Metals: Aluminum Cans & Scrap

COMMODITY PROFILE

North Carolina Department of Environment and Natural Resources
DIVISION OF POLLUTION PREVENTION AND ENVIRONMENTAL ASSISTANCE

MARKETS ASSESSMENT 1998

OVERVIEW

According to the U.S. Geological Survey, the estimated primary aluminum production (from virgin material) for 1997 was 3.6 million metric tons, while secondary aluminum production (from scrap material) was 3.7 million metric tons. Of this recovered metal, 59 percent came from new (manufacturing) scrap and 41 percent came from old (discarded aluminum products) scrap. Old scrap accounted for approximately 17 percent of the total apparent domestic consumption. Apparent consumption is total aluminum production plus net imports plus stock changes.[1]

Used (aluminum) beverage can (UBC) scrap is the major component of processed old scrap, accounting for approximately one-half of the old aluminum scrap consumed in the United States. Most UBC scrap is recovered as aluminum sheet and manufactured back into aluminum cans. Most of the other types of old scrap are recovered in the form of alloys used by the die-casting industry; the bulk of these diecasts are used by the automotive industry.[2]

Overall, the aluminum industry produced 100.5 billion cans, or 1.5 million tons, in 1997, with the weight of the average can declining 2.1 percent to 32.57 cans per pound. The typical aluminum beverage can has a recycled-metal content of 54.7 percent.[3] The total estimated UBCs recovered nationally in 1997 was 63.3 billion cans (972,000 tons), representing an overall recovery rate of 63 percent. The average end-user price for UBCs in the Southern United States region for 1997 was $1,142.50 per ton or $0.57 cents per pound.

In North Carolina, out of an estimated total supply of 42,891 tons of UBCs, approximately 21,076 tons were recovered by the public and private sectors. This represents a 49 percent overall recovery rate for UBCs in North Carolina in 1997.

Figure 1: Supply of Aluminum Cans

Year	Number of Cans Shipped (Billions)[1]	Number of Cans Per Pound[1]	Pounds of Cans Shipped	United States Population[2]	Per Capita Consumption (Pounds)	Per Capita Consumption (Number of Cans)
1993	94.2	29.51	3,192,138,258	257,752,702	12.38	365.47
1994	99	30.13	3,285,761,699	260,292,437	12.62	380.34
1995	100.7	31.07	3,241,068,555	262,760,639	12.33	383.24
1996	99	31.92	3,101,503,759	265,179,411	11.70	373.33
1997	100.5	32.57	3,085,661,652	267,636,061	11.53	375.51
Average	**98.68**	**31.04**	**3,181,226,785**	**262,724,250**	**12.11**	**375.58**

Source: 1) The Aluminum Association
2) U.S. Census Bureau

SUPPLY

Generation

The domestic supply of aluminum cans is presented in Figure 1. The weight of an individual aluminum can has been decreasing during the past five years as manufacturers have improved production efficiency. The number of aluminum cans produced by a pound of aluminum has increased from 29.5 cans per pound in 1993 to 32.6 cans per pound in 1997. Thus, when determining the trend of per capita supply, it is necessary to look at the number of cans rather than pounds being supplied. From 1993 until 1995, the quantity of aluminum cans consumed per person per year rose from 365 to 383, an increase of 18 cans per person. In 1996, that figure dropped to 373 cans per person per year, but began to rise again in 1997. The 1997 estimate is very close to the average of the past five years (approximately 376 cans), showing no definite trend of increase or decrease.

The generation and recovery estimates of UBCs in North Carolina are presented in Figure 2. The projections for generation of UBCs for 1998-2002 were estimated by taking the 1997 per capita UBC supply rate (11.53 pounds per person), multiplied by the anticipated North Carolina population for the next five years. The generation figure assumes that the number of aluminum cans per pound will remain relatively constant, and the average consumption per person will remain constant as well. However, the supply of UBCs during the next five years depends largely on the effects of increasingly popular alternative beverage container materials. The PET plastic bottle is one material that has seen significant growth recently. Much of the growth in PET usage has been attributed to its aggressive capture of market share in the soft drink container business. The fastest growing market for PET bottles is single serve containers, especially 20-ounce drink bottles.[4]

Recovery

Based on survey results from North Carolina's private industry and local governments, the estimated total UBCs recovered in North Carolina in 1997 was 21,076 tons. This translates into a recovery rate of 49 percent, showing a four-percent increase from the 1994 estimated UBC recovery rate of 45 percent. The State of North Carolina implemented an aluminum can ban in July 1994, but even with this mandate, a significant portion of the UBCs continue to be landfilled. In Figure 2, the projected quantities of UBCs recovered for 1998-2002 are based on the current per capita recovery rate (5.67 pounds per person), adjusted for future population estimates.

The national recovery rates for UBCs are presented in Figure 3 along with recovery rates for North Carolina. In 1997, the estimated national recovery rate for UBCs was 63 percent. This figure is an average of the estimated recovery rates reported by The Container Recycling Institute (59.1 percent) and The Aluminum Association (66.5 percent). According to the Container Recycling Institute, approximately 7.4 billion cans out of the 66.8 billion recycled in 1997 are imported cans.[5] Although it is difficult to accurately determine the exact quantity of cans being imported for recycling, an estimated figure should be taken into account to accurately reflect domestic generation and recovery.

Other Aluminum Scrap

Aluminum UBCs continued to make up the largest portion of the scrap aluminum purchased domestically in 1997. However, discarded aluminum products (old scrap) other than UBCs are also significant sources. Figure 4 shows a breakdown of the total amount of purchased old scrap for 1996 and 1997. Purchased old scrap includes the materials that are purchased from post-consumer sources and

Figure 2: Estimated Generation and Recovery of Aluminum Used Beverage Containers (UBCs) in North Carolina

	1994[1]	1997	1998	1999	2000	2001	2002
Generation (Tons)[2]	43,740	42,891	43,504	44,073	44,601	45,055	45,513
NC Population[4]	7,024,000	7,436,690	7,542,996	7,641,684	7,733,097	7,811,951	7,891,238
Estimated NC Recovery (Tons)[3]	19,683	21,076	21,377	21,657	21,916	22,140	22,364

Sources: 1. N.C. DENR, Assessment of the Recycling Industry and Recycling Materials in NC: 1995 Update
2. The Aluminum Association
3. North Carolina Recycling Survey, 1998
4. North Carolina Office of State Planning

Figure 3: Estimated North Carolina and National Recovery rates for UBCs

	1991	1992	1993	1994	1997
Estimated North Carolina Recovery[1]	14.5%	22.6%	38.8%	45%	49%[3]
Estimated United States Recovery[2]	62.4%	67.9%	63.1%	65.4%	63%

Sources: 1. N.C. DENR, Assessment of the Recycling Industry and Recycling Materials in North Carolina: 1995 Update
2. The Aluminum Association
3. North Carolina Recycling Survey

Figure 4: United States Consumption of Purchased Old Aluminum Scrap for 1996-1997 (Metric Tons)

Material Type	1996	Percent	1997	Percent
Aluminum Cans	871,000	51%	949,000	57%
Castings, Sheet, and Clippings	764,000	45%	587,000	35%
Other	61,700	4%	110,000	7%
Aluminum – Copper Radiators	17,800	1%	25,400	2%
Total	**1,714,500**	**100%**	**1,671,400**	**100%**

Source: U.S. Geological Survey, 1996 and 1997 Annual Reports for Aluminum, Table 4.

does not include in-house or pre-consumer scrap derived from the aluminum production process. Aluminum UBCs were 57 percent of all the old scrap aluminum purchased domestically in 1997. Castings, sheet, and clippings have the second largest share, at 35 percent. Aluminum-copper radiators and other aluminum make up the remaining small portion of old scrap.

Figure 5 shows the generation and recovery of all aluminum for 1993-1997, including old and new scrap. The total secondary recovery figures are different from the figures for scrap aluminum purchased in Figure 4. The total secondary recovery is the estimated total quantity (tons) of aluminum and aluminum alloy products manufactured by secondary aluminum producers derived from purchased aluminum scrap. On average, for the past five years, old and new scrap have held an approximately even share of the total scrap consumed.

Of the total available supply, the percentage of all aluminum recycled remains at around 40 percent. However, a large portion of aluminum products are durable goods, and

Figure 5: Generation and Recovery of the Total Domestic Aluminum Supply (thousand metric tons)

	1993	1994	1995	1996	1997	Average
Recycled from New Scrap	1,310	1,580	1,680	1,730	2,160	1,692
Recycled from Old Scrap	1,630	1,500	1,510	1,580	1,530	1,550
Total Secondary Recovery	2,940	3,090	3,190	3,310	3,690	3,244
Apparent Supply	7,920	8,460	8,010	8,330	8,850	8,314
Total Secondary Recovery (Percent)	37%	36%	40%	39%	42%	39%

Source: U.S. Geological Survey, 1997and 1998 Annual Reports for Aluminum, Table 1.

Figure 6: United States Aluminum Industry Net Shipments (thousands of metric tons)

Major Market	1995	% of Total	1996	% of Total	1997	% of Total
Transportation	2,608	27.3%	2,640	27.5%	2,990	29.2%
Containers & Packaging	2,308	24.1%	2,175	22.6%	2,220	21.7%
Building & Construction	1,215	12.7%	1,325	13.8%	1,325	12.9%
Electrical	657	6.9%	671	7.0%	708	6.9%
Consumer Durables	621	6.5%	655	6.8%	694	6.8%
Machinery & Equipment	570	6.0%	569	5.9%	626	6.1%
Other	279	2.9%	291	3.0%	318	3.1%
Domestic, total	8,258	86.3%	8,325	86.6%	8,881	86.8%
Exports	1,307	13.7%	1,287	13.4%	1,355	13.2%
Aluminum Total	**9,565**	**100.0%**	**9,613**	**100.0%**	**10,237**	**100.0%**

Source: The Aluminum Association

it is important to note that the apparent supply of aluminum is going to be more than the amount of aluminum actually available for consumption as scrap within the same year. Since no data are available for the amount of aluminum (other than UBCs) recovered locally in North Carolina, the recovery rates are assumed to be similar to the national rates.

DEMAND

The demand for UBCs and other aluminum scrap is dependent upon the supply and demand for primary aluminum derived from virgin material. The demand for primary aluminum is determined by the domestic and international demand for aluminum ingot and aluminum finished products. In 1997, domestic primary production was estimated to be 3.6 million metric tons, which shows no relevant increase in production from 1996.

Transportation accounted for an estimated 32 percent of domestic consumption in 1997; containers and packaging, 26 percent; building and construction, 16 percent; electrical and consumer durables, eight percent each; and other uses, 10 percent.[6] The international distribution of United States goods, which is included in the United States aluminum industry net shipments (Figure 6). is as important as domestic consumption. Exports for aluminum remain the third largest component of all shipments, with a 13.2 percent share, making international markets for aluminum vital to the industry.

The containers and packaging segment of US shipments of aluminum is decreasing. The increasing use of plastics in soda bottles is having a negative effect on the overall demand for aluminum packaging. Figure 6 shows the decreasing percentage of containers and packaging in United States shipments of aluminum for 1995, 1996, and 1997, with the percentages being 24.1, 22.6, and 21.7 respectively.

Figure 7. Demand Estimates for Aluminum Scrap in the United States and North Carolina

	1997	2002
Old Scrap Aluminum Consumed in United States (tons)	1,671,400	1,772,158
North Carolina Population (thousands)	7,243	7,891
North Carolina Demand (tons)	47,260	50,109

The aluminum industry currently is attempting to counter the use of plastics through a series of advertising and marketing efforts supporting the use of aluminum cans.

The largest and most promising segment of United States shipments of aluminum is the transportation industry. Aluminum is a desirable material in the industry because of its relative strength and lightweight properties. The average aluminum content per passenger car jumped to 252 pounds in 1996, up from 191 pounds in 1991.[7] If the use of aluminum in automobiles continues to grow, then the prosperity of the transportation industry may determine the demand for aluminum. Since the demand for lighter cars with increased fuel efficiency is expected to rise, this presents a competitive advantage for the aluminum industry over the steel industry.

Overall, losses in the packaging industry should be offset by the increased use in the transportation industry, allowing for continued growth. Additionally, a strong international (global) economy will continue to be the driver for all aluminum goods, and should be considered the best indicator of what the demand for aluminum will be in the future.

The per capita demand for all scrap aluminum can be calculated by dividing the 1997 scrap consumption rate (Figure 4) by the national population in 1997 and the projected population for 2002. Figure 7 shows the estimated demand for scrap aluminum in North Carolina for 1997 and 2002. A per capita demand rate was established for 1997's current demand (12.7 pounds per person) and projected outward for 2002. Demand is expected to continue to exceed supply of aluminum scrap in North Carolina. Depending on the prices for primary aluminum, the industry should easily be able to absorb additional amounts of aluminum scrap as it becomes available.

Specifications

Since most aluminum cans are processed into new cans, it is imperative that only high quality scrap is generated from processors. If secondary aluminum needs any additional processing, then limited cost savings will be realized by using scrap. According to the Institute of Scrap Recycling Industries, UBC scrap must be free of steel, lead, bottle caps, plastic cans, and other plastics, glass, wood, dirt, grease, trash, and other foreign substances. All UBC scrap must undergo a magnetic separation process to ensure the removal of all ferous materials; any free lead is basis for rejection.[8]

Profiles of Major End-Users

The aluminum industry encompasses a group of highly specialized businesses. For UBCs to be recycled back into new cans, they pass through many different handling and processing stages, which are listed below.

1. UBCs are collected curbside or at local drop-off centers by residents. Also, some individuals and businesses collect cans and bring them to market.
2. UBCs are collected by intermediate processors such as material recovery facilities (MRFs) and are separated from other food and beverage containers. Some MRFs have balers, which allows them to ship the UBCs to end users, brokers, or toll processors.
3. MRFs without balers and businesses or individuals that wish to market UBCs individually may bring their cans to a scrap dealer. Scrap dealers consolidate volumes of UBCs and sell them to larger scrap dealers with balers.
4. Baling operations consolidate bales of UBCs until large truckload quantities are generated.
5. Brokers and can sheet manufacturers purchase the truckload quantities of baled cans.
6. Can sheet manufacturers typically have arrangements with toll processors to refine the metal and melt it into ingots. Toll processors act as contractors and are paid by can sheet manufacturers to process the materials and typically are not involved in purchasing or selling the aluminum materials.
7. Can sheet manufacturers melt the ingots into can sheet.
8. Can manufacturers punch out cans from the can sheet, produce lids for the cans separately, then sell the cans back to the beverage industry.

Figure 8: UBCs Five-Year Price History

End Users Price (per ton)	1993	1994	1995	1996	1997
Quarter 1 (March)	$690.00	$750.00	$1,390.00	$1,100.00	$1,170.00
Quarter 2 (June)	$660.00	$800.00	$1,320.00	N/A	$1,130.00
Quarter 3 (Sept)	$700.00	$1,070.00	$1,280.00	$990.00	$1,140.00
Quarter 4 (Dec)	$580.00	$1,310.00	$1,150.00	$1,010.00	$1,130.00
Average	$657.50	$982.50	$1,285.00	$1,033.33	$1,142.50

Source: *Recycling Times*, "The Markets Page."

While North Carolina does not host any end-users, the surrounding Southeastern United States has a considerable share of the major United States end-users. These companies are described below. These descriptions do not imply endorsement by the North Carolina Division of Pollution Prevention and Environmental Assistance (DPPEA) or the North Carolina Department of Environment and Natural Resources (DENR) of any company or its products.

Alcan Aluminum Corp., Mayfield Heights, Ohio, recycles cans at its U.S. facilities in Berea, Kentucky; Greensboro, Georgia; and Oswego, New York. In 1997, Alcan bought 577 million pounds of scrap cans, capturing 28 percent of the market. The company paid suppliers $375 million for UBCs.[9] In addition to the company's can recycling activities, Alcan's Shelbyville, Tennessee, secondary aluminum facility annually recycles approximately 115 million pounds of post-consumer scrap, such as cookware and lawn furniture to produce alloys primarily for the automobile industry.

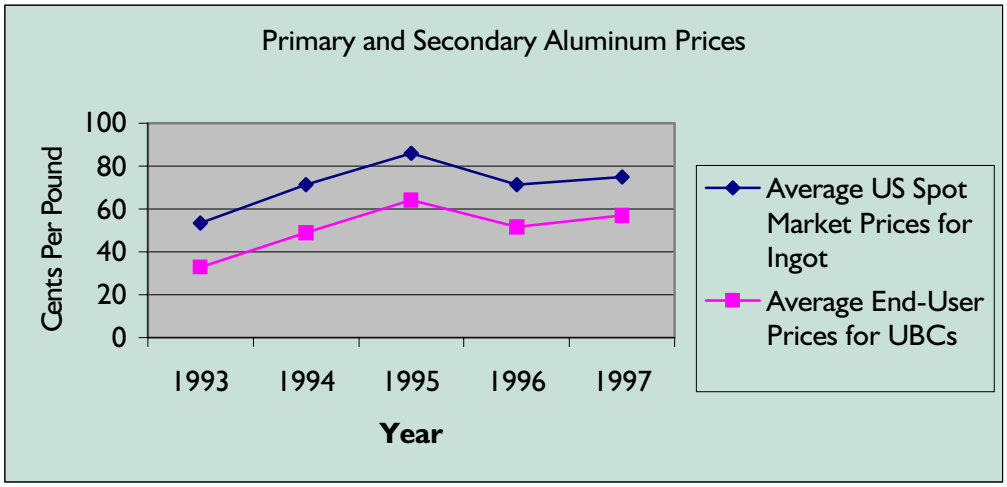
Reynolds Metals Company, Richmond, Virginia, took in 398 million pounds of UBCs last year (a 19-percent share), up 11 percent from 1996. The firm also bought 35 million pounds of other aluminum scrap at its other locations nationwide in 1997. Reynolds subsequently sold its consumer recycling division to Baltimore-based Wise Metals.[10] Reynolds operates two processing facilities in North Carolina: in Clayton, near Raleigh, and in Charlotte. Aluminum cans are processed through a magnetic separator and are shredded. Shredded UBCs are primarily shipped to Reynolds' reclamation facility in Sheffield, Alabama. Other aluminum scrap is processed, baled, and shipped to another reclamation plant in Richmond, Virginia.

Anheuser Busch Recycling Corporation – ABRC, St. Louis, Missouri, is the largest aluminum recycler in the world, a position it has held for 10 consecutive years. It recycled more than 648 million pounds of aluminum in 1997, equal to 20 billion cans. The firm captured 32 percent of the market, an increase of nearly seven percent during the previous year.[11] In 1996, ABRC recycled the equivalent of more than 110 percent of the Anheuser-Busch beer cans that were sold. Cans that are purchased by ABRC from processors are shipped to major can sheet manufacturers such as Alcan and Alcoa. Metal Container Corporation (MCC), which is a subsidiary of Anheuser Busch, purchases the can sheet from these manufacturers and makes 60 percent of Anheuser Busch's cans. MCC is also a major supplier to the soft-drink industry, producing more than 21 billion cans and 22 billion lids in 1997.

Aluminum Company of America – Alcoa, Maryville, Tennessee, operates the largest aluminum can sheet production facility in the world in Alcoa, Tennessee. Alcoa Recycling Company, a wholly owned subsidiary of Alcoa, purchases aluminum can scrap for this mill, and its other facility in Newburgh, Indiaina. The company uses two materials processors in North Carolina to process UBCs for end-use: United Metal Recyclers in Kernersville and Wagram Paper Stock in Scotland County. Alcoa also buys cans from the Western part of the state for direct shipment into its Marysville, Tennessee, processing facility. Alcoa also currently operates a primary aluminum production facility in Badin, Stanly County, North Carolina.[12]

IMCO Recycling, Irving, Texas, is the world's largest secondary aluminum recycler and also recycles magnesium and zinc. IMCO's primary business is the recycling of customer-owned materials in exchange for a processing fee. Its customers include aluminum companies such as Alcoa, Kaiser Aluminum, and Wise Metals who use recycled aluminum to produce containers, building construction materials, and automotive products. The company processes the aluminum at 16 United States plants and also owns a 50-percent interest in a German plant. IMCO owns two processing facilities in Tennessee. Their Rockwood facility has an annual melting capacity of 220 million pounds and the Loudon facility has an annual capacity of 180 million pounds.

Figure 9: Aluminum Five-Year Price History



Sources: 1) *Recycling Times*, The Markets Page
2) U.S. Geological Survey, *Minerals Commodity Summaries*, January, 1998.

SUPPLY / DEMAND RELATIONSHIP

Price History

The five-year price history for UBCs is displayed in Figure 8. The price fluctuations paralleled those for primary aluminum ingot (Figure 9).

Major international economic events (both positive and negative) appear to be the largest contributor to fluctuations in supply and demand for aluminum. In the first half of 1998 the UBC market experienced an inter-related effect of a major economic downturn in Asia, and a contrasting booming United States economy. Recyclers in the scrap metal industry, as well as other recycling industries, claim that the boost in the value of the United States dollar is a double-edged sword. On one hand, the dollar is so strong, that importing raw material from overseas is cheaper than buying abroad. On the other hand, Asian currencies have devalued greatly compared to the United States dollar.[13] Without the significant demand for finished aluminum products from Asian markets, major surpluses are resulting, causing a slump in prices for both primary and secondary materials.

As of June 1998, the price of UBCs had dropped to around 35 cents per pound, down 22 cents (39 percent decrease) from last year's average price of 57 cents per pound. According to one local processor, aluminum UBCs are typically a low margin / high volume commodity. With the current low prices, it becomes difficult to obtain the desired volumes and, consequently, difficult to move the UBCs.[14]

CONCLUSION

Unlike most recyclable commodities, the prices for UBCs and other aluminum scrap are derived from perceived demand. If there is strong global demand for primary aluminum in the future, then the demand for aluminum UBCs will continue to be favorable as well. Regardless of the fact that aluminum prices are currently relatively low, the demand for UBCs and other aluminum scrap still remains strong enough for the material to be recycled by local governments and private industry. The cost savings and actual revenue generated from recycling aluminum cans should enable UBCs to continue to be included in all recycling programs.

At the average 1997 price of 57 cents per pound, the estimated 23,000 tons of UBCs that were disposed last year had a value of approximately $26 million dollars. Al though UBCs are a high volume / low margin commodity, with $26 million dollars worth of available supply, there is still an opportunity for new or existing collection and processing businesses to capture the materials profitably.

In North Carolina, the current estimated recovery rate of approximately 50 percent is significantly lower than what would be anticipated from a 100 percent diversion mandate. The aluminum can ban, which went into effect in North Carolina in July of 1994, has resulted in an estimated increase in recovery of only approximately five percent. Although there are no calculations of secondary end use capacity available, there are no indications that the aluminum industry would not be willing and able to adapt to

the consumption of all aluminum cans supplied from North Carolina in the future. Thus, an increase in the aluminum recovery rate statewide depends more on improved collection efficiency, and not necessarily increased capacity or markets for the material.

RECOMMENDATIONS

The state should take the following steps to increase UBC recycling:

- *Determine why aluminum cans are still being sent to landfills*. The state should analyze existing recycling programs in all counties and make sure that residents and businesses have adequate access to recycling. Either drop-off or curbside services need to be available locally for UBCs to be properly diverted from disposal. This alternative is more viable than enforcing the aluminum can ban by visual inspection at local landfills.
- *Educate local government recycling coordinators that there are still UBCs to be recovered*. A barrier to increasing aluminum can recovery is the misperception that UBC recovery is at or near its peak, because of the landfill ban and the relatively high value of UBCs.
- *Improve efficiency of existing recycling programs*. To increase the quantity of aluminum collected throughout the state, equitable, waste reduction based collection systems such as pay-as-you-throw (PAYT) should be encouraged. PAYT programs charge system users based on the amount of waste generated, providing financial incentives to reduce and recycle. Consistent, targeted educational campaigns have also been shown to increase participation in recycling programs.
- *Encourage small retail / commercial sector recovery*. The first step the state should take to encourage recovery from this sector is to work with counties to increase awareness of the law among businesses. Since the can ban went into effect more than four years ago, awareness may have waned, and it may be time now to emphasize the importance of complying with the law. In addition, municipalities and counties should be encouraged to examine the feasibility of adding small businesses to existing recycling programs, since UBCs are a revenue generating material.
- *Determine the number of multi-family units in North Carolina that are not being serviced with recycling*. A potentially significant amount of UBCs from the residential waste stream may be discarded in multi-family units. Determine the feasibility of including these units in existing local government recycling programs would help capture additional UBCs.

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