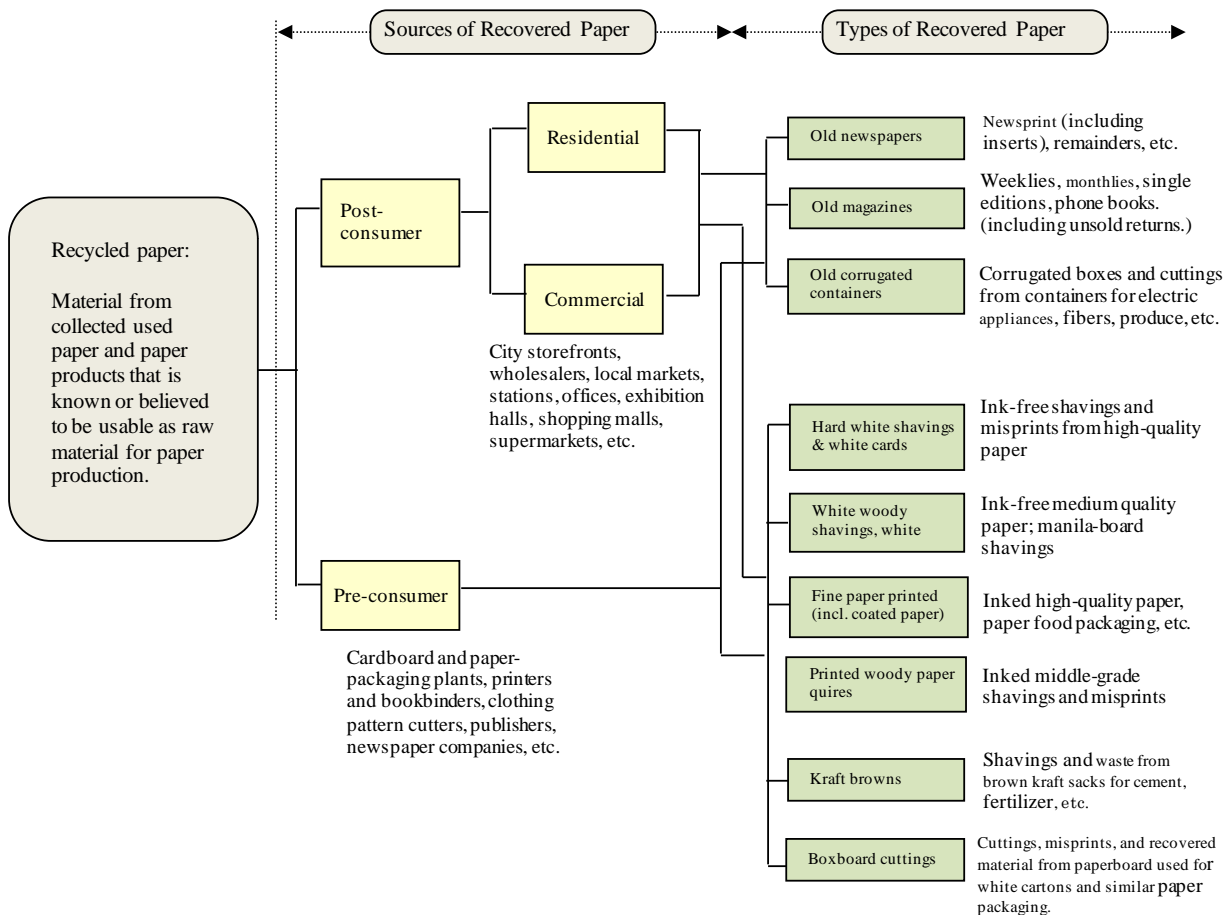


Figure 3 Products from Recovered paper

2) Use for Non-Paper-Items

The remaining 1% was used as raw material for producing non-paper items such as molded pulp products, paper stock board, animal bedding, and solid fuel. Recent noteworthy non-paper applications also include use in road paving and waste-water treatment (where recovered paper is mixed with fibers to absorb moisture). Use of recycled paper for such non-paper applications remains relatively low in Japan, but is expected to increase as a result of ongoing efforts to promote effective use of the segment of recovered paper that is not suitable for papermaking.

In particular, such paper can be mixed with waste plastic to create a high-quality fuel known as RPF (Refuse Paper & Plastic Fuel). This fuel type is now in considerable demand, as it is possible to vary the fuel's calorific value (over a range of 5,000 to 10,000 kcal/kg) by controlling the ratio of input paper and plastic. A 50:50 mix, for example, provides a calorific value of 6,190 kcal/kg (measured LCV), which is about the same as that of coal. RPF is now used in boilers and driers at paper and steel plants. Use of RPF as an alternative to fossil fuel helps to reduce CO₂ emissions and is considered environmentally friendly.

4 Current State of Paper Collection

1) Recovery Rate

The recovery rate can be defined as the total amount of P&PB (paper and paperboard) recovered as a percentage of the total amount consumed RP (recovered paper) fiber. Within this document, we use the term to refer exclusively to consumption and recovery within Japan.

$$\text{Recovery rate (in Japan)} = \frac{\text{Amt recovered RP in Japan (Amt shipped RP to manufacturers + Amt exported RP - Amt imported RP)}}{\text{Amt consumed P\&PB in Japan (Amt sold P\& PB by manufacturers + Amt exported P\&PB - Amt. Imported P\& PB)}} \times 100$$

*includes shipments of pulp generated from recovered paper, converted to corresponding paper amount.

2) Trends in Recovery Volumes and Recovery Rates

●Trends in recovery rates

Annual recovery volume has risen steadily since the 1980s, almost tripling from 8.078 million tons in 1980 to 21.581 million tons in 2011. Since 1980s the recovery rate held fairly steady at about 50%, and remained stagnant at about 51% for the five-year period from 1992 to 1996, but then began a rapid and long-term rise as recovery efforts were boosted by an increased awareness of environmental problems and resource recycling, and efforts by local authorities to reduce waste, with recovery outpacing recovered paper supply and demand. In particular, it began a steep climb that has continued to the present. By 2011 the rate had reached 78.1%, significantly higher than the 46.2 % recorded for 1980(Figure4).

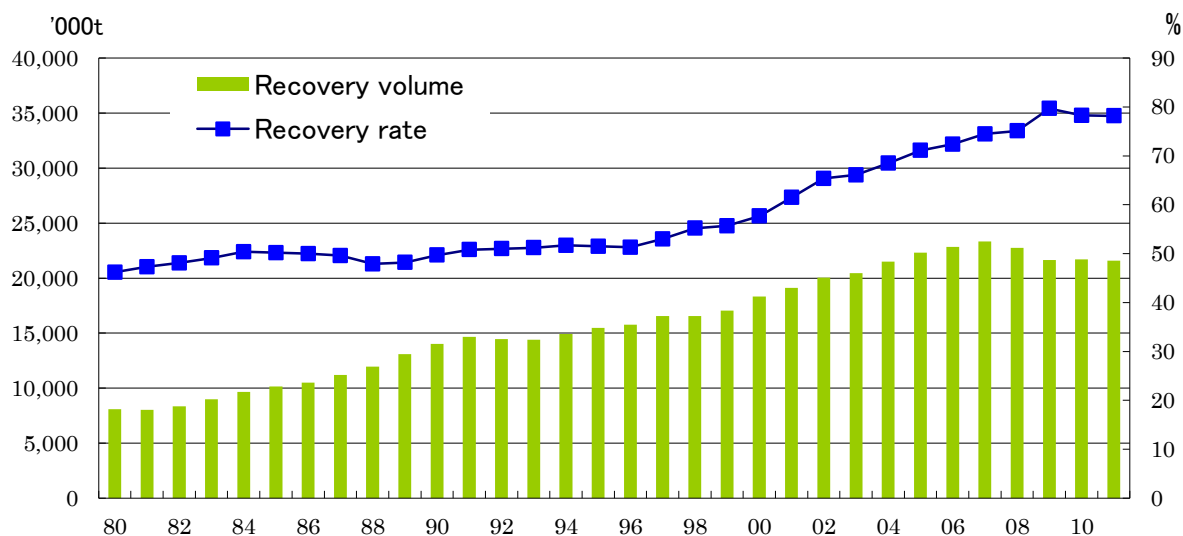


Figure 4 Trends in Recovery Rates

●Recovery Rates by Category

The 2011 recovery rate of pure newsprint, discounting the large volume of advertising inserts that are mixed in (estimated at 40% by weight), is calculated to have been about 86%.

Recovery of printing & copier paper, inclusive of the aforementioned advertising inserts, was approximately 21%. Recovery of corrugated container is estimated to have been about 95%, derived by discounting the published figures by about 13% to eliminate the impact from the counting of corrugated container that entered the country as packaging for imported goods.

3) Upper Limit of Recovery Rate

It should be kept in mind that the denominator used to calculate the recovery rate (that is, the total quantity of paper consumed in Japan) includes non-recoverable and non-recyclable items such as sanitary paper (tissue paper, etc.) and water-resistant and humidity-resistant processed papers. This fact effectively places an upper limit on the achievable rate. This limit is provisionally calculated to be about 73% (a rough calculation that omits consideration of recovery of import/export packaging materials and of other potentially relevant parameters).

In view of this upper limit, the current recovery rate appears to be very high and can be considered a very significant achievement.

5 Trends in Recovered Paper Consumption and Utilization Rates

1) Utilization Rate

The utilization rate for recovered paper can be defined as the volume of RP (recovered paper) consumption in paper production as a percentage of the total volume of fiber consumption as raw material for this purpose. Specifically;

$$\text{Utilization rate (in Japan)} = \frac{\text{Amt of RP consumption that is used in paper production}}{\text{Total fiber used in paper production (wood pulp + recovered paper + deinking pulp from RP + other fiber*)}} \times 100$$

* Fiber that does not originate from wood pulp. Accounts for less than 1% of total figure used. Includes viscous staple fiber, knot screen waste, manila fiber, mitsumata fiber, etc.

2) Trends in Consumption Volumes and Utilization Rates

●Trends in Utilization Rates

Consumption of recovered paper has been rising since the 1980s, increasing from 7.857 million tons in 1980 to 16,997 million in 2011 (an increase of 116%). The utilization rate has also risen steadily during this period, from 41.5% in 1980 to 51.5% in 1990 (the first year the rate exceeded 50%). Subsequent increases outpaced the targets set by the Recycling Law: the 2000 target of 56% was achieved in 1999 (56.1%), while the 2005 target of 60% was passed in 2003 (with actual rates of 60.2% in 2003, 60.4% in 2004, and 60.3% in 2005). As a result of the rapid increase, a new 2010 target of 62% was announced in December of 2005, which was achieved in 2009 and 2010. Currently, manufacturers and other significant participants are working to reach a new 2015 target of 64%, which was announced in March of 2011. As of 2011, it achieved 63.0% (Figure5).

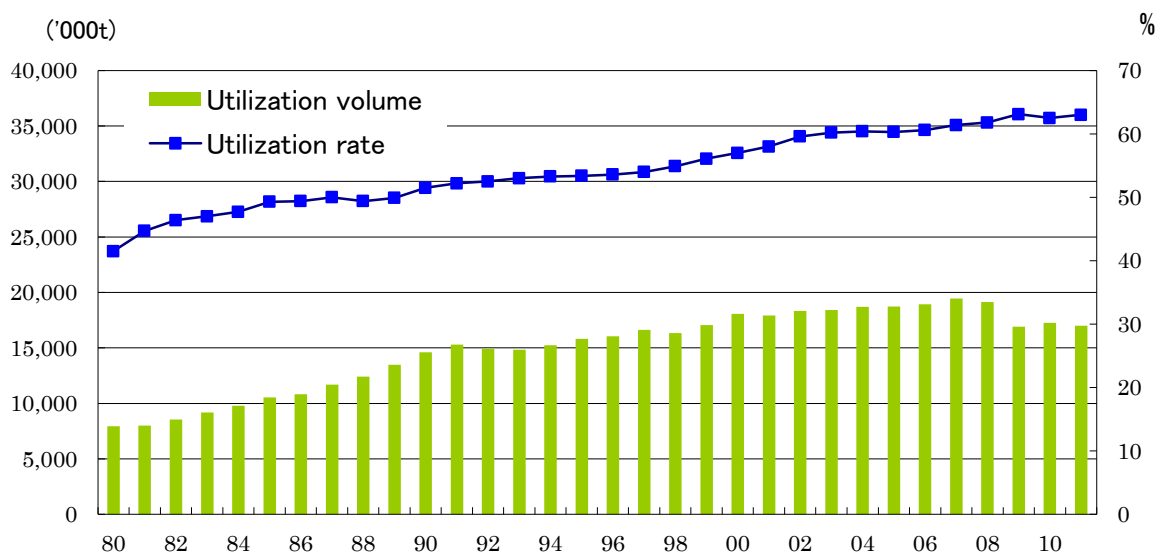


Figure 5 Trends in Utilization Rates

●Utilization Rates for Paper and Paperboard

In 2011, the consumption of recovered paper in paper manufacture stood at 39.5%, while the rate in paperboard manufacture reached 92.8%. To achieve further progress, therefore, it is apparent that emphasis must be placed on improving the rate for paper manufacture—for example, by increasing use in the manufacture of printing paper.

6 Recovery Rates and Utilization Rates

1) Recovery Rates Exceed Utilization Rates

In recent years, collection and supply of recovered paper has been driven up by increased awareness of environmental problems, stronger interest in recycling, and constant efforts by local authorities to reduce waste. As a result, supply is exceeding demand by an increasing margin.

The recovery rate for 2011 was 78.1 %, down 0.1 % from 2010. The utilization rate within Japan, at 63.0%, trailed the recovery rate by 15.1 %. As the table 1 shows, this disparity has increased since 2002.

Table 1 Trends in Recovery Rates and Utilization Rates

year	Recovery rates (A) (%)	Utilization rates (B) (%)	Difference (A) – (B)
2002	65.4	59.6	5.8
2003	66.1	60.2	5.9
2004	68.5	60.4	8.1
2005	71.1	60.3	10.8
2006	72.4	60.6	11.8
2007	74.5	61.4	13.1
2008	75.1	61.8	13.4
2009	79.7	63.1	16.6
2010	78.2	62.5	15.7
2011	78.1	63.0	15.1

2) Exports of Recovered paper

Exports of recovered paper exceeded 1 million tons for the first time in 2001 and have been growing sharply ever since, reaching 4.433 million tons in 2011. The 2011 export volume was equivalent to 16.1% of domestic paper and paperboard consumption for the year, which stood at 27.62 million tons. Export demand is a significant factor underlying the high recovery rate.

The table 2 shows yearly export volumes for each year since 2001, both by weight and as a percentage of total paper and paperboard consumption for that year. The share in 2011 came to somewhat lift than in previous year.

Table 2 Trends in Recovered Paper Export

Year	Exported Recovered Paper ('000 tons)	As Share of Paper and Paperboard Consumption (%)
2002	1,897	6.2
2003	1,971	6.4
2004	2,835	9.1
2005	3,710	11.8
2006	3,887	12.3
2007	3,884	12.3
2008	3,491	11.5
2009	4,914	18.1
2010	4,374	15.7
2011	4,344	16.1

7 Importance of Paper Separation

1) Why Paper Is Separated

As indicated above, the most recently established target calls for a utilization rate of 64% by 2015. In fact, however, the current utilization rate of 63.0% appears to be close to an upper limit, and additional growth may be extremely difficult to attain. In particular, continued growth would require improvement in the rate achieved in the manufacture of printing & copier paper (where the current utilization rate remains low). But this would in turn require reliable supply of higher-grade recovered paper, as well as a significant increase in demand for recycled paper among both large-volume users including printing and publishing businesses and general consumers. The target is therefore a topic of considerable concern within the industry.

A noteworthy characteristic of paper recycling is that each type of paper tends to have its own specific destination: recovered newspapers are mainly turned into new newsprint; corrugated containers become input for new corrugated containers (cardboard boxes); magazines are turned into paper boxes; computer paper and copier paper are processed into new printing & copier paper; and so on. This in turn suggests how important it is to separate paper correctly at a source, and to remove *any prohibitive materials* that may interfere with subsequent processing. Such *prohibitive materials* include not only foreign matters such as metals and cloth, but also any paper that has plastic film or adhesive tape attached to it. The *prohibitive materials* refer to all non-paper materials as well as those paper materials that are unsuitable for paper recycling (Table 3).

Table 3 Troubles from Prohibitive Materials

Troubles in processing and production control	Troubles in product quality
<ul style="list-style-type: none"> ● Damage to facilities ● Increased burden for cleaning and maintenance because of clogged screens and dirt in places in the process (adhesive substances, etc.) ● Unusable for paper stock, increasing the amount of waste 	<ul style="list-style-type: none"> ● Poor appearance (dust, specks, glittering, holes, uneven surface, low whiteness level, poor color, etc.) ● Odor (other than paper odor) adherence

2) ***Recovered Paper Quality Standards***

The Paper Recycling Promotion Center’s Recovered Paper Quality Standards define two types of contaminants, types A and B, as outlined in Figure 6.

Type A contamination consists of prohibitive material (unattached non-paper objects) as well as any mixed-in material that may significantly interfere with new paper manufacture. Specifically, this category includes items such as: stones, metal, plastic, cloth, thermal foaming coated paper (paper that incorporates foam that expands in response to heat to generate a patterned surface), textile printing paper, perfumed paper and synthetic paper (writable paper-like film made from plastic). Type B contamination consists of material that should preferably be excluded from raw production material: items such as carbon paper, carbonless copy paper, laminated paper, adhesive tape, thermal paper.

Prohibitives ! (Items to be removed from recovered paper.)



Paper

Envelopes with adhered stickers, plastic-coated paper, wax paper, oiled paper, photos, synthetic paper, processed water-resistant paper, thermal paper (fax paper),

printing, etc), thermal foaming coated paper, carbon-backed paper, carbonless copy paper

Non-Paper

Adhesive tape, stickers, metal pieces on folders, metal clips, film, polystyrene foam, cell phone, plastic items, glass items, cloth, etc.



Figure 6 Prohibitive Materials

8 Recovered Paper Treatment Process

The basic treatment processes in recycling recovered paper into recovered pulp are: defibering, dust removal, dispersing, bleaching, deinking, washing and drainage. Because paperboard mills do not have to make pulp white, they usually do not have the ability to conduct the dispersing, bleaching, and deinking processes. In these processes, the following treatments are carried out.

1) Defibering

Recovered paper is thrown into water and stirred. Then recovered paper is defibered by kneading. At the same time, large foreign objects are removed. This is carried out in a device called a pulper (Figure 7).



Figure 7 Pulper

2) Dust removal

Foreign particles (dust) in recovered paper are removed by a cleaner and a screen (Figures 8,9,10). The cleaner uses centrifugal force to remove stones, sand, and metal that are heavier than the recovered fiber. The screen uses its slits or round holes to remove foreign objects that are larger than recovered fiber.

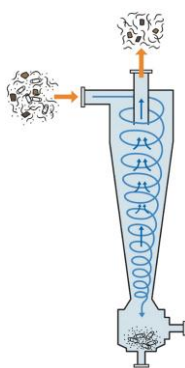


Figure 8 Cleaner

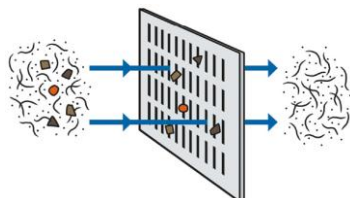


Figure 9 Screen A

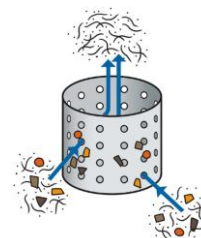


Figure 10 Screen B

3) Dispersing

By strongly kneading recovered fiber, the ink, adhesives, and other foreign objects are peeled off the recovered fiber. At the same time, these foreign objects are broken

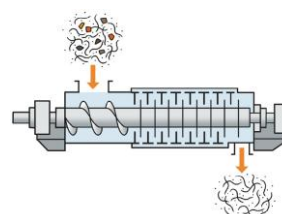


Figure 11 Kneader, Disperser

down to a size indiscernible to the naked eye and dispersed. This is carried out in a device called a kneader or a disperser (Figure 11).

4) *Deinking*

Detergent is added to the recovered fiber and air bubbles are blown in. These bubbles adhere to the ink and float. By removing these bubbles, the ink is removed. This is carried out in a device called a flotator (Figure 13).

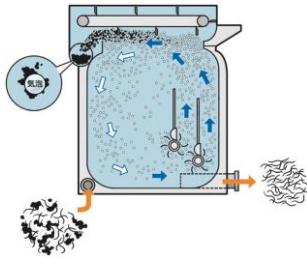


Figure 13 Flotator

5) *Bleaching*

Recovered fiber is turned white with a bleaching agent such as hydrogen peroxide (Figure 12).

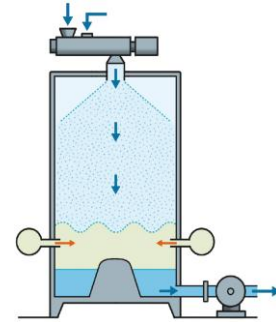


Figure 12 Bleaching Tower

6) *Washing and drainage*

By repeated rinsing and drainage, fine foreign objects are removed. This is carried out in a device called a washer (Figure 14).

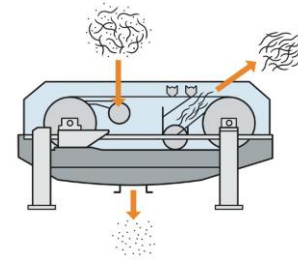


Figure 14 Washer

9 Supply and Quality of Recovered Paper

Since recovered paper is generated as waste at a wide variety of indeterminate sources and variable amounts and qualities, paper manufacturers may find it somewhat less reliable in terms of quality and supply than wood pulp, which is produced specifically for use as a raw material. For recovered paper to serve effectively as a raw material, the following conditions should hold.

- ① Recovered paper must be assembled into units suitable for delivery to and handling at the yard (Figure 15).
- ② Assembled units must offer uniform quality (must consist of the uniform grade).
- ③ It must be possible to maintain a stable quantity of supply (Table 4).



Figure 15 Pressed Recovered Paper

Reference: After recovered paper has been fully sorted, the recycler presses each type into units suitable for transport by truck to the paper mill. The unit size is approximately 1m (H)×1m (W)×1m (L). Each unit weighs approximately 1 ton.

Table 4 Supply and Quality Characteristics

Items	Characteristics
Supply	<ul style="list-style-type: none"> ● As the generated supply and the manufacturer demand both vary, supply and demand are subject to imbalance. ● Supply tends to peak in December and to drop to a low in January and February. ● Demand is affected by current production levels of paper and board products.
Quality	<ul style="list-style-type: none"> ● Initial separation at the collection source has an important impact on ultimate quality as a raw material. ● Subsequent rounds of sorting during the distribution stage are required to reach the quality required for use as a raw material.

~Paper Recycling Issues~

1 Paper Recycling Efforts by Local Authorities and Citizens

We do not have data showing separate recovery and utilization rates by residences, offices, local authorities, and the government. It is known, however, that the government and local authorities are making considerable progress in raising their recovery rates and their use of recovered-paper products.

For example, in a 2004 survey by the Paper Recycling Promotion Center, all responding prefectures and local authorities indicated that they were carrying out separate collection of recovered paper.

The Green Procurement Law passed in April 2003 obligates the government to use recovered-paper products, and obligates local authorities to make an effort to use such products. This in turn is expected to promote green purchasing among offices, residents, and others.

2 Paper Recycling and the Environmental Problems

Environmental issues, and in particular the appropriate handling of waste, are particularly important concerns in Japan. These issues merit attention and cooperation from all members of society. The country's Waste Management and Public Cleansing Law establishes a basis for developing measures for managing waste. While people have long known that recovered paper can be recycled, they are often less aware that inappropriate handling of such paper can turn it into waste. Accordingly, it is necessary to educate and gain cooperation from all paper users—residences, offices, industrial users, and so on. Effective recycling is also important in terms of protecting forest resources and reducing energy use. For this reason, the government and local authorities are tasked with developing systems, application technologies, and distribution methods that support effective recycling.

The relationship between paper recycling and the carbon dioxide it produces is a little complicated. Wood fiber is largely divided into mechanical pulp, which is made from wood chips by mechanical force, and chemical pulp, which is made using chemicals. Using recovered fiber, compared with using mechanical pulp, can reduce the total amount of carbon dioxide produced, which is the total of carbon dioxide from biomass fuel and carbon dioxide from fossil fuel, as well as the carbon dioxide from fossil fuel. However, a comparison with chemical pulp shows that while using recovered fiber produces less total carbon dioxide, chemical pulp produces less carbon dioxide from fossil fuel because black liquor can be used as energy from biomass. Black liquor's main ingredient is lignin, which is separated and extracted from wood chips with chemicals. Therefore, chemical pulp produces less carbon dioxide from fossil fuel than recovered fiber does. To avoid increasing carbon dioxide in the atmosphere, it is also important to try not to lose accumulated carbon storage in forests.

3 Recovered Paper vs. Wood Pulp

As the base for paper stock, there is wood fiber and recovered fiber. Recovered fiber is weakened each time paper is recycled. The use of wood fiber is effective to compensate for this weakening. For this reason as well it is necessary to use a certain amount of wood fiber as a raw material for paper and paperboard. However, which paper and paperboard products use wood fiber and how much of it to mix in should be considered carefully in terms of environmental implications as well as product quality. A good balance with the use of recovered fiber is desirable.

The wood chips used for pulp material are mostly from scrap wood from furniture and housing materials, or low-quality wood and thinning-out trees from natural or artificial forests. Therefore, even wood fiber is an effective use of forest resources.

4 Paper Recycling at the Office

1) Major challenges for paper recycling at the office

- ① Establishing a classification of recovered paper
While a standard classification of recovered paper at the office is: newsprints, magazines, corrugated container, copier paper, and others, some offices were found discharging different types of recovered paper together without separation.
- ② Copier paper and other paper
It was revealed that recovery rates are high for newsprints, magazines, and corrugated containers, but low for copier paper and other paper.
- ③ Recovered paper from small offices
The recovery rates for copier paper are low at offices with few employees.
- ④ Shredded paper recycling
If well separated, shredded paper can be treated as ordinary recovered paper, although there is some argument over its yield rate. However, if it is not well separated, shredded paper needs to be treated in a paper mill with facilities for treating difficult-to-defiberize-paper. Shredded paper also needs to be packed in bags and compressed for ease of transport, as well as storage space for simultaneous separate collection with other types of recovered paper.

2) Five points for good functioning of paper recycling in office building for tenants

- ① Active involvement of the manager of each office and the manager of the building in office paper recycling
- ② Efficient cooperation with collectors of office paper
- ③ Confirmation of office paper classification and separation method
- ④ Marketable paper quality by removal of foreign matters and separation
- ⑤ Identifying the end products and users

3) Five points for successful paper recycling in an office building

- ① Keeping employees interested through appropriate PR and notices
- ② Placing attractive collection containers
- ③ Securing a storage space and convenient location
- ④ Exchanging opinions about the state of recycling program (performance, outcome, etc.) on a regular basis
- ⑤ Clarifying the roles of the building manager, janitors, tenants, and collector

5 Legal Framework for Paper Recycling

Since the 1991 establishment of the Law for the Promotion of Utilization of Recycled Resources, we have seen ongoing efforts to reduce waste and to promote recycling. These efforts and experiences have gradually led to a more uniform and comprehensive policy, and to the development of our current legal framework as outlined Figure 16. There are now broad-based efforts underway to pursue the 3 Rs (reduction, reuse, and recycling).

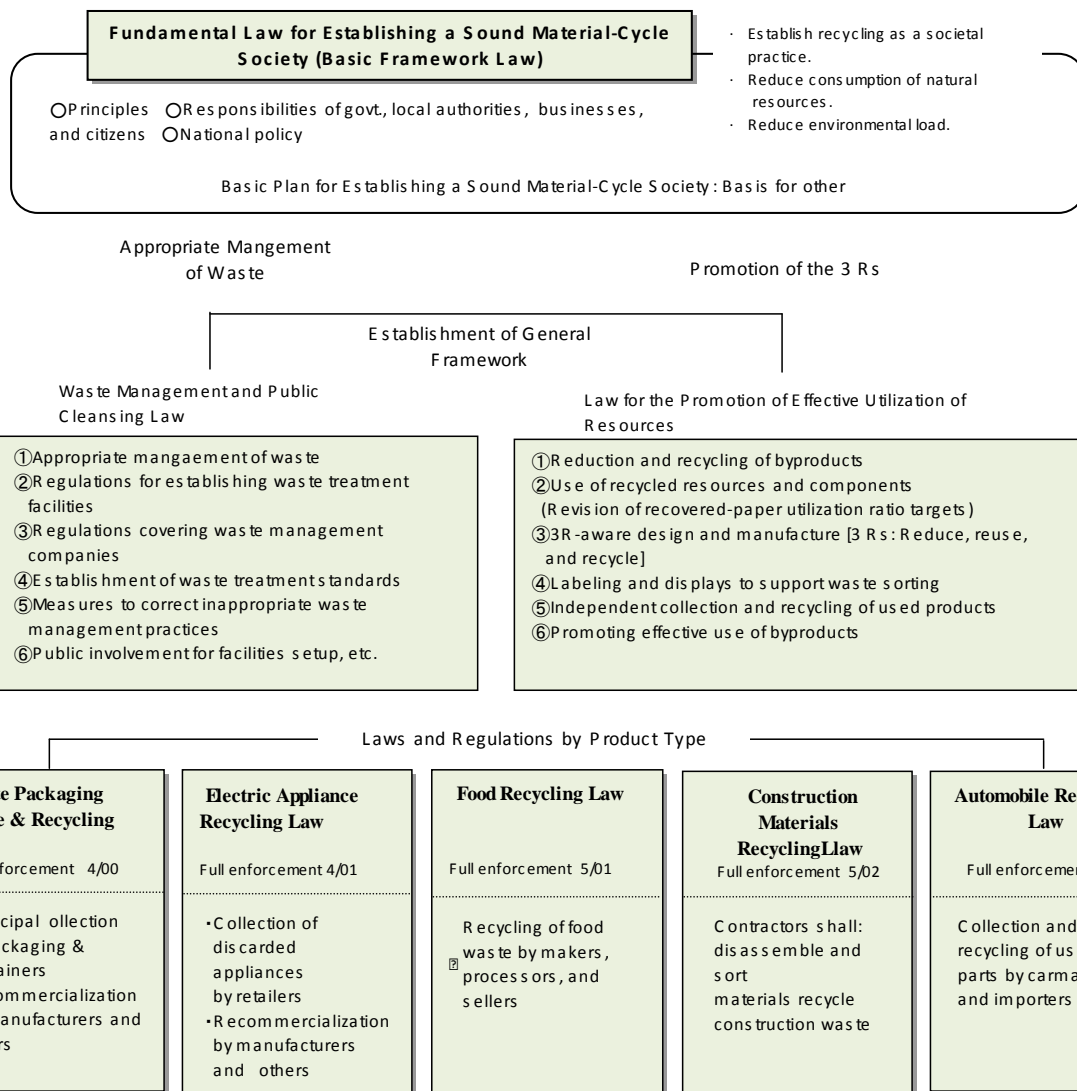


Figure 16 Legal Framework for Paper Recycling

Selected References

- 1 Paper Recycling Promotion Center, *Survey Report on Recovered Paper Use and Environmental Impact*, March 2001.
- 2 Paper Recycling Promotion Center, *The 2010 Handbook of Recovered Paper*, March 2011.
- 3 Ministry of Economy, Trade and Industry, “Revision in recovered paper utilization rate targets with respect to the paper manufacturing industry”; public commentary, Feb. 2011.
- 4 Ministry of Economy, Trade and Industry, “Monthly statistics for paper, print, plastic, and rubber products.”
- 5 Ministry of Finance, “Monthly trade report.”

Appendix

Grouping and Major Grades of Recovered Paper

Paper Recycling Promotion Center
 Enacted: March 1979
 Revised: June 5, 2000
 Revised: Sept. 30, 2004
 Revised: Sept. 29, 2008
 Revised: April 22, 2010

Statistical Group	No.	Grade	Description
Hard white shavings; cards	1	White shavings	Shavings or sheets of white unprinted wood-free paper collected from bookbinders, printers, and sheet cutting facilities
	2	Cream shavings	Shavings or sheets of cream-colored unprinted wood-free paper collected from bookbinders, printers, and sheet cutting facilities.
	3	Ruled-paper shavings	Shavings or sheets of white or cream-colored unprinted wood-free paper with red or blue ruling or register marks, collected from bookbinders, printers, and sheet cutting facilities.
White woody shavings; white manila	4	High-grade white wood-containing shavings	Shavings or sheets of white unprinted high-grade wood-containing paper collected from bookbinders, printers, and sheet cutting facilities.
	5	White wood-containing shavings	Shavings or sheets of white unprinted groundwood paper collected from bookbinders, printers, and newspaper printing plants.
Fine printed paper	6	White ledger	White wood-free paper printed with black ink.
	7	Color ledger	White wood-free uncoated or coated paper printed in color.
	8	Wood-free shavings with partial color print	Shavings of white uncoated or coated wood-free paper, some of which is color printed, collected from bookbinders and printers.
	9	Coated white shavings	Shavings or sheets of unprinted coated paper collected from bookbinders and printers.
	10	Fliers	high-grade wood-containing white paper, etc.
	11	Polycoated milk carton stock	Washed used household polycoated beverage cartons, and shavings and sheets of industrially generated polycoated milk carton board, with no aluminum content.
Woody printed paper	12	Sorted office paper	Paper and paper products from offices, consisting primarily of loose black-printed or color-printed paper and copier paper
	13	High-grade color-printed wood-containing shavings	Shavings of high-grade wood-containing white paper printed in various colors, collected from bookbinders and printers.
	14	Color-printed wood-containing shavings	Shavings of groundwood paper printed in various colors, collected from bookbinders and printers.
Old newsprint	15	High-grade wood-containing waste	Sheets of high-grade wood-containing paper, black-printed or color-printed, and groundwood paper collected from bookbinders and printers.
	16	Old newsprint	Old newspapers and Inserts collected from residences, companies, public offices, etc.
Old magazines	17	Old magazines	Old magazines, old books, returned books, remaindered books, and pamphlets collected from residences, companies, public offices, etc.
Kraft browns	18	New brown kraft cuttings, unprinted brown kraft	Cuttings and sheets of unprinted brown kraft paper collected from kraft paper sack factories.
	19	Used brown kraft sacks	Used brown kraft sacks for rice, wheat, etc.
	20	Kraft lined corrugated container	Kraft corrugated cuttings and old kraft corrugated containers. (Comprised mainly of imports.)
Old corrugated containers	21	Corrugated container	Old corrugated containers collected from offices, residences, etc.
	22	New Double-lined kraft corrugated cuttings	New corrugated cuttings and sheets from packaging products factories.
Boxboard cuttings	23	Mill wrapper	Used wrapping for paper and paperboard
	24	White paperboard cuttings	Cuttings and die cuttings of white paperboard, chipboard, etc. collected from carton makers.
	25	Chipboard cuttings (Carton)	Old cartons from offices, etc.
	26	Sorted residential old paper and paperboard	Paper, paperboard, and products thereof, collected from residences, exclusive of (separated from) old newsprint, old magazines, old corrugated containers and milk cartons.

Guidelines for sorted residential old paper and paperboard, and sorted office paper

Paper Recycling Promotion Center

Enacted: May 25, 2005

Revised: Feb 22, 2010

Overview

These standards present information essential to proper separation of recovered paper falling into the categories of *sorted residential old paper and paperboard*, and *sorted office paper*. It is assumed that issues not covered herein shall be worked out through mutual agreement of generator and collector.

1 Sorted residential old paper and paperboard

(1) Content

Sorted residential old paper and paperboard denotes paper and paperboard, and products thereof, discarded by residences, and not separable into categories of newsprint (inclusive of newspaper insert leaflets), magazines, corrugated container, and beverage packaging. In general, *Sorted residential old paper and paperboard* consists of items such as discarded loose fliers, pamphlets, copier paper, wrapping paper, paper bags, and paper boxes.

(2) Items not to be included in sorted residential old paper and paperboard

- Processed water-resistant paper (paper cups, paper plates, paper instant-ramen containers, paper yogurt containers, oiled paper, wax paper, etc.)
- Carbon paper, carbonless paper (delivery service forms, etc.)
- Sealed (confidential) postcards
- Thermal paper (fax paper, receipts, etc.)
- Photo print paper; inkjet photo printing sheets; photosensitive paper (cyanotype copy paper)
- Paper compounded with plastic film, aluminum leaf, etc.
- Paper covered with metallic (gold, silver, etc.) leaf
- Perfumed paper (individual soap wrappers, paper detergent containers, paper incense boxes, etc.)
- Dye-sublimation paper (textile printing paper, mainly paper that is heated to print a design on fabric)
- Thermal foaming coated paper (where heat causes paper to rise; mainly used for printing of Braille)
- Synthetic paper (technically not “paper,” as it is made of plastic)
- Paper that has had oil or water spilled on it; used tissues and paper towels; food-stained paper: etc.
- Any other paper that is unsuitable for use as raw material for new paper manufacture

(3) Steps to take prior to discarding sorted residential old paper and paperboard

- Remove any attached stickers before discarding postcards and envelopes.
- Remove any attached plastic film before discarding paper (for example, plastic film at outlet of tissue boxes and over address windows of envelopes).
- Where plastic film is adhered to the cover of a magazine, remove the corresponding part of the cover before discarding the magazine.
- Remove all metal and plastic before discarding folders, binders, etc.
- Remove all adhesive tape from paper and paper boxes.

(4) Tying sorted residential old paper and paperboard for disposal

Paper and paperboard should be arranged into groups according to size (with small items set into paper bags), and groupings tied crosswise with paper cord or similar material.

2 Sorted Office Paper

(1) Content

Office paper denotes paper and paper products from offices, consisting principally of loose black-printed and color-printed matter and copier paper. In general, the term refers to discarded office items such as copier paper, paper slips, business cards, envelopes, wrapping paper, and paper bags.

(2) Items not to be included in sorted office paper

- Processed water-resistant paper (paper cups, paper plates, paper instant-ramen containers, paper yogurt containers, oiled paper, wax paper, etc.)
- Carbon paper, carbonless paper (delivery service forms, etc.)
- Sealed (confidential) postcards
- Thermal paper (fax paper, receipts, etc.)
- Photo print paper; inkjet photo printing sheets; photosensitive paper (cyanotype copier paper)
- Paper compounded with plastic film, aluminum leaf, etc.
- Paper covered with metallic (gold, silver, etc.) leaf
- Perfumed paper (individual soap wrapper, paper detergent containers, paper incense boxes, etc.)
- Dye-sublimation paper (textile printing paper, mainly paper that is heated to print a design on fabric)
- Thermal foaming coated paper (where heat causes paper to rise; mainly used for printing of Braille)
- Synthetic paper (technically not “paper,” as it is made of plastic)
- Paper that has had oil or water spilled on it; used tissues and paper towels; food-stained paper; etc.
- Any other paper that is unsuitable for use as raw material for new paper manufacture

(3) Steps to take prior to discarding sorted office paper

- Remove any attached stickers before discarding postcards and envelopes.
- Remove any attached plastic film before discarding paper (for example, plastic film at outlet of tissue boxes and over address windows of envelopes).
- Where plastic film is adhered to the cover of a magazine, remove the corresponding part of the cover before discarding the magazine.
- Remove all metal and plastic before discarding folders, binders, etc.
- Remove all adhesive tape from paper and paper boxes.

(4) Tying sorted office paper for disposal

Paper and paperboard should be arranged into groups according to size, and groupings tied crosswise with paper cord or similar material.

(5) Handling of paper that has been through a shredder

Handling of shredded paper shall be decided through mutual agreement of generator and collector.

Production and consumption/recovery volume and utilization volume

1 Trends in paper and paperboard production

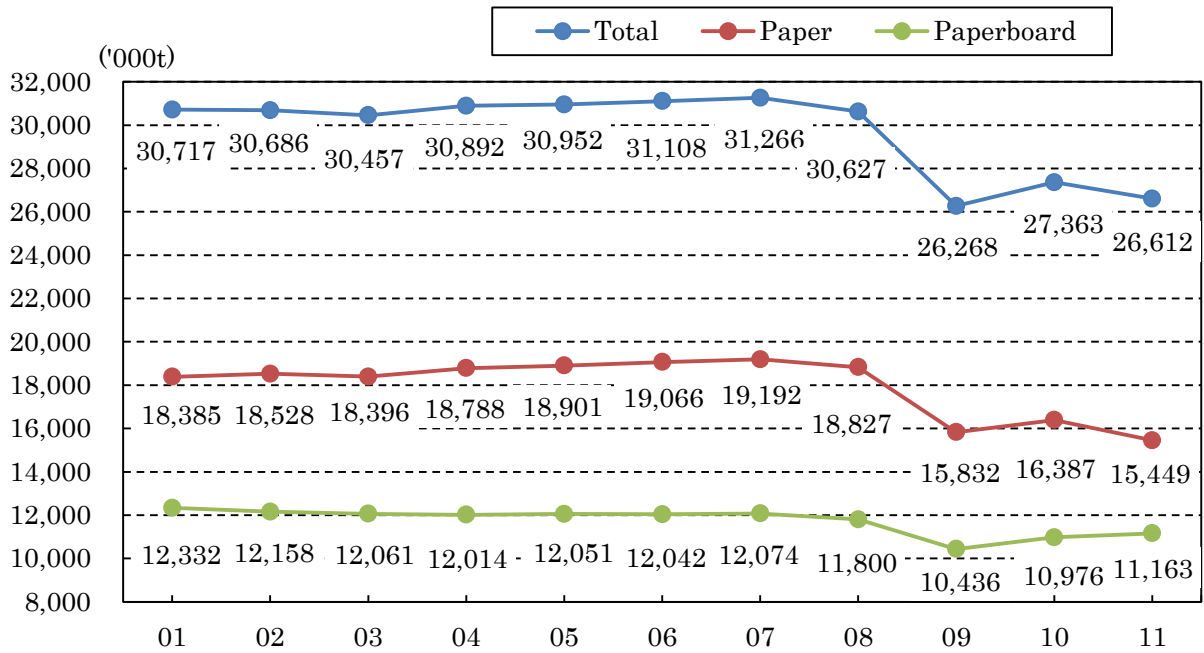


Figure A1 Trends in paper and paperboard production

Source: Monthly statistics for paper, print, plastic, and rubber products

Table A1 Paper and paperboard production by grades

('000 ton; %)

Grades	2008		2009		2010		2011	
	Production	'08/07	Production	'09/08	Production	'10/09	Production	'11/10
Newsprint	3,680	96.8	3,455	93.9	3,349	96.9	3,205	94.3
Printing and writing	11,502	98.6	9,120	79.3	9,547	104.7	8,772	91.9
Packaging	1,010	101.6	786	77.8	904	115.0	901	91.6
Sanitary	1,805	102.0	1,776	98.4	1,793	101.0	1,782	99.4
Others	828	86.1	659	83.6	794	114.2	790	99.4
Paper total	18,826	98.1	15,832	84.1	16,387	103.5	15,449	94.3
Corrugated fiber	9,219	97.8	8,223	89.2	8,647	105.3	8,811	101.9
Box board	1,819	101.0	1,637	90.0	1,673	102.2	1,696	101.4
Others	762	89.7	587	77.0	655	111.6	656	100.1
Paperboard total	11,800	97.7	10,447	88.5	10,976	105.2	11,163	101.7
Total	30,625	98.0	26,279	85.8	27,363	104.2	26,612	97.3

2 Trends in consumption of recovered paper and wood pulp

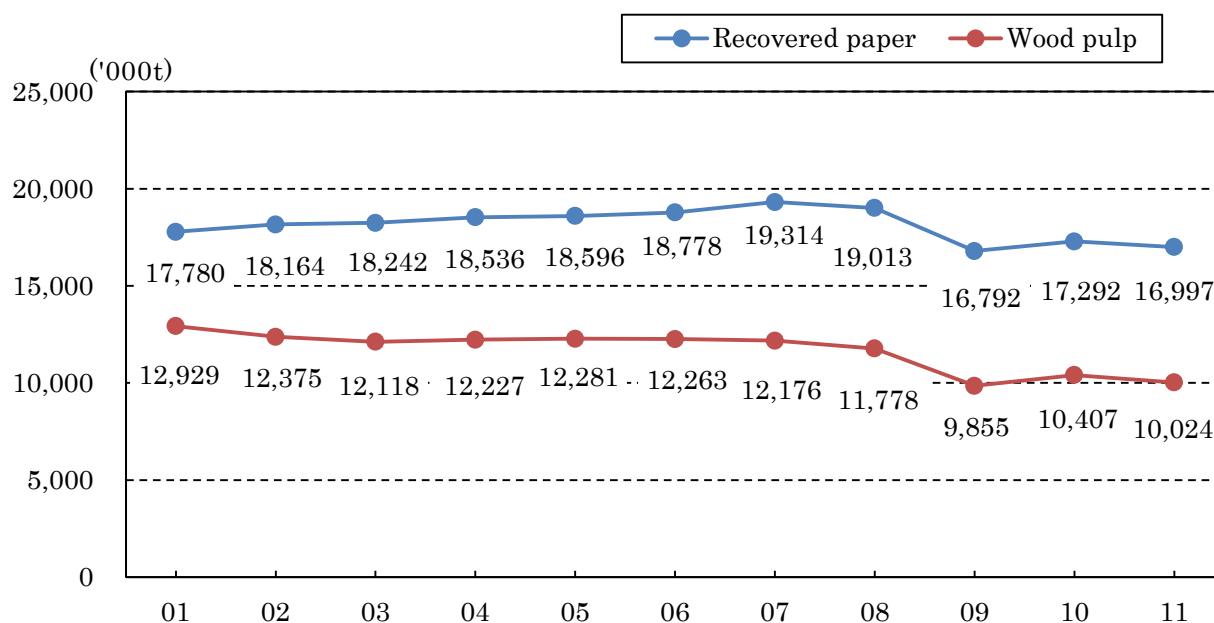


Figure A2 Trends in consumption of recovered paper and wood pulp

Source: Monthly statistics for paper, print, plastic, and rubber products

Table A2 Consumption of recovered paper by grades and wood pulp

('000 ton; %)

Grades	2008		2009		2010		2011	
	Production	'08/07	Production	'09/08	Production	'10/09	Production	'11/10
Newsprint	4,945	97.4	4,473	90.4	4,386	98.3	3,965	90.4
Magazines	2,562	100.4	2,328	91.0	2,298	98.8	2,234	97.2
Corrugated containers	8,479	98.7	7,341	86.6	7,903	107.7	8,090	102.4
Other grades	3,021	97.8	2,650	87.6	2,705	95.2	2,563	94.8
Recovered paper total	19,007	98.4	16,792	88.3	17,292	103.0	16,977	98.2
Pulp total	11,775	96.7	9,886	83.9	10,408	105.6	10,024	96.3

3 Trends in import and export of paper and paperboard

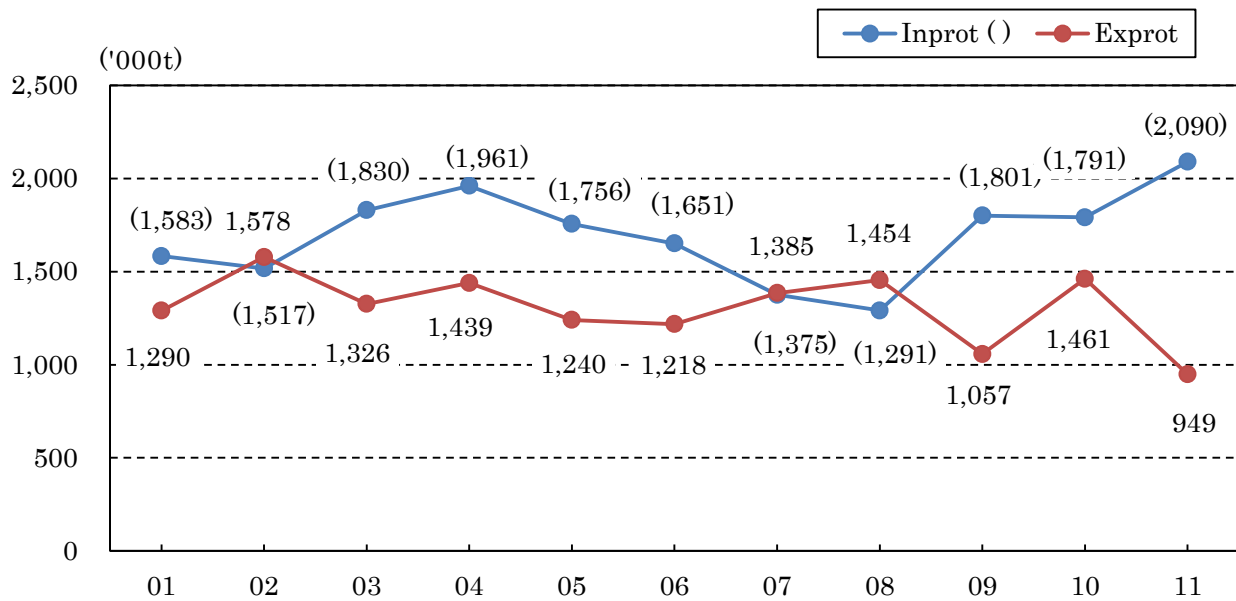


Figure A3 Trends in import and export of paper and paperboard

Source: Monthly trade report

Table A3 Import of paper and paperboard

('000 ton; %)

Years \ Grades	2008		2009		2010		2011	
	Volume	'08/07	Volume	'09/08	Volume	'10/09	Volume	'11/10
Paper	942	93.5	1,430	151.8	1,396	97.6	1,737	124.4
Paperboard	348	94.8	373	106.9	395	106.5	353	89.4
Total	1,290	93.8	1,803	139.7	1,793	99.6	2,091	116.6

Table A4 Export of paper and paperboard

('000 ton; %)

Years \ Grades	2007		2008		2010		2011	
	Volume	'08/07	Volume	'09/08	Volume	'10/09	Volume	'11/10
Paper	1,294	106.4	992	76.7	1,346	135.6	831	61.8
Paperboard	160	94.7	65	40.6	116	178.4	117	101.6
Total	1,454	105.0	1,057	72.7	1,462	138.3	949	69.4

4 Trends in import and export of recovered paper

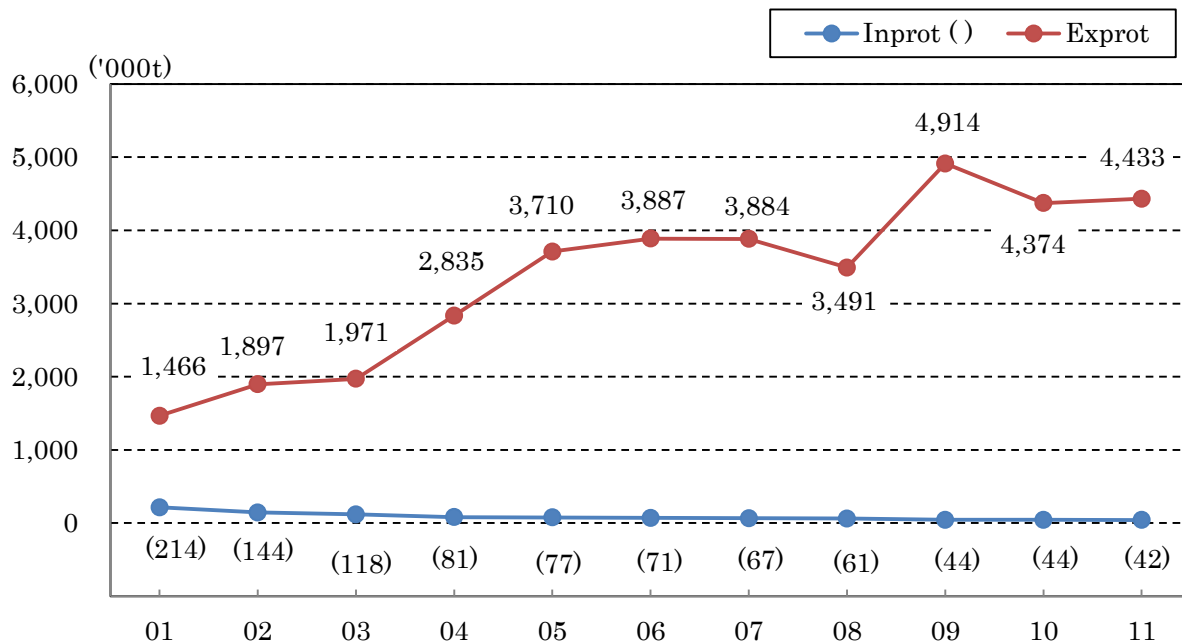


Figure A4 Trends in import and export of Recovered paper

Source: Monthly trade report

Table A5 Import of recovered paper by grades

(‘000 ton; %)

Grades	2008		2009		2010		2011	
	Volume	‘08/07	Volume	‘09/08	Volume	‘10/09	Volume	‘11/10
OCC and Kraft	37	84.1	30	81.1	29	96.7	24	82.8
ONP	6	200.0	0	4.6	0	1.7	0	4020.0
Others	18	90.0	14	77.8	14	107.7	18	128.6
Total	61	91.0	44	72.1	44	100.0	44	95.5

Notes: OCC; Old corrugated containers, ONP; Old newsprints

Table A6 Export of recovered paper by grades

(‘000 ton; %)

Grades	2008		2009		2010		2011	
	Volume	‘08/07	Volume	‘09/08	Volume	‘10/09	Volume	‘11/10
OCC and Kraft	1,599	96.1	2,450	153.2	2,213	90.4	1,938	87.5
ONP and OMG	1,270	88.0	1,714	135.0	1,499	87.5	1,794	121.5
Others	622	84.4	750	120.6	563	75.1	700	124.4
Total	3,491	90.8	4,914	140.8	4,374	89.0	4,433	101.3

Notes: OMG; Old magazines

Table A7 Export of recovered paper by countries

(‘000 ton; %)

Grades	2008		2009		2010		2011	
	Volume	‘08/07	Volume	‘09/08	Volume	‘10/09	Volume	‘11/10
China	2,925	92.3	4,191	143.3	3,489	83.2	3,368	96.5
Thailand	238	85.3	362	152.1	440	121.5	402	91.4
Taiwan	100	56.8	123	123.0	128	104.1	188	146.9
South Korea	130	154.8	86	66.2	100	116.3	216	216.0
Others	98	72.6	152	155.1	217	142.8	258	119.4
Total	3,491	90.8	4,194	140.8	4,374	89.0	4,433	101.3

5 Trends in recovery rate and utilization of recovered paper

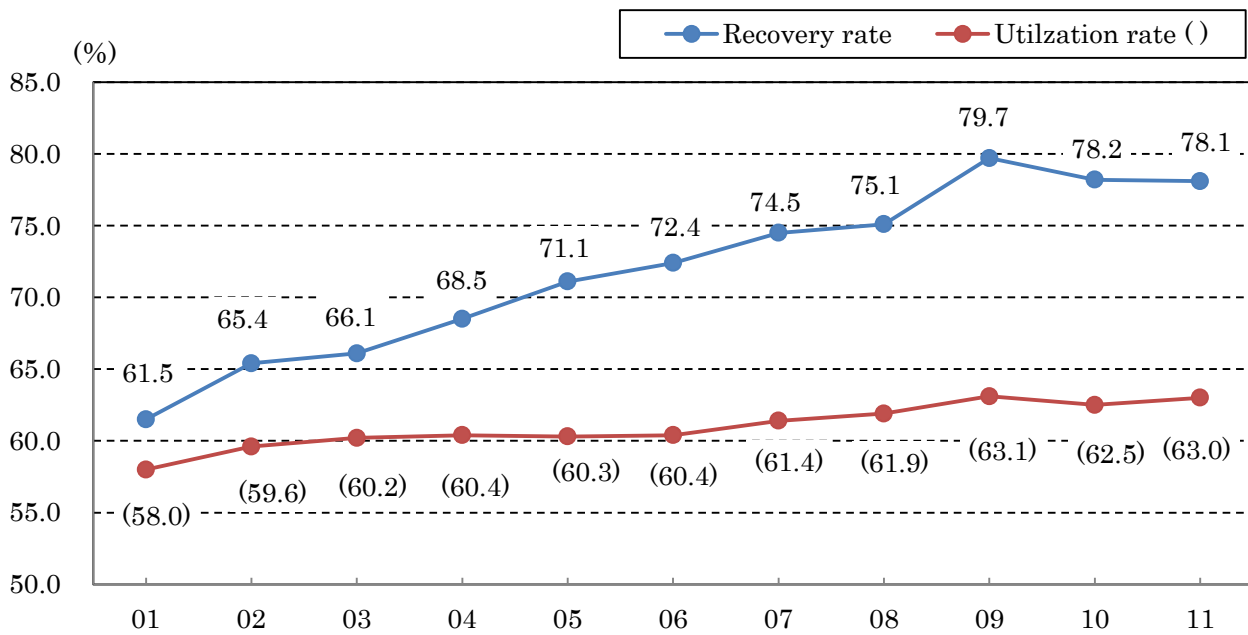


Figure A5 Trends in recovery rate and utilization rate of recovered paper

Source: Monthly statistics for paper, print, plastic, and rubber products

Table A8 Utilization rate of recovered paper by grades

		(%)									
Grades \ Years	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Paper	33.8	36.2	36.5	37.1	37.5	38.1	40.1	40.5	42.1	42.5	39.5
Paperboard	90.3	91.1	92.3	92.4	92.6	92.7	92.4	92.8	92.5	92.8	92.8
Total	58.0	59.6	60.2	60.4	60.3	60.6	61.4	61.8	63.0	62.5	63.0

Table A9 Recovery rate of recovered paper by grades

		(%)									
Grades \ Years	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
OCC and Kraft	86.6	91.9	94.2	97.3	100.8	102.1	103.0	103.7	110.8	109.0	108.3
ONP	126.9	128.2	134.2	140.4	141.9	145.3	149.9	147.2	149.8	146.0	144.1
Others	33.1	36.6	35.7	37.0	39.4	40.4	41.7	38.0	45.4	44.5	45.5
Total	61.5	65.4	66.1	68.5	71.1	72.4	74.5	75.1	79.7	78.2	78.1