

Recycling as an industry

Reclamation is a big business—\$8 billion/yr—but in spite of its potential there are many real problems, such as those encountered in the recycling of paper and copper



Recycling, a word that just a few years ago was almost unknown, is now a household word. Yet, how well is it understood? What is recycling? What makes it tick? Is it something new? Is recycling just a matter of starting a "recycling center" and collecting a lot of cans, paper, and bottles? What are the economic factors that control recycling, and how can they be changed to maximize recycling?

If we are to be realistic—and if we wish to deal effectively with the solid waste problem today, considering the affluence and sophistication of our society—then the following premises should be understood. First, there always has been and always will be a solid waste problem. Even on the trips to the moon, solid waste, recycling, and disposal are critical areas. In the last few years, the magnitude of the solid waste problem has grown exponentially as a direct result of our affluent throw-away culture.

Second, recycling represents a two-pronged approach to this mountain of solid waste; it conserves natural resources, and it reduces the quantity of material to be disposed. Burning and burying should occur only after every effort has been exerted for recycling.

Finally, and probably most important, recycling will occur only when economic conditions are justified. In recycling as in any other major industry, the profit motive is a prime factor. Supply and demand must be balanced. If there is an oversupply of material, the price spirals downward, reducing the incentive on an industrywide base to supply material. Make no mistake about it; recycling is a major industry—an \$8 billion industry.

The recycling industry

The recycling industry is more than 100 years old and consists of thousands of companies processing and handling a multitude of materials. These com-

panies are usually located in the industrial centers of the country, close to their sources of supply. In fact, almost 30% of the recycling industry is located in the Middle Atlantic States (New York, New Jersey, and Pennsylvania).

To understand the recycling industry, actual flow of materials in a plant and movement of scrap from source to consumer should be analyzed. At the collection source, a vast flow of scrap materials from industry, government, farms, railroads, shipyards, etc., moves to either small scrap firms, where basic sorting and segregating is undertaken before transfer to larger scrap plants, or is shipped immediately to larger plants. The variation in the amount of recycled materials varies from 0 to almost 100% (Table 1).

At the scrap plant, material is identified, sorted into different grades, and processed (cleaned, cut, sheared, and packed by either being baled, bundled,

or briquetted) for shipping to intermediate consumers. These intermediate consumers include secondary smelters, brass and ingot manufacturers, refiners, brass mills, foundries, etc. From this point, the secondary product made from scrap goes to fabricators, manufacturers, converters, etc., or is exported.

With some variation, this is the flow of nonferrous scrap metals as well as wastepaper or paperstock. In handling most material, there are collection, sorting, cleaning, sizing and packaging, or baling operations.

NASMI/EPA study

In response to numerous requests for information and data on the secondary materials industry, a study on the industry was authorized by the federal Environmental Protection Agency (EPA). This study, released in June, consists of nine volumes and over 1000 pages of text and charts, and was done under the direction of the National Association of Secondary Material Industries, Inc. (NASMI) by the Battelle Memorial Institute. Funded jointly by NASMI and EPA, the study covers general solid waste utilization and recycling problems and focuses on such principal recycled commodities as copper and brass, aluminum, lead, zinc, nickel alloys and stainless steel, precious metals, paper, and textiles.

Statistical tables in the study delineate the availability of various recycled materials, their flow through the industrial cycle, and the tonnages which eventually return to the economic mainstream. The report points out losses of recoverable secondary materials, analyzes the losses, and indicates moves to raise levels of recyclability. Thus, the NASMI study gives a definitive picture of recycling by the secondary materials industry, commodity by commodity, and relates these activities to the general economy and the basic industries these materials serve. A total biography and history of the recycling industry in the U.S. is developed by including such diverse factors as flow of scrap, employment factors in the industry, and geographic spread of secondary materials companies.

The NASMI study for EPA required intensive research on the part of Battelle,

the Conference Board, the NASMI staff, and a 40-man industry advisory group for a year and a half. It initiated responses from hundreds of generators, processors, and consumers of all types of recycled materials as well as government agencies.

An extensive survey of the secondary industry, conducted as part of the study, discloses that the average recycling company (one engaged in the collection, processing, conversion, and sale of the selected solid waste materials) is a substantial operation. As shown in Table 2, average annual sales exceed \$7.5 million, and the average company employs 71 persons. Almost 10% of the dealer/processors have more than 150 employees; almost 31% of industry have more than 50,000 ft² of plant under roof; and over 15% have more than \$2 million invested in plant and equipment.

The huge tonnage of material currently being recycled is shown in Figure 1. Perhaps of greater importance is the tonnage still available for recycling. Only 14% of the available zinc is recycled—more than 1,000,000 tons to go to dumps. Paper (19%) and textiles (17%) show minimal recycling. The problem now is how to increase these recycling rates.

Copper

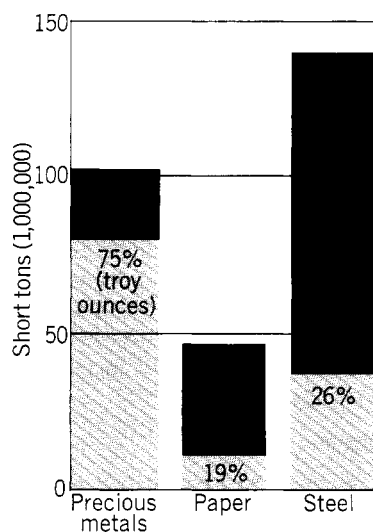
To truly understand the secondary materials industry, one must understand each component of the industry. The recycling or secondary materials industry really consists of a multitude of different industries. For example, the secondary zinc industry is very different from secondary textile industry. The federal EPA, in its publication, "Solid Waste Processing," lists some 109 items as "major waste categories." In the

TABLE 1
Types of recyclable materials

Material type	Examples	Condition of scrap	Recycle rate, %
Manufacturing residues	Drosses, slags, skimmings	25-75% recoverable	Over 75
Manufacturing trimmings	Machining wastes, blanking and stamping trimmings, casting wastes	90% recoverable	Nearly 100
Manufacturing overruns	Obsolete new parts, extra parts	Variable compositions	Nearly 100
Manufacturing composite wastes	Galvanized trimmings, blended textile trimmings, coated paper wastes	Often not all constituents are recovered	0-100
Flue dusts	Brass mill dust, steel furnace dust	Often not economical to recover	Under 25
Chemical wastes	Spent plating solutions; processing plant sludges, residues, and sewage	Often recoverable	Under 10
Old "pure" scrap	Cotton rags, copper tubing	Over 90% recoverable material	Over 75
Old composite scrap	Irony die castings, auto radiators, paper-base laminates	Often not economical to recover valuable materials	0-100
Old mixed scrap	Auto hulks, appliances, storage batteries	Not all materials are recovered	Under 50
Solid wastes	Municipal refuse, industrial trash, demolition debris	Very low recovery rates now	Under 1

Figure 1

Recoverable material resources currently recycled



Based on Battelle Memorial Institute statistics and estimates

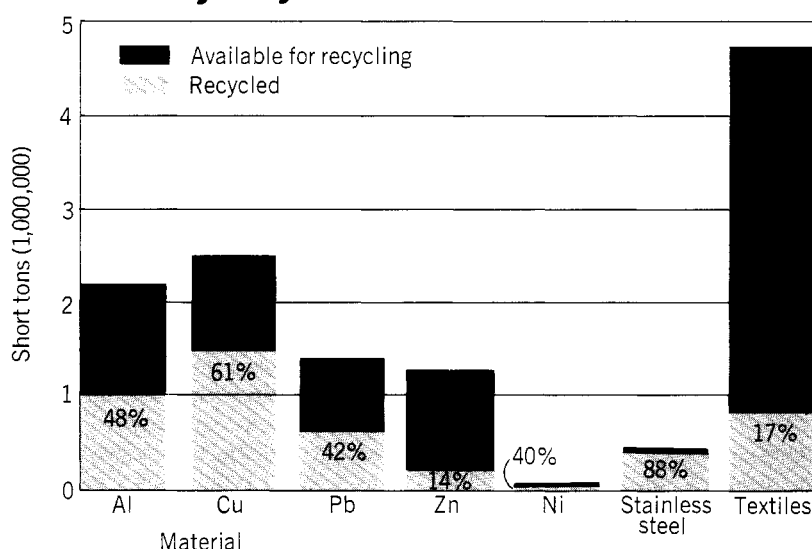


TABLE 2

Recycling industry companies

Average annual sales	\$7,540,000
Average number of employees	71
Average value of plant and equipment	\$1,480,000
Average investment per employee	20,800
Average annual sales per employee	106,000
Average investment per dollar of sales	5 cents

TABLE 3

Less than one fourth of paper consumed is recycled (million tons) 1969

	News-papers	Container-board	Pulp substitutes and mixed papers	Permanent end use	Total U.S. consumption of paper and paperboard
Total paper consumed	9,800	15,000	22,500	10,000	58,200
Paper recycled	2,400	3,900	5,100	...	11,400
% Recycled	24	24	23	0	19
Paper not recycled	7,400	12,000	17,400	10,000	46,800
% Not recycled	76	76	77	100	81

NASMI study, 14 different materials were covered in detail. Here, two of those materials, copper and paper, are examined as examples of how the industry works, what the flow of material is, and what some of the problems are.

The importance of the U.S. copper recycling industry is reflected in the fact that almost as much copper (Figure 2), 1,375,000 short tons (2000 lb/ton), comes from recycled sources as comes from domestic ores, 1,469,000 short tons. At the present time, products made with secondary copper or primary copper are used interchangeably. Recycled copper accounts for 42% of the total copper consumed in the U.S.

Although 1,489,000 tons of copper were recycled in 1969, still some 966,400 tons were not recycled (Figure 3). Although available for recycling, 151,000 tons of copper wire, 144,500 tons of

magnet wire, 76,700 tons of cartridge brass, 496,500 tons of other brass, and 153,000 tons of miscellaneous copper are not recycled.

Since copper has such a high intrinsic value, it is rather startling to learn that there is still so much copper available for recycling. Copper wire, a product highly sought by most scrap dealers, still has a way to go before it is 100% recycled. Since 18% of the available copper wire is not recycled, this appears to be one promising area where recycling can be increased.

Magnetic wire, a material used for the windings in motors and generators, is only 9% recycled. Battelle points out that it is now uneconomical to recycle all of this material since "the most common motors contain small amounts of copper individually but large amounts in aggregate." In addition, copper windings

are generally surrounded by iron which makes simple recovery difficult.

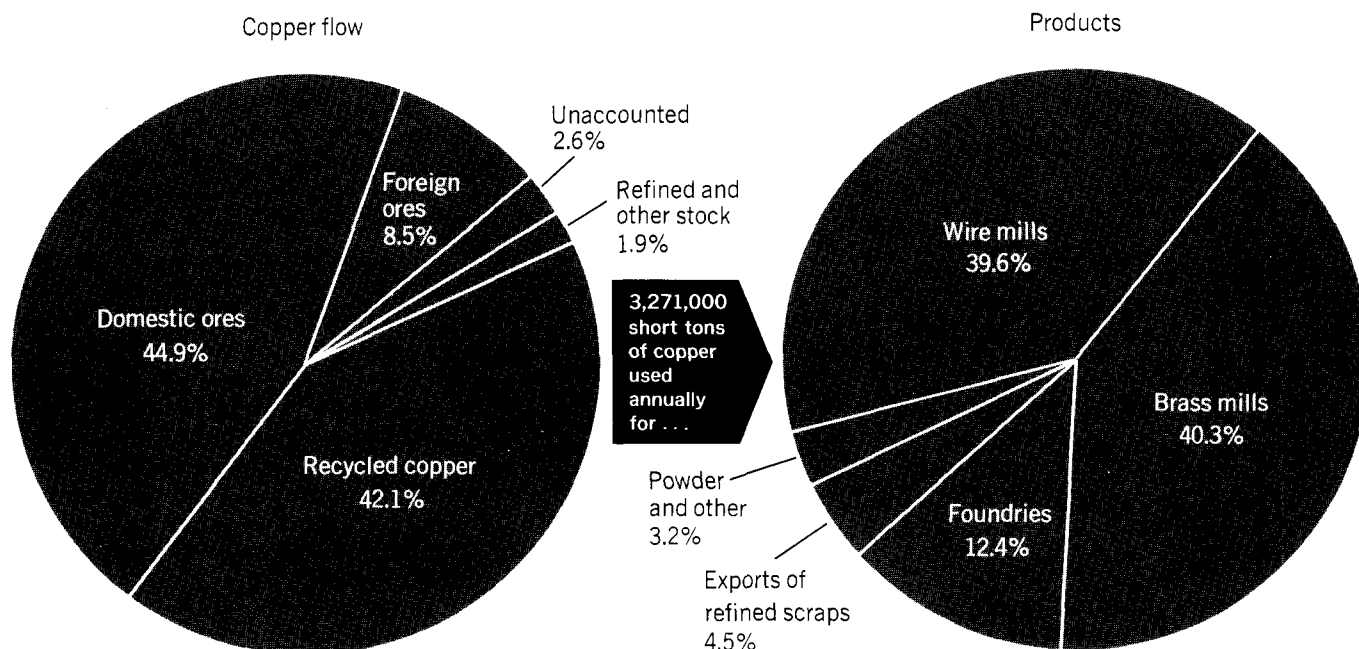
A total of 529,000 short tons of copper in brass products (40% of the available brass) is lost to use each year. Some of this is cartridge brass that is uneconomical to recycle, and the remaining includes valves, tubing, and miscellaneous brass items. Battelle suggests that many more statistics must be gathered before an accurate analysis of the problem can be made. This may be true, and more statistical data are always helpful; however, 39% of the copper that should be recycled is not and probably adds to the solid waste problem.

Paper

Recycling is both collecting and utilizing waste material. Paper recycling, more than any other material, starts with utilization. All too often col-

Figure 2

42% of copper flow recycled in 1969



lection drives for paper take place, large quantities of paper are collected, and the collected paper, with no commercial market, is dumped or incinerated.

The economics of the paper industry require that markets for paper containing recycled fibers must be available before it is collected. For most grades of paper, paper containing recycled fiber is competitive in both price and quality. Specifications for most paper being used by the U.S. government are now being changed and now require some recycled fiber content.

Of the yearly consumption of 58 million tons of paper, only 11 million tons were recycled, leaving over 47 million tons for disposal (Table 3). In its 1969 report, one of the stated goals of the Ad Hoc Committee of Solid Waste Management of the National Academy of Sciences/National Academy of Engineering is that, of the projected 50 million ton increase in paper production expected by 1985, 50% be recycled. It is further stated that "there are no major technological limitations to the reuse of newsprint and paperboard." The dollar saving on disposal costs alone of this 25 million tons of recycled paper will amount to approximately \$200 million per year. In addition, "the saving would be equivalent to 31 million cords of wood—more than two and one-half times the present total annual production of the four leading states—Georgia, Washington, Alabama, and Florida. Even by including the 25-million ton increase in recycling, the

projected 1985 production will require an additional 55 million acres of forest lands. The potentials are staggering, and the national benefit to risk payoff is many thousands. This is in addition to reducing the waste load in the selected areas by perhaps as much as 25%."

The major portion of the paper stock consumed (70.5%) goes into container-board products (Table 4). The smallest percentage goes into newsprint (3.2%); during 1969, 9,800,000 tons of paper were used to make newsprint, but of this total only 36,000 tons of it was recycled fiber.

Major problems of the paper recycling industry brought out in the

Battelle study were the declining demand for products made with paper-stock and the lack of tax incentives to equal those provided the virgin industries. Some solutions suggested by Battelle to combat these problems are:

- conduct technical research to improve paper, paperboard, and converted products made from paper stock
- develop strategies and educational programs to increase acceptance of, and remove stigma from, products made of paper stock
- push for nondiscriminatory purchase specifications from government agencies and others

Figure 3

61% of total available copper is recycled

2455.7 short tons total

Recycled
1489.3 short tons

Not recycled
966.4 short tons

2.4% Miscellaneous

0% Additives

.5% Magnet wire

5.2% Cartridge brass

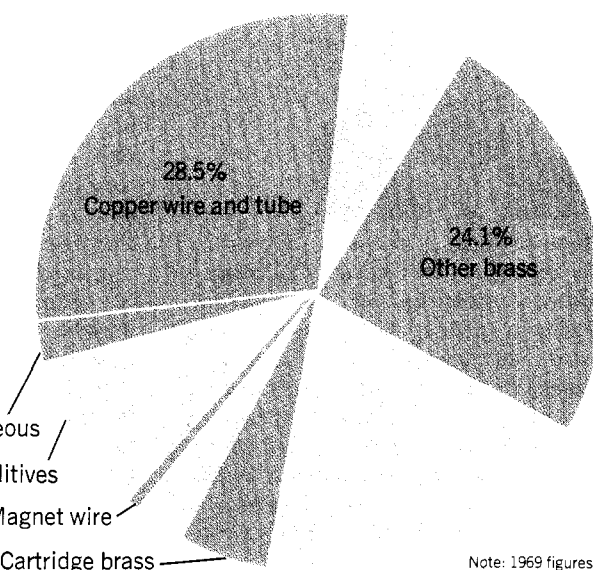


TABLE 4

Paper stock consumption in the U.S.

(thousands of short tons) 1969

END-USE

Category or grade	Container-board	Construction paper and board including gypsum wallboard	News-print	Fine paper	Total	% of total
Mixed paper	1,835	1,000	...	...	2,835	24.8
Old corrugated	3,468	400	...	...	3,868	33.9
News	1,455	600	360	...	2,415	21.1
High grades	1,291	...	...	1,000	2,291	20.2
Total	8,049	2,000	360	1,000	11,409	...
% of Total	70.5	17.5	3.2	8.8	...	100.0

- encourage freight rates favorable to expansion of recycled waste paper and paper stock.

- push for economic incentives to dealers or processors to increase recycling by offsetting the high costs of overseas shipments now restricting exporting.

Space limits detailed reports on the remaining commodities, but Battelle made the following suggestions to increase recycling of specific commodities:

- promote increased aluminum segregation at the source of generation, and expansion of present collection systems



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to broaden can and packaging scrap utilization

- initiate technical research to develop economic methods to separate zinc from die castings and from other metals

- expand research for increased use of battery lead

- for textiles, repeal Wool Labeling Act, introduce federal incentives to encourage exports, and develop new uses for synthetic blends of materials.

Changing priorities

The National Commission on Materials Policy in its interim report of April 1972 states, "Secondary processing—i.e., recycling of materials after end-use and reclamation of waste prior to end-use—plays a major role in attaining both goals of enhancing environmental quality and conserving materials for more effective utilization of our natural resources."

Even though recycling has gone on for years, it now must be developed and increased to become a "new way of life." Maximum consideration must be directed to these questions. How can recycling be increased? How can the amount of material recycled be more meaningful in terms of total raw material supply? To do this, priorities must be reexamined; attitudes and prejudices must be changed; and man can no longer be satisfied with the status quo.

A hearing was held last November by the joint Economic Committee of Congress to discuss recycling, to identify the restraints and impediments to expanded recycling, and to project the specific legislative and regulatory policy changes that must now be projected.

One of the most important obstacles to recycling, the Committee was told, is the *inequitable federal tax policies*. Present tax policies provide economic encouragement for continued and expanded use of primary or virgin products to the direct economic disadvantage of recycled material. Tax policies must be reexamined and changes made, changes that would:

- provide manufacturers a realistic incentive factor for utilizing more recycled materials through a recycling tax deduction or credit

- encourage new and expanded plant investment in recycling facilities and equipment through rapid write-off and amortization of such investments

- provide a basis for expanding research and development activities by industrial firms capable of recovering recycled materials.

Discriminatory transportation rates are a significant factor in restraining recycling. Freight rates for shipping materials to be recycled are as much as 50% higher than those rates for comparable primary or virgin materials. The complete rate structure should be reexamined with an eye toward encouraging and increasing recycling rather than the reverse.

Local, state, and national procurement policies in many cases discriminate against recycled material. Specifications that call for virgin or new materials should be changed and the specifications rewritten based on performance standards desired. Government agencies must take the lead in stimulating the demand for products made with recycled materials. Demand for these products must precede any successful and meaningful rise in the recycling rate. The individual consumer can help by requesting products made with recycled materials which creates the demand that is so vital to the recycling effort.

Many towns and cities still have antiquated licensing and zoning regulations that adversely affect recycling. While giving lip service to increasing recycling, municipalities zone and license scrap dealers and processors out of business. This *lack of leadership at the municipal and state level* inhibits recycling. As in any other major industry, *continued research and new technology* are basic growth factors and are necessary for the continued expansion of recycling efforts. These factors must change to create a climate for economic incentive for the recycling industry.