United States Environmental Protection Agency
Solid Waste and Emergency Response (OS-301)
Policy, Planning and Evaluation (PM-221)

EPA/530-SW-90-072A
April 1993
NTIS: PB93-170132

EPA

Markets for Recovered Aluminum

Printed on paper that contains at least 50 percent recycled fiber.

Markets for Recycled Aluminum

United States Environmental Protection Agency
Office of Solid Waste
Office of Policy, Planning and Evaluation

Table of Contents

I. Summary 1

II. Market Overview 3
- Which Markets Are Included?
- Who Participates in These Markets?
- How Large Is the Market for Recycled Aluminum?
- Trends In Scrap Consumption

III. Factors Influencing Aluminum Scrap Markets 17
- Supply of Scrap Aluminum
- Demand for Scrap Aluminum

IV. Government Intervention in Aluminum Scrap Markets 26
- Government Intervention in Markets
- Summary of Current Involvement
- Effects of Possible Federal Initiatives to Increase Aluminum Recycling
- Conclusions

References 29

I. Summary

Recycling is experiencing a rebirth as an important method for dealing with growing volumes of solid waste. The time of abundant, inexpensive landfills is coming to an end as capacity is constrained by shutdowns at existing operations, increased costs of compliance with pending regulations from states and the federal government, and difficulty siting new operations. The attraction of recycling is its recognition of the intrinsic value of much of the material that is thrown away. However, the economics of recovering these materials has made recycling viable for only a limited number of materials.

The viability of recycling for a given material depends on economics: used materials that can be collected, processed, and reused at a lower cost than substitutes can be produced will be in demand by manufacturers. Markets for recycled materials have developed over time to facilitate the consolidation of material into quantities that are "worth" handling. These markets are the key to continued and expanded recycling opportunities because they provide an alternative to landfills for a number of materials.

With the renewed interest in recycling, an important issue to consider is the operation of these existing markets and how they would react to policies developed to increase recycling in the United States. This study describes the operation of the markets for scrap aluminum as an example of:

- how recycling markets are structured,
- what factors influence the supply of and demand for materials,
- what projections can be made about recycling markets, and
- how government policies to increase recycling may affect these markets.

The aluminum industry was chosen because the markets for scrap are established and (comparatively) well understood. Recycling used aluminum beverage cans (UBCs) is often cited as a "success story" in the management of municipal solid waste, with current recycling rates of about 60 percent.[1] Aluminum has been recovered since the early 1900s, and today includes recovery from both municipal sources (mostly aluminum cans) and other sources (scrap from production and from reuse of old aluminum products).

---

[1] The Aluminum Association, Inc., *Aluminum Statistical Review for 1989*, p. 30.

Before governments proceed very far with initiatives to promote recycling, it is important that they understand the operations of the private sector in handling these materials. Otherwise, policies that appear to expand recycling opportunities may replace private ventures with government operations. Another argument for this type of study is to understand the influences on the scrap markets so that incentives designed to encourage recycling are targeted appropriately.

The aluminum industry is comprised of producers of primary and secondary ingot, mill products (such as sheet and plate), and castings. Because the aluminum industry produces many different types of products, aluminum scrap comes in many different forms, and this scrap has a variety of uses in the industry. This study covers the scrap market as a whole.

Although it comprises only a small fraction of municipal solid waste, aluminum is one of the most profitable materials to recycle and has achieved high recycling rates. Virtually all aluminum scrap generated in manufacturing operations (new scrap) is recycled, and a significant fraction of aluminum discarded by households or businesses (old scrap) is also recycled.

For individual households, the most commonly recycled aluminum product is used beverage cans, which account for about 60 percent of the old scrap recovered. Many other aluminum materials are recycled, including aluminum siding, automobile parts, and foil. Because of the range of products in aluminum recycling, many firms, communities, and non-profit organizations are all part of the aluminum recycling market and collect scrap for sale to intermediaries and ultimately to industries that reuse the material to make new products. In some cases, the same firms that manufacture primary aluminum also purchase recovered aluminum (manufacturers of can sheet, for example). For other types of aluminum, separate industrial processes are required to reuse the aluminum in final products.

In 1989, about 28 percent of the total aluminum supply in the United States came from recovered aluminum. Additional aluminum could be recovered from municipal and other waste streams. However, the metal is often mixed with other materials, complicating identification and separation of the aluminum. Higher scrap prices might make additional separation profitable for scrap dealers.

Many manufacturers demand recovered aluminum as an input to production or demand products that contain recycled aluminum. In some applications, products made from recycled aluminum are used exclusively, while in others recovered aluminum may be a perfect substitute for aluminum made from virgin materials. Because demand for scrap aluminum is strong both domestically and abroad, the principal limitation to increased recycling is on the supply side of the market - if the material could be supplied at a reasonable price (i.e., a price competitive with that of virgin aluminum), firms would purchase more scrap.

II. Market Overview

The principal distinction in aluminum scrap markets is between new and old scrap.[1] New scrap is generated at plants making end products from aluminum. It includes clippings, borings, and surplus products such as the skeleton left after cans are cut from sheet. Old scrap is retrieved from post-consumer uses of aluminum, including beverage cans, automobiles, and old cables. In this report we are concerned primarily with old scrap.

Which Markets Are Included?

Depending on where they live and their particular inclination, individuals who want to collect aluminum beverage cans for recycling may give them to nonprofit operations (e.g., churches or civic groups), sell them to redemption centers, have them collected at curbside (e.g., through municipal collection programs), or return them for deposits. The motives for collecting cans differ. For example, the collector may wish to raise money for charity, to generate profit, to divert material from landfills or municipal waste combustors, or to simply cash in on a deposit. This study covers the aluminum recycling market from collection through processing and eventual reuse of the aluminum.

Who Participates in These Markets?

Collectors and Scrap Dealers

Collectors consolidate flows of new scrap aluminum from many different sources and channel the scrap into specific categories for reuse.[2] Collectors may be dedicated to aluminum, as in the case of industry-sponsored buy-back operations for cans, or may be larger-volume scrap dealers who also handle other materials, such as other metals and paper.

Scrap dealers handle virtually all of the non-UBC post-consumer scrap. They buy old scrap such as old aluminum castings, wire, aluminum siding, and scrap from automobile shredders, and new scrap such as clippings from the fabrication of aluminum products.

---

[1] Aluminum scrap generated by foundries or mill product producers is classified as "home scrap" or "run-around" scrap. This scrap never enters scrap markets, since it is reused in-house. Thus, it is not included in any of the recovery data cited in this report.

[2] New scrap may also flow through collectors, but the current trend is toward direct purchase by manufacturers of mill products. Personal communication with Robert Garino, Director of Commodities, Institute of Scrap Recycling Industries, September 4, 1988.

Dealers process and sort scrap, depending on the customers' demands and on the facilities they have available. As with all nonferrous metals, sorters are needed to hand-pick through material to spot particular alloys. Dealers may also invest in equipment to separate, shred, or bale aluminum. Some dealers have installed sweat furnaces, which separate other metals from the aluminum and reduce the aluminum scrap to ingots for shipping. This ingot is not produced to any particular specification, however, so it does not command a very high price. The Aluminum Recycling Association estimates that in 1988 about 1,200 dealers handled scrap aluminum.[3]

Collectors of UBC are more numerous than scrap dealers, since they serve the broad generator segment of can users rather than the more concentrated industrial generators of aluminum scrap. UBC operations include municipal programs, which separate cans from the waste stream, industry-sponsored drop-off or buy-back centers, bottlers and distributors in states with mandatory deposits, and nonprofit collection programs. With the exception of large-volume industry operations and large bottler operations in deposit states, these are small, labor-intensive operations. Even the largest of these are likely to have only minimal capital requirements for equipment, such as can flatteners or balers. Vendor quotes for can flatteners/blower systems begin at $10,000, for example, and balers for cans are available for as little as $4,000.[4]

Scrap Consumers

The demand for the individual products made from aluminum affects the demand for scrap. If the automobile industry is strong, there will be a strong demand for aluminum castings from foundries. If construction is doing well, demand for building materials and siding from primary producers will be strong as well. The amount of scrap demanded is ultimately dependent on demand for all products made from aluminum (as well as on other factors, such as the price of primary aluminum).

Scrap consumers purchase and reuse the aluminum scrap. We have categorized the major scrap consumers as secondary smelters, producers of mill products, and producers of castings (foundries). The major relationships between these and the other market participants is shown in Figure II-1.

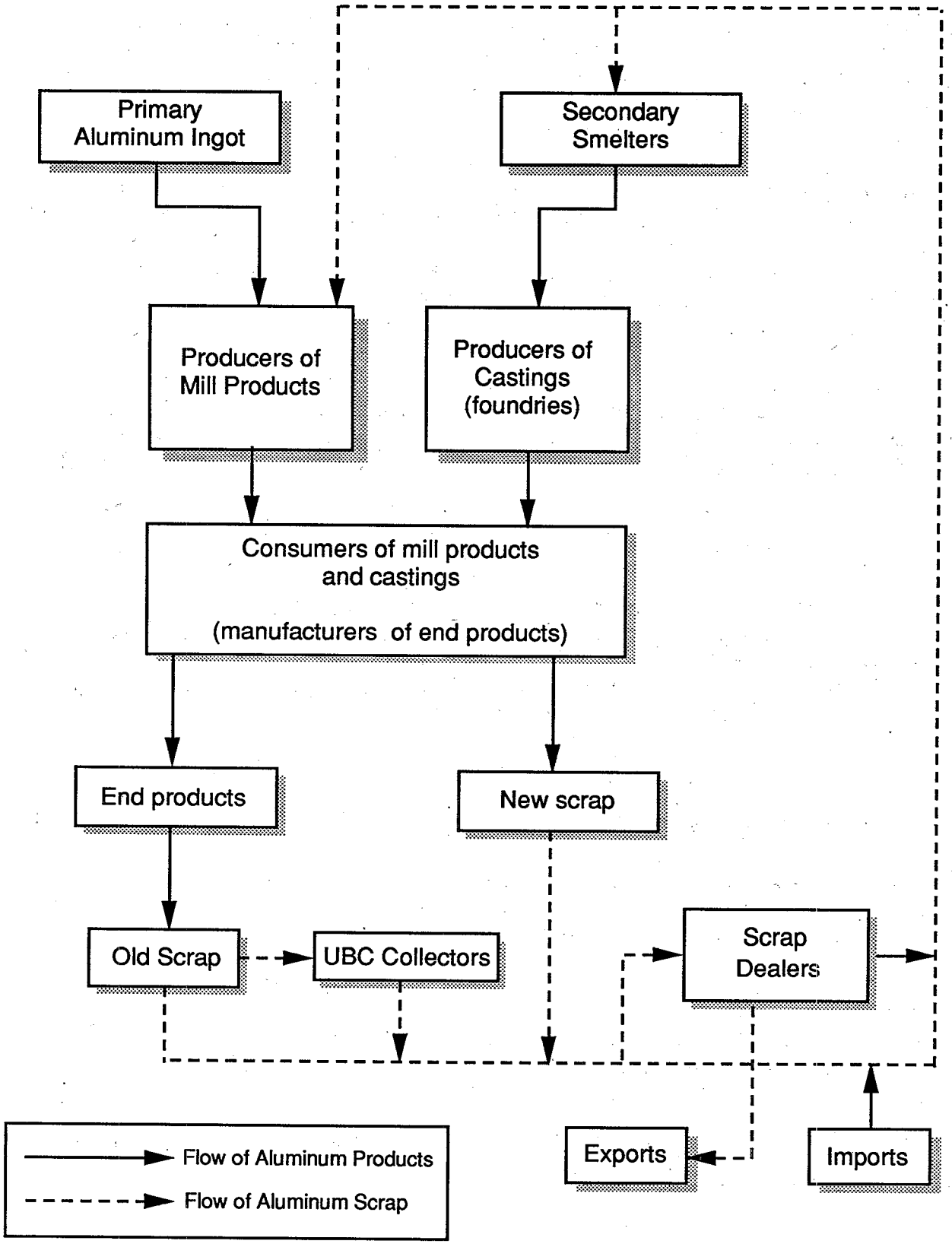
---

[3] Personal communication with Richard Cooperman, Executive Director, Aluminum Recycling Association, September 2, 1988.

[4] Personal communication with Mark Cerniglia, American International Company, September 21, 1990.

Figure II-1

Flow of Aluminum Scrap



Scrap Consumers: Secondary Smelters

Secondary smelters convert scrap into specification aluminum ingot for resale.[5] These operations process aluminum to remove contaminants, melt the aluminum, and produce alloys to meet customers' specifications by adding alloying elements such as silicon, zinc, copper, manganese, and nickel. The aluminum is then tested to ensure that it meets specification and is shipped as ingot to an end user.

Secondary smelters buy the vast majority of non-UBC post-consumer scrap. They typically buy scrap by specification as well. The industry has established standards for shipments and lists 34 distinct specifications for scrap, including new pure aluminum clippings, aluminum airplane castings, painted siding, and automobile shredder scrap. This scrap may come from scrap dealers (usually old scrap) or directly from producers of finished aluminum products, such as automobile parts manufacturers (new scrap).

Secondary smelters are concentrated where aluminum scrap is readily available. Many are located in the Northeast and North Central regions of the country and in Southern California. Currently, 39 companies operate 48 plants in the United States. They may draw in scrap from as far away as 500 miles.[6]

Scrap Consumers: Producers of Mill Products

Many mill product producers are integrated into the major primary production companies. The primary producers smelt aluminum metal from alumina. These firms (e.g., Aluminum Company of America (ALCOA), Reynolds Metals Company, Alumax, Alcan Aluminum Corporation, and Kaiser Aluminum and Chemical Company) are the most familiar to the general public. These integrated producers are increasing their purchase of UBC scrap for their own use in producing can sheet.

Scrap Consumers: Foundries

Foundries that produce castings for automobiles, motors, and hardware comprise the other major group of scrap consumers. The metal that they pour into their molds must meet specifications set by the foundries' customers. Foundries often use ingot from secondary

---

[5] Specification ingot meets predetermined standards for its content of aluminum and other alloying ingredients; setting specifications such as these provides a method of assuring quality in the production of finished goods.

[6] Personal communication with Richard Cooperman, Executive Director, Aluminum Recycling Association, September 2, 1988.

smelters exclusively, because of their need for specific alloys that are manufactured only by the secondary smelters. Foundries do not directly purchase a large share of aluminum scrap, although some do buy scrap directly and add it to their castings. Their primary role in the aluminum scrap market is as the major consumer of specification aluminum ingot from the secondary smelters.

Other Scrap Consumers

Less significant scrap consumers include fabricators of finished mill products (e.g., independent can manufacturers) and the chemical industry. These two groups are specifically identified in U.S. Bureau of Mines data presented later in this chapter, although they account for a very small share of total scrap aluminum consumption.

How Large Is the Market for Recycled Aluminum?

The total *supply* of aluminum in the United States is defined as domestic primary production (aluminum produced from alumina) plus imports plus scrap. Scrap is measured in terms of its *recovery* and its *recycling*. Recovered aluminum includes the weight of new and old scrap purchased by end-users. Recycled aluminum is recovered aluminum consumed to make new products.[7]

The principal source for estimates of recycled aluminum used in this report is the U.S. Bureau of Mines' Minerals Yearbook. [8] The Aluminum Association also compiles

---

[7] In many cases the terms recovered aluminum and recycled aluminum are used interchangeably to describe aluminum metal reutilized to make new products. Secondary recovery and secondary aluminum are terms also used by some sources to describe recycled aluminum. To avoid confusion, this report will use common solid waste management terminology where the term "recovery" means materials removed from the solid waste stream for the purpose of recycling; and the term "recycling" refers to the material actually reutilized to make new products.

[8] The U.S. Bureau of Mines uses different terms for scrap recovery and scrap recycling than used in this report. The Bureau defines *scrap consumption* to be the weight of old and new scrap purchased by end-users (scrap recovery), and *scrap recovery* as the metal utilized to make new products (scrap recycling). Scrap consumption is estimated annually by the Bureau of Mines and includes the weight of new and old purchased scrap. The Bureau of Mines produces annual statistics on scrap consumption by industry category. In addition to the consumption estimates, the Bureau also reports recovery, i.e., the metal actually recovered in a given year from the scrap purchased.

Bureau of Mines and other data in its annual statistical review. The Aluminum Recycling Association, which represents secondary smelters, has estimates for its own recycling, but not for that of any other sector.

Growth in the Aluminum Recovery Market

Aluminum recycling has increased steadily since 1970, with recycled aluminum becoming a much more important source of supply over the period. The quantity of aluminum recycled in 1989 was slightly more than 2.0 million metric tons, which is more than twice that recycled in 1970. Figure II-2 illustrates the stable growth of aluminum recycling relative to the more variable fluctuations in primary production.

The rate of growth does not tell the entire story of recycled aluminum's increased importance in total production, however. Figure II-3 shows the recycling rate (i.e., the amount of recycled aluminum expressed as a percentage of total aluminum supply) climbing from 18.9 percent in 1970 to 27.5 percent in 1989. Increased UBC recycling has fueled this increase in overall recycling. The Aluminum Association and the Can Manufacturers Institute have reported that the UBC recycling rate rose from 26.4 percent in 1977 to 60.8 percent in 1989. Compared with other products in the municipal solid waste stream, this is a very high recycling rate. The pattern of sharp increases after 1980 reflects the recent importance of UBC as a feedstock for can sheet production.

New scrap, which is included in the recycling estimates, is virtually 100 percent recycled.[9] The inherent value of this scrap ensures that waste is returned to the mill or foundry for reuse.

The third category of scrap included in the recycling estimates is non-UBC old scrap. As measured in this report, recycling rates of this old scrap are difficult to interpret. Many products from which this scrap is derived are durable goods with relatively long service lives. Therefore, recycling in any given year may include aluminum sold many years before. This distinction is important to keep in mind when citing recycling rates for the aluminum industry as a whole.

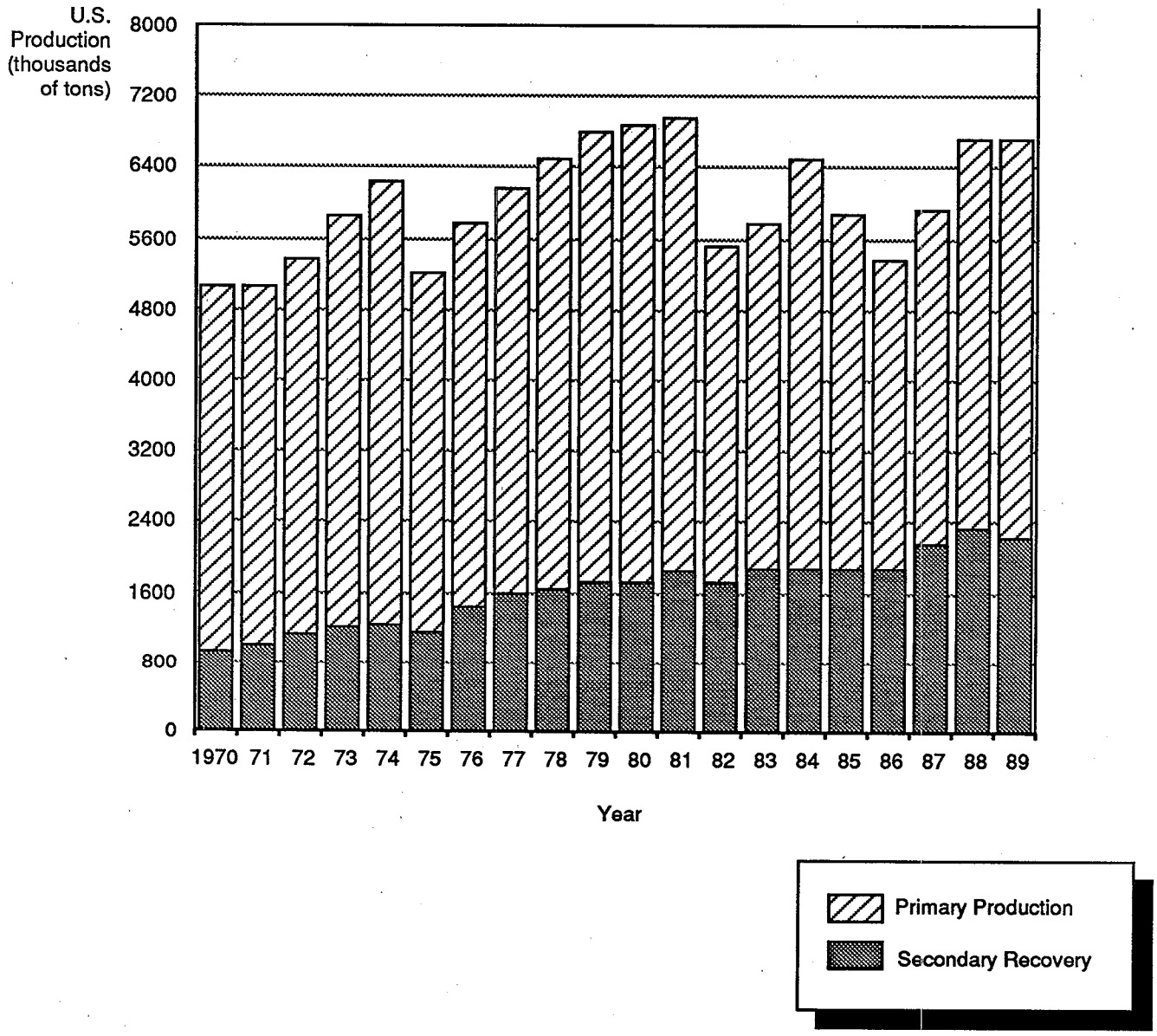
Throughout the 1970-1989 period, domestic primary production has declined as a share of total aluminum supply (see Figure II-4); domestic primary production in absolute terms rose during the period from 1970 (3.6 million metric tons) to 1980 (4.7 million metric tons), but then declined to 4.0 million metric tons in 1989. Imports increased from 8 percent to 25 percent of total supply during the same period, representing a tripling of total tons

---

[9] *Aluminum Recycling Casebook*, Aluminum Association, December 1985, p. 14.

Figure II-2

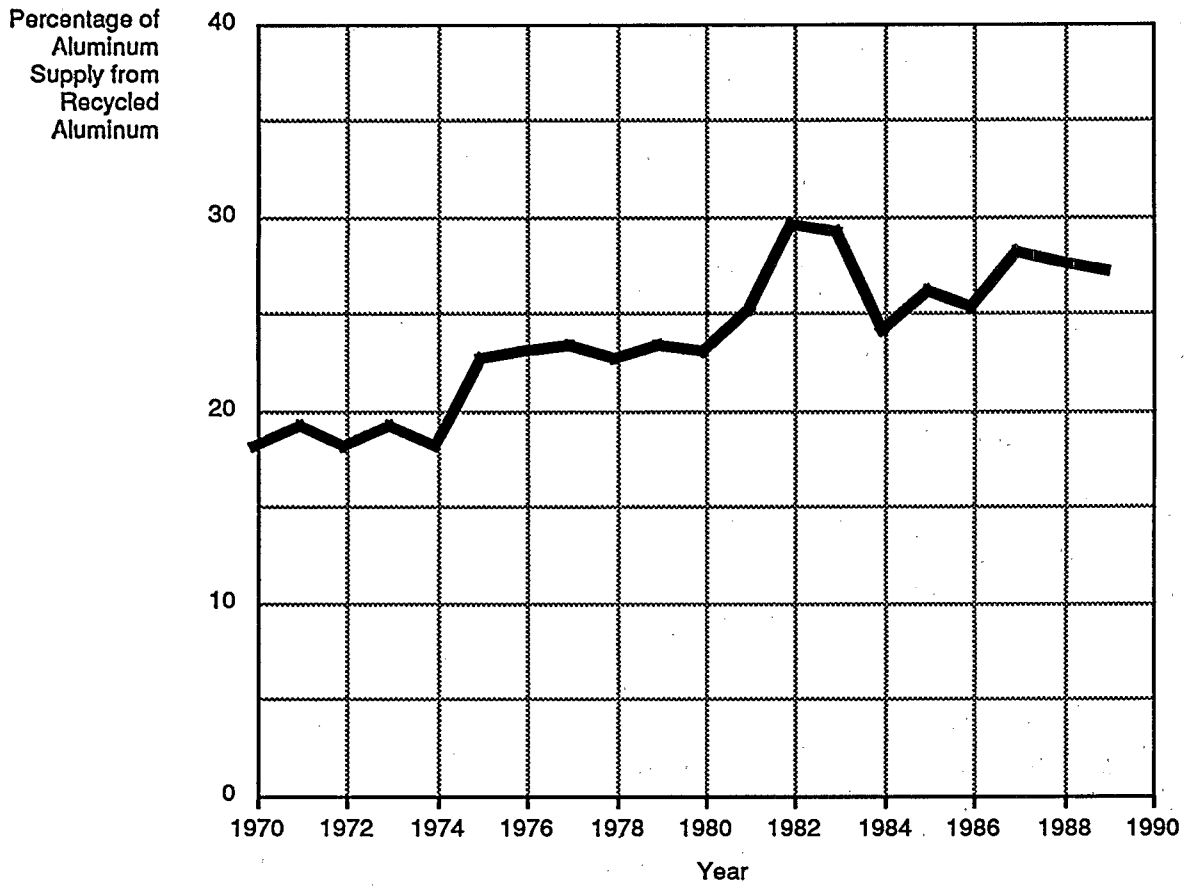
U.S. Aluminum Production



Source: Aluminum Association, *Aluminum Statistical Review for 1989*, p. 23.

Figure II-3

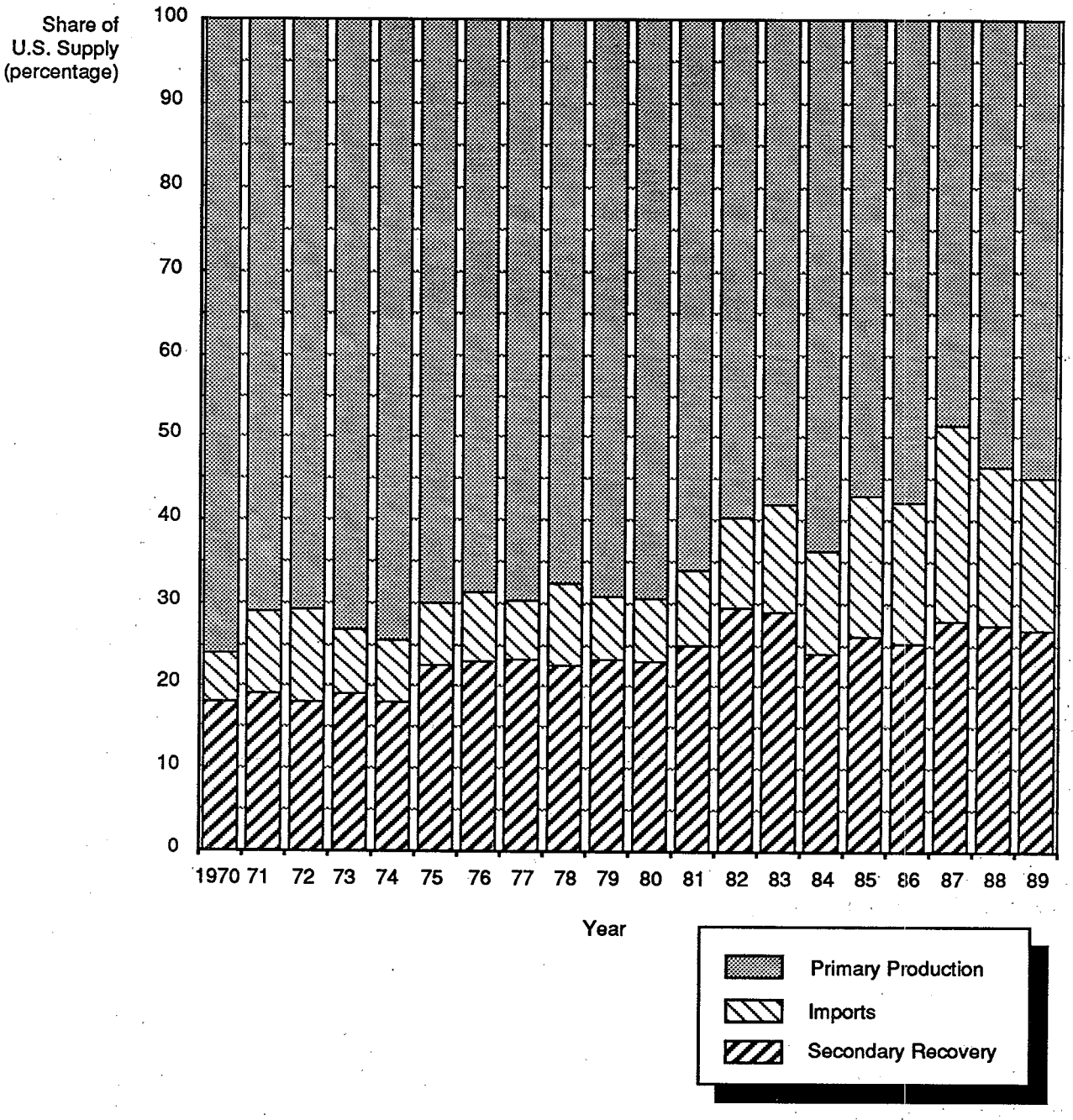
Aluminum Recycling Rates



Source: Aluminum Association, *Aluminum Statistical Review for 1989*, p. 23.

Figure II-4

Changing Market Shares in the Aluminum Industry



Source: Aluminum Association, *Aluminum Statistical Review for 1989*, p. 23.

imported. The largest component of the growth in recycled aluminum's share of supply is the increased use of UBC as an input in can sheet production.

Trends In Scrap Consumption

Total purchases of scrap are somewhat larger than the amount recycled (Figure II-5). This is because of changes in inventory and losses in handling and processing. As a result of inventory changes, scrap recovery (purchase of scrap) is not perfectly correlated with scrap recycling; when scrap recovery rises well above scrap recycling, it may indicate increases in inventories either in anticipation of price increases or because of slackening demand.

Secondary smelters are the largest consumers of non-UBC post-consumer scrap, but they were once the dominant consumers of *all* aluminum scrap. Until the 1970s, secondary smelters consumed 90 percent or more of the aluminum scrap recycled.[10] While their absolute level of consumption has increased since the early 1970s, their share of scrap recovery has fallen. The secondary smelting industry has been struggling financially as its customers, such as the automobile industry, have lost market share to foreign producers.[11]

The big new buyers of scrap, in both absolute and percentage terms, are the producers of mill products who use UBC as feedstock for can sheet. Most of these firms are classified in the Bureau of Mines recovery data as primary producers, since they also produce aluminum from primary materials. Independent can producers would be classified as fabricators in the consumption data below. Figure II-6 shows the Bureau of Mines data on the composition of scrap recovery each year since 1972. Firms classified as primary producers (which are integrated firms that produce mill products as well as primary metal) purchased 1,025,107 tons in 1988, up from 205,000 tons in 1972. This represents an increase in their share of scrap recovery from 17.8 percent to 45.9 percent over 16 years. Purchases of scrap by foundries and chemical producers are much less significant, accounting for a combined share of 4.8 percent of consumption in 1988.

Higher energy costs during this period have driven producers of primary aluminum and aluminum products to cut costs. One way to reduce costs is to use more scrap: Remelting aluminum scrap to produce new aluminum products saves about 95 percent of the

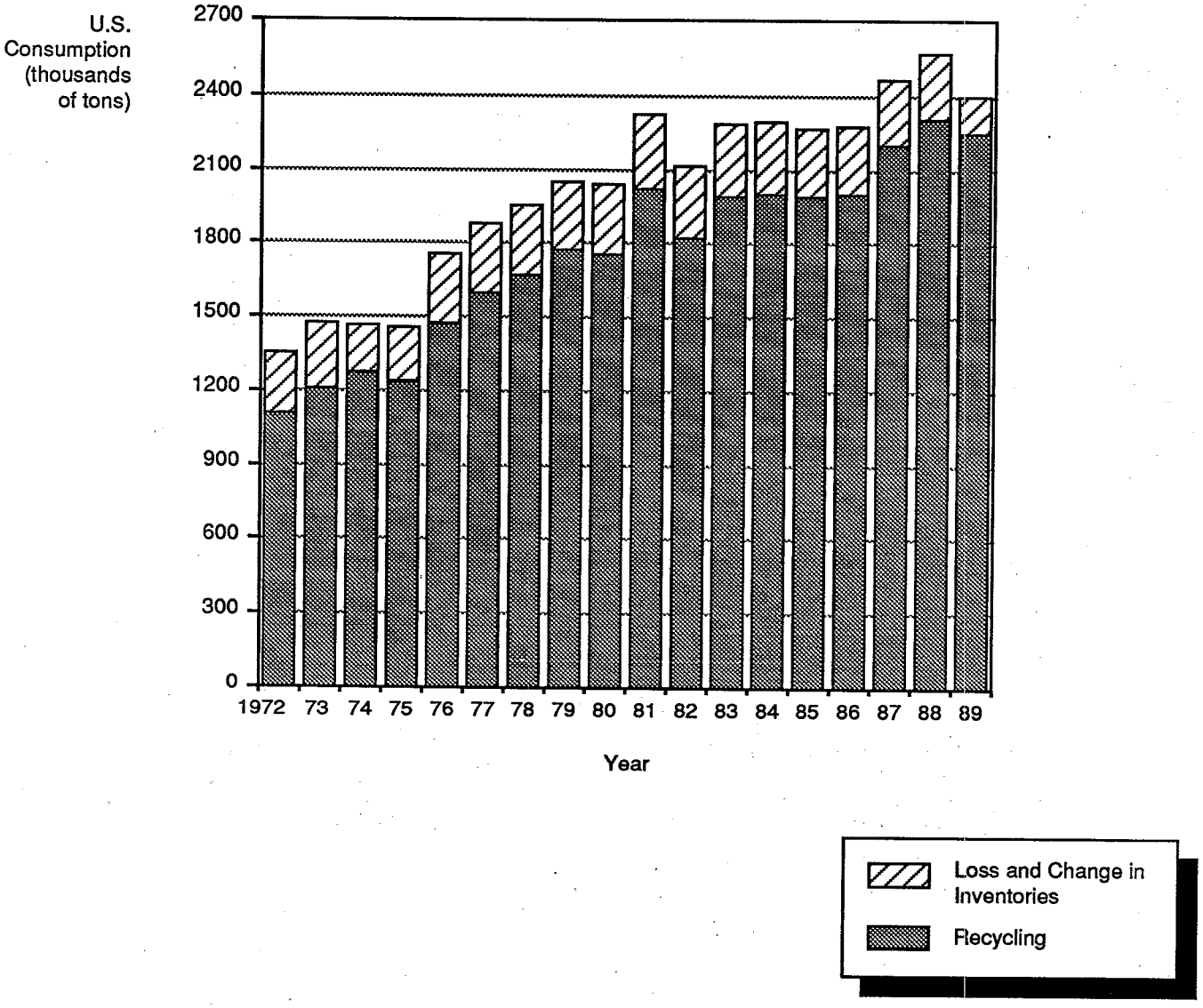
---

[10] Personal communication, Richard Cooperman, Executive Director, Aluminum Recycling Association, September 2, 1988.

[11] "Aluminum Recycling: More Than Just Aluminum Beverage Cans," *Phoenix Quarterly*, Winter 1987-88, Institute of Scrap Recycling Industries, Washington, D.C.

Figure II-5

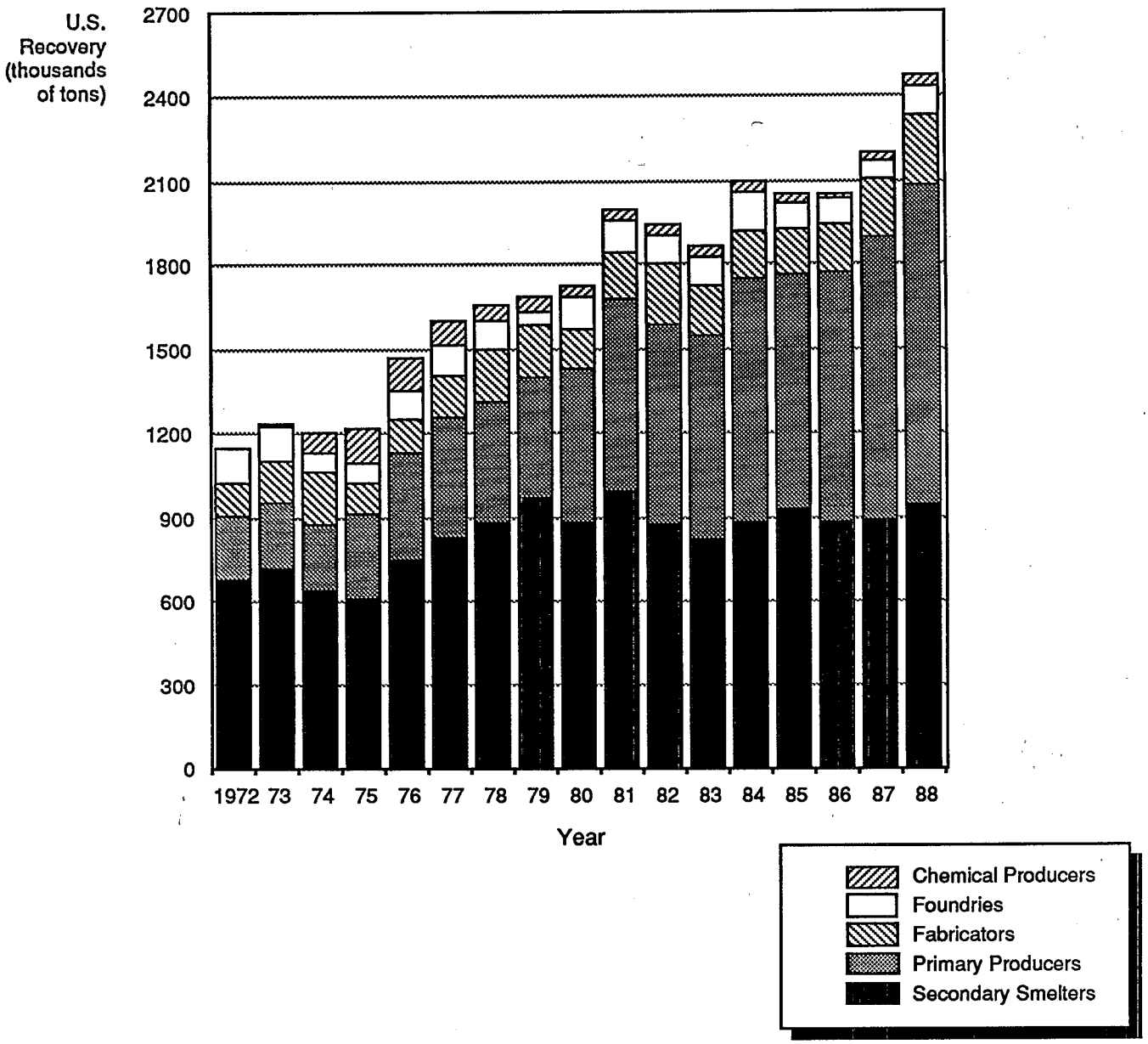
Scrap Aluminum Recovery Versus Recycling



Source: U.S. Bureau of Mines, *Aluminum Mineral Yearbook, 1988.*

Figure II-6

Aluminum Scrap Recovery by Type of Firm



Source: U.S. Bureau of Mines, *Aluminum Mineral Yearbook, 1988.*

energy required to convert bauxite into virgin aluminum. In addition, each ton of remelted aluminum used replaces four tons of bauxite.[12]

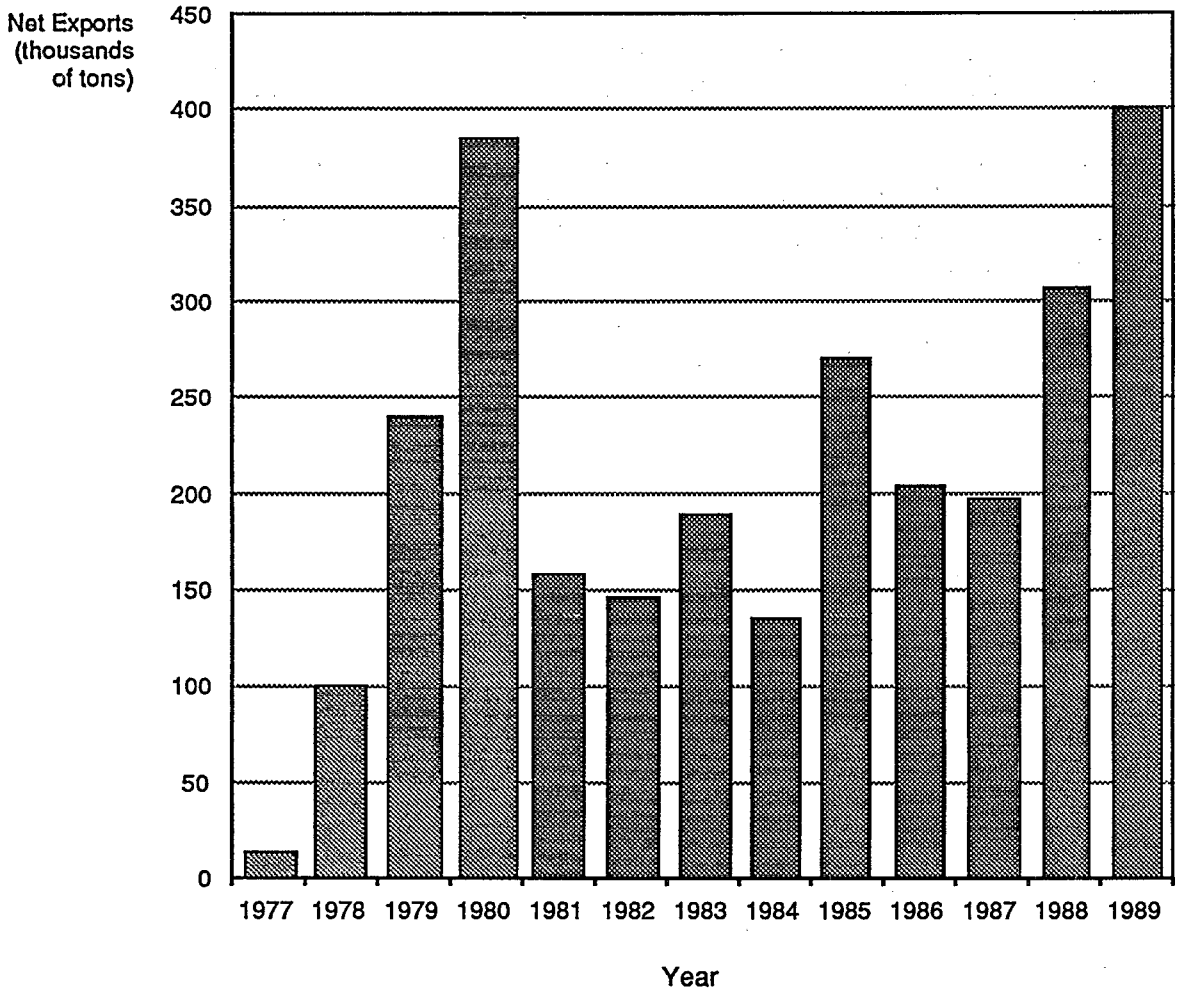
One other important category of scrap use is exports. The United States has been a net exporter of aluminum scrap for over 10 years, as shown in Figure II-7. More than half of those exports go to Japan, where energy costs are so high that Japan has very little primary smelting capacity. The scrap is remelted abroad and made into semifabricated or fabricated aluminum products, some of which are shipped back to the United States for sale. In 1989, despite primary aluminum exports of 1,200,000 tons and scrap exports of 646,000 tons (about 27 percent of domestic consumption of scrap), the United States imported 1,491,000 tons of primary aluminum, as well as 245,000 tons of scrap. About 75 percent of the imported scrap comes from Canada.

---

[12] Cynthia Pollock, *Mining Urban Wastes: The Potential for Recycling*, Worldwatch Paper 76, Worldwatch Institute, April 1987.

Figure II-7

U.S. Scrap Trade Balance



Source: Aluminum Association, *Aluminum Statistical Review for 1989*, pp. 36-37.

III. Factors Influencing Aluminum Scrap Markets

Several conditions affect aluminum markets. Some affect the supply of recovered aluminum, others affect demand for recovered aluminum, and still others affect both.

Supply of Scrap Aluminum

Assuming no government intervention, the supply side of a market reflects the costs of producing a given output. For scrap markets, the supply function is the relationship between the price of scrap and the quantity that a supplier is willing to provide at the price. As with most markets, a certain quantity of scrap aluminum is available at relatively low cost, especially for plants that use in-house scrap. Supply of new scrap would probably not be very sensitive to price because so much new scrap is recycled already - it is so valuable that producers simply do not want to waste it, and it is available at near-zero cost. For old scrap, however, we would expect a supply response to changing prices.[13] If the price of scrap is high enough, suppliers will go to great lengths to obtain scrap. In 1987 and 1988, the prices paid for scrap aluminum were so high that in some areas, such as California, guardrails and lampposts vanished from roadsides and appeared at material reclamation centers.

Factors Affecting Supply

1. The Cost of Acquiring Scrap Accounts for the Majority of Collectors' and Processors' Costs

The cost of aluminum scrap is the largest cost component incurred by the scrap suppliers (collectors and processors) in the markets described in Chapter II. None of the suppliers, including the most capital-intensive processors of scrap, spends more on processing than on obtaining the raw material itself. This is what makes aluminum such a "recyclable" product: Aluminum is easy to reuse without a great deal of expensive processing.

Some scrap dealers and most can recycling centers have very low capital costs; the type of equipment necessary for their operations is not expensive. A small baler may cost less than $10,000, so the barriers to entry are not high for these operations. Hand-sorting

---

[13] This price sensitivity was noted by Richard Gordon et al., in *The Collection of Nonferrous Scrap: A Literature Review of the Copper and Aluminum Sectors*, Pennsylvania State University, July 1972.

mixed scrap is expensive, so another important cost component for dealers is labor. However, in the case of single-material operations such, as container buy-back centers, even the labor costs are very low.

Secondary smelters are the most capital-intensive processors of scrap, given the cost of their furnaces and necessary metallurgical testing equipment. Nevertheless, the cost of scrap accounts for about 85 percent of the cost of their product (specification ingot).[14] Changes in the costs of other inputs to production, such as capital costs, will be less important to the smelters than changes in the cost of scrap.

Many suppliers of UBC operate in a much different situation. Municipal and nonprofit operations such as curbside programs, voluntary recycling programs, and drop-off centers do not actually pay for scrap; their major costs are for handling the scrap and marketing it. They are much more a part of the collection side of the market than the processing side, and they operate on the payment they receive from scrap consumers or brokers who buy from them.

A final group of UBC suppliers are those operating in states with deposits or redemption values for containers. These businesses do not actually purchase containers from consumers, but they must bear the full cost of collecting the material (e.g., additional vehicles, labor, and storage facilities). Even if these operations do process the material (e.g., bale cans to compact the material), the cost of this activity is comparatively low and, in some cases, the firm purchasing the UBC may provide the equipment to compact the UBC.

2. Government Policies Have Altered the Supply of Aluminum Beverage Containers

Ten states containing 29 percent of the U.S. population have programs that assign a value to aluminum beverage containers independent of scrap value. (Nine states with 18 percent of the population use deposits. The tenth, California, has a minimum redemption value of $0.025.) These programs have a major effect on the market for UBC because they artificially raise the value of containers, resulting in a higher quantity collected than if scrap values were the only incentive.[15] In general, as long as deposit values remain higher than

---

[14] Personal communication with Richard Cooperman, Executive Director, Aluminum Recycling Association, September 2, 1988.

[15] The fraction of soft drink containers in these 10 states returned for their deposit or redemption value ranges from roughly 60 percent to 90 percent. See, for example, *Soft Drink Bottler Costs Under the Massachusetts Bottle Bill*, Temple, Barker & Sloane, Inc., April 1988; *The Economic Effects of New York State's Returnable Beverage Container Law*, National Economic Research Associates, January 1989; and *Michigan Soft Drink Bottlers' Costs Resulting*

scrap values, deposit programs will increase the amount of UBC supplied. At deposits of $0.05 per container, the deposit is much higher than the value at current prices of approximately $0.53 per pound for UBC[16] (about $0.02 per container). Even at the historically high prices of 1988 and 1989 (as high as $0.80 per pound or nearly $0.03 per container), deposits were above scrap prices.

These programs do not directly affect the value of UBC once it leaves collectors because the deposits flow between consumers, retailers, and bottlers and distributors. The effect of these programs is, however, to push more UBC into the market than would be there given current scrap prices. All else being equal, one would also expect deposit programs to cause a decline in UBC prices, since more UBC is supplied than "called for" by the market scrap price.

3. The Price Responsiveness of Scrap Supply Is Uncertain

New scrap is already recycled to a much greater extent than is old scrap. Because of the value of new scrap and the high recycling rate, it is expected that new scrap supply would be relatively unresponsive to price.[17]

Some research, such as a report prepared in 1979 by the Research Triangle Institute for EPA, suggests that changes in the price of aluminum scrap have no effect on the quantity of UBC supplied. RTI cites two primary reasons for this lack of response: consumers' "do good" motivations to recycle, and the fact that the decision by a household to recycle is an all-or-nothing decision. If the price of aluminum scrap increases enough to induce a household to recycle its aluminum cans, it generally recycles all of them. Further price increases have no effect on the quantity of UBC supplied, since the household is already supplying 100 percent of its UBC.[18] Other factors, such as deposit laws and location of collection centers, also act to decrease the price responsiveness of consumer scrap supply.

Deposit programs create a value for containers that is much higher than their scrap value (i.e., an artificial supply-price is set greater than the market price for scrap). Consumers return containers to regain the deposit value rather than the scrap value. Consequently, fluctuations in the market price of scrap are unlikely to affect the supply of UBC. Therefore, in states with deposit laws, we would not expect UBC supply to be responsive to scrap price changes.

---

from the Deposit Law, Temple, Barker & Sloane, Inc., April 1989.

[16] Resource Recycling, *Bottle/Can Recycling Update*, August 1990.

[17] See footnote 13 referring to the Gordon analysis.

[18] Research Triangle Institute, *The Supply of Secondary Aluminum Cans*, April, 1979.

The large number of collection centers for UBC may also minimize supply response to price changes. Given convenient opportunities to recycle cans, consumers may simply get into the recycling habit (e.g., stop on the way to the store). Changes in prices paid may have little effect on the UBC supplied in those cases.

Empirical evidence, however, suggests that the supply of old scrap, including UBC, may be responsive to price, especially in non-deposit states. The use of price by scrap dealers as a mechanism to control supply is evidence that at least marginal suppliers are influenced by price. In any case, price is only one of numerous factors influencing the supply of old scrap. Supply of non-UBC old scrap is probably the most responsive type of aluminum scrap to scrap price changes. Higher scrap prices will increase the collection activity of dealers, will make longer hauls more worthwhile, and will justify higher expense for separation. Lower prices will push marginal dealers out of the business or at least cause them to shift to other materials.[19]

Trends in the Supply of Scrap Aluminum

The major change in the supply of scrap aluminum in the next several years will be the continued growth in scrap tonnage supplied by UBC scrap. The level of competition in the packaging industry and the political pressures for recyclable packaging indicate that the big changes shown in Figure II-6 (driven by can sheet producers buying more UBC) will continue.

Municipal waste concerns are driving communities to go beyond deposit laws to much broader recovery strategies, such as mandatory and voluntary curbside collection programs. The rate of new legislative initiatives in this area is increasing, so communities will become more important suppliers of aluminum, providing a relatively inexpensive source of the metal to scrap dealers and producers.

With the change in focus from industrial to residential recycling, the role of scrap dealers in the market has changed somewhat, with cleaner industrial and UBC scrap more likely to bypass dealers and flow directly to can sheet producers. The expansion of community recycling programs over wide areas, however, may tax the ability of can sheet producers to consolidate that material and bring it to their plants. This is a role that might be filled by scrap dealers, who are more geographically dispersed.

---

[19] See footnote 13 referring to the Gordon analysis.

Demand for Scrap Aluminum

The demand side of a market reflects the potential quantities of the product that consumers are willing to buy. For scrap markets, the demand function expresses the relationship between a given price of scrap and the quantity that consumers of scrap will purchase at that price. The scrap aluminum market is typical in that some consumers are willing to buy some scrap at a relatively high price; however, if scrap suppliers wish to increase sales, the price must drop to increase quantity demanded.

Factors Affecting Demand

1. Scrap Demand Depends on Demand for Finished Products

Aluminum scrap of all types is a product input. Furthermore, although scrap is used in several different markets, suppliers can market some types of scrap to only one type of consumer. This further binds the fortunes of those scrap markets to the final product producers who buy that type of scrap.

As with other input markets, the tie between demand in the aluminum processing and consuming industries and demand in the aluminum scrap market results in volatile aluminum scrap prices (see Figure III-1). A slump in scrap demand, caused by a fall-off of demand in the scrap-using industries, manifests itself more in falling prices than in slow sales. For example, during the 1981-82 recession, the automotive industry was hit particularly hard; as a result, demand for aluminum castings dropped. In the scrap market, consumption of scrap by secondary smelters and foundries did drop (see Figure II-6), but most of the impact was seen in price. Real scrap prices declined by more than 50 percent between their high point of 1980 and their low of 1982.

2. Scrap Aluminum Demand Depends on the Price of Primary Aluminum

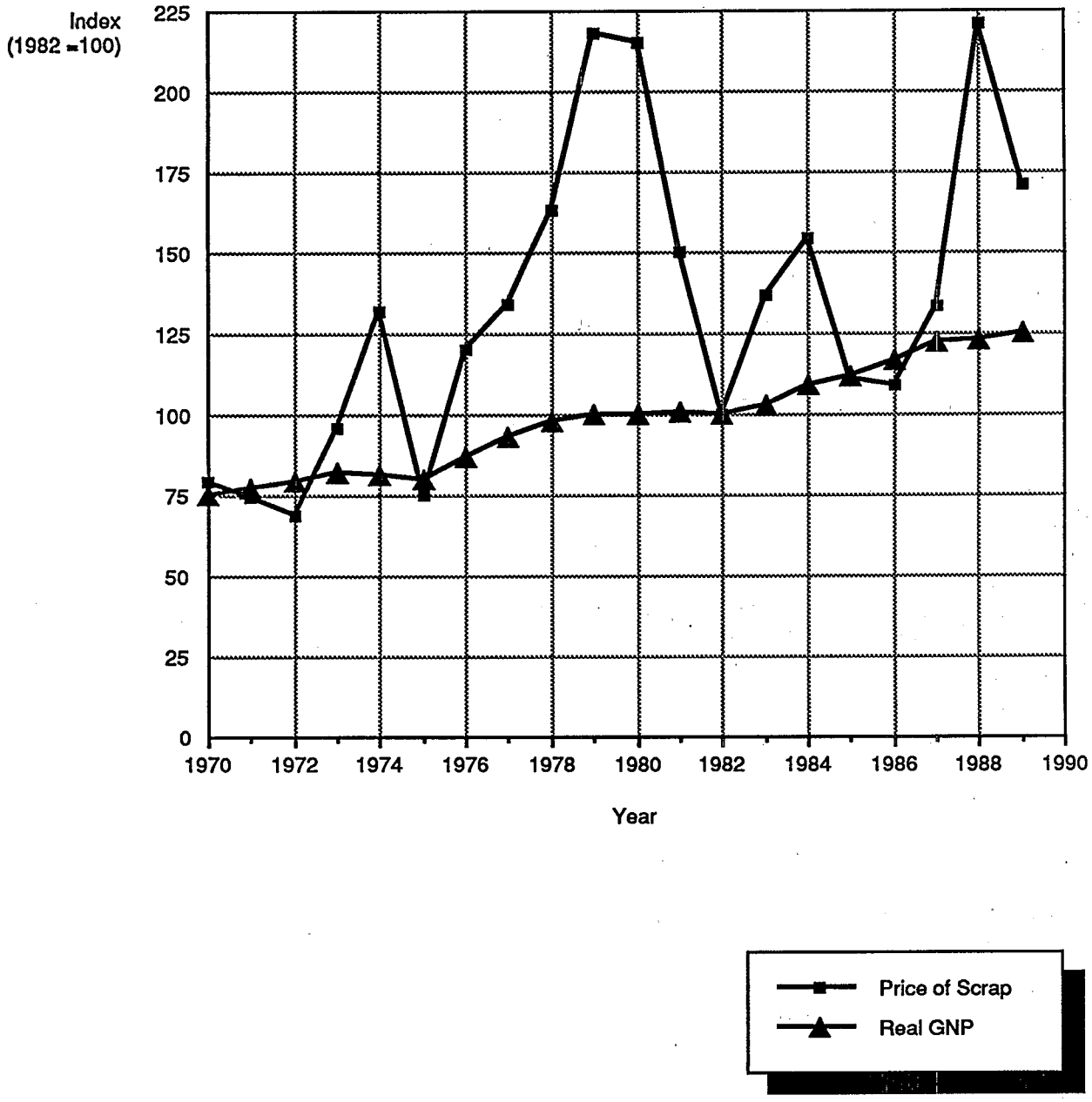
Recycled aluminum is often a nearly perfect substitute for the primary product, so scrap demand should move in the same direction as primary prices. If recycled aluminum competes directly with primary aluminum, a higher price for the primary metal should boost scrap demand. In can manufacturing, for example, we would expect that a jump in primary aluminum prices (brought on by an energy price shock, for example) would strengthen the incentive for mills to purchase UBC.

3. No Significant Stigma Is Attached to Aluminum Made from Scrap

Both aluminum scrap and secondary ingot produced by smelters are classified by specifications. The importance of the specifications is that they help scrap consumers know the properties of the input they are buying.

Figure III-1

Aluminum Scrap Price Index



Source: U.S. Bureau of Labor Statistics; U. S. Department of Commerce.
U.S. Department of Commerce, *Survey of Current Business*, January 1990.

Scrap consumers buy only certain types of scrap, depending on the production processes for their products. For instance, can sheet manufacturers buy UBC because they know the composition of that type of scrap and can use the scrap in making new can sheet. On the other hand, secondary smelters will take a wide variety of scrap because they have the capability to mix the scrap with other ingredients to create a specification secondary ingot. As a result, secondary smelters use scrap to create a product whose properties are precisely known.

Firms that make aluminum mill products or foundry ingot (for castings) from scrap either are selective in their scrap purchases or have the ability to create a specification product from a variety of scrap. Most of the scrap consumers' products are purchased by industries whose buyers are familiar with the properties of different types of aluminum products and are willing to buy products with recycled content as long as they meet the buyers' needs. The use of recycled aluminum results in products whose quality is nearly indistinguishable from products made from virgin materials.

4. Primary Producers and Secondary Smelters Have Been Closing Excess Capacity

The high cost of raw materials and energy in the United States has shifted production of primary aluminum overseas. Since 1980, non-scrap aluminum imports have risen to a 1989 level of slightly more than 1,500,000 tons per year, representing an increase of 126 percent. During the same period, domestic shipments of aluminum increased only 27 percent.[20] With off-shore plants producing cheaper aluminum, both primary producers and secondary smelters have reduced capacity. Since 1980, primary producers have reduced their capacity approximately 18 percent below that year's high of about 5.1 million tons per year.[21] Several small secondary smelters have gone out of business and others have sold plants. This reduced capacity is driven primarily by the energy prices faced by U.S. aluminum producers, which average 77 percent more than energy prices paid by producers in other market economy nations.[22]

This shift in capacity will not constrain the growth of UBC recycling, however, since most can sheet is still made domestically. Even if the ingot were made overseas, domestic mills still melt the ingot and roll the can sheet, so they will still be interested in purchasing UBC as an input.

---

[20] *Aluminum Statistical Review for 1989*, Aluminum Association, pp. 23, 23.

[21] Ibid., p. 26.

[22] U.S. Department of Commerce, *1990 U.S. Industrial Outlook*, p. 17-1.

5. Foreign Demand for Aluminum Scrap Is Strong

Counterbalancing the pressure on aluminum ingot from imports is a strong foreign demand for U.S. scrap exports. About 650,000 tons of aluminum scrap were exported in 1989, which is approximately two times the exports of ten years ago. Nearly 60 percent of those exports go to Japan, with only about 6 percent destined for Canada. Japan has almost no primary production capacity. The Japanese aluminum industry uses imported primary ingot (for 2/3 of its supply) and imported scrap (for 1/3 of its supply)[23] to support a per capita aluminum consumption that was fifth among industrialized countries in 1987. Furthermore, half of Japan's aluminum imports from the United States is waste and scrap, providing a large market for U.S. aluminum scrap.[24]

6. The Scrap Market Is Regional

Scrap consumers tend to buy scrap in the region where their plants are located. For instance, a secondary smelter will generally limit its scrap purchases to a radius of 500 miles. One exception is UBC, whose high market prices allow it to be transported longer distances.

7. Technical and Economic Factors May Limit Demand Growth in Some Market Sectors

The ability of scrap consumers to use aluminum scrap depends to a great degree on the quality of the scrap and on the firm's ability to deal with impurities. UBC is so amenable to reuse (i.e., it can be freed of impurities and contains all of the right alloying ingredients) that Reynolds Aluminum makes aluminum can body stock from 100 percent scrap input.[25] On the other hand, some scrap consisting of certain aluminum alloys must be melted and mixed with certain alloying ingredients by secondary smelters before it can be used again. However, assuming additional supply is generated and that consumers are willing to pay the costs of processing, few technical barriers exist to replacing primary aluminum with recycled aluminum.

The economic ease with which additional scrap can be collected and processed depends on the type of scrap and the channel the scrap follows through the recycling path. UBC, as mentioned above, is readily reusable in the production of can sheet; if more UBC is collected, it will probably be absorbed easily by can sheet manufacturers. Absorption of additional new scrap should be relatively easy, as well.

---

[23] *Aluminum Statistical Review for 1989*, Aluminum Association, pp. 39, 53.

[24] Ibid.

[25] Personal communication with Charles Rayfield, Vice President and General Manager, Reynolds Aluminum Recycling Corp., September 2, 1988.

For other forms of old scrap, however, the story is not as clear. Much of this scrap is contaminated by attachment to or alloying with other materials. Scrap dealers and processors will find it more expensive to process this additional scrap. Therefore, an increase in supply that lowers dealers' and processors' costs of acquiring scrap may not pass through completely to end users as a reduction in the price they pay for processed scrap. Furthermore, much of this scrap is the type usually bought by secondary smelters, whose output is mainly directed at the castings industry, which is largely dependent on the auto industry. To successfully absorb additional old scrap, the secondary smelters will have to open up new channels in which to sell their product (secondary specification ingot). Alternatively, other scrap end users, such as foundries, will have to develop the capability to recycle the additional old scrap themselves.

Trends in Aluminum Scrap Demand

A major trend in demand for aluminum scrap over the next few years will be the continued expansion of scrap buying by consumers other than the secondary smelters. Can sheet manufacturers continue to represent a growing share of scrap consumption. In addition, foundries are beginning to make their own aluminum alloys from scrap and are expanding their scrap purchases to include old scrap as well as the new scrap they previously bought. These changes should increase demand for scrap as scrap finds new uses in the scrap-consuming industries. As a result, the recovery rate for aluminum should increase from its 1989 level of 27.5 percent.

While recovery is increasing, the overall market for aluminum is also growing, but at a very slow rate. The consumer-related markets (such as beverage containers) should gain steadily, although not as much as the 6 percent growth rate of the past several years. Total aluminum deliveries to the containers and packaging sectors (27 percent of total 1989 shipments) grew 3.3 percent in 1989. Other markets such as the building and construction sector (16 percent of 1989 shipments) declined in 1989. The other major sector, transportation, lost 1.3 percent in 1989.[26] Given this combination of markets and growth projections, the Department of Commerce projects that the industry will experience an annual growth rate of approximately 2 percent between 1991 and 1994.[27] So, although the scrap used per ton of aluminum produced will increase, aluminum production growth will be sluggish.

The combination of falling primary aluminum prices and slow growth in real GNP means that scrap prices are likely to fall in the next few years. The decline primarily depends on how much primary prices drop. At the same time, however, the volume of scrap moving through the market should continue to grow at a healthy rate.

---

[26] Standard & Poor's *Industry Surveys*, August 30, 1990, pp. M75-M79.

[27] U.S. Department of Commerce, *1990 U.S. Industrial Outlook*, p. 17-3.

IV. Government Intervention in Aluminum Scrap Markets

Governments are not major players in the aluminum scrap market, although government programs at the federal, state, and local levels influence the markets. This chapter discusses the desirability of increased government involvement in the aluminum market, describes existing policies, and then considers potential federal involvement in the market with the objective of increasing recycling. The list of potential initiatives is not indicative of intended government actions or policies. Instead, it simply presents possible scenarios for consideration should a determination be made that the market is not functioning properly, and that government intervention is appropriate to address the problem.

Government Intervention in Markets

In cases where significant environmental problems result due to the existence of market failure, EPA strongly supports the use of economic incentives (at the appropriate jurisdictional level) rather than traditional command-and-control regulatory approaches to address the environmental problem. With respect to the aluminum recycling markets, EPA's conclusion to date is that, where government intervention is appropriate, incentive-based options are best applied at the state and local level, where the solution can be tailored to the particular needs of that jurisdiction.

Another reason to carefully consider government intervention is the current extent of recycling. Aluminum recycling is well established and quite effective: The recovery rate was 27.5 percent in 1989 and greater than 60 percent for aluminum beverage cans, there is high participation among both consumers and industrial generators, and no significant government barriers hinder the recycling of aluminum.

Summary of Current Involvement

Government influence on the aluminum scrap market is strongest at the state and local levels where deposit laws and mandatory recycling are enforced. The programs in place currently almost affect aluminum beverage containers exclusively and are important influences on that portion of the scrap market. Non-container markets for scrap are minimally affected by these programs because virtually all UBC is returned to use primarily as cans; its content of other metals makes it inappropriate for many other recycled uses.

Deposit programs push additional aluminum into the scrap markets in particular regions by assigning a value to the containers that is well above their actual scrap value. This makes the containers available for entry to the scrap market at a lower collection cost than would otherwise be the case because consumers, bottlers, and distributors subsidize the

cost of collection. Mandatory recycling programs, a more recent state and local initiative, will have a similar result; they will encourage consumers to supply used containers to the scrap market, thus providing more low-cost aluminum for the scrap market.

Effects of Possible Federal Initiatives to Increase Aluminum Recycling

Supply Options

Supply-side changes are an important component of any program to increase the quantity recycled. Efforts to model supply behavior leave unanswered the question of how well supply responds to increases in price caused by greater demand. It may be that more direct efforts to stimulate supply would be more effective.

Old Scrap

For increasing post-consumer scrap, federal programs could require can recycling, either through mandatory recycling or through a financial incentive, such as deposits. Either of these programs drives down the cost of obtaining scrap by shifting the cost of collection to consumers (through their time and effort expended to save and return cans), collection programs (also funded by consumers/taxpayers), and industry (in the case of deposits). This low-cost scrap allows suppliers to provide more scrap at an even lower cost. Grants or loans for establishing recycling programs would have the same effect, decreasing collection costs by subsidizing collectors.

Tax incentives - such as property tax waivers (local), investment tax credits, and accelerated depreciation for suppliers - would have insignificant effects because of the dominance of scrap acquisition cost in dealers' and processors' total costs.

An alternative to decreasing the cost of scrap is to increase the cost of alternative management. A fee on disposal at landfills would increase the advantage of recycling, especially if, as is often the case, landfill costs do not reflect the true marginal cost of disposal.

One of the most promising incentives that the Agency has identified with respect to municipal waste services is unit-based pricing, which bases waste management rates on the volume (or weight) of waste generated, thereby providing an incentive for households to reduce the amount of waste generated. Unit-based pricing would also increase the supply of recovered materials, since households would have an incentive to recycle rather than dispose of materials. Further, households would have an incentive to purchase goods that minimize waste generation (for example, the demand for goods with excessive packaging would decrease).

New Scrap

Generation of new scrap is much more geographically concentrated than is generation of old scrap, which means that reducing collection costs does not provide as much leverage as it does for consumer scrap. The result is that it is more difficult to shift the supply curve for industrial scrap. Also, virtually all new scrap is already recovered.

Demand Options

Demand for scrap aluminum appears strong already, with major increases in scrap use over the past several years. Virtually all new scrap is already recycled, and demand for old scrap appears limited only by exogenous factors (e.g., the demand for finished products containing aluminum, such as automobiles). In general, however, increased scrap use is more limited by the supply side of the market. As a result, government intervention does not appear necessary on the demand side if the purpose of government policy is to increase the volume of aluminum recycled.

If demand intervention were indicated, several different approaches would be possible. For example, the federal government could provide a tax credit to firms that purchase mill products or ingot made from scrap. The credit would be based on the quantity or value of the scrap content. A policy like this was debated in the late 1970s, with secondary smelters opposing the intervention as unnecessary intrusion and scrap dealers and foundries supporting the plan.

One direct federal initiative is procurement requirements for the use of scrap in government and contractor purchases. The policy could require purchase of castings, ingot, or sheet with a minimum recycled content or provide favorable treatment to suppliers with products containing recycled aluminum. No apparent barriers exist now to the purchase of recycled aluminum products, but these incentives would give recovered aluminum a competitive edge. The federal government, however, purchases small amounts of aluminum directly; consequently, a procurement requirement may have little impact on the market.

Conclusions

While these potential initiatives have their respective advantages and disadvantages, there is a broader question of the desirability of any type of government intervention in these markets. Some of the policy objectives, such as increasing supply, are already being achieved through expanded recycling programs for used aluminum beverage cans. It is important that government efforts not duplicate or replace existing momentum for change.

References

"Aluminum Recycling: More Than Just Aluminum Beverage Cans", *Phoenix Quarterly*, Winter 1987-88, Institute of Scrap Recycling Industries, Washington, D.C.

Aluminum Recycling Casebook, Aluminum Association, 1985.

Aluminum Statistical Review for 1987, Aluminum Association, 1988.

Cooperman, Richard. Aluminum Recycling Association.

Garino, Robert, Duane Siler, and Deb Levin. Institute of Scrap Recycling Industries.

Gordon, Richard L., *The Collection of Nonferrous Scrap: A Literature Review of the Copper and Aluminum Sectors*, Pennsylvania State University, July 1972.

Industry Surveys, August 17, 1989, Standard & Poor's.

Meyer, M. Barry. Aluminum Association.

Minerals Yearbook, Volume 1, various years, U.S. Department of Interior, Bureau of Mines.

1990 U.S. Industrial Outlook, U.S. Department of Commerce.

Producer Price Index, various reports, U.S. Department of Labor, Bureau of Labor Statistics.

Phoenix Quarterly, Fall 1981, Special Issue on Recycling Markets, Institute of Scrap Iron and Steel.

Pollock, Cynthia, *Mining Urban Wastes: The Potential for Recycling*, Worldwatch Paper 76, Worldwatch Institute, April 1987.

Rayfield, Charles. Reynolds Aluminum Recycling Corporation.

Recycling Aluminum, National Association of Recycling Industries, 1981.