The Role of the Consumer

in Reducing Primary Aluminum Demand

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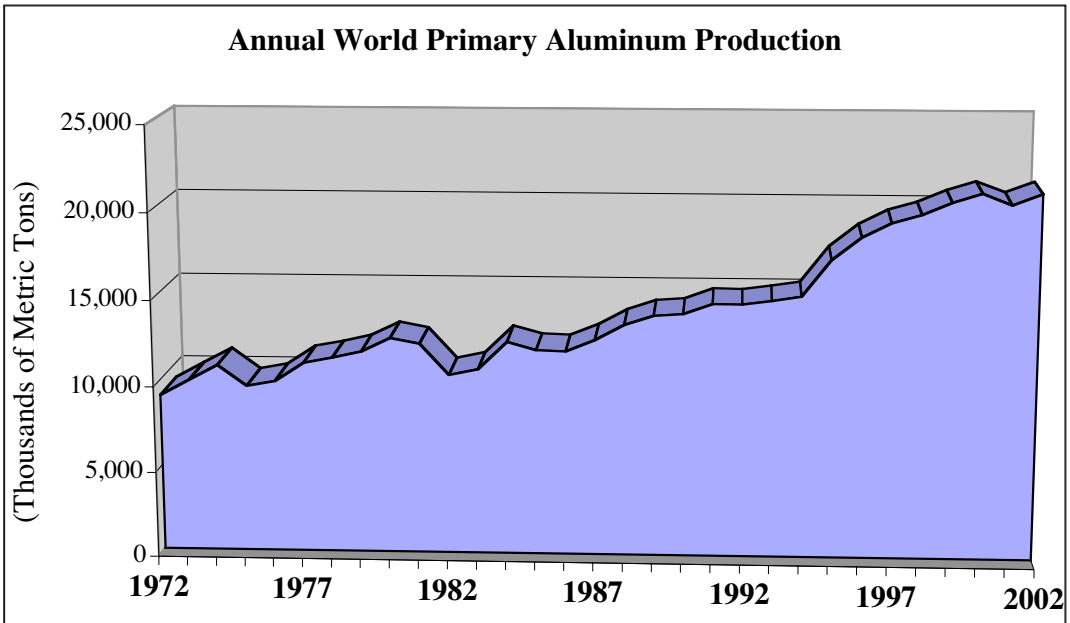
INTRODUCTION: TRENDS IN WORLD PRIMARY ALUMINUM PRODUCTION

Since the birth of the modern aluminum industry in the 1890's, primary aluminum production has been intimately connected with hydroelectric power. Alcoa's first large commercial reduction plants used hydropower generated at Niagara Falls. World War II created a huge demand for aluminum fighter planes and other industrial products, and dams and smelters sprung up in Canada, Europe, and Russia. In the United States, vast networks of hydroelectric dams were constructed in the Tennessee Valley and in the Columbia River basin, both at expense of the U.S. government, and the aluminum industry flourished.

In the post-war period, aluminum companies worked to develop other sources of demand for the output of their huge smelters: furniture, cooking utensils, a vast array of electrical and building materials, and in the 1960's, the now-ubiquitous aluminum beverage can. Smelter and dam construction continued hand-in-hand—from Ghana to Norway and Brazil to Quebec.

What makes the current climate for aluminum industry watchers important is today's extremely high level of aluminum production. World output of primary aluminum has increased almost five-fold in the last forty years, growing from 4.5 million tons in 1960 to 15 million tons in 1980 to 21.2 million tons in 2000. Growth is projected to continue as vast new markets for consumer goods open up in China and other rapidly industrializing countries. This growth poses a threat to the diminishing global "supply" of wild rivers, and will impact the environment—and human communities dependent on the environment—in numerous other ways.



Source: International Aluminium Institute, http://www.world-aluminium.org/iai/stats/150.html. Downloaded 7/14/03.
Note: 1999 IAI world total is 2.9 million tons lower than the 1999 AA total; the difference is in the "Asia" category; AA is probably including estimated production in China, while IAI is probably excluding it.

This report provides an introduction to the locales where dams and smelter projects are pending, and discusses the leading producers for aluminum and its precursor products, bauxite and alumina; trends in end-uses for aluminum; factors affecting scrap prices, and finally, the range of consumer and citizen actions that can be taken to reduce primary aluminum demand.

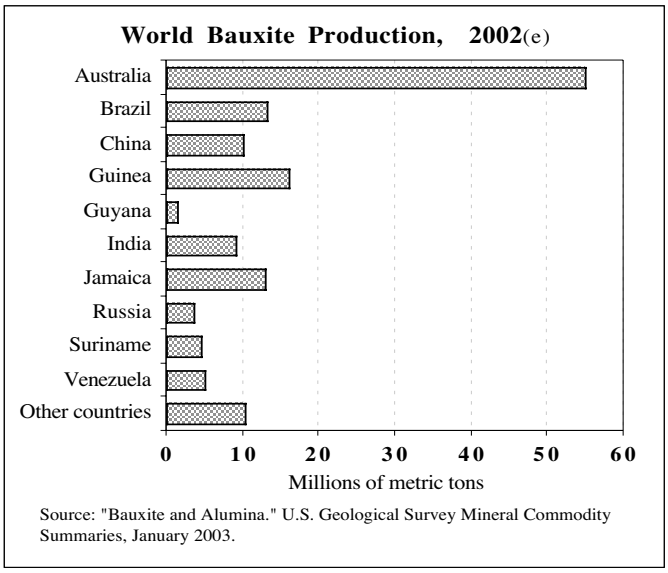
PRODUCTION, CONSUMPTION, AND RECYCLING

Before embarking upon an international campaign to publicize these destructive, interconnected projects, activists need a basic understanding of the structure of the world aluminum industry: who the major producers and consumers are, what the major products are, what the growth markets are, and what factors influence price, demand, and recycling.

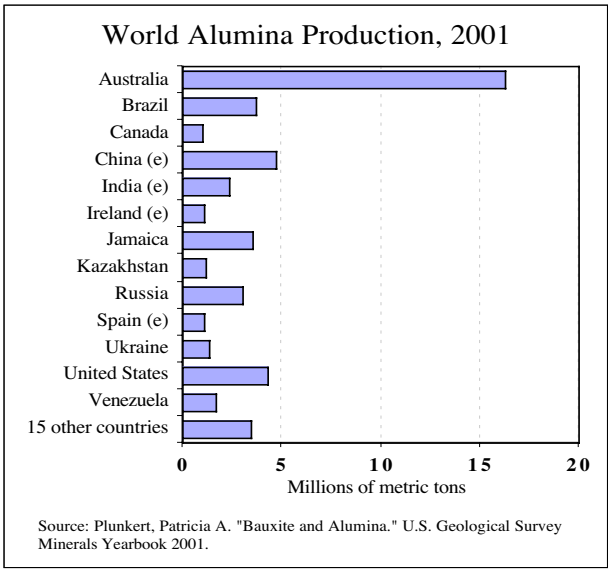
The Major Producing Countries

Aluminum and its precursors, alumina and bauxite, are international commodities. The materials needed to produce a ton of finished aluminum product may be mined, refined, smelted, fabricated, and sold, in several different parts of the world, and then recycled and refabricated in still other countries. Electricity comprises 20 to 30% of aluminum's total production cost, while transportation costs from mine to smelter comprise less than 1%; therefore, it is common to ship bauxite or alumina around the world to take advantage of cheap power.

As the figures show, Australia is the world leader in both bauxite and alumina production. Guinea, Brazil, Jamaica, China, and India are the next largest bauxite producers, while alumina production is dominated by these same countries as well as the United States.



Source: "Bauxite and Alumina." U.S. Geological Survey Mineral Commodity Summaries, January 2003.



Source: Plunkert, Patricia A. "Bauxite and Alumina." U.S. Geological Survey Minerals Yearbook 2001.

The Hydro-Aluminum Connection: New Capacity Threatens Rivers

As electricity becomes more expensive in industrialized countries, multinational aluminum companies are shutting down expensive existing smelters—even those that employ modern equipment and technology. In turn they are seeking to develop new smelters—and all of their associated infrastructure, including dams—in regions where they can be assured of cheap—and often subsidized—power. These greenfield projects, and expansions of existing smelters, can be found in far-flung locales, from Africa and South America to China and Iceland.

An expansion of the Mozal aluminum smelter near Maputo, Mozambique, is the impetus for building the proposed Mepanda Uncua Dam on Mozambique's Zambezi River. The dam would flood 100 square kilometers of pastoral land on the river's floodplain, displace an estimated 2,000 people, and reduce valuable silt infusions into the Zambezi delta.[1]

In southern Chilé, the proposed Alumysa Project would entail the construction of six large dams, together producing 1,154 MW for a 440,000 ton aluminum smelter. Additional infrastructure would include new roads and transmission lines in undeveloped areas, and a new deepwater port. Should the project be completed, farmers would be relocated due to 96 square kilometers of projected flooding. Salmon fisheries and a host of vulnerable land, riverine, and marine species would also face threats from fluoride deposition from the smelter, mercury, and other heavy metals released into the water, and spillage of imported alumina.[2]

The largest remaining wilderness area in Europe is also threatened by this hydro-aluminum connection. Alcoa Aluminum has teamed up with Iceland's national power company to propose a series of dams along several major rivers north of the Vatnajoekull Glacier in the Icelandic highlands. Alcoa would buy all of the electricity generated—an estimated 690 MW—to power its proposed 322,000 ton Reydaral smelter. Environmentalists in Iceland and Norway, as well as the national Icelandic Planning Agency, have been fighting the project. They object to the proposed inundation of over 50 square kilometers of land containing more than 100 scenic waterfalls, the loss of habitat for reindeer and pink-footed geese, and other impacts on regional wildlife and agriculture.[3]

The British-Icelandic company Atlantsal has also recently announced plans to build a 360,000 ton aluminum smelter in the town of Husavik in northern Iceland. The proposed smelter would use geothermal as well as hydroelectric power, requiring new large dams in Iceland's Central Highlands. If permits are granted, the smelter is slated to open as early as 2006.[4]

At present, Iceland exports all of the primary ingot it produces (220,000 metric tons in 1999), and imports all the milled (semi-fabricated) aluminum products it uses domestically, or about 5,000 tons. In other words, the Icelandic aluminum industry is strictly a raw materials export industry, not a value-added industry that takes advantage of a skilled domestic labor force.

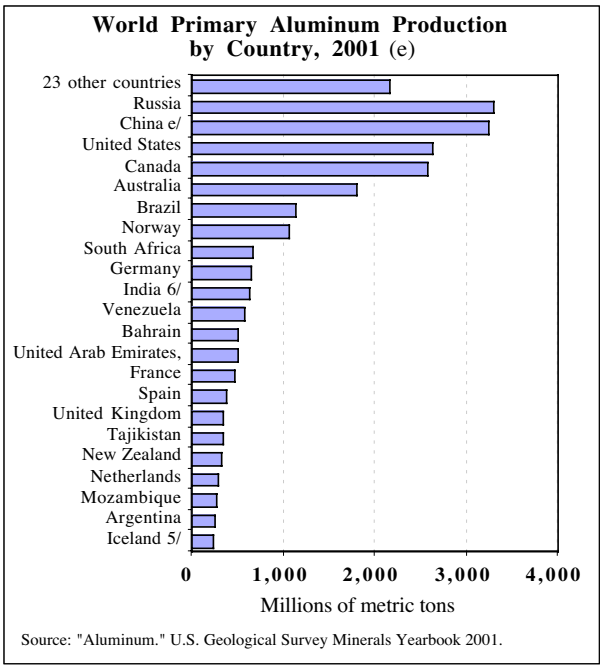
Finally, as other papers at this conference will point out in more depth, major tributaries of the Amazon River are threatened by Brazil's powerful aluminum industry. In response to the recent drought, aluminum companies have faced mandatory cutbacks in energy purchases, and are now hoping to build more of their own dams to hedge against future supply restrictions. Alcoa, Billiton, and other Brazilian and multinational consortia have proposed building three huge dams with more than 3,000 MW of combined capacity on the Tocantins and Araguaia river systems. If completed, the Estreito, Santa Isabel, and Serra Quebrada dams would flood areas of rainforest and ecological reserves, displacing more than 20,000 people, and would affect Apinajé, Surui-Aikewar, Karajá and Krikati indigenous people. The projects face legal challenges, and none has yet been approved by environmental authorities.[5]

Shifts in World Primary Aluminum Production

For most of the 20th century, the United States dominated world production and capacity expansion—going from 2 million tons in 1960 to almost 5 million tons in 1980. Canada and the Soviet Union came in a distant second and third—although Soviet aluminum was not then traded on the open market. Trailing behind these powers were other—primarily European—industrial-ized countries: France, Germany, Austria, Norway, and Japan.

In the wake of the 1970's energy crisis, world energy prices spiked, and aluminum production and capacity expansion began to shift away from high-cost, energy import-dependent countries to areas with abundant energy sources: primarily coal-rich Australia, and Brazil and

Canada, who had vast untapped hydroelectric potential.[1] Many new dams and smelters were constructed during this period, for example the Tucuruî dam in Brazil, and the massive James Bay hydroelectric project in Quebec which provided electricity to four giant new smelters.

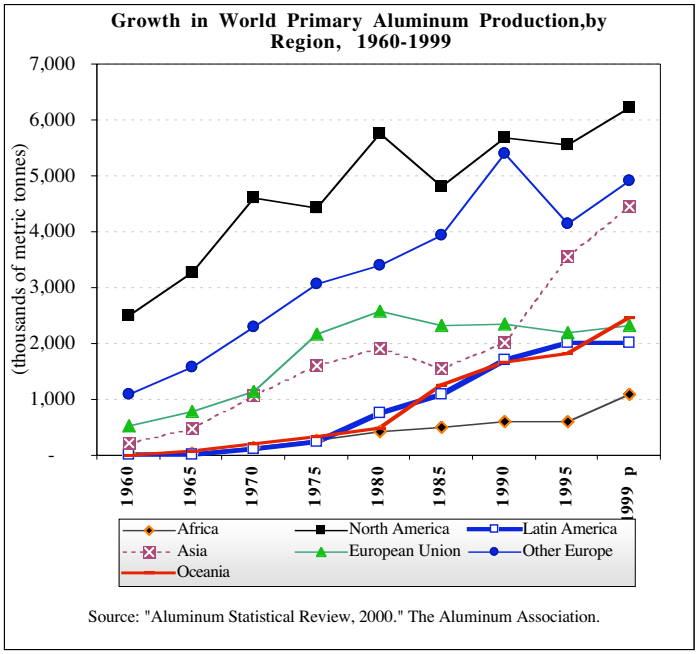


The world aluminum market changed dramatically after the 1990 fall of the Soviet Union and China's entry into the global economy. Russia's "dumping" of aluminum onto the world market in the early 1990's was driven by a need for western currency. The ensuing market glut intensified pressure on higher cost locations in the United States and Europe, forcing some older plants to close or become "swing" capacity, and driving down prices for primary as well as secondary (scrap) aluminum. China's access to investor capital has enabled production capacity to skyrocket.

In the fall of 2000, deregulation and collusion in the electricity industry sent energy prices in the western U.S. skyward. Ten Pacific Northwest smelters who used hydroelectricity from Columbia River dams were hit hard. The federal Bonneville Power Administration refused to renew the cheap, long-term contracts they had provided the smelters since WWII, and all but one of them were forced to close permanently. Pacific Northwest production plummeted by over 1.6 million tons in just a year and a half, and although other U.S. smelters picked up some of the slack, the U.S. yielded the top spot to Russia and China, as the figure shows.

By 2001, world primary aluminum production (including China) had grown to over 24 million tons. Despite what industry analysts acknowledge is a market glut today, they predict continued growth in world demand, and unabated growth in new smelter capacity to meet this projected demand growth.

On a regional basis, North America is still the leading producer of primary aluminum, but it is rapidly being eclipsed by Asia and eastern Europe, including the former Soviet Union, as the figure to the right shows. Appendix A tracks the world leaders in aluminum production from 1960-2001.

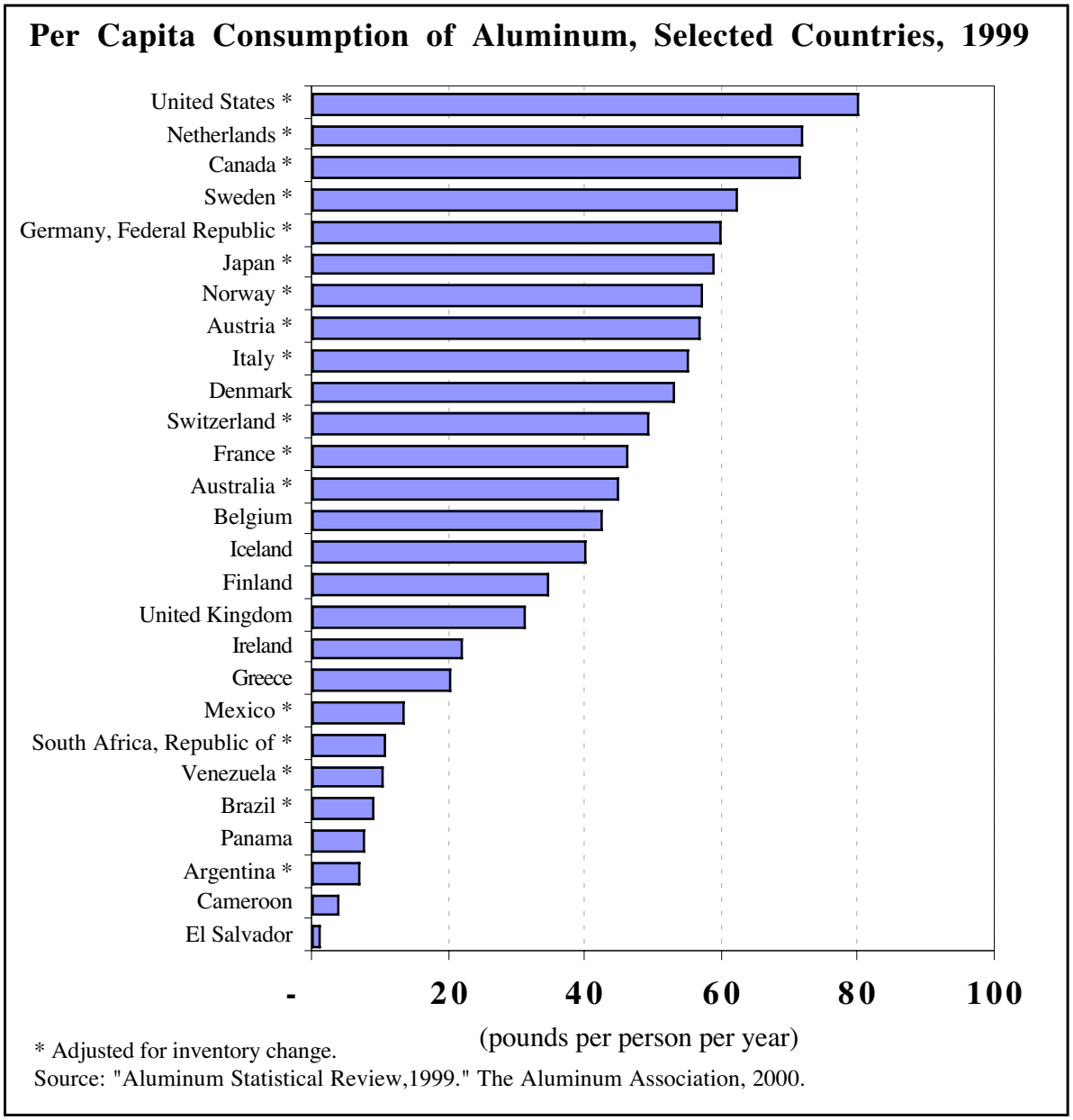


[1] Industry insiders called this the "ABC transition," named for the first letters of these countries. See "The World Aluminum Industry in a Changing Energy Era," by Merton Peck.

Per Capita Aluminum Consumption

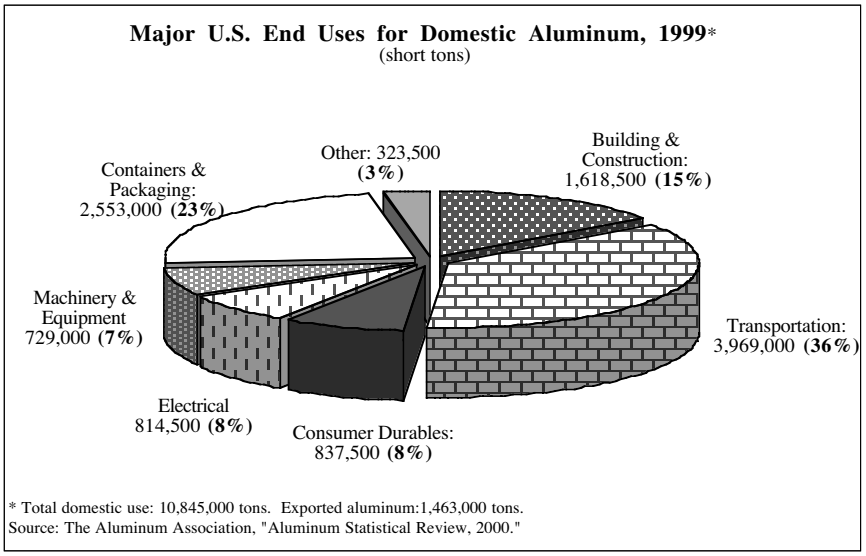
There is a wide variance in per capita aluminum consumption worldwide. As expected, the United States is ranked first at 80 pounds per person per year, followed closely by the Netherlands, Canada, Sweden and Germany, at 60-78 pounds. Most other major industrialized countries, including most of western Europe, Japan, Australia, and Norway, consume between 20-60 pounds per person annually. By contrast, the average South American consumes less than 10 pounds annually, and most Asian and African countries are not even ranked. Appendix B provides per capita consumption data, where available, from 1960–1999.

Data on per capita consumption for major rapidly-developing economies, including Russia, China, and Asian nations, are unavailable. Their future demand growth may be steep, however, as they acquire the means to purchase automobiles, soda cans, and other products.



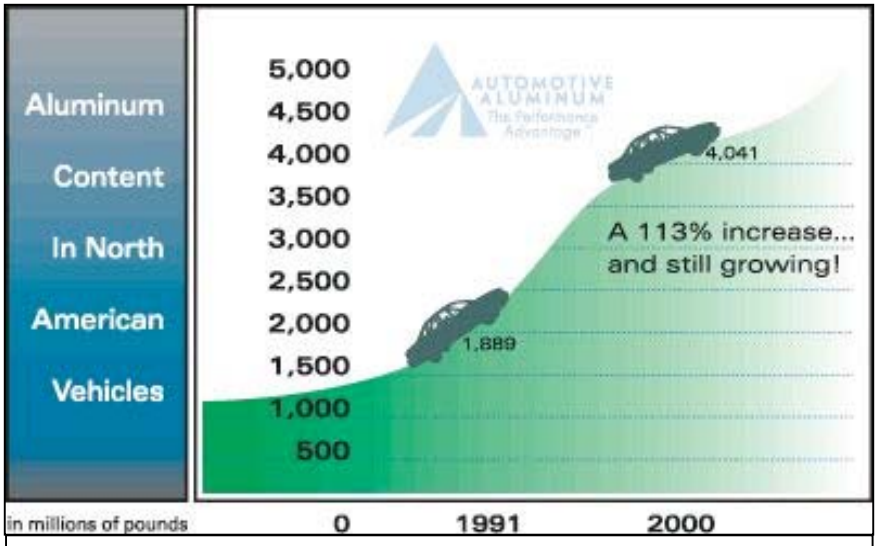
End-Use Sectors and Trends

In 1995, **transportation** surpassed containers and packaging as the single largest major end use of aluminum in the United States, and now constitutes just over a third of U.S. net aluminum shipments. The amount of aluminum in passenger cars has increased dramatically in recent years, growing from an average of 245 pounds per passenger vehicle in 2000 to 267 pounds in 2002, and is still a high-growth market. This includes parts and bodies for automobiles, commercial and military aircraft, railroad cars, trucks, trailers, busses, etc., and has been the biggest growth market in the past decade. Similar trends exist worldwide.



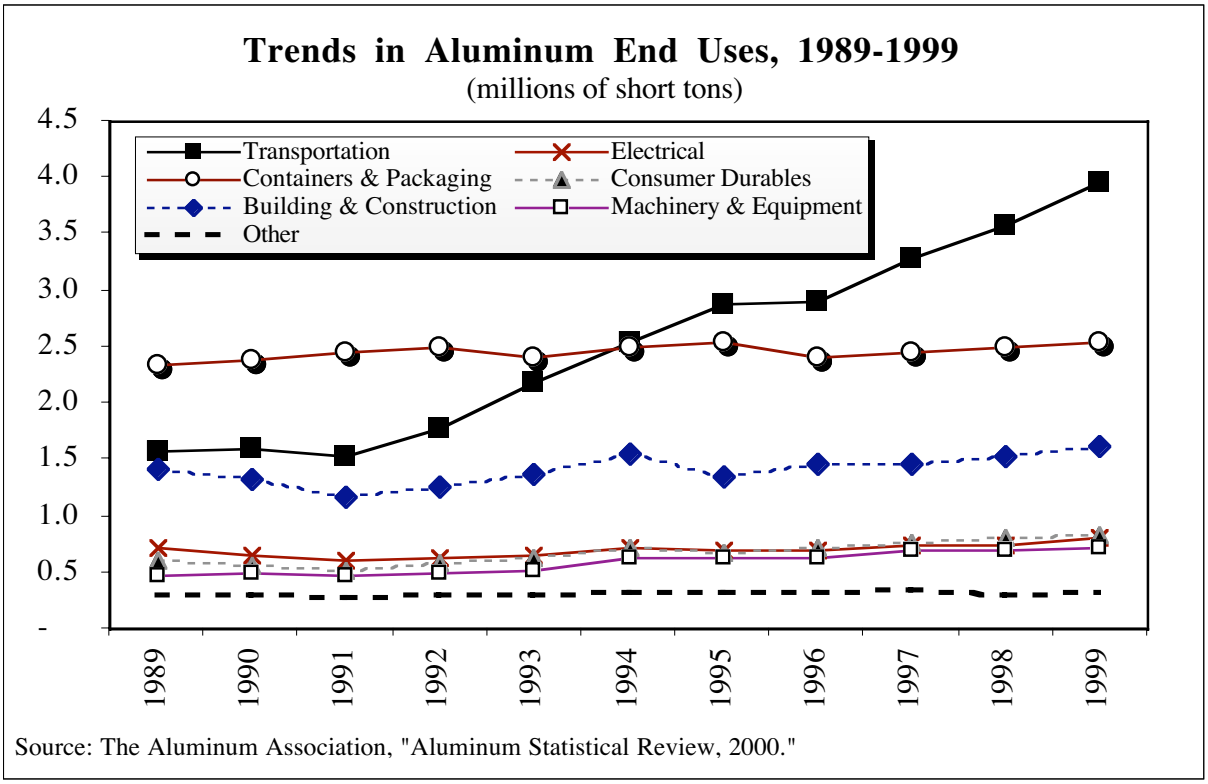
The environmental impact of the increasing use of aluminum in the transportation sector is offset in part by the energy savings afforded by substituting aluminum for steel car parts. This substitution would be overshadowed, however, by the energy that could be saved by returning to the average vehicle weights and fuel economies of the pre-SUV era, or enacting a national transportation policy which encouraged mass transit. An irony is that the Aluminum Association is officially opposed to raising American fuel economy standards because their customers (the auto industry) do, even though higher fuel economy goals would increase the demand for aluminum car parts. [6]

The second biggest end use for aluminum in North America is **containers and packaging**. This category, which includes food and beverage cans, foil, and other closures and packaging, grew dramatically between 1970 and 1990, but has since been losing market share to plastics, especially in beverage containers. U.S. production in 1999 was 2.6 million tons, 24% more than in 1990. Containers and packaging is the only market sector tracked from production through consumption through recycling, because its largest



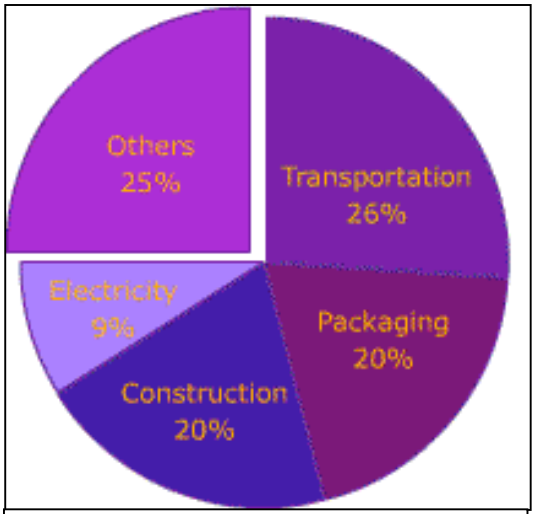
Source: http://www.autoaluminum.org/apps.htm

component is used beverage cans (UBC's), which are recycled in a "closed-loop" system, or made into cans again. Four U.S. companies use UBC's to manufacture can sheet: Alcoa, Alcan, Wise Alloys, and Arco.



Source: The Aluminum Association, "Aluminum Statistical Review, 2000."

Beverage cans are the only consumer products designed to have a short lifetime: in many cases a few minutes between consumer purchase and disposal. Aluminum foil is usually only used once, as are trays and closures.



Source: International Aluminium Institute http://www.world-aluminium.org/applications/use.html (derived from Canadian data: Minerals Yearbook, Aluminium, Natural Resources Canada 1998).

The other end-use sectors are:

- **Building and construction materials:** window/ door frames, screens, awnings, siding, bridges, girders, mobile homes, guardrails, signs, etc.
- **Electrical** products, including wire & cable.
- **Consumer durables:** furniture, appliances, cooking utensils, etc.
- **Machinery and equipment.**

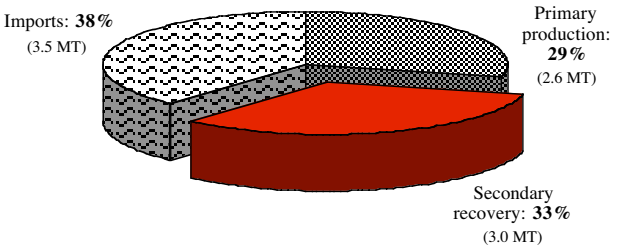
According to the International Aluminium Institute, the proportion of end uses worldwide roughly parallels that of the United States, at least in Canada, from which they base their worldwide data. The major difference is that beverage containers have a smaller (yet rapidly-expanding) market share in other parts of the world.

Scrap Utilization and Total Supply

Each country gets its aluminum from a variety of sources: domestic production of primary ingot; imports of ingot, semi-fabricated aluminum products (sheet, rod, bar, wire, etc.), and scrap; and domestic scrap. The latter is broken down into "old" (or post-consumer) scrap, and "new" (pre-consumer/industrial) scrap. For the most part, new scrap has always been recycled, because clean, fairly homogenous quantities are generated by large industrial users. Old scrap, on the other hand, is heterogeneous, combined with other materials, and its return is more dependent on price.

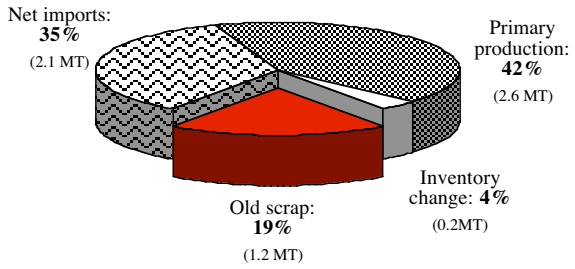
Industry trade organizations and government agencies are inconsistent about the way they measure total supply: some—such as the U.S. Geological Survey—are careful to differentiate between old and new scrap, and others—such as the Aluminum Association, a U.S. industry trade group—lump them together as the figures to the right show. The latter method creates the impression that recycling (or "recovery") accounts for a third of total supply, while the former—recognizing the in-house nature of new scrap recycling—paints a picture of [post-consumer] recovery accounting for just under one fifth of total supply.

The 2001 U.S. Aluminum Supply,
According to The Aluminum Association, Inc.



Source: Personal communication with Nick Adams, Director, Statistics & Economics, Aluminum Assoc., 7/15/03

The 2001 U.S. Aluminum Supply,
According to The United States Geological Survey



Note: To get "Apparent Consumption," USGS subtracts exports from imports, adds inventory change, and deducts purchased new scrap. Source: Table 1, "Salient Aluminum Statistics," Minerals Yearbook 2001, USGS.

Aluminum Recycling Worldwide

Only in the last five years has the International Aluminium Institute (formerly the International Primary Aluminium Institute) published statistics on the global rate of secondary recovery. Their data suggest that world scrap recovery has been equivalent to about 10% of the primary aluminum ingot produced annually, as the table at left shows. It must be noted that these data do not distinguish between old and new scrap. They are also not geographically comprehensive. According to the statistics expert at the Aluminum Association, scrap consumption and export data from Russia and China, both of whom have surpassed the U.S. in primary production, are "huge black holes;" no data is being collected. It is also not always possible to be sure whether certain shipments of aluminum are primary or secondary; because they are only categorized by alloy type, they may or may not contain scrap.[7]

Aluminium Recovered from Scrap, Worldwide

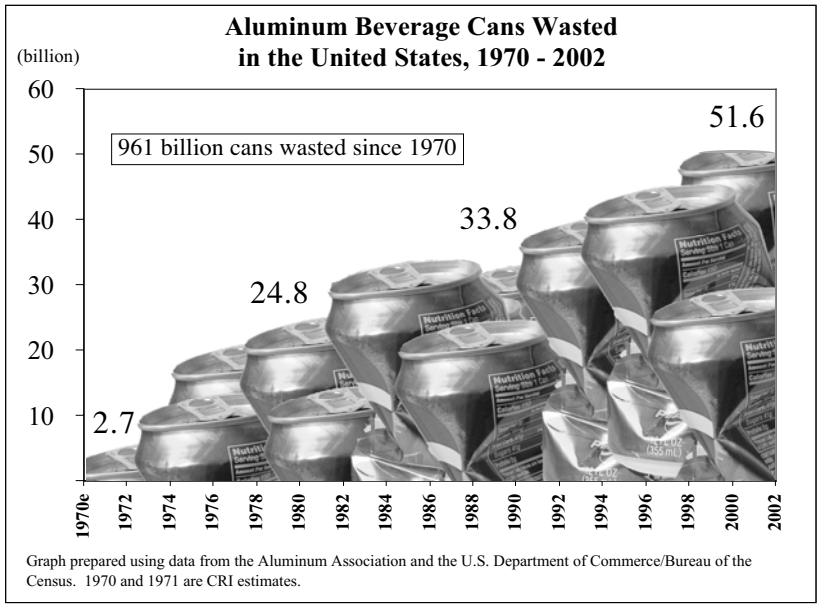
Year	Primary Aluminium Production	Aluminium Recovered From Scrap
	(Thousands of Metric Tons)	
1997	19,479	2,175
1998	19,949	2,135
1999	20,655	2,177
2000	21,191	2,244
2001	20,551	2,217

Source: Form 750, International Aluminium Institute Statistical Report. Date of issue: 22 April 2002. http://www.world-aluminium.org/iai/stats/data_files/750.csv

Aluminum Beverage Cans: Global Per Capita Consumption and Recycling

As it does in total per capita aluminum consumption, the United States leads the world in aluminum beverage can consumption. In 2002, 100 billion aluminum beverage cans were sold to American consumers. U.S. per capita consumption is **350** cans per year: the equivalent of almost one can a day for every U.S. resident.[8] No other country in the world comes even close to this rate, as the table below shows. The next highest per capita can consumers are Sweden (103), Greece (96), Austria (93) and the United Kingdom (88).

In the United States, the recycling rate for used beverage cans (UBC's) has shrunk considerably in the last decade as collection options have failed to keep pace with increasing can sales and changing consumption patterns. Despite a tripling in the U.S. population's access to curbside recycling programs, the UBC recycling rate shrunk from an all-time high of 65% in 1992 to 48.4% in 2002. In 2002, 760,000 tons of aluminum cans were wasted in the U.S.: a 38% increase from the 551,000 tons wasted in 1992.



Graph prepared using data from the Aluminum Association and the U.S. Department of Commerce/Bureau of the Census. 1970 and 1971 are CRI estimates.

A major reason for the recycling decline is the insufficient availability of recycling options at the point of consumption. As Americans' commutes to work grow longer, an "immediate consumption" trend has emerged, with people consuming more food and beverages on the go, and less at home. While residential curbside recycling is convenient and available to at least half the U.S. population, there are very few recycling programs in place away from home: the office, mall, airports, theaters, parks, etc. Beverage cans consumed away from home are most likely to be thrown in the trash.

The other factors affecting the recycling decline are economic. Unemployment has been relatively low, so fewer people have needed to supplement their income with scrap cans. Scrap aluminum prices have also failed to keep up with inflation, making it decreasingly worthwhile to collect cans for their scrap value, which has hovered between 1 and 2 cents a can for several decades. Finally, in the nation's 10 "bottle bill" states (home to about 30% of the population), the standard nickel deposit has also not risen with inflation.

The UBC recycling rate in Europe ranges widely: from over 80% in Switzerland, Denmark and Scandinavia, where deposit return systems are mandatory, to 20% in Spain and Portugal. As the table on the following page shows, the average UBC recycling rate for the major Western European countries is 46%: roughly comparable to the 48% achieved in the United States.

Aluminum Beverage Can Sales, Recycling and Wasting:
The United States vs. Selected European Nations

Country	Pop.	Sales		Recycling			Wasting		
	Millions	Millions	Per capita	Rate	Millions	Per capita	Rate	Millions	Per capita
Switzerland	7.2	185	26	91%	168	23	9%	17	2
Norway, Iceland	4.8	224	47	89%	199	42	11%	25	5
Sweden	8.9	916	103	88%	806	91	12%	110	12
Finland	5.2	110	21	84%	92	18	16%	18	3
Belgium, Netherlands, Luxembourg	26.7	490	18	80%	392	15	20%	98	4
Germany	82.2	950	12	80%	760	9	20%	190	2
Austria	8.1	750	93	50%	375	46	50%	375	46
Turkey	66.3	835	13	50%	418	6	50%	418	6
Italy	57.8	1,850	32	46%	851	15	54%	999	17
UK	60.0	5,300	88	42%	2,226	37	58%	3,074	51
Greece	10.9	1,050	96	36%	378	35	64%	672	62
France	59.2	820	14	29%	238	4	71%	582	10
Ireland	3.8	265	70	26%	69	18	74%	196	52
Portugal	10.0	340	34	21%	71	7	79%	269	27
Spain	39.8	2,350	59	20%	470	12	80%	1,880	47
Current, selected Western European nations	451	16,435	36	46%	7,514	17	54%	8,921	20
Hypothetical, Europe (90% recycling)	451	16,435	36	90%	14,792	33	10%	1,644	4
Reduced annual UBC wasting, W. Europe (at 90% recycling)								**7,278**	million cans
Current, the United States	285	99,802	351	49%	49,059	172	51%	50,743	178
Hypothetical, U.S. (70% recycling)	285	99,802	351	70%	69,861	246	30%	29,941	105
Hypothetical, U.S. (90% recycling)	285	99,802	351	90%	89,822	316	10%	9,980	35
Reduced annual UBC wasting, U.S. (at 70% recycling)								**20,802**	million cans
Reduced annual UBC wasting, U.S. (at 90% recycling)								**40,763**	million cans
The United States now wastes								**5.7**	times as many cans as Western Europe.
The average American now wastes								**9.0**	times as many cans as the average European.

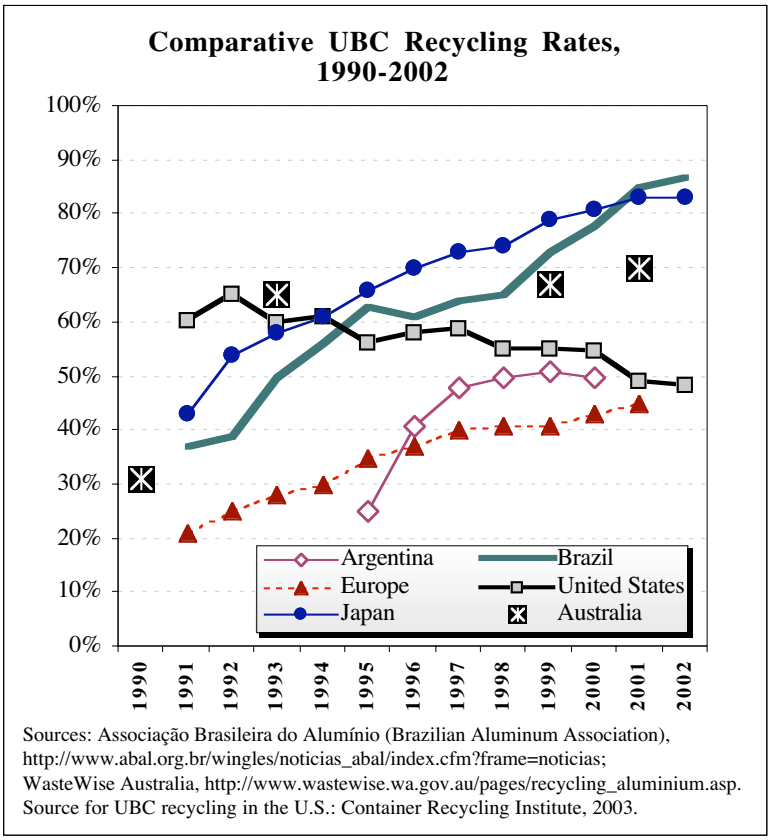
Sources: Population Reference Bureau, <<http://www.prb.org/Content/NavigationMenu/Other_reports/2000-2002/sheet1.html>>. Source for recycling in Western Europe: *Business and the Environment* Aug. 2002 (using data from the European Aluminum Association);

But **percentage** recycling rates (cans recycled ÷ cans sold) are not a necessarily a good indicator of environmental impact, since total sales--based on population and per capita consumption--varies so widely. A more useful yardstick might be *per capita wasting*. In this light, the worst performers are Greece, Ireland, the UK, Austria, and Spain.

But in terms of who could make the biggest impact on reducing aluminum demand by significantly increasing domestic recycling, *total wasting*, as measured in tons or cans, is the most significant measure: among the western European nations, the United Kingdom, Spain, and Italy have the farthest to go, with 3, 1.9 and 1 billion cans wasted respectively in 2002.

The impact of potential recycling progress in Europe, however, is really a drop in the bucket compared to what could be achieved in the United States through recycling legislation. Were all of the European nations listed above to increase their UBC recycling rates to 90% (about what Switzerland now achieves), *7 billion* additional aluminum cans could be saved each year. Were the United States to increase its UBC recycling rate to only 70%, however (the average rate in the 10 existing "bottle bill" states), *21 billion* additional aluminum cans would be saved each year--or three times as many cans as in the European example--with a much more modest rate increase. This could be accomplished with a national bottle bill using a 5¢ deposit. With a 10¢ deposit on a federal bottle bill, the U.S. could achieve an 80-90% UBC recycling rate, saving up to *41 billion* additional cans a year, or about 560,000 metric tons of aluminum annually at the current average can weight.[2] This potential savings is <u>six times greater</u> than what could be achieved across Europe with the same 90% recycling rate. This seeming disconnect in achievable savings is due to the huge disparity between U.S. and European per capita beverage can sales. The average American purchases 350 beverages in aluminum cans each year: about ten times as many as the average European.

As the figure at right shows, Brazil and Japan are world leaders in UBC recycling, with rates of 87% and 83% respectively. These rates are notable not only because they are so high, but because they are achieved without mandatory recycling or artificial financial incentives (such as container deposits).



Sources: Associação Brasileira do Alumínio (Brazilian Aluminum Association), http://www.abal.org.br/wingles/noticias_abal/index.cfm?frame=noticias; WasteWise Australia, http://www.wastewise.wa.gov.au/pages/recycling_aluminium.asp. Source for UBC recycling in the U.S.: Container Recycling Institute, 2003.

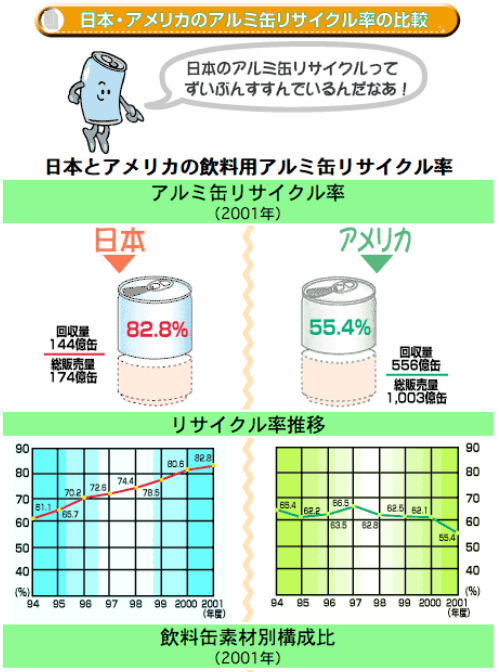
In Brazil, the value of discarded aluminum beverage cans is extremely attractive to millions of people who are unemployed, or who depend on a minimum wage of only $86/month.[9] But According to the Brazilian Aluminum Association (ABAL), can recycling is not limited to the destitute. "150 thousand people currently earn their living exclusively from the collection of aluminum cans. In addition to that, the profile of who collects cans has changed considerably in the past five years. Today, schools, charitable organizations, church groups, retired folks and housewives have been added to the traditional ranks of the individual street collectors."

[2] Michigan, the only U.S. state with a 10¢ deposit, achieves container redemption rates of 95% or more. Because some of this may be due to fraudulent interstate redemption (people bringing in cans from other states), we think 90% is a more reasonable figure to assume for a nationwide deposit system with a 10¢ refund value.

Municipalities in Japan have made serious commitments to residential curbside and drop-off recycling programs, though specific English-language data on Japanese aluminum recycling are limited. The Japan Aluminum Recycling Association takes noticeable pride in comparing their UBC recycling rate to that of the United States, as the figure at right shows.[10]

It is worth noting that Japan has phased out primary aluminum production due to the high cost of electricity and the lack of domestic energy sources. In the late 1970's, Japan produced over a million tons of primary aluminum a year, but by 1999, its annual output of primary ingot had shrunk to 11,000 tons. In this climate, used cans are a valuable domestic metal source.

Data on aluminum can sales and recycling in other major markets, notably Russia and China, are lacking, but we know anecdotally that canned beverage sales are increasing, and that these countries have not had time to develop mature recycling infrastructures.



A cartoon can figure points to the disparate UBC recycling rates achieved by Japan (82.5%) and the United States (55.4%) in 2001. Source: Japan Aluminum Recycling Association.

Recycling Non-Beverage Can Aluminum

As previously described, it is difficult to estimate the amount of non-beverage can post-consumer scrap that is recycled worldwide, both because some countries do not report scrap recycling or exports, and because others do not differentiate between "old" and "new" scrap. The International Aluminium Institute reports that worldwide, aluminum recovered from scrap is equivalent to about 10% of world primary ingot production, without specifying old vs. new.

The U.S. Geological Survey (USGS) reports that 1.2 million metric tons (MT) of old scrap were recycled in the United States in 2001, or about 19% of the total U.S. supply. The other major components of supply were primary ingot production (2.6 MT) and net imports (2.1 MT). Using data from the Aluminum Association and the U.S. Department of Commerce, CRI has estimated that used beverage can recycling in 2001 was about 735,000 short tons (=637,000 metric tons), or 53% of the total old scrap reported recycled by the USGS. By extension, about half a million tons of old scrap were from non-can sources. USGS data is gathered by surveying smelters that purchase old scrap, and appears to be more reliable than estimates generated by the U.S. EPA Office of Solid Waste in their annual municipal solid waste characterization report. In the latter, production statistics and average products lifetimes are used to estimate the quantity of aluminum generated (disposed of by consumers), recycled, and discarded (wasted, or not recycled).

According to this EPA report, 830,000 tons of UBC's were recycled in the year 2000, and only 40,000 tons of non-UBC aluminum were recycled, for a total of 870,000 tons recycled, and 2.3 million tons wasted. Even if this wasting figure were adjusted downward by 330,000 tons (to account for the higher recycling quantities estimated by the USGS), it would still mean that

about 2 million tons of aluminum are being wasted in the United States annually. About three quarters of a million tons of UBC's are wasted annually, which means that as much as 1.25 MT of non-can aluminum may also be wasted. In actuality, the figure may be quite a bit higher, since the USGS old scrap numbers include thousands of tons of recycled automotive aluminum, whereas the EPA data does not; EPA only includes products considered to be *municipal* solid waste: items that might be put in a household garbage can.

Aluminum Products in U.S. Municipal Solid Waste, 2000

	Generation	Recovery		Discards (Wasting)	
Product category	(000 short tons)	(000 short tons)	%	(000 short tons)	%
Beverage containers (beer and soft drink)	1,520	830	55%	690	45%
Food and other cans	50	Neg.	Neg.	50	Neg.
Foil and closures	380	40	11%	340	89%
Subtotal, containers and packaging	1,950	870	45%	1,080	55%
Durable goods	1,000	Neg.	Neg.	1,000	Neg.
Non-durable goods	220	Neg.	Neg.	220	Neg.
Subtotal, durable and non-durable goods	1,220	Neg.	Neg.	1,220	Neg.
Subtotal, non-beverage can aluminum	**1,650**	40	2%	1,610	98%
Total aluminum in MSW	**3,170**	**870**	27%	2,300	73%

Neg=negligible. Source: U.S. Environmental Protection Agency. "Municipal Solid Waste in the United States: 2000 Facts and Figures," Tables 1,2,3, and 6.

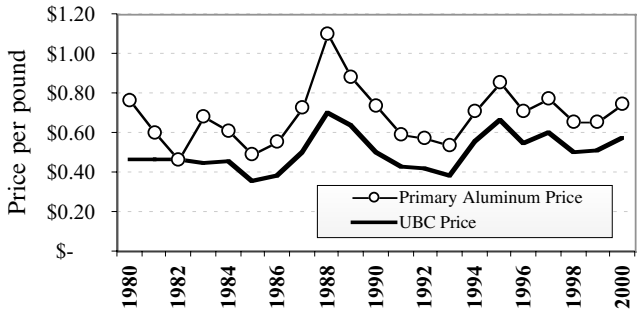
If the 2.3 million ton figure is in the right ballpark, then the amount of aluminum wasted annually in the United States alone is equivalent to the output of 8-10 large primary aluminum smelters with rated capacities of 250,000 to 300,000 tons.

It would be purely speculative to estimate how much is being wasted in other countries. It would be more useful to look at the other primary end-uses for aluminum, and to ask if there are established recycling infrastructures for these items. The biggest and fastest growing end use for aluminum is the automotive industry. In the U.S., close to 100% of the aluminum that goes into car parts is being recycled, because the automotive dismantling industry is well-established. The same may be true in other countries.

One of the biggest obstacles to recycling more non-can aluminum is that unlike aluminum beverage cans, non-can products are too varied to be collected easily together. (Exceptions are automotive aluminum, and other large industrial or commercial products, such as building materials or aluminum siding, which contractors collect in bulk quantities.) Because the only collection mechanisms consist of drop-off or buy-back recycling centers, scrap prices must be high enough to encourage people to make a special trip to the recycling center to cash in on smaller pieces of non-can aluminum scrap: old screen doors and camp chairs, broken tent poles, etc., and that has not always been the case. Many people may not realize that aluminum that is attached to other materials—such as glass, steel, plastic, rubber and textiles—are even recyclable. Other than a massive public education campaign, only an adequate price incentive can bring these materials back. People are sensitive to the price incentive. For example, during highs in the scrap price cycle, vandals in the United States have ripped aluminum siding off of people's houses to turn in for the cash.

Secondary Prices

According to government and industry analysts, secondary alloys generally cost less than primary ingot, but some alloys being exported from Russia and China are now being sold so cheaply that they are undercutting secondary aluminum.[11]



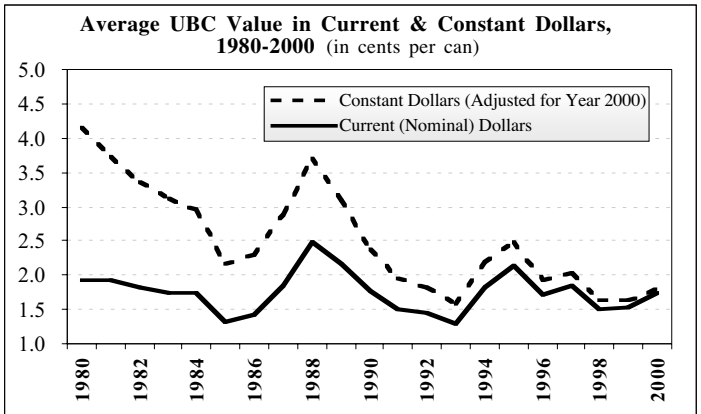
Primary ingot prices are annual averages for the U.S. spot market. Source for 1980-1998 prices: "Minerals Yearbook 2000." U.S. Geological Survey, 2000. Source for 1999-2000 prices: "Aluminum." Patricia Plunkert, U.S. Geological Survey, 2001.

Container Recycling Institute, 2002.

The scrap price for used beverage cans (UBC's) closely follows world prices for primary aluminum ingot, as the figure at right shows. Both have not risen much in the last 20 years. This price stagnation has many causes, including falling energy prices, and excess capacity due in part to the entry of eastern bloc countries into the global market since the breakup of the Soviet Union.

Prices have also been held down due to subsidization of the primary aluminum industry in the U.S., Canada, and many other countries. Because of long-term, cut-rate energy contracts, below-market water rates, the easy acquisition of government lands for mining, and a myriad of tax breaks and infrastructural assistance, aluminum companies have perhaps been less vulnerable to global economic forces than some other primary industries. Subsidies and easy development terms have enabled the world aluminum primary industry to expand capacity ahead of demand. As long as excess primary aluminum production capacity exists on the global market, and as long as the cost of making virgin ingot remains low, scrap prices will remain suppressed.

Ironically, depressed prices are exacerbated by "lightweighting." Since 1972, the average weight of the can has been reduced by 35% through design changes in the can walls and lid. Without lightweighting, can waste in 2001 would have been much higher. But reduced can weight has increased the burden on street collectors: whereas it took about 27 cans to make a pound (worth 50¢) in 1987, by 1998 it took 33 cans to make the same pound (also worth 50¢). In other words, *the time cost of making 50¢ has increased, while the real value of 50¢ has declined.*



Source for UBC prices: Industry surveys conducted by *Container Recycling Report* and *Bottle and Can Recycling Update,* publications of *Resource Recycling* magazine.
Source for average can weight: Aluminum Association.

The figure above shows that while the current (nominal) value of one aluminum can has largely fluctuated between 1.5¢ and 2¢ during the 1980's and 1990's, its *constant* value was actually cut in half: from 4¢ to 1.7¢.[12]

Two actions are possible to counteract the declining real value of aluminum:

- address subsidization within the primary aluminum industry.
- promote an artificial scrap value using the deposit mechanism, as described later.

STRATEGIES FOR REDUCING PRIMARY ALUMINUM DEMAND

1. The Use of Alternative Materials: Focus on Beverage Containers

Aluminum is used in a wide range of applications for which many alternatives are available. In some cases, aluminum is a substitute for more expensive traditional materials--copper, for example, in electrical transmission lines, or for cheaper materials of lesser performance value—for example, steel in car parts. Any recommendation of alternatives must take availability, price, quality and characteristics, recyclability, and other impacts into account. It is beyond CRI's ability to evaluate aluminum alternatives in non-container product categories.

We can make some observations about beverage container alternatives based on per unit energy consumption and recyclability. One-way glass and one-way PET plastic bottles require far less energy per beverage unit than aluminum cans do: an estimated 796 Btus per PET bottle, and 711 Btus per glass bottle, compared to 2,745 Btus per aluminum can, as shown below. However, neither glass nor plastic one-way, non-returnable bottles are desirable alternatives to aluminum beverage cans.[13] Glass is heavy and energy-intensive to transport, both at the pre-consumer and post-consumer stage. With the exception of beer, and some juices and teas, glass is also not preferred by consumers, because it is heavy and breakable; it has already lost much market share to cans and plastic. Finally, markets for post-consumer glass are "in the dumps," at least in North America, due in part to the move toward commingled recycling. Because of the high levels of contamination, most of the glass collected through curbside recycling programs is used as roadbed aggregate rather than in making new glass bottles.[14]

Comparative Energy Requirements for New Containers

Container Type	Container Weight		Energy Used	
	Units/lb	Units/ton	MBTu/ton	BTU/unit
Aluminum cans	33.8	67,580	185.5	**2,745**
P les	14.0	28,000	22.3	**796**
Glass bottles	1.9	3,800	2.7	**711**

Source for energy values: Ferland et al, U.S. EPA, 2001.

Although one-way PET plastic bottles have an advantage over glass in transportation, they are slightly more energy-intensive to produce, per unit, than glass bottles. More important, PET recycling markets are still immature. With the exception of Coca-Cola, the major beverage companies have yet to set—much less attain—even a 10% recycled content goal for their PET bottles. Most PET collected today is not recycled back into plastic beverage bottles in a "closed-loop" process; rather, it is made into plastic strapping or into fibers for sleeping bags, apparel, or carpeting. Virgin plastic resin used for new containers is not being displaced. The value of PET to recyclers is also low: around 10¢/lb, as compared to 20-50¢/lb for aluminum, so there is little market incentive for consumers (in non-bottle bill states) to save PET bottles. Finally, because of its low value **and** its high volume-to-weight ratio (about 14 containers per pound, compared to 33 per pound for aluminum cans), PET bottles are not economical to collect at curbside. As collection has failed to keep pace with skyrocketing sales, the national recycling rate for PET bottles in the U.S. has fallen from a high of 37.5% in 1995 to only 19.9% in 2002.[15]

In contrast to one-way bottles, returnable, refillable bottles pose an attractive alternative to the aluminum can. In its seminal 2001 publication, "Reduce, Reuse, Refill!," the Institute for Local Self-Reliance summarizes a host of beverage container lifecycle analyses and concludes that refillable glass bottles are less expensive per unit than cans, and environmentally preferable in 5 major air pollutant categories, although they are more energy-intensive and water polluting. Refillable PET bottles, however, out-perform refillable glass bottles (and presumably by extension, cans) in avoided water and air pollution (all classes), solid waste, and energy use.[16]

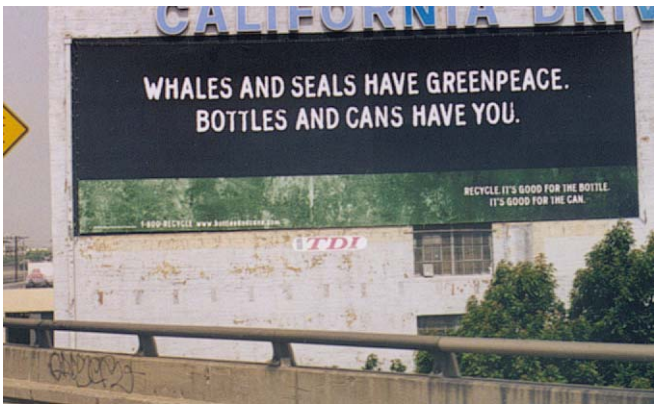
Mechanisms for encouraging refillables include taxes or outright bans on one-way, non-refillable containers, higher deposits on one-ways and lower deposits on refillables, mandatory refillable quotas, and tax incentives for refillable bottlers. Platt and Rowe point out that the preservation of an *existing* refillable infrastructure, as in Europe, is more realistic than the *re-creation* of a refillable infrastructure that has already been dismantled, as in the United States.

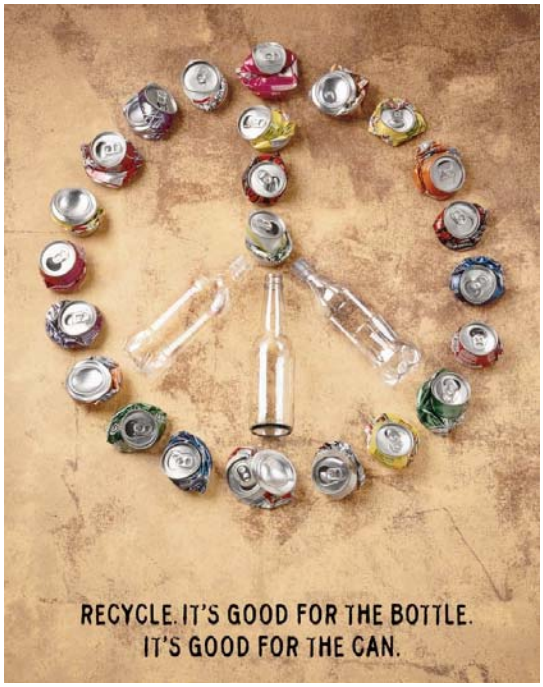
2. Public Education

Increased public awareness about the social and environmental impacts of aluminum manufacturing may lead to increased recycling or a reduction in aluminum consumption in product areas where consumers can exercise a choice. For example, because aluminum is not apparent to the naked eye in most automotive, construction, or electrical applications, consumer education targeting those markets (assuming acceptable alternatives were identified) would be of little use. Beverage cans, however, are the most *visible* aluminum consumer product, and the one for which consumers have ready alternatives: including glass and plastic. They are also recyclable. As was mentioned earlier, dramatically increasing can recycling would increase the supply of secondary aluminum, and in turn would lower its price relative to primary aluminum. This could, in theory, discourage the construction of new primary aluminum capacity.

CRI has developed an aluminum can fact sheet with (see Appendix C) that has been widely quoted by a variety of media outlets who find the short "sound bites" useful.

The disadvantages of public education campaigns are that they are very expensive to mount, they have difficulty competing with the barrage of advertising and news in people's daily lives, and they must be continually maintained to be effective. In CRI's experience, unless public education campaigns are combined with increased recycling opportunities and/or financial





Multi-media ad campaign (clockwise): printed posters, outdoor billboard, the "Can Man" at a subway station in San Francisco. Photos courtesy of the California Department of Conservation.

incentives to recycle, they are generally ineffective. For example, the high-concept, multi-media, multi-million dollar campaign in California (above) has failed to stop the beverage container recycling rate from slipping. It seems that flashy ads cannot compensate for the weak financial incentive of a lower-than-average deposit (2.5¢ on single-serve containers.)

3. Direct Action: Boycotts, Mail-ins, Protests, Advertisements

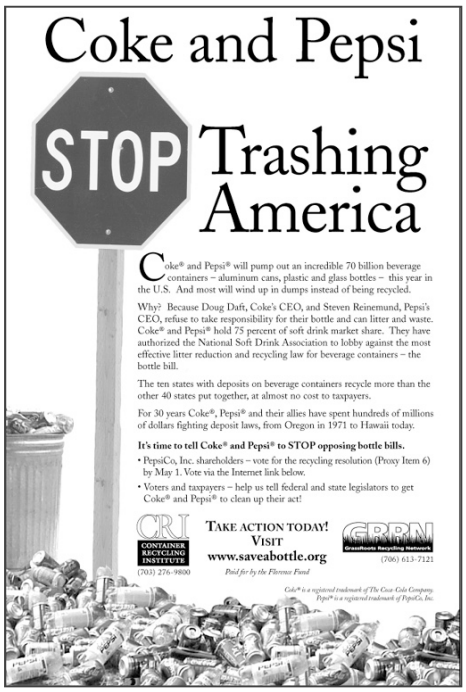
Negative publicity for the major aluminum companies could be generated through threatened or actual can boycotts; protests at the annual meetings or corporate headquarters; or campaigns where consumers send postcards—or even cans—to the brand owners or the aluminum companies.

In 1990, the National Container Recycling Coalition, CRI's precursor, rolled out the "Cans to Congress" campaign, wherein people sent steel and aluminum drink cans to their legislators. A wrap-around mailing label (see Appendix D) urged the Congresspeople to support a national bottle bill. An Earth Day demonstration at the Capitol (right), was captured by the *Washington Post*.[17]

Jan Hartke, of Earth Day 1990, speaks on the Capitol grounds during the ... encourage voters to mail recyclable cans to their elected officials to show

4. Shareholder Resolutions

With its coalition partners, the GrassRoots Recycling Network and the socially responsible investor groups As You Sow Foundation and Walden Asset Management, CRI has brought shareholder resolutions before the world's largest soft drink brand owners, Coca-Cola and PepsiCo.



Between 1999 and 2002, shareholder resolutions were introduced calling on the giant soda companies to set recycled content goals for PET bottles, to take steps to reach an 80% recycling rate for all the containers they sold, and to stop opposing bottle bills. Although these resolutions have yet to pass (or even to get 10% of the vote), they have on several occasions garnered enough votes to be placed on the ballot the following year.

Shareholder resolutions are not legally binding; they are merely recommendations to a company's board of directors. Their real utility is probably in their visibility in the mainstream media. Our coalition's efforts, including post-card write-ins and full-page paid ads (like the one at left that ran in the *New York Times* and the *Wall Street Journal*), were probably instrumental in getting Coca-Cola to adopt a 10% recycled content goal for all PET bottles it sells in North America, and for Pepsi to adopt a similar goal for its U.S. soft drink bottles.[18]

Alcoa, Alcan, Billiton, and other aluminum companies could be similarly targeted. Rather than rely on individual investors' votes, however, stronger pressure could be exerted by large investors such as state pension funds, universities, or mutual funds.

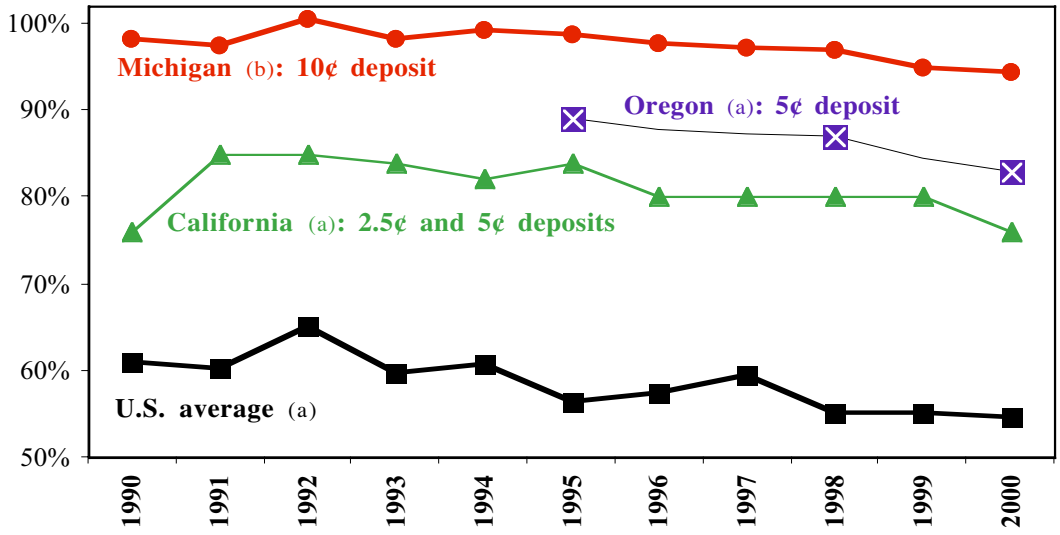
The question is: what type of demand would be appropriate? Stop building new smelters and dams until the global recycling rate for aluminum reaches 80% Commit to programs to achieve this goal? Fully disclose construction financing and energy contract terms? What else?

5. Legislation at the state or federal level: the deposit mechanism

The demand for primary aluminum in the beverage container sector can be reduced through increased secondary recovery. The most effective mechanism for encouraging aluminum can recycling (and glass and plastic bottle recycling) has been the artificial financial incentive created by beverage container deposit laws, or "bottle bills." For twelve years, the Container Recycling Institute has advocated for the passage of new bottle bills, and for preserving and expanding existing ones.

Ten U.S. states* and eight Canadian provinces have laws requiring refundable deposits of 2.5-10¢ all beer and carbonated soft drinks. Several deposit systems also include non-carbonated beverages and/or wine and liquor bottles. As the figure shows, deposit systems in the United States have successfully achieved aluminum can recycling rates of 70-95%, well above the U.S. average of only 54% in 2000 (and 48% by 2002). The U.S. average itself would be much lower if not for the influence of the bottle bill states, where 30% of the American population lives.

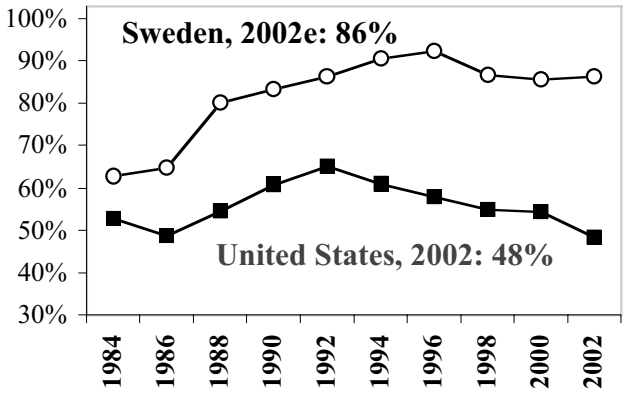
Aluminum Can Recycling in Deposit States vs. the U.S. National Average



(a) Recycling rate for aluminum only (container types reported separately.)
(b) Redemption of plastic, glass and aluminum containers not reported separately. Actual state recycling rates for aluminum are probably higher than those indicated here, because in some states, cans are considered unredeemed (or "abandoned") even when they are recycled through curbside programs or by commercial haulers, and because some non-carbonated beverages in aluminum cans are also being recycled for their scrap value.
Source: Gitlitz, Jennifer. Figure 10 in "Trashed Cans: The Global Environmental Impacts of Aluminum Can Wasting in America." The Container Recycling Institute, 2002.

Other countries with larger deposit values also achieve higher can recycling rates. For example, the voluntary, industry-led deposit system in Sweden has a deposit value of 50 öre, about 10 cents, has and is achieving a nationwide aluminum can recycling rate of 86 percent, as the figure to the right shows.

Recycling Rate for Aluminum Cans in Sweden and the United States, 1984-2002



Sources: Aluminum Association; U.S. Bureau of the Census; AB Svenska Returpack. Swedish 2002 rate is a preliminary estimate.

Deposit systems not only produce high recycling rates for cans and bottles, but they cost only slightly more per unit than other, much less effective recycling systems. A 2002 multi-stakeholder report by the group Businesses and Environmentalists Allied for Recycling (BEAR) found that a combination of recycling methods operating in the nation's 10 deposits states recycles 490 containers per capita per year, at an average unit cost of 1.53 cents, while the nation's 40 non-deposit states (which rely on curbsides and drop-offs to do the whole job) recycle 191 containers per capita per year, at an average unit cost of 1.25 cents, as the table below shows. In other words, deposit states have great "bang for the buck": at an additional cost of only 1.5 cents per six-pack of soda or beer, their recovery rates are more than two and a half times higher than those in states without bottle bills.[19]

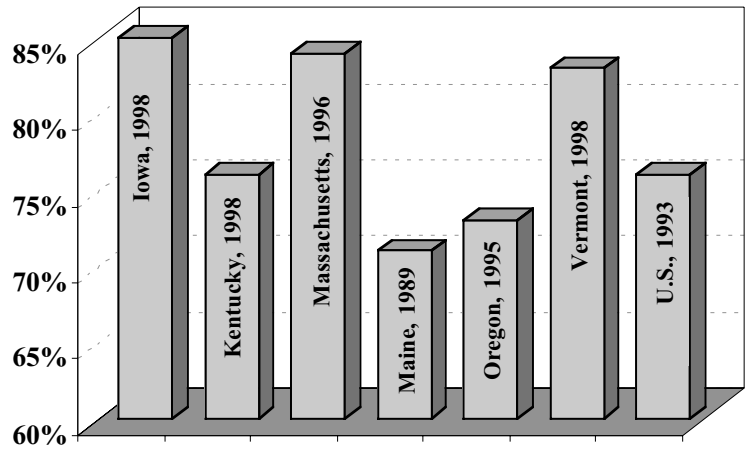
Beverage Container Recycling in Deposit and Non-Deposit States: A Comparison of Program Effectiveness and Per Unit Cost

	Type Program	Overall Recovery Rate	Annual Per Capita Recovery (units)	Net Cost Including Revenues (cents/unit)
40 U.S. Non-Deposit States	Curbside	18.5%	127	1.72
	Residential Drop- Off	4.5%	31	0.3
	Other (e. g., non- residential and buy-backs)	4.8%	33	unknown
	Subtotal, 40 Non-Deposit States	**27.9%**	**191**	**1.25**
10 U.S. Deposit States	Weighted Average, 9 Traditional Deposit States	61.6%	422	2.21
	CA Redemption System	54.5%	373	0.55
	Curbside	9.5%	65	1.72
	Residential Drop- Off	1.6%	11	0.3
	Other (e. g., non- residential and buy-backs)	1.8%	13	unknown
	Subtotal, 10 Deposit States	**71.6%**	**490**	**1.53**
Total, United States		**40.6%**	**277**	**1.31**

Source: Derived from data in Table ES-1, "Understanding Beverage Container Recovery: A Value Chain Assessment Prepared for the Multi-Stakeholder Recovery Project, Stage 1." Businesses and Environmentalists Allied for Recycling (BEAR), a Project of Global Green USA, January 16, 2002.

Public support for deposits is strong in the U.S., as shown in numerous public opinion polls where respondents are asked if they support a national bottle bill. Statewide polls conducted by universities, businesses, and non-profit organizations also show strong public support for bottle bills, as the table shows.

Public Support for Bottle Bills in the United States



Sources: "Attitudes and Opinions on Iowa's Beverage Container Recycling Law." Robert E. Kramer and Gene M. Lutz, Center for Social and Behavioral Research, University of Northern Iowa. June 1998; "Public Opinion Survey on the Expanded Bottle Bill." Massachusetts PIRG, March 1996; "Town Metting Day Opinion Survey." Senator Bill Doyle, Vermont. March 1997; "Fall 1998 Kentucky Survey." University of Kentucky Survey Research Center. April 1999; "Oregon's Bottle Bill Initiative." International Bottled Water Association, State Report. February, 1996; U.S. General Accounting Office, 1989.

Unfortunately, new bottle bill proposals are seldom voted on by a full state legislative body. They are generally defeated in committee—often by a narrow margin. These defeats are due to the influence of the politically powerful, well-funded beverage and grocery industry lobbies. Bottle bill opponents have spent large sums to defeat ballot initiatives over the past twenty years, with industry opponents outspending proponents by as much as 30:1.[20] According to a 1996 report by the U.S. Public Interest Research Group, from 1989 to 1994 the beverage industry spent over $14 million in campaign contributions aimed at defeating the National Bottle Bill. Members of a U.S. senate committee who voted against the national bottle bill in 1992 received an average of 75 times more in anti-bottle bill PAC money than those who voted in favor of the bill.

In a Columbia, Missouri 2002 referendum (see ad on left), the anti-deposit lobby waged the most expensive initiative campaign in the city's history, and succeeded in repealing the nation's only local bottle bill. In 30 years, however, no state deposit law has ever been repealed.

The relationships that the major aluminum companies have with their clients, the beverage manufacturers, have prevented them from taking a public position on bottle bills, even though deposits benefit their industry by increasing the supply of high quality scrap. Their silence on the matter is compounded by their implementation

and promotion of programs to collect cans in one-time drives, specific local venues, or high-profile charities such as "Habitat for Humanity." These programs have good public relations value, but they are little more than token gestures as far as recovering significant quantities of aluminum cans.

In 2002, after Alcoa announced a range of environmental and "sustainability" goals without specifying what steps it it would take to reverse the aluminum can wasting trend, CRI publicly called on the company to endorse deposits, and in lieu of token programs, to take other meaningful steps to improve recycling. CRI's challenge to Alcoa, and subsequent media coverage, can be found in Appendix E.

It is highly unlikely that aluminum companies and can manufacturers will publicly support a policy that is so strongly opposed by beverage manufacturers. If the goal is to promote deposit legislation specifically, it would be more effective for activists to exert direct pressure on the users of the aluminum cans: the beverage brand owners, especially Coke, Pepsi, Anheuser-Busch, and other beer companies with international market penetration.

6. Actions Restricting Trade in Aluminum Products

Import tariffs as applied to raw aluminum ingot or semi-fabricated products are one possible mechanism that could be used to target countries who subsidize local aluminum production, but this is beyond CRI's purview.

We can cite examples of taxes or bans on the import or sale of beverage cans specifically. In Ontario, Canada, non-refillable containers are taxed. The impetus for this law is thought by some to be a means of protecting the Canadian beer industry from American imports.[21] In Denmark, the sale of aluminum cans was banned from 1982-2002, as a way to protect the refillable bottling industry and cut down on can litter. The ban was repealed in reaction to opposition from the EU, and was replaced with an 18¢ deposit on cans.[22] Since January 2003, Germany has also imposed a 25 to 50¢ deposit on non-refillable cans and bottles. Although the law has not affected domestic brewers who primarily use refillable bottles, it has reduced the can sales of larger regional brewers in Germany and other European countries by 50-70%, causing outrage in the industry. Consumers have turned away from canned beer not because of the new deposit itself, but because the beverage and retail industries failed to invest in a consumer-friendly return system prior to implementation of the law.[23]

Perhaps it goes without saying that any campaigns aimed at restricting aluminum imports, or imposing taxes on cans or other aluminum products, must be carefully researched as to the impact on labor, and on competing or substitute products.

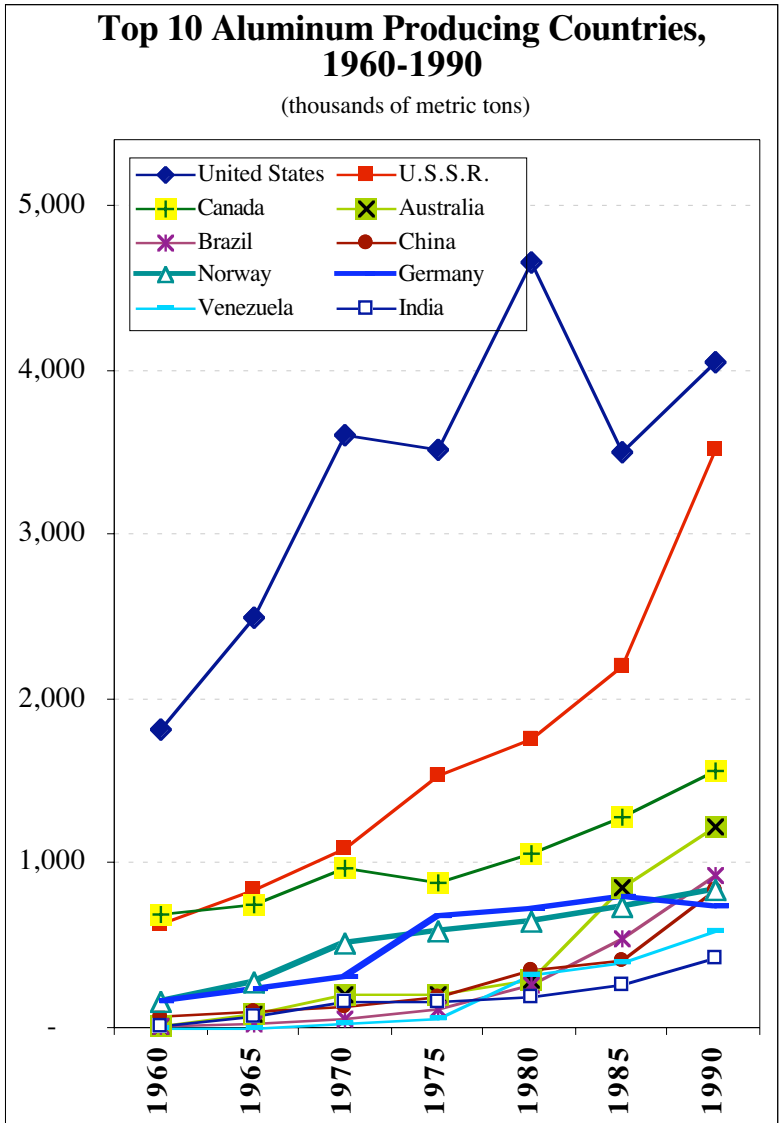
CONCLUSION

In light of the entrenched nature of the multi-national aluminum industry, the difficulty in recycling multi-material products, and the trends of population growth and expanding economies in developing countries, reducing global demand for primary aluminum will be a major challenge. Any strategic campaign to affect a demand reduction must have actions targeting all levels of the production-consumption chain: the industry itself; governments hosting mines, smelters, and electric power generators; producers of aluminum products and packaging; and the consumer.

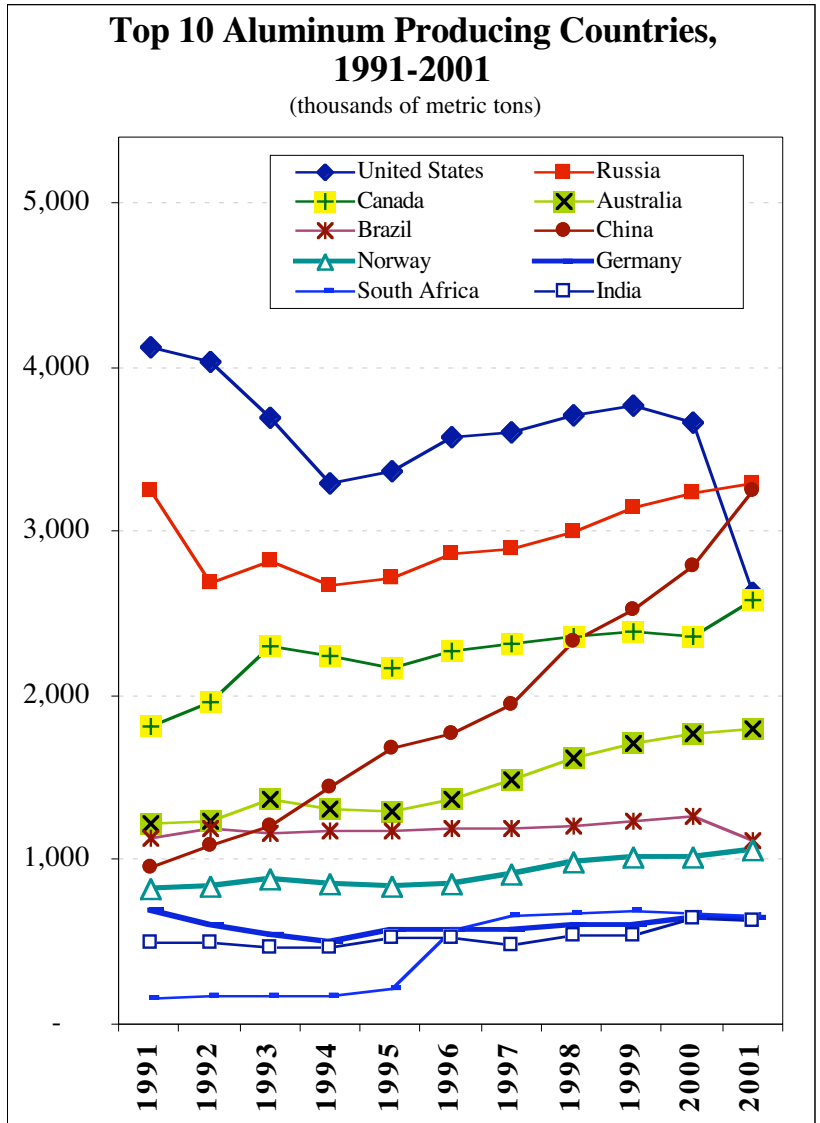
ENDNOTES

[1] Hoover, Ryan. "Damming the Zambezi for Aluminum: Proposed Dam a 'Power Play' to Gain Control of Upstream Dam?" *World Rivers Review,* Vol. 16 No. 5, October 2001. International Rivers Network, Berkeley, CA.
[2] Aguirre, Monti. "Six Dams in Chile's Alumysa Project." *World Rivers Review,* Vol. 16 No. 5, October 2001. International Rivers Network, Berkeley, CA; Gitlitz 1993, pp. 128-130.
[3] Finnsson, Arni. "Icelandic Dams and Aluminum Smelters Meet Resistance: Norsk Hydro Dams Would Drown 100 Waterfalls." *World Rivers Review,* Vol. 16 No. 5, October 2001. International Rivers Network, Berkeley, CA.
[4] Hagalin, Sigga. "Atlantsal picks Iceland site for aluminium smelter." *Reuters*, July 2, 2003.
[5] Switkes, Glenn. "Aluminum Companies Press for Dams on Amazon." *World Rivers Review,* Vol. 16 No. 5, October 2001. International Rivers Network, Berkeley, CA.
[6] Personal communication with Scott Meyers, Reynolds Metals Co., 1991.
[7] Personal communication with Nick Adams, Director of Statistics, Aluminum Association, July 14, 2003.
[8] McCutcheon, Andrew H. "Aluminum Can Recycling Overcomes a Rocky Start." *Resource Recycling,* Portland, O.R., October 1992. 91 billion cans sold/year ÷ 250 million people in United States = 364 cans/person/year.
[9] "Brazil sets voluntary aluminum recycling record." http://www.planetark.org/dailynewsstory.cfm/newsid/15682/newsDate/26-Apr-2002/story.htm>>.
[10] Japan Aluminum Recycling Association: <<ttp://www.alumi-can.or.jp/F/f00e.htm>>.
[11] Personal communication with Nick Adams, Director of Statistics, Aluminum Association, July 14, 2003, and personal communication with Patricia Plunkert, U.S. Bureau of Mines, July 21, 2003.
[12] Portions of this section were previously printed in the report: "Trashed Cans: The Global Environmental Impacts of Aluminum Can Wasting in America," by Jenny Gitlitz, Container Recycling Institute, 2002.
[13] Source for energy values: "Waste Management and Energy Savings: Benefits by the Numbers." A. Choate, S. Brown, H. Ferland, E. Lee. U.S. Environmental Protection Agency, 2001. Source for containers per ton: Understanding "Understanding Beverage Container Recycling", Businesses and Environmentalists Allied for Recycling (BEAR), 2002.
[14] Gitlitz, J. "Glass Recycling Market Trends, Contamination Problems Discussed." *American Recycler*, Oct. 2001.
[15] "2002 Report on Post Consumer PET Container Recycling Activity." National Association of PET Container Resources (NAPCOR), Sept. 2003.
[16] Platt, Brenda and Doug Rowe. "Reduce, Reuse, Refill!" Institute for Local Self-Reliance, Washington. April 2002.
[17] *The Washington Post*, April 16, 1990.
[18] Personal communication with Ken Scott, Walden Asset Management, September 24, 2003.
[*] Hawaii's bottle bill, the 11th in the United States, was passed in 2002 and is slated to be implemented in 2005. Hawaii 's Republican Governor Linda Lingle has vowed to repeal the legislation before it takes effect
[19] "Understanding Beverage Container Recovery: A Value Chain Assessment Prepared for the Multi-Stakeholder Recovery Project, Stage 1." Businesses and Environmentalists Allied for Recycling (BEAR), a Project of Global Green USA, January 16, 2002.
[20] "The Returnable Times," Environmental Action, 1988. Also, data from Oregon Public Interest Research Group, 1996.
[21] "Canada's Experience with Refillable Beverage Containers." GrassRoots Recycling Network and Institute for Local Self-Reliance: http://www.grrn.org/beverage/refillables/Canada.html.
[22] "Aluminum Cans Are Back in Denmark," *Aluminum Now*, May/June 2002. Vol. 4 No. 3. http://www.aluminum.org/AluminumNow/majormarkets/0403mm/0403m05_cans.htm.
[23] "Decline and fall of the can." Benoit, Bertrand, Joanna Chung and Hugh Williamson. *Financial Times*; Jul. 9, 2003.

Appendix A: Top 10 Aluminum Producing Countries, 1960-2001



Source: Aluminum Association, "Aluminum Statistical Review 2000." Notes: Countries selected based on ranking in 1990; Top 10 in 1960 did not include Brazil, Venezuela, Australia, or India, but did include France, Japan, Italy and Austria--each of whom produced less than 250,000 tons/yr.



Sources: USGS, "Minerals Yearbook 2001"; Aluminum Assoc. "Aluminum Statistical Review 2000." Notes: Countries based on 2001 ranking. 1991 data point for Russia is actually the USSR. In 2001,11 additional countries produced 200,000-300,000 tons per year (TPY), 12 countries produced 100,000-199,000 TPY, and 9 countries produced under 100,000 TPY.

Appendix B. Per Capita Aluminum Consumption of Selected Countries, 1960-1999

(Pounds per person per year)

Country	1960	1965	1970	1975	1980	1985	1990	1995	1999
Argentina *	na	4.4	5.9	8.3	4.8	2.6	3.4	5.5	6.9
Australia *	11.6	16.3	24.0	25.7	38.9	39.9	40.9	38.1	44.5
Austria *	na	11.6	18.2	24.4	27.6	27.7	47.3	58.6	56.6
Belgium	6.3	7.9	13.1	16.5	20.6	21.4	27.3	14.3	42.4
Brazil *	1.2	1.3	2.5	5.2	6.5	5.8	4.7	7.1	8.9
Cameroon	na	na	3.6	6.8	6.3	6.4	4.1	3.4	3.6
Canada *	11.4	21.4	25.8	28.4	35.5	45.1	47.9	57.5	71.3
China, PRC	na	na	na	na	na	na	na	4.1	na
Denmark	na	na	na	19.6	27.6	19.4	38.9	44.9	52.9
Finland	na	9.7	16.7	21.3	14.3	13.9	23.0	22.1	34.5
France *	10.9	12.1	19.5	20.5	31.5	29.0	38.3	38.9	46.1
Germany, Federal Republic *	15.9	20.0	30.1	32.2	54.8	54.7	65.3	58.7	59.7
Greece	na	2.8	5.9	9.8	13.0	8.6	12.8	20.5	20.0
Hungary *	na	na	na	na	32.4	32.4	33.5	na	na
Iceland	4.5	9.3	7.8	16.5	22.2	17.3	11.9	32.7	40.1
India	na	na	na	na	0.9	0.9	1.1	1.2	na
Indonesia	na	0.1	0.4	2.9	na	na	na	na	na
Iran	0.4	0.5	1.8	3.0	na	na	na	na	na
Ireland	na	na	4.7	4.1	9.7	10.0	13.5	22.4	21.8
Israel	na	5.3	12.1	na	na	na	na	na	na
Italy *	6.5	8.0	17.0	15.2	32.3	30.1	42.6	47.0	54.8
Japan *	4.3	8.7	24.8	26.9	42.9	47.4	69.1	66.7	58.6
Korea, Republic of	na	na	na	2.6	4.2	9.9	na	na	na
Mexico *	na	1.8	3.2	3.5	5.6	4.8	4.8	4.7	13.3
Netherlands *	5.6	6.4	12.6	18.3	27.2	29.5	35.4	63.4	71.8
New Zealand *	na	10.5	19.2	15.1	17.1	22.2	22.6	35.8	na
Nicaragua	na	na	1.3	1.4	na	na	na	na	na
Norway *	na	11.6	31.0	43.6	50.0	45.0	41.8	47.6	56.9
Panama	0.5	2.2	2.4	2.6	2.0	1.7	5.2	6.9	7.5
Philippines, Republic of	na	0.3	0.6	0.5	0.8	0.3	na	1.7	na
Portugal	na	2.2	3.1	2.7	8.5	9.4	13.9	na	na
Russia	na	na	na	na	na	na	na	5.6	na
El Salvador	na	na	na	0.4	0.4	0.1	0.3	0.5	1.1
Saudi Arabia, Kingdom of	na	na	na	2.8	24.7	30.2	na	na	na
Singapore, Republic of	na	na	na	7.8	20.2	25.8	na	na	na
South Africa, Republic of *	na	3.6	6.0	6.2	9.9	9.3	6.2	9.7	10.5
Spain *	na	4.9	7.3	11.6	14.2	10.0	16.3	23.8	na
Sweden *	na	22.1	32.6	39.8	34.4	45.1	47.1	57.8	62.1
Switzerland *	14.8	22.6	30.1	22.2	37.7	41.7	49.8	41.0	49.1
Taiwan, Republic of China *	1.1	2.2	4.9	6.9	13.5	17.1	na	na	na
Turkey, Republic of	na	0.4	1.4	3.7	2.3	4.1	9.6	6.2	na
United Kingdom	17.2	20.2	24.4	21.7	18.0	21.8	26.4	24.5	31.2
United States *	23.8	41.1	44.9	44.9	56.7	58.7	59.2	67.4	79.7
Venezuela *	na	2.1	2.5	6.1	15.3	10.6	18.3	13.8	10.1

* Adjusted for inventory change

na - Not available at publication

Source: "Aluminum Statistical Review,1999." The Aluminum Association, 2000.

Appendix C: CRI Fact Sheet

CONTAINER RECYCLING INSTITUTE

Main office: 1911 N. Ft. Myer Dr. #702 • Arlington, VA 22209 • (703) 276-9800
www.container-recycling.org • www.bottlebill.org

Massachusetts office: 2 Pomeroy Ave. • Dalton, MA 01226 • (413) 684-4746
jgitlitz@container-recycling.org

Aluminum Can Wasting Facts

- In 2001, Americans bought **351** aluminum beverage cans per person (**twice** as many as in 1980) and wasted **70 more** cans per person than in 1980.
- The 759,625 tons of cans wasted in 2001 was equivalent to the entire annual production capacity of **four major aluminum smelters** in the Pacific Northwest and greater than the amount used for **trucks, buses, bridges, street and highway** applications combined.
- Since the first Earth Day in 1970, Americans have wasted over 910 billion cans worth over **$15 billion**. If current trends continue, we will have squandered **one trillion** cans by 2003—or almost **3,600 wasted cans** for every man, woman and child in America.
- Between 1990 and 2000, Americans wasted 7.1 million tons of cans: enough to manufacture **316,000 Boeing 737 airplanes**.
- Laid end-to-end, the 50.7 billion cans wasted in 2001 would encircle the Earth **153** times.

Energy and Environmental Facts

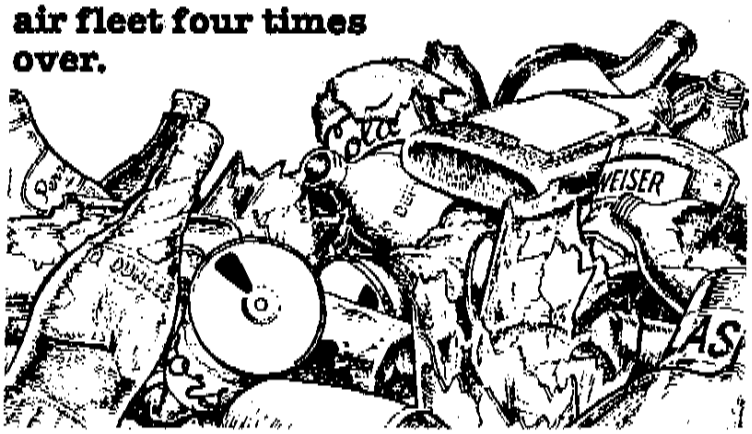
- Recycling used cans into new cans takes **one third** as much energy as making them from raw materials.
- The energy required to replace the aluminum cans wasted in 2001 was equivalent to **16 million barrels of crude oil**: enough to meet the **electricity needs** of all the homes in Chicago, Dallas, Detroit, San Francisco, and Seattle.
- If 9 out of 10 aluminum cans were recycled, we could save the energy equivalent of **50%** of the annual oil production anticipated from the **Arctic National Wildlife Refuge**.
- Replacing one wasted can requires the energy equivalent of about 0.5 kWh: enough to light a **100-watt bulb** for 5 hours, or to power an average **laptop computer** for 11 hours.
- For every **six-pack** of cans wasted, the energy equivalent of **one beverage can full of gasoline** is squandered.
- Over **3 million tons of greenhouse gases** were produced to replace the aluminum cans trashed in 2001 with new cans made from virgin materials.
- Over **two hundred thousand indigenous people have been relocated** to make way for hydroelectric reservoirs in nine aluminum-producing countries.

Recycling Facts

- After peaking at 65% in 1992, the aluminum beverage can recycling rate dropped to 49.2% in 2001—**the lowest rate in 15 years**.
- In 2001, Americans consumed **9 billion more** aluminum beverage cans than they did in 1991, yet recycled **6 billion fewer**.

Appendix D: Wrap-Around Mailing Label for 1990 NCRC "Cans to Congress" Campaign

Americans threw away 31 billion aluminum cans last year - enough to build our entire commercial air fleet four times over.



Illustrated by Edward Epstein Courtesy of the Laughing Bear Assoc.

CANS TO CONGRESS

_____

_____

_____

35¢
postage
required

_____

UNITED STATES CONGRESS
WASHINGTON, D. C. 20515

Dear _____

The 53 billion aluminum, glass and plastic beverage containers that we discard every year are placing a needless burden on our landfills, and represent a terrible waste of energy and natural resources. A **National Bottle Bill** would reclaim this valuable resource and reduce solid waste and litter too.

I urge you to support passage of HR 586/S 932 - the **National Bottle Bill.**

Sincerely,

Appendix E: CRI Urges Alcoa to Live up to Sustainability Pledge

WASTE NEWS .COM

Alcoa urges aluminum industry to be environmentally ambitious

By Joe Truini, October 14, 2002

WASHINGTON -- Alcoa Inc. challenged the North American aluminum industry to adopt ambitious sustainable development goals during the Aluminum Association's annual meeting this month, but some are challenging Alcoa to better define its own goals.

"Unless we are perceived to be a sustainable enterprise, new smelters will not be permitted, new mines will not be allowed, new residue ponds will not be approved, and electric power projects for our industry will not be built," said G. John Pizzey, Alcoa executive vice president, during the meeting held Sept. 30 through Oct. 1.

"He's thrown down the gauntlet to us," said Patrick Kelly, a spokesman for the Aluminum Association in Washington.

Alcoa has established a new global goal to use recycled aluminum in 50 percent of its products by 2020 except for raw ingot sold directly to others. The Pittsburgh-based aluminum product maker currently uses recycled content in about 20 percent of its products, said Joyce A. Saltzman, a company spokeswoman. In 2001, Alcoa sold 49 percent of the 1.8 million metric tons of material it shipped directly to third parties.

"If other continents and countries are exceeding the success rate of the U.S. industry, then that's not a good thing," said Robin King, vice president of public affairs for the Aluminum Association. "We want to make sure that we are a leader in the effort."

The North American aluminum industry uses about one-third recycled material in its products, King said. Beverage cans and automotive scrap each make up about 45 percent of the recovered material. The remaining 10 percent consists of new scrap, or material left over from the manufacturing process, construction and other sources.

About two-thirds of the aluminum produced since 1886 -- 440 million tons of 680 million total tons manufactured -- is still in use, Pizzey said.

Alcoa also recommended that the industry continue to reduce greenhouse gases. Alcoa has reached 90 percent of its goal to reduce its greenhouse gases by 25 percent by 2010 from a base year of 1990, Pizzey said.

"Obviously, Alcoa is making a huge play on this right now," Kelly said. "It is very much a front-burner issue for them."

King said Alcoa is calling for an awareness among senior management in the industry to examine goals and best practices, and not just within recycling. "The industry itself has to say that this is an important goal for them, and our challenge is to facilitate that process," King said.

In February, President Bush recognized 12 companies in the aluminum industry for meeting their voluntary goal to reduce emissions from primary aluminum smelting by 45 percent. Alcoa's largest competitor, Alcan Inc. in Montreal, set a goal last year to reduce greenhouse gas emissions by 500,000 metric tons by 2005.

"As far as greenhouse gas reductions, we are very much ahead of the curve in our industry as well as other industries," said Pat Persico, an Alcan spokeswoman.

But Alcoa's goals and how they will reach them are not clear, said Pat Franklin, executive director of Container Recycling Institute in Arlington, Va. "We applaud Alcoa's willingness to implement pollution control measures to mitigate their impact on the global environment," Franklin said. "But we are concerned by the vagueness of Alcoa's recycling goals and the company's failure to explain how these goals will be achieved."

Alcoa is working on initiatives to increase aluminum recovery but could not release specific information at this point, Saltzman said.

It also is unclear how much recovered aluminum Alcoa will use in its products, said Jenny Gitlitz, research director with the Container Recycling Institute.

"As stated, the goal could mean that 50 percent of the products will be made with 90 percent recycling content or with 9 percent recycled content, and there's a huge difference," Gitlitz said.

The Container Recycling Institute is urging Alcoa to adopt a global recycling policy that endorses container deposits. Aluminum beverage cans make up 20 percent of U.S. aluminum production. But the aluminum can recycling rate fell to 49.2 percent in 2001, down from a peak of 65 percent in 1992, according to the institute.

"If its true that two-thirds of the aluminum ever made is still in use, and we are not convinced that is true, then the converse must also be true," Gitlitz said. "One-third, or at least 220 million tons of valuable aluminum, has been wasted over the past century."

WASTE NEWS .COM

October 14, 2002

EDITORIALS

NEEDED NEXT: THE MINUTIAE

Alcoa Inc. has done the responsible, proactive thing by setting ambitious recycling goals for itself and the aluminum industry. Now it needs to follow through and answer its critics' concerns that the goals are vague enough that they could be ineffectual.

The company has set a global goal of using recycled aluminum in 50 percent of most of its products by 2020. That's up from the current 20 percent. The company also is calling on the industry to continue to reduce greenhouse gases. Alcoa said it's closing in on its goal of reducing greenhouse gases by 25 percent since 1990.

While applauding Alcoa's intent, the Container Recycling Institute expressed concern about how imprecise the goals currently are. That 50 percent goal, for example, could include products with a little or a lot of recycled content, which would make a big difference in the overall recycling effect.

Alcoa says it is still developing the specifics of its plans. The company needs to keep the ball rolling by going public when it does have the specifics. That can help serve as a much better road map to other aluminum product makers.

Alcoa insists it wants to be an industry leader in this area. The company is off to a good start. It should continue to lead with an aggressive, detailed plan.

CRI
CONTAINER RECYCLING INSTITUTE

Holding Alcoa Accountable for its Sustainability Goals

by Jenny Gitlitz, CRI Research Director, and author of the report, "Trashed Cans: The Global Environmental Impacts of Aluminum Can Wasting in America."

Background: On September 30, 2002, Alcoa Executive Vice President John Pizzey addressed the Aluminum Association at its annual meeting in Nemacolin, Pennsylvania.[1] On the surface, his speech (see footer for link to full text) was a strong endorsement of Alcoa's environmental practices and goals, and a pitch to other aluminum companies to adopt them as well.

We are heartened by Alcoa's acknowledgement that global climate change is a reality, and applaud its on-going R&D efforts on inert anodes—technology which would dramatically reduce greenhouse gas emissions from smelting. We also applaud Mr. Pizzey's recognition of the need to clean up the industry's environmental practices in general, and to undertake "cradle-to-cradle" LCAs (lifecycle analyses). That said, we are concerned about other aspects of Mr. Pizzey's speech, including things he did not say.

- **Alcoa Vice President Mr. Pizzey says:** "**Sustainability** requires environmental excellence, economic success and social responsibility. … At Alcoa, we have developed a strategic framework that allows each of our businesses worldwide to develop its own goals and action plans within that framework."

- **CRI responds:** Use of the word "sustainability" without concrete, well-defined goals and policies is not meaningful. Further, we fear that by allowing each of its businesses worldwide to set and attain their own sustainability goals and action plans, people and natural habitats in countries with weak environmental laws will lose out.

- **Alcoa Vice President Mr. Pizzey says:** "The set of goals we have established will serve as milestones along the way to our ultimate vision of a company where… **"the environment is fully integrated into manufacturing."**

- **CRI responds:** **How will the environment fare** in places like Iceland, Brazil, Chile, and Mozambique, **where irreplaceable wilderness areas are threatened** by proposed dams, smelters, and other elements of the megalithic aluminum manufacturing infrastructure?

  Once a rainforest has been inundated by a series of hydroelectric dams and reservoirs, there is no environment left to "integrate." Once a deep scenic canyon is flooded, it is gone. Once wetlands or estuaries have been drained, filled or contaminated as a result of smelter construction or operation, they no longer serve as breeding grounds for waterfowl or habitat for marine life. Once archaeological treasures have been buried by rising waters, they are lost to history. Once agricultural lands have been subsumed by mines or tailings ponds, there is no going back.

  The construction of new dams, smelters, and strip mines is not compatible with environmental protection, period. No matter how it is couched--the constant addition of bauxite and aluminum production capacity through greenfield construction is not sustainable.

[1] *CRI document originally published in October 2002.* The full text of Mr. Pizzey's speech is available at http://www.alcoa.com/global/en/environment/further_reading.asp

❖ **Alcoa Vice President Mr. Pizzey says: "By 2020, 50 percent of our products, except raw ingot that we would sell to others directly, will be made from recycled aluminum"**

❖ **CRI responds:**

1) **This statement is unclear**, and is not clarified on Alcoa's website. Does it mean that these products will be wholly made from recycled aluminum, or partially, and if so--what percent? Will the recycled aluminum be "new scrap," which has always been recycled, or "old scrap," which is truly post-consumer? *The industry has played fast and loose with recycled content terminology and percentages before; we must be vigilant about what these goals really mean.*

2) **2020 is not soon enough**. Irreplaceable ecosystems and human communities will be swallowed by the industry's great maw if 18 years transpire before a modest—and vague—50% goal is met. In the last decade, cans and other products have been introduced in many markets lacking recycling infrastructures. With $22.9 billion in annual revenues, Alcoa has investment capital at its disposal to build greenfield plants in remote, often inaccessible regions. The company must **act now**, using all its powers of persuasion, to convince investors to develop a global recycling infrastructure.

❖ **Alcoa Vice President Mr. Pizzey says:** "**[A]pproximately two-thirds of aluminum ever produced**—440 million tons of 680 million tons manufactured since 1886…**is still in use**."

❖ **CRI responds:**

1) We would like to see **data to corroborate this statement.** Data on current and historic recycling rates suggest that the percentage of aluminum "still in use" may be much lower.

2) If it is true that two thirds of the aluminum ever made is still in use, the converse must also be true: one third, or about **230 million tons of valuable aluminum, have been wasted** over the past century: dumped, landfilled, incinerated, or littered. This represents an energy waste equivalent to more than 6 billion barrels of crude oil (yes, billion, not million)--enough to keep all 200 million American passenger cars and light trucks on the road for over two years.[2]

3) **The wasting of valuable aluminum continues**. For each ton of metal landfilled, another ton must be made from virgin materials to take its place. Aluminum can waste in the United States alone was 760,000 tons in 2001, as the domestic UBC recycling rate dropped to 49%--the lowest rate in 15 years.[3] In 2001, 50.7 billion cans were wasted—up from 45.8 billion wasted the previous year.

Alcoa and its industry colleagues must address the wasting problem now:

Declining aluminum can recycling rates ands increasing beverage can **wasting can and must be reversed, by adopting deposit laws**, or "bottle bills." By placing a refundable deposit (historically a nickel) on cans and bottles, these systems have routinely achieved beverage container recycling rates of 70% or more, even though a nickel today is worth less than half of what is was 20 years ago when most deposit laws were passed. In Michigan, where the deposit is a dime, the rate exceeds 95%. Rates in non-deposit states range from 20-40%.

Yet despite this evidence, the Aluminum Association has opposed bottle bills, favoring "voluntary" and taxpayer-funded programs, which have failed to achieve high recycling rates.

If Alcoa is serious about encouraging recycling to meet broad sustainability goals, **it must come out in favor of deposit legislation**, and must persuade its industry colleagues to do the same.

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[2] Based on an average of 12,000 miles per year at 20 miles per gallon.

[3] The U.S. EPA estimated that 2.3 million tons of aluminum were wasted in 2000, including 1.6 MT from non-can sources.